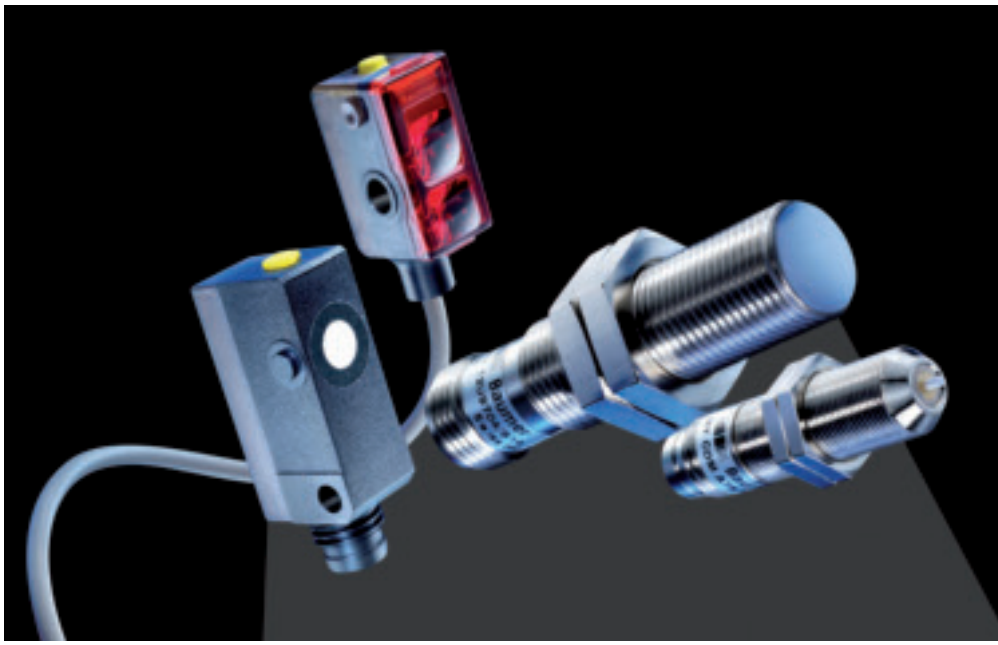
Baumer

# Sensor Solutions
# for Factory Automation



## Sensor Solutions
Motion Control
Vision Technologies

# Welcome
## to the world of sensors

Baumer – a name known worldwide for more than 55 years – is recognized as a leading producer of innovative sensor solutions for the factory and for the process automation industry.

More than 2,000 employees in 32 countries work in the product segments: **Sensor Solutions, Motion Control, Vision Technologies, Process Instrumentation** and **Gluing Systems**. In innumerable fields, our products keep processes running.

The demands placed on sensors by industry can only be met by a company which constantly works innovatively. It is for this reason that Baumer maintains an outstandingly staffed development department in an international network of highly qualified specialists.

A global presence, outfitted with the highest level of expertise with regard to consultation, sales and service assures you of the well known Baumer standard of quality around the world.

In this catalog you will find a broad range of sensor products from Baumer's Factory Automation Division.

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# Who we are

The globalization of the market has also resulted in the transformation of Baumer. Through numerous subsidiaries and partnerships around the world, Baumer has moved even closer to its customers.

Here, in the world of sensors, visitors can experience our practiced core values: **partnership**, **precision**, **pioneering**.

Baumer has always obligated itself to quality. Based on high precision and reliability, Baumer provides fully developed precision products and innovative solutions for the benefit of its customers.

As our customer, Baumer listens to you and works closely with you. Thanks to an optimal presence in the market, many solutions are the result of individual, on-site collaboration.

Your personal contact is close to you.

Headquarters Frauenfeld, Switzerland

Baumer – Sensor solutions worldwide.

## What we do

# High demands for quality and precision

To fulfill the highest demand for quality and precision for our customers all Baumer production sites are operating under the strict rules of the "Baumer Operations System".

Excellence in operations through "Baumer Operations System" ensures:

- Highest quality for our customer
- Shortest delivery times
- Maximum service level
- Committed, involved and excellent trained employees
- Best logistics
- One piece flow
- Best point assembly
- Latest production technology

# Innovative Sensor Solutions for Factory Automation

## Compact, fast, reliable.
## Inductive, capacitive and magnetic sensors.

Inductive sensors detect and measure simple presence or accurate position of metal object without physical contact to the target. Capactive sensors for non-metallic materials do the same, regardless if objects are solid or liquid. Linear and rotational movement easily sensed with magnetic sensors.

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## Precise, measurably better.
## Photoelectric sensors. Fiber optics and fiber optic sensors. Vision sensors.

Photoelectric sensors have revolutionized automation and continue to push the limits ahead. Objects and movements a human eye cannot precisely detect are among the numerous tasks photoelectric sensors solve. Sensors with LED, laser of fiber technology sense presence of objects or measure distance, widths, heights etc. with great accuracy.

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## Compact, multi-purpose, robust.
## Ultrasonic sensors.

Ultrasonic sensors provide information on presence or absolute position of a target or moving object. For shiny surfaces, for transparent objects or environments with dust and high humidity, the ultrasonic technologies are often the only alternative to mechanical probing.

See page 560

## Fast, reliable, ultra-precise.
## My-Com Precision switches.

Setting reference points, monitoring tolerances, controlling, adjusting. Fast, reliable, ultra-precise. Uncompromising accuracy tried and tested millions of times in industrial applications. Repeatability of 1 micrometer. For critical applications where spot-on precision is not good enough. Baumer helps you make exactly the right choice.

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# Other products for Factory Automation

## Motion Control. Reliable and precise rotation monitoring.

Motion, speed and acceleration – controlling and regulating drives is the domain of the Motion Group.

Contact us and order the latest Motion Control catalog: www.baumerelectric.com

## Vision Technologies. High-quality digital cameras for automated image processing.

Based on modern CCD and CMOS sensor technologies, Baumer offers a wide range of matrix and line scan cameras supporting the FireWire™ and Gigabit Ethernet interfaces. We also provide digital high-speed multi-camera systems including PCI interface boards and vision sensors.

We can assist you in finding the best solution for your application.
Contact us: www.baumeroptronic.com

# Baumer Group products for Process Automation

## Process Instrumentation.
## Made to measure.

Baumer manufactures mechanical and electronic measuring instruments and offers customers one-stop pressure, temperature, level and conductivity solutions. A world-class division with more than 150 years of experience.

Our products are designed to provide precise measurement results whatever the environment. Through the expertise and knowledge, we are able to meet your requirements worldwide from standard to customized solutions.

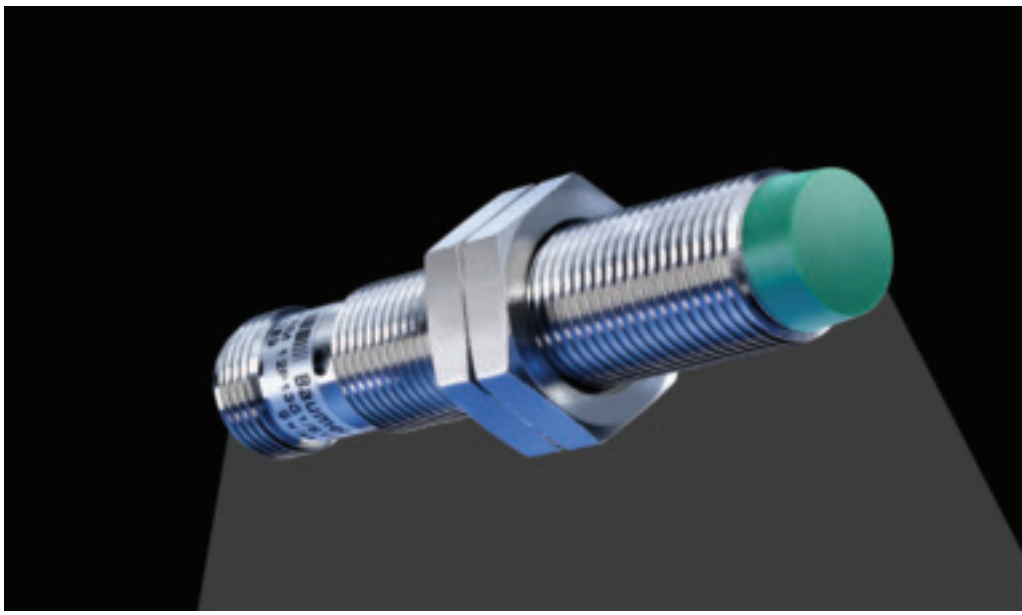
For more information go to: www.baumerprocess.com

# Baumer products
## keep processes running in numerous applications

- Automotive Assembly
- Chemical, Petrochemical
- Electronic Production
- Food, Beverage, Semi-luxury Goods
- Graphical Machinery
- Injection Molding, Die Casting
- Machine Tools
- Medical Industry
- Pharmaceutical, Bio Technology
- Semiconductor Industry
- Textile Machinery
- Transportation
- Water, Energy, Mining
- Warehouse and Logistics
- Wood Machinery

Baumer

# Compact, fast, reliable. Inductive, capacitive and magnetic sensors.



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Motion Control
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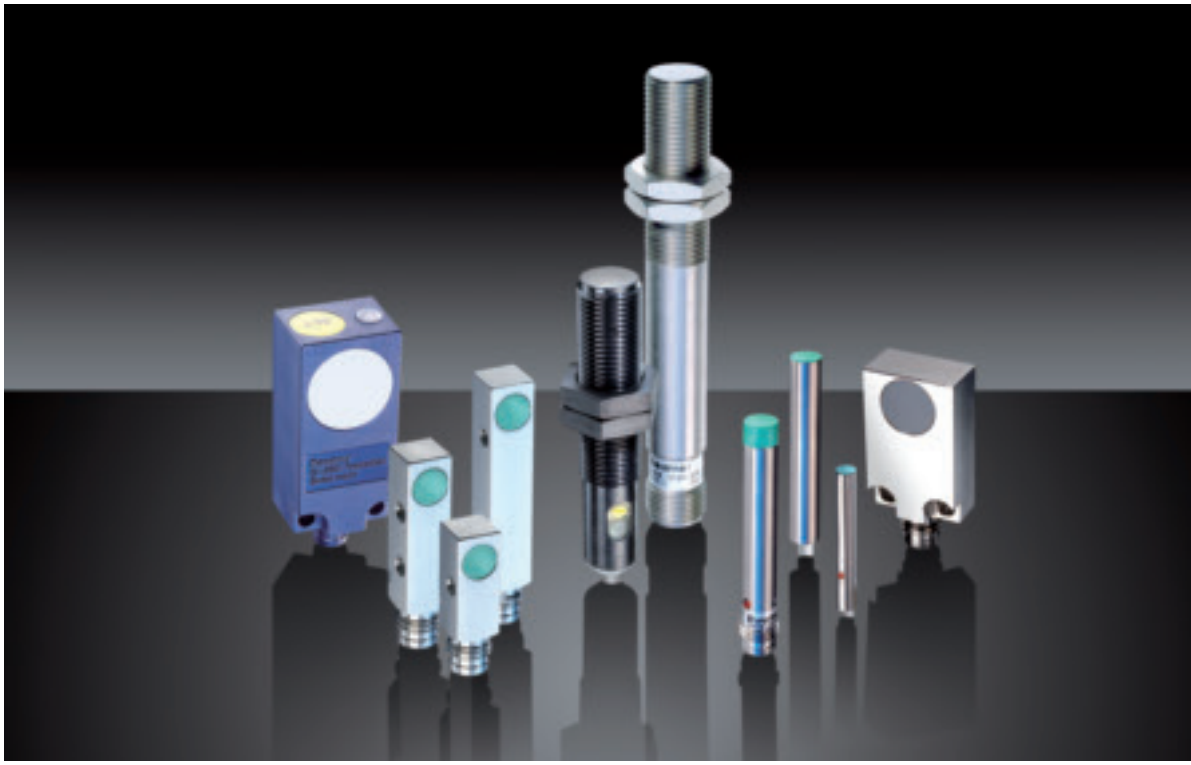

Around the globe, automation would not be the same without non-contact inductive proximity sensors. For decades, millions of such metal-detecting devices have been monitoring presence, measuring movement and position of machine parts, valves and gears. Reliably. Day in and day out. Even in high-speed applications, exposed to the toughest industrial conditions, inductive proximity sensors safely detect steel targets as well as non-ferrous metal targets. The sensors provide feedback with precise switching points and extremely high repeat accuracy.

The range of inductive 3-wire sensors consists of two basic designs:
- Sensors with digital output providing accurate on/off information
- Sensors with analog output signals providing absolute distance information

Both technologies are available in a wide range of housing styles ranging from subminiature to standard size enclosures. Special custom solutions are available for OEM requirements.

Inductive sensors are undoubtedly the best tested and best proven sensor technology on the market. Because of this, they are still going strong and continue to provide good and reliable solutions for many challenging tasks in the world of automation.

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# *Powerful and flexible standard sensors*

**You as the client set the standard!**

You can choose from Baumer's wide range of inductive and capacitive sensors. Baumer's new miniature range fully meets the current demand for highly compact models with great sensing distances. Sensor sizes with diameters of 6,5 mm and more offer a four times greater sensing distance and models with M12 or larger housings can sense at distances up to five times greater. You can choose from three different housing materials: nickel-plated brass, chrome-nickel steel 1.4305 or plastic to suit your application needs.

**Three different housing lengths!**

Short and sweet is how we make them, which gives you all the benefits of longer sensors in a much smaller housing. Nothing on earth can beat our star product with the world's shortest installation length of barely 28 mm, naturally equipped with M8 x 1 plug connector.

You want it longer? No problem – simply pick the medium-sized or long version, also available in a cable version!

**Plug connector**

Compact sensors require space-saving plug connectors too. Our range now includes the new M5 x 0,5 plug connector for our miniature series. We rely on the well-tested M8 x 1 and M12 x 1 connectors for our medium-sized and larger models. They naturally come in both straight and angular configurations.

# *Special versions according to customer specifications*

Special versions according to customer specifications
Baumer's comprehensive range of standard inductive sensors satisfies most engineering and design requirements. Nevertheless, should you encounter an application that cannot be solved with an „off the shelf product":

Baumer has years of experience in tailor made sensor solutions, a small selection of which is displayed on this page for your reference.

Our R & D team is up to the challenge of tackling your every sensing need with products customized to your application.

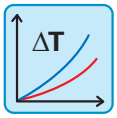
**Try us. Present your specification sheet today!**

# *AlphaProx* **Inductive distance measuring sensors with high resolution 0,1 µm**

Whether in industry, the construction field or process chemistry, it always requires a team of competent specialists to create strong solutions.
Baumer too puts its faith in a "team" when it comes to finding solutions for industrial applications. This team is known as ***AlphaProx*** and comprises a family of high-quality, inductive analog sensors. Each sensor displays an individual specification which is ideally matched to its specific application areas.

**Miniature housing**

The trend towards miniaturization is unstoppable, even when it comes to distance measuring sensors. With a diameter of 4 mm, the IWRM 04 likely holds the title as the smallest inductive distance measuring sensor with an integrated amplifier.




**Temperature stability at the greatest measurement distances**

High temperature stability at the greatest possible measuring distance represents a further strength. Over 80 % of all distance measuring applications operate at ambient temperatures between +20 … +50 °C. Our sensors exhibit a negligibly small temperature drift in the range between 0 … +60 °C.

**Flexibility through Teach-In**

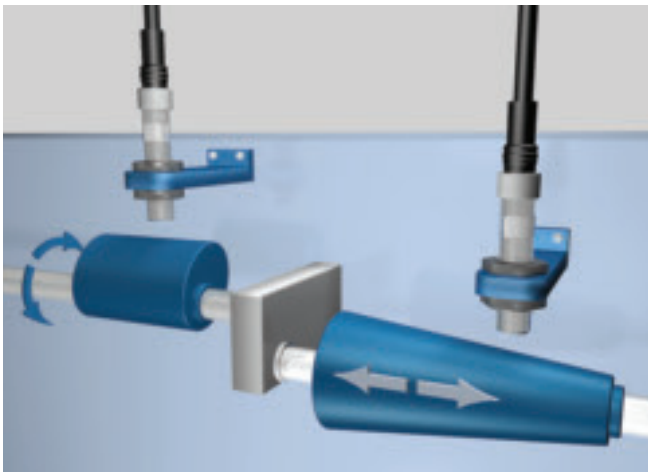
Sensors with Teach-in inputs can be optimally adapted to their individual applications. The extremely simple Teach-in routine allows not only the analog output to be influenced, but also an additionally integrated switching output.

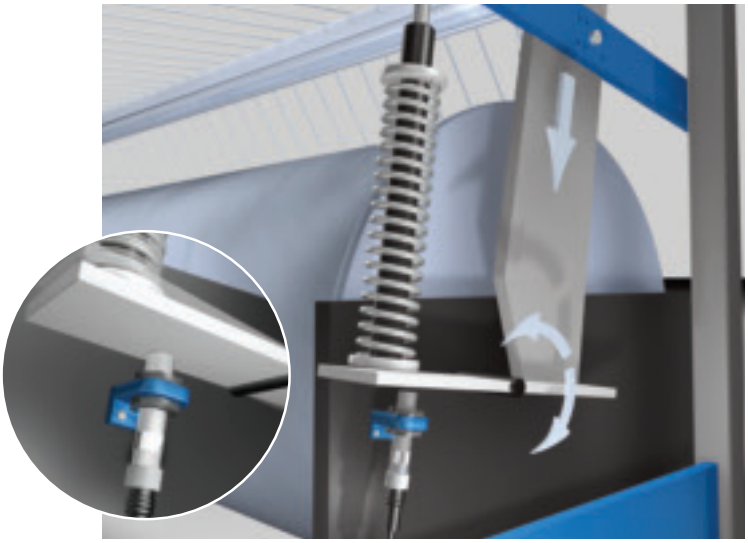
**Very high EMI resistance**

Resistance to electromagnetic interference is one of the most significant factors for the practical employment of sensors. Our sensor's EMI resistance limit values lie significantly above the specifications defined by the sensor standard, thus ensuring extremely high operational security.

**Absolute linear and angular measurement**

- Absolute linear measurement
- High reliability through contactless measurement
- Dirt-resistant measuring system
- Linear ways greater than the sensor measuring range can be measured
- Linear and rotary movements can be measured
- Compact sensor designs permit installation in even the most limited spaces





**Belt tension regulation and monitoring**

- High regulation quality at large frequencies is possible
- The sensor performs two functions: linear measurement (analog) and end position shutoff (digital)
- Using Teach-in, the sensor's measuring range can be optimally adjusted to the roll diameter

**Vibration measurements on shafts and bearings**

- Bearing play or true running measurements
- Measurements of distances down 1 µm
- Installation in even the most limited spaces (the amplifier is integrated in the sensor)
- Very rapid movements can be measured
- Miniature sensors also available in connector versions

# *Miniature versions of inductive sensors*

The trend towards ultra compact machines and devices is here to stay. Baumer recognized this trend early on, resulting in the development of the world's smallest inductive sensors. A complete range of different sizes and enclosure shapes is perfectly matched to applications where space is scarce.

**Miniature versions**

- Smallest ø 3 mm sensor
- Unthreaded housing designs for ø 3 mm, ø 4 mm, ø 6,5 mm
- Steel housings with threads for M4, M5 and M8 dimensions
- Rectangular sensors for 4 mm, 6 mm, 8 mm dimensions

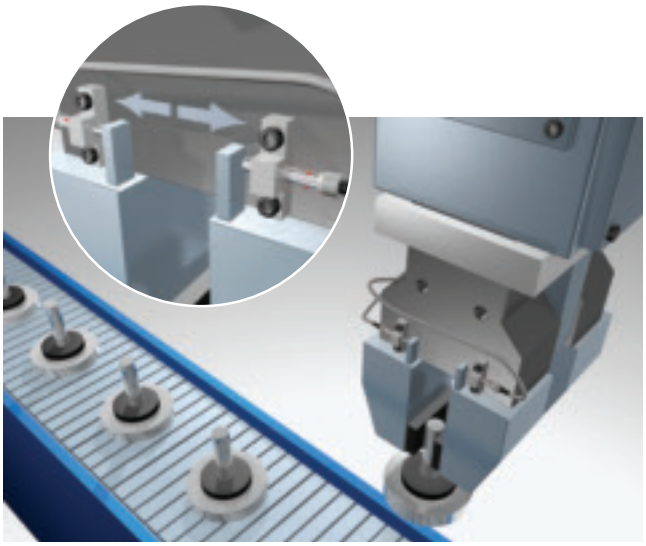
**Special versions in miniaturized design**

- 2-wire NAMUR versions in dimensions from 4 to 8 mm
- 2-wire NAMUR button sensors for mounting directly on PCBs in 10 mm dimension
- Measuring sensors with analog output (current/voltage) in dimensions from 4 to 8 mm

**Electrical connection**

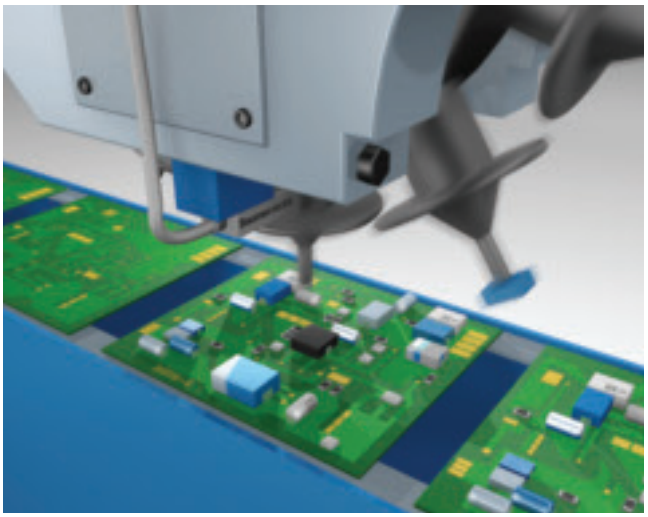
- PUR and PVC leads
- M5 x 0,5 miniature connectors
- M8 x 1 connectors

# Application examples for miniature sensors



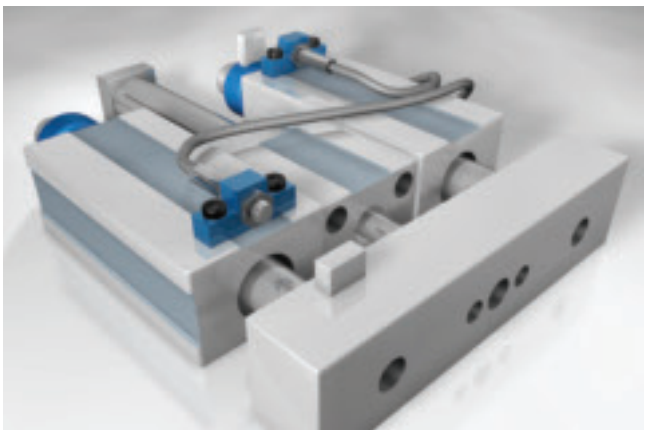
**Robot grippers**

- Gripper jaw end position detection
- Workpiece presence/absence check
- Miniature sensors designed for limited space conditions



**Automatic SMD population equipment**

- Synchronization of processes
- Precise position determination
- Absolute spacing measurement at high resolution



**Linear unit**

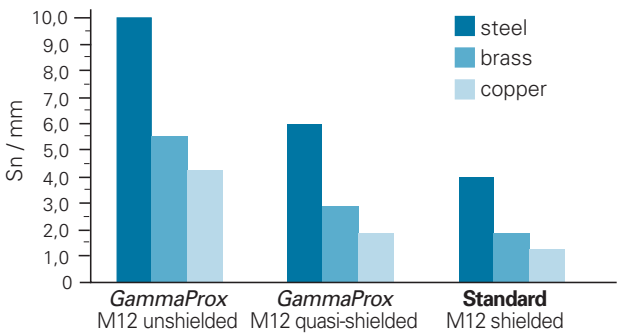
- Return report of the end positions
- Referencing / initialization

# *GammaProx* Sensors with increased sensing distances

5xSn

**Five times greater sensing distance than the CENELEC standard**

The sensing distances of the *GammaProx* line of sensors is up to five times that required by the CENELEC standard. This allows both steel and nonferrous metals to be effectively and reliably detected. The increased sensing distance generally permits greater distances to the moving objects to be selected which, in turn, allows greater mounting tolerances and helps to prevent mechanical damage and increase the overall reliability of the equipment.



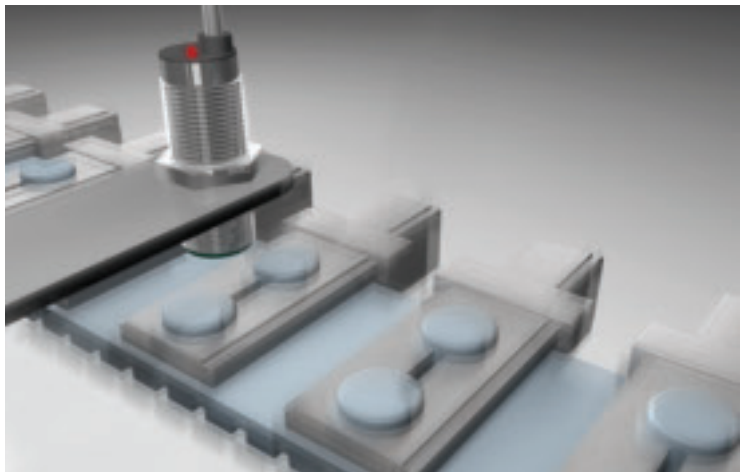

**Quasi-shielded installation method**

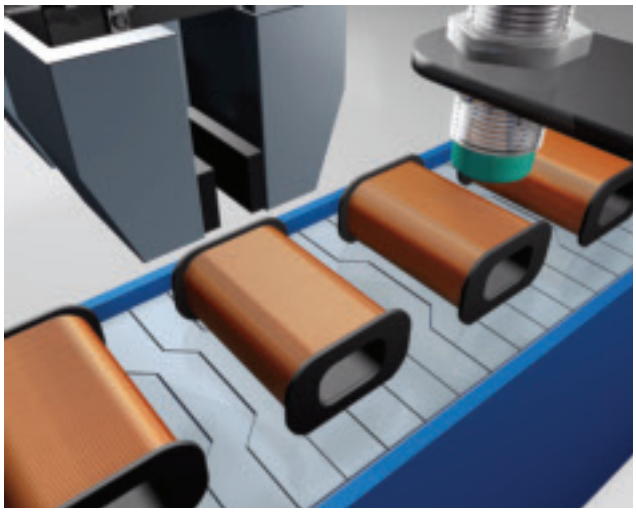
When installing quasi-shielded sensors in ferromagnetic metals, special installation instructions must be observed. In non-ferromagnetic materials such as copper, brass and aluminum, the sensors can be installed shielded.

# Application examples for *GammaProx* sensors

**Detection and counting of metal objects**

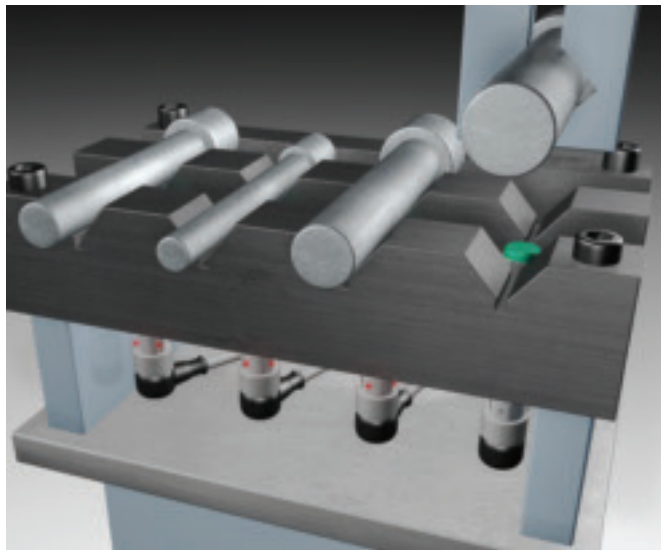
- Where object distances vary greatly (mechanical tolerance compensation)
- Reliable detection of varying object sizes
- Detects a variety of metals (lowering the influence of the reduction factor)
- Also detects plastic-coated metals reliably





**Coil and transformer production**

- Detection of copper windings
- Quality control during spool manufacturing
- Can be employed on automatic winders



**Handling and robotics**

- Presence detection for tool pickups
- Permits greater mounting tolerances
- Reliable detection even where object distances vary greatly

# *DuroProx* Inductive sensors with rugged full metal housings

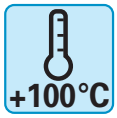
***DuroProx* Designed for daily use under harsh industrial conditions**
*DuroProx* sensors are built to take it in every sense. The inductive sensors with their full metal housing (Ø 6,5 to M18) providing IP 69K class protection were designed from the outset for harsh and demanding industrial applications. Thanks to an operating temperature range from -25 … +100 °C and a housing made of V4A stainless steel, these sensors are equally at home in food handling applications, cutting oil environments and any other applications where heavy contamination is a factor. They also function flawlessly under conditions of severe EMI pollution thanks to both their full metal housing with an active surface made of stainless steel and increased noise immunity in accordance with EN 61000-6-2.

**Quasi-shielded installation method**

When installing quasi-shielded sensors in ferromagnetic metals, special installation instructions must be observed. In non-ferromagnetic materials such as copper, brass and aluminum, the sensors can be installed shielded.

**Highest protection class**

The family of *DuroProx* sensors meets the requirements of protection class IP 69K and is practically predestined for use in the food handling industry.




**Large operating temperature range**

The temperature span across which *DuroProx* sensors can be reliably employed ranges from -25 … +100 °C.

**Full metal housing**

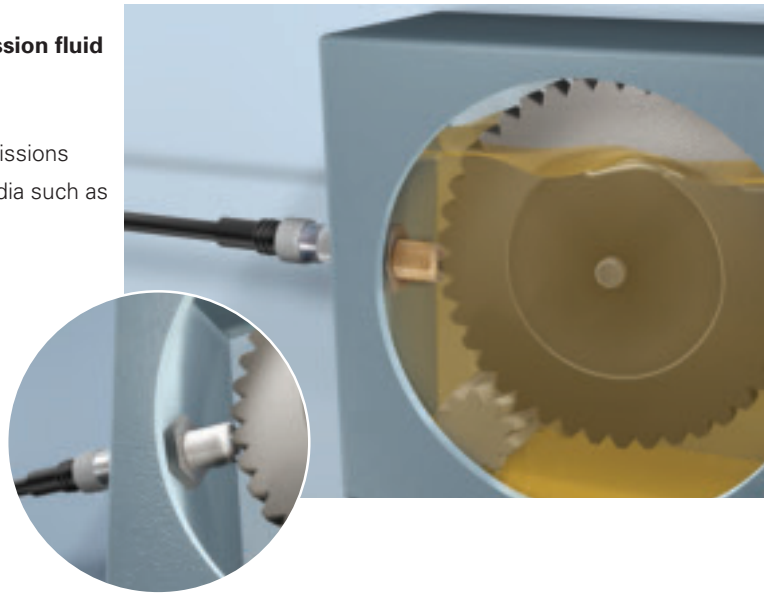
The entire housing, including the active surface is made of V4A (1.4404) stainless steel. This makes *DuroProx* highly resistant to abrasive and chemically aggressive media such as acids, bases and salt water and is according the food and beverage standards.

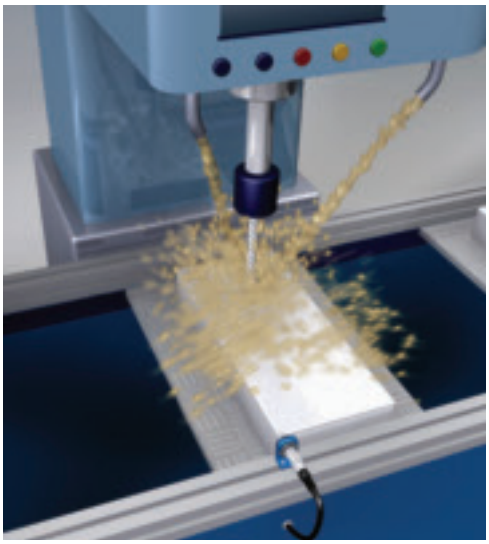
# Application examples for *DuroProx* sensors



**Long-term employment –
Directly exposed to transmission fluid or motor oil**

- Motor rpm counters
- Position reporting in transmissions
- Resistant to aggressive media such as oil additives





**Continuous employment in wet cells**

- During production processes involving cutting (CNC)
- Subjected to the influence of cutting, grinding and cooling/lubricating agents

**Food processing industry**

- Direct contact with foods (V4A steel)
- Cleaning using high-pressure water and steam
- Resistant to industrial detergents

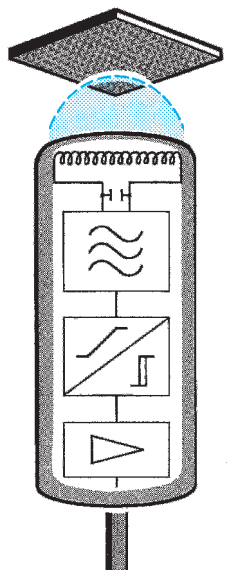
# Applications - digital and analog outputs



## The sensor

Baumer inductive proximity switches are non-contact electronic sensors. They consist of three components: Oscillator, Schmitt Trigger and Output.

Inductive sensors will recognize any conducting metal target. Care must be taken when specifying a sensor to take into account correction factors due to target material. It is also important to ensure that target size guidelines are met.




## Operation

The oscillator creates a high frequency electromagnetic field, which radiates from the sensing face of the switch. When a conductive metal object enters this electromagnetic field, eddy currents are induced within the metal, causing a change in the amplitude of the oscillations. The result is a voltage change at the output of the oscillator, which causes the trigger to change state and alter the output state.

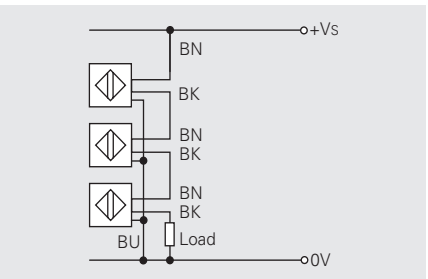
## Output

Standard DC proximity sensors use digital on/off NPN or PNP transistor outputs. Analog DC outputs are available on the NAMUR range (current) as well as on the inductive linear sensor range (voltage and current).

## Series switching

**3-wire DC (PNP circuit shown)**

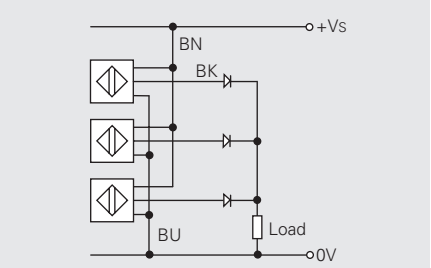
The voltage drop across each conducting sensor reduces the voltage available to drive the load. The number of proximity switches which can be connected in series is therefore limited and may be worked out by summing the individual voltage drops plus the load requirement.




## Parallel switching

**3-wire DC**

3-wire DC sensors may be connected in parallel as shown. A parallel connection, however, must incorporate a decoupling diode.



## Sensing distance

The IEC defines the sensing distance (s) in the international Standards IEC 60947-5-2 as follows:

**Sensing distance**

Sensing distance is defined as the distance at which the output signal is triggered when a standard target is moving towards the active sensor face.

**Nominal sensing distance $s_n$**

Nominal sensing distance is defined as a classification, that does not take into account either manufacturing tolerances or variations due to external conditions.

**Real sensing distance $s_r$**

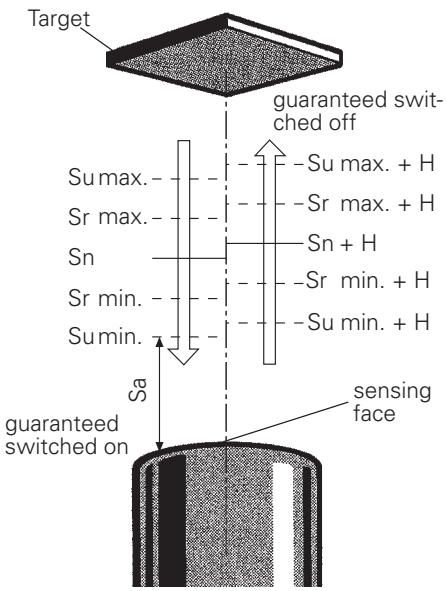
At nominal voltage ($V_n$) and nominal ambient temperature of 20 °C (68 °F) the real sensing distance has to be in the range of 90% to 110% of the $s_n$. ($0,9 \times s_n \leq s_r \leq 1,1 \times s_n$)

**Usable sensing distance $s_u$**

Usable sensing distance is defined to be within the allowable range for the operating voltage and ambient temperature in the range of 90% to 110% of the $s_r$. ($0,9 \times s_r \leq s_u \leq 1,1 \times s_r$)

**Operational sensing distance $s_a$**

The safe operational sensing distance lies between 0% and 81% of the $s_n$ ($0 \leq s_a \leq 0,9 \times 0,9 \times s_n$)




Inductive proximity switch

**Standard target**

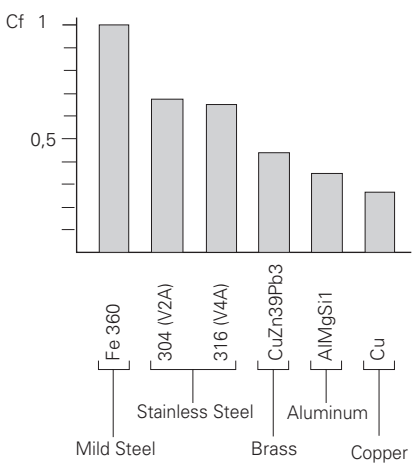
The standard target is defined as a square plate, 1 mm thick, made of Fe 360 (mild steel). The length of its side is defined as the larger of either the sensing face diameter or three times $s_n$ (nominal sensing distance).

## Correction factor

If the target material differs from the standard target (as defined above), then the applicable published sensing distance must be multiplied by the appropriate correction factor (Cf).

Note: The published figures should be taken as a guideline only. Targets which differ in size and shape from the standard geometry may also give a different sensing distance when compared to the figures stated in the data sheets.

When sensing aluminum foil or non-metallic materials coated with a thin layer of aluminum or copper, the sensing distance achieved may be close to the value of mild steel. Actual $S_n$ depends on the thickness of the layer as well as the alloy composition.



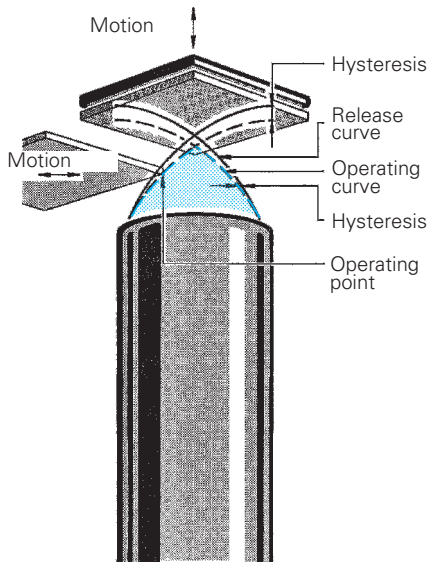
# Sensing characteristics



## Hysteresis

At approach and removal of the target, there is a difference between operating and release point which is defined as Hysteresis.

Hysteresis is designed into a sensor's characteristics to guard against possible incorrect pick-up due to vibration.




## Repeatability

The repeatability of the actual switching point of two successive switchings within 8 hours, at an ambient temperature between +15 °C and +30 °C, and a voltage of ±5% deviation from nominal, is ±5%.

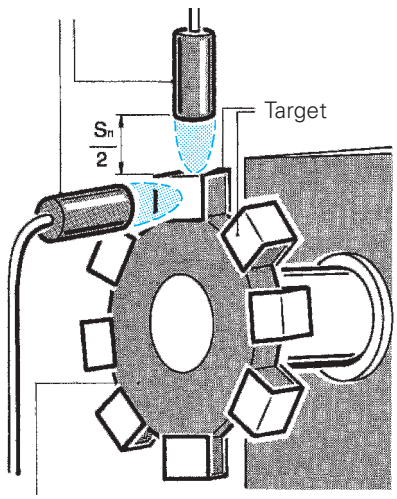
## Temperature range

The normal temperature range is between -25 °C and +75 °C. Please call should your application require installations in areas where this range may be exceeded.

## Switching frequency

Inductive proximity switches

Meeting EN 50010 standards, the switching frequency is the highest possible number of switchings per second.



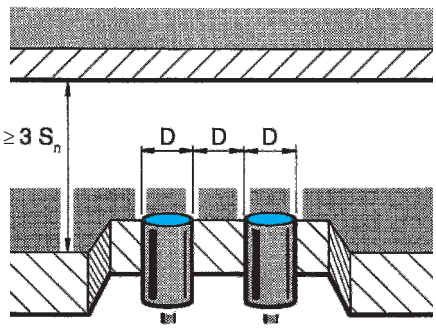

Disk
Non-magnetic and non-conducting material

## Mounting instructions for cylindrical forms

● shielded (flush) mounting

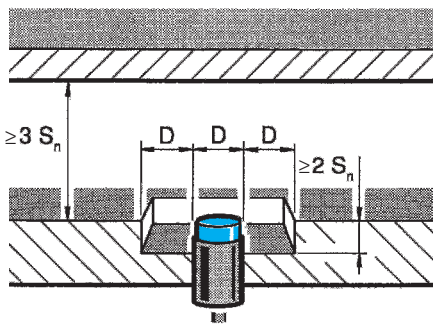
Sensor may be mounted flush in a metal plate.

Choice of carrier material can have an influence on sensing distance.




○ unshielded (non-flush) mounting

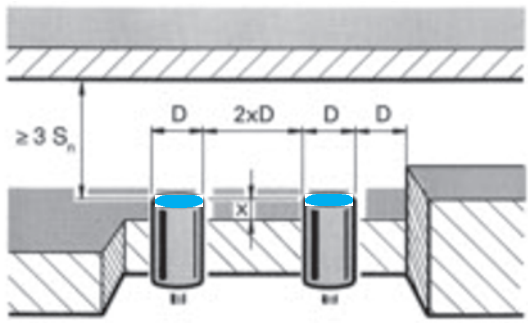
There must be a space equal to the diameter of the sensing head, with no metal interference. Following this rule the electrical field strength is less attenuated, which enables a larger sensing distance.




◑ quasi shielded mounting

When mounted in ferromagnetic material these sensors require a space (x) behind the active area that is free of metal.

Sensors can be installed shielded (flush) when mounted in non ferrous materials (colored metals etc.).




x ≥ 1/3 Sn for ferromagnetic material

x = 0 for all other materials

# Electrical and mechanical specifications

| | |
|---|---|
| Voltage supply range +Vs | Maximum ripple 10 % of Vs. The supply voltage should not be higher or lower than the indicated maximum or minimum values. |
| Voltage drop Vd | This value indicates the maximum voltage drop measured across the conducting output. |
| Supply current | This is the maximum current consumed by the sensor, at nominal voltage, exclusive of output. |
| Oil resistant | The standard PVC cables as well as the PBT sensing faces are not made to operate continuously within an oily environment. PUR (polyurethane) cable options are available on both sensors and connectors. |
| Output resistance | 3-wire proximity switches have a built- in load resistance. In case of high frequency switching an external load resistance can be connected in parallel in order to reduce the time constant. |
| Maximum cable length | A large cable length means a capacitive load for the output circuit and increases the influence of interference. Length should therefore be kept as short as possible. |
| Dimension | Normally the dimension refers to the width of the sensor, which for cylindrical body styles equals the diameter. Normally, the larger the body, the larger the coil and therefore the larger the sensing distance. |
| Reverse polarity protection | These sensors are protected against temporary reversed polarity voltage connection. |
| Max. Switching current | The maximum permissible load current passed through the sensor. |
| Output protection | All Baumer sensors are protected against back EMF. |
| Short circuit protection | Depending on the application, any sensor in our product range may be available with protection against short circuiting. |
| Magnetic fields | Strong magnetic fields might push the ferrite cores of the proximity switch into saturation. A proper switching is no longer guaranteed. Protective shielding is recommended. |
| NAMUR | NAMUR proximity switches change their current consumption as a metallic object approaches. The changed current consumption or the change in the internal resistance serves as the output signal. Together with suitable tested switching amplifiers, they can be used in an explosive environment. |
| Status display | Most of our proximity switches have an LED-display. It indicates the output switching status. |
| | The voltage supplied to the sensor should always be within the specified range for proper operation. Within this range a 10% ripple ($V_R$) is allowed. |
| Connection cable | Most of our proximity switches are equipped with highly flexible PVC cable. If a high resistance against oil and grease is required, the cable material can be changed to PUR. For high temperature resistance a teflon cable is used. The standard cable length is 2 meters. |

# Electrical and mechanical specifications

**Maximum installation torque**

To avoid damage to the proximity switches during mounting, the default torque value should not be exceeded.

Stainless steel thread:
M4 = 1,8 Nm / M5 = 2 Nm / M8 = 10 Nm  M12 = 20 Nm / M18 = 55 Nm

Brass nickel plated thread:
M8 = 7 Nm / M12 = 15 Nm
M18 = 40 Nm / M30 = 200 Nm

Polybutylenterephthalate thread:
M12 = 1,5 Nm / M18 = 3 Nm
M30 = 15 Nm

(reduce torque values by 30% at the sensor's face)

The above data is valid for installations using the mounting nuts supplied with the sensor.

**Protection class**

IP 65 1) Protection against penetration of dust and complete protection against contact with electrical components.
2) Protection against a water jet from any direction.

IP 67 The stipulations in 1) also apply here. In addition, this class provides protection against water when the housing is immersed in water under specified conditions of time and pressure (30 minutes at 1 m water depth).

IP 69 The stipulations in 1) also apply here. In addition, water directed from any direction under strong pressure against the housing must have no detrimental effects.

IP 69K Protection class IP 69K is an important standard for devices used in the food and automotive industries. It describes high-pressure cleaning with pure water at a pressure of 8,000 to 10,000 kPa and a temperature of +80 °C. The duration of exposure is 30 seconds in each position. As this test method differs significantly from the other IP tests, devices with the test label IP 69K do not automatically have protection class IP 67 or IP 68. Only devices in protection class IP 67 also have the lower protection classes.

**Mounting instructions for housings without threads**

Heavy point loads on the housing, as can occur during fastening with grub screws, must be avoided (IFRM 03, 04, 06). Incorrect installation can cause irreversible damage to the proximity switch.

Various mounting aids are available for sensors without threads (ø 3, ø 4, ø 6,5).

**Cable dimensions**

| Housing diam. | Wire diam. | |
|---|---|---|
| ø 3 | 3 x 0,05 mm² | PVC |
| M5 / ø 4 | 3 x 0,08 mm² | PUR |
| M8 / ø 6,5 | 3 x 0,14 mm² | PVC |
| M12 | 3 x 0,25 mm² | PVC |
| M18 | 3 x 0,25 / 3 x 0,50 mm² | PVC |
| M30 | 3 x 0,50 mm² | PVC |

# *Inductive distance measuring sensors*

## *AlphaProx*

## cylindrical designs

| product family | IWRM 04 | IWRM 06 | IWRM 08 | IPRM 12 | IWRM 12 | IWRM 12 | IWRM 12Z |
|---|---|---|---|---|---|---|---|
| |  | | | | | | |
| | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* |
| shielded | | | | | ■ | | |
| quasi shielded | ■ | ■ | ■ | ■ | | ■ | ■ |
| measuring distance Sd | 0 ... 1 mm | 0 ... 2 mm | 0 ... 2 mm | 0 ... 2 mm | 1 ... 1,5 mm<br>1 ... 2 mm | 0 ... 4 mm | 0 ... 4 mm |
| housing length | 30 mm | 40 mm<br>46 mm | 40 mm<br>46 mm | 90 mm | 50 mm | 50 mm | 60 mm |
| voltage output | ■ | ■ | ■ | | ■ | ■ | |
| voltage output / PNP | | | | | | | ■ |
| current output | | ■ | ■ | ■ | | ■ | |
| cable | | ■ | ■ | | ■ | | |
| connector M5 | ■ | | | | | | |
| connector M8 | | ■ | ■ | | | | |
| connector M12 | | | | ■ | | ■ | ■ |
| stainless steel | ■ | ■ | ■ | | | | |
| brass nickel plated | | | | | ■ | ■ | ■ |
| steel (9 SMn (Pb) 28/36) | | | | ■ | | | |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | | | |
| **Page** | **37** | **38** | **39** | **40** | **41** | **42** | **43** |

## rectangular designs

| product family | IWFM 12 | IWFM 12 | IWFM 18 | IWFM 20 | IWFK 20 | IWFM 20 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* |
| shielded | ■ | ■ | ■ | ■ | | ■ |
| quasi shielded | | | | | ■ | |
| measuring distance Sd | 0 ... 4 mm | 1 ... 2 mm | 0 ... 4 mm | 2 ... 3 mm<br>2 ... 5 mm | 0 ... 10 mm | 0 ... 2 mm |
| housing length | 60 mm | 55 mm | 30 mm | 35 mm | 42 mm | 30 mm |
| voltage - / current output | ■ | | ■ | | | |
| voltage output | | ■ | ■ | ■ | | ■ |
| voltage output / PNP | | | | | ■ | |
| current output | | | | ■ | | |
| cable | | ■ | | | | |
| flylead connector M8 | | | | | | ■ |
| connector M8 | ■ | | ■ | ■ | ■ | |
| brass nickel plated | ■ | ■ | ■ | ■ | | ■ |
| polyester | | | | | ■ | |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **50** | **51** | **52** | **53** | **54** | **55** |

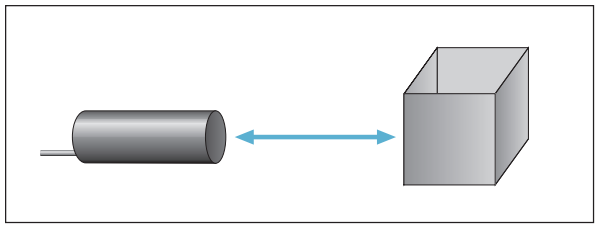
| IWRM 18 | IWRM 18 | IWRM 18Z | IWRM 30 | IWRM 30 | IWRM 30Z |
|---|---|---|---|---|---|
| | | | | | |
| *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* | *AlphaProx* |
| ■ | | | ■ | | |
| | ■ | ■ | | ■ | ■ |
| 2 ... 4 mm<br>2 ... 5 mm | 0 ... 8 mm | 0 ... 8 mm | 5 ... 9 mm<br>5 ... 10 mm | 0 ... 16 mm | 0 ... 16 mm |
| 31,5 mm<br>65 mm | 60 mm | 60 mm | 60 mm | 63 mm | 62 mm |
| ■ | ■ | | ■ | ■ | |
| | | ■ | | | ■ |
| ■ | ■ | | ■ | ■ | |
| ■ | | | ■ | | |
| | | | | | |
| | ■ | ■ | | ■ | ■ |
| | | | | | |
| ■ | ■ | ■ | ■ | ■ | ■ |
| | | | | | |
| IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | |
| **44** | **45** | **46** | **47** | **48** | **49** |

## Function

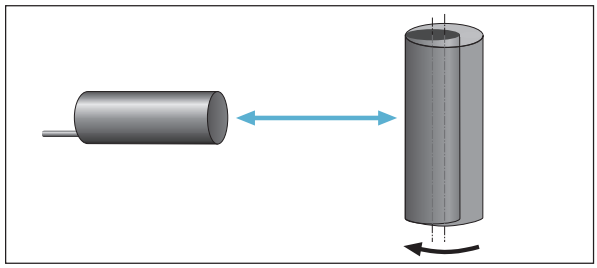
Inductive sensors with analog output signals are characterized by their short response times, high resolution and linearity as well as their outstanding repeat accuracy. The output current and voltage values are proportional to the distance between the sensor and the object being detected. In other words, they represent absolute measured values corresponding to the distance between the active surface and the object. These properties make inductively measuring linear sensors extremely interesting for numerous applications in the area of measurement and control engineering.

## Typical applications

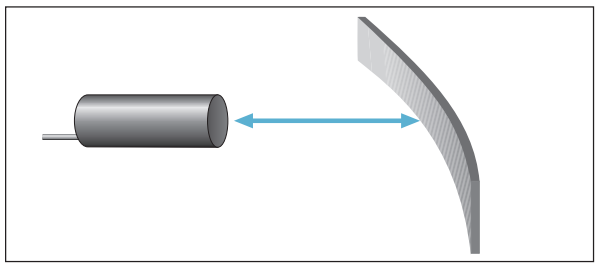
Travel / position / displacement



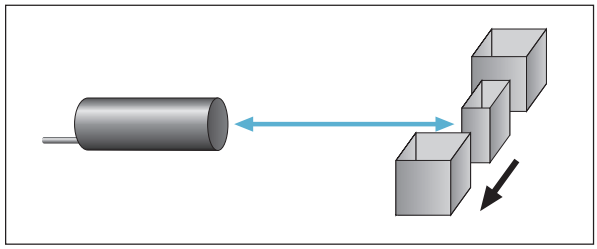
Diameter / eccentricity



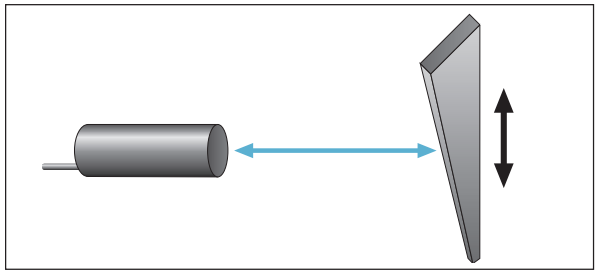
Deflection / deformation



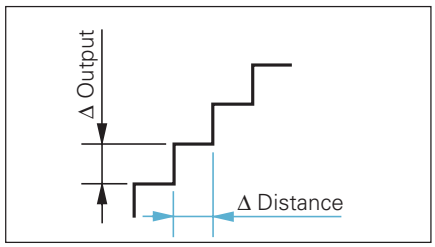
Size comparison / measurement tolerance



Taper / ramp

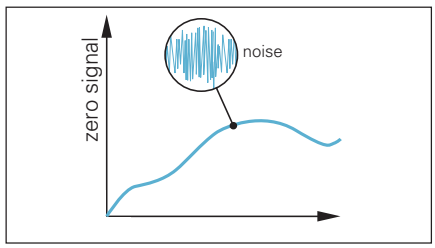


## Resolution in general



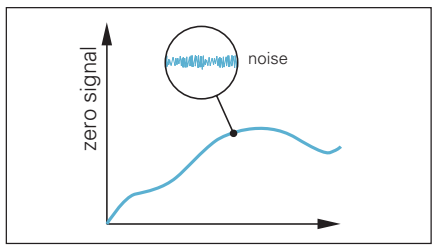

Resolution represents the smallest possible change in distance which will produce a measurable signal change at the sensor's output. Resolution can be impaired by high-frequency electrical interference (noise) or by the resolution of digital/analog converters.

## Dynamic resolution



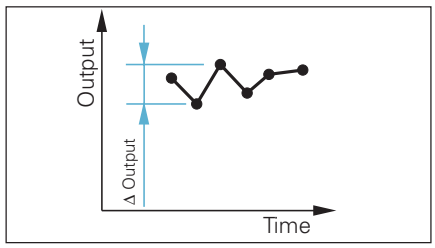

Signal noise exerts full effect on signal processing during very rapid measurements (high scan rates). Filtration without influencing the useful signal is only possible to a limited extent, if at all.

## Static resolution



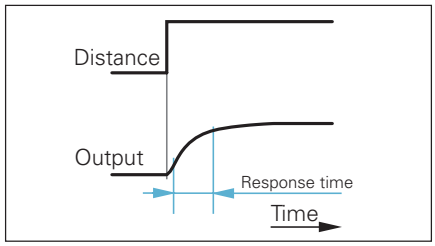

Very slow object movements (low scan rates) such as the temperature expansion of shafts allow the high-frequency interference to be filtered. The carrier signal is not influenced by this filtration. Using this technique significantly increases the resolution when compared to dynamic measurements.

## Repeat accuracy



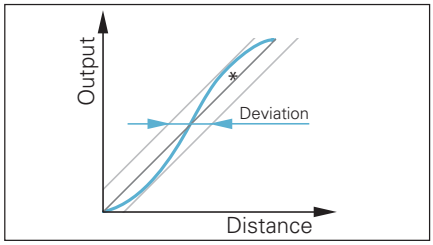

Repeat accuracy means the difference between the measured values of successive measurements within a period of 8 hours at an ambient temperature of 23 °C ± 5 °C.

## Response time




The time which the signal output of a sensor requires to rise from 10% to 90% of the maximum signal level is called the response time.

## FS Linearity




Linearity defines the deviation between the output signal and a straight line. It is given as a percentage of the measuring range end value (FS or Full Scale). The following alternatives are available for applications where the indicated linearity is insufficient:

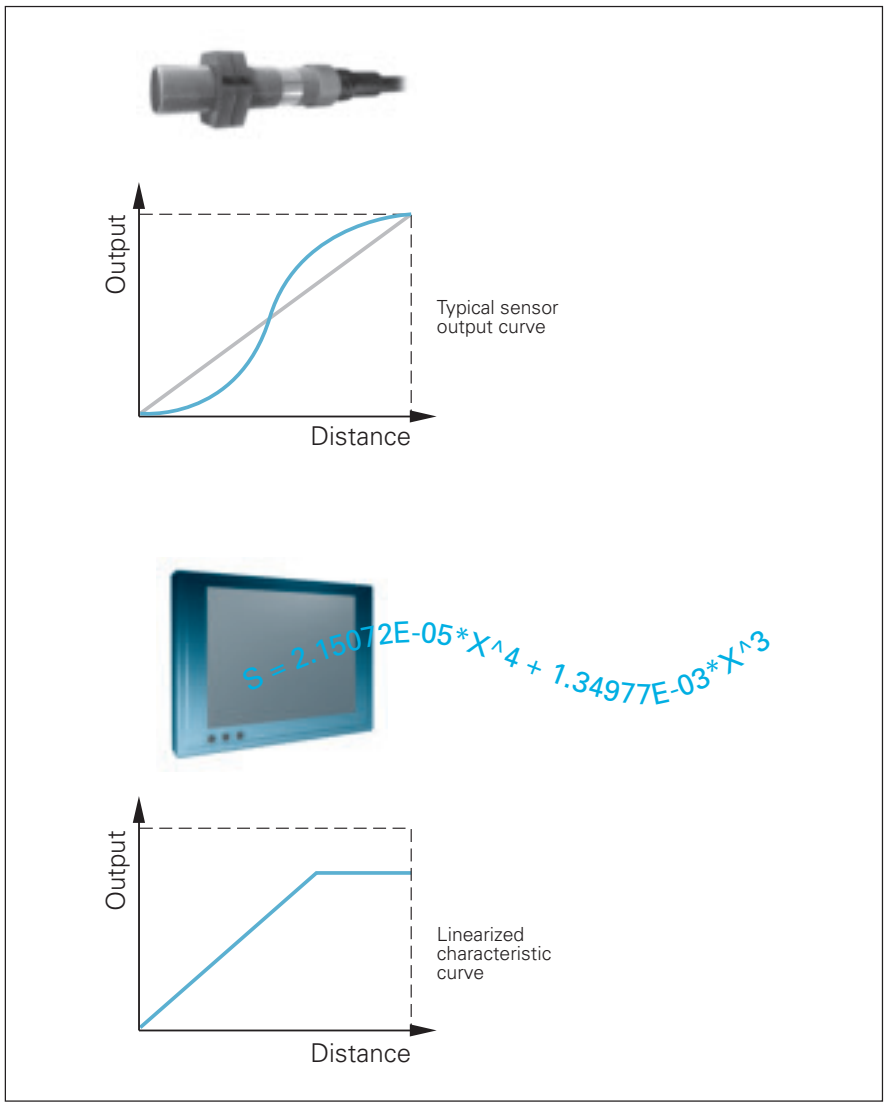
- Sensors with linearized output curves
- Polynomials for the mathematical linearization of the sensor curve's in the controller

## Signal linearization with polynomials

Polynomials represent a mathematical function which converts a typical inductive analog sensor output curve into a linear signal. For example, it is integrated in the software of a programmable logic control to change the s-shaped sensor signal into a straight line.

## Polynomials are used when ...

- a linear signal progression is required across the entire signal range
- rapid measurements are to be performed
- no sensors with linear output curves are available for the intended measuring range
- an economical solution is desired




A variety of sensors with linear output curves are also available as alternatives.

## Functions

The following parameters can be altered using the Teach-in function:

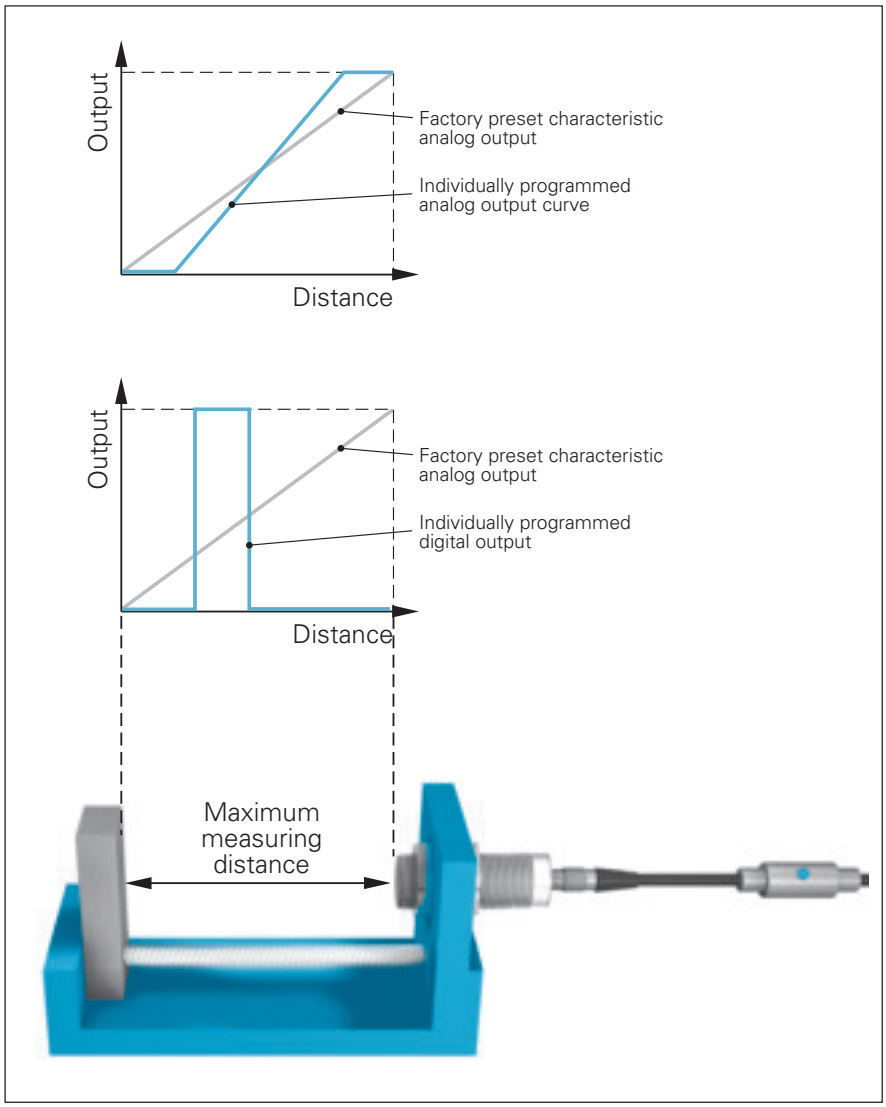
- Analog output (measuring range)
- Digital output (switching window)

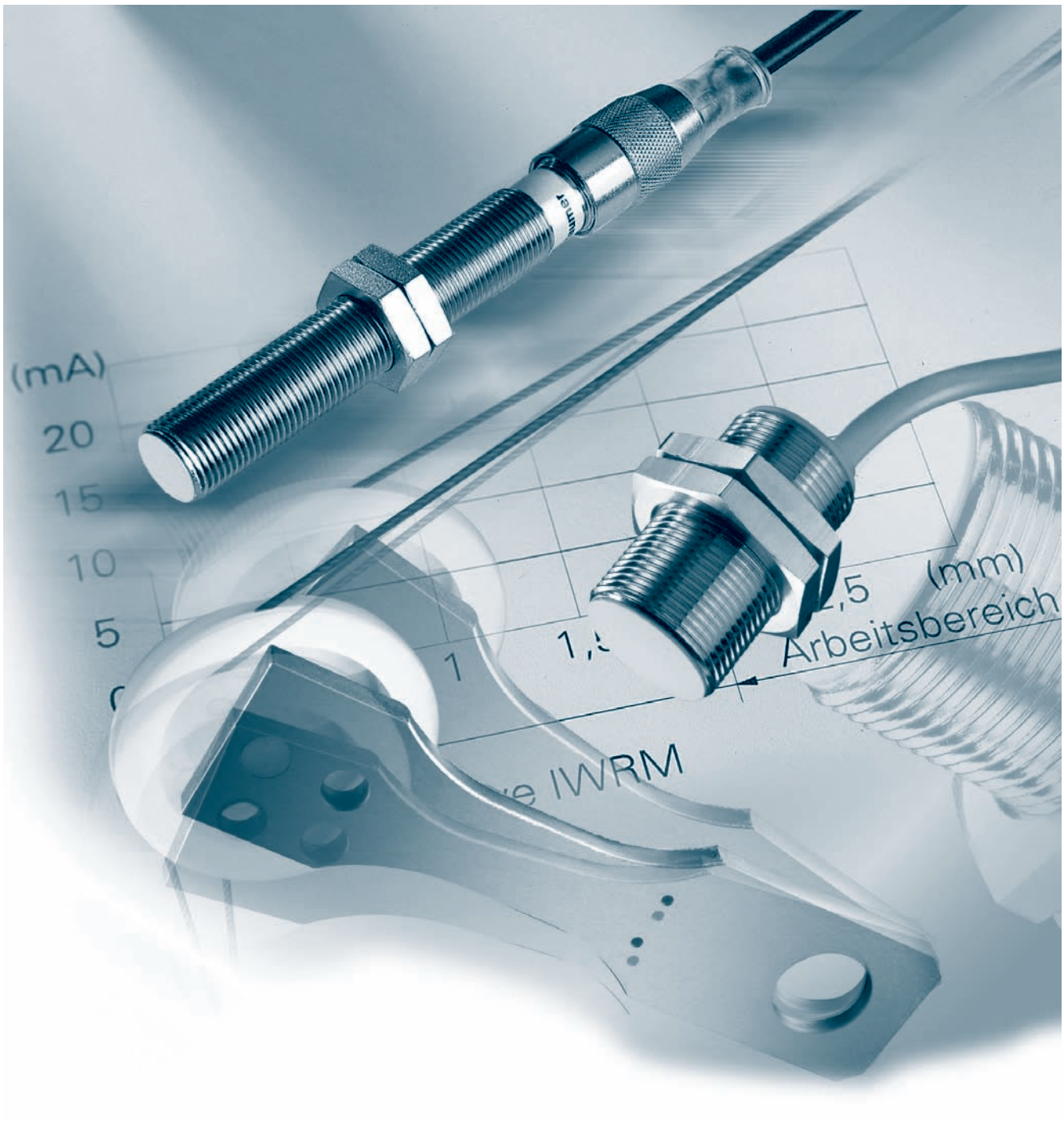
## Procedure

The same Teach-in function menu structure is used for all sensors from Baumer, with the primary emphasis being on the simplest operation possible. This function allows the measuring range to be freely programmed within predefined limits. If, for example, a small measuring range with a large signal amplitude is desired, the range can be limited to merely a few millimeters. If necessary, the direction of the analog output's flow can be inverted, too.

In addition, the points at which one of the digital outputs switches on and off can be specified. These can lie either within or outside the individually programmed measuring range.

## Programmable output curve




(mA)
20
15
10
5
1
(mm)
Arbeitsbereich
IWRM

ANALOG

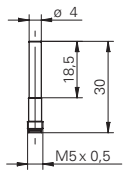
# Sd = 0 ... 1 mm

- Compact housing design
- Very high resolution
- Short response time

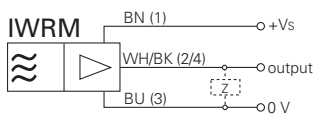
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 1 mm |
| resolution | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) |
| repeatability | < 0,005 mm |
| linearity error | ± 100 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 0,5 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 25 mA |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| housing material | stainless steel |
| dimension | 4 mm |
| housing length | 30 mm |
| connection types | connector M5 |
| **ambient conditions** | |
| operating temperature | 10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 05, ESG 05 |

| order reference |
|---|
| **IWRM 04U9701/S05** |

## dimension drawing




## connection diagram



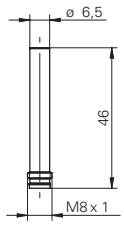
ANALOG

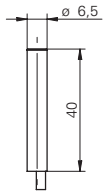
## Sd = 0 ... 2 mm

- Very high resolution
- Short response time

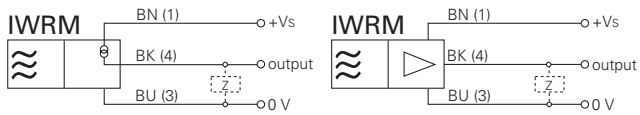
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 2 mm |
| resolution | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) |
| repeatability | < 0,02 mm |
| linearity error | ± 100 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 0,7 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 25 mA |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 mA |
| load resistance +Vs min. | < 910 Ohm |
| load resistance +Vs max. | < 2400 Ohm |
| **mechanical data** | |
| type | cylindrical smooth |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **ambient conditions** | |
| operating temperature | 10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |

**dimension drawings**




**connection diagrams**




| order reference | output circuit | housing length | connection types |
|---|---|---|---|
| **IWRM 06I9501** | current output | 40 mm | cable |
| **IWRM 06I9501/S35** | current output | 46 mm | connector M8 |
| **IWRM 06U9501** | voltage output | 40 mm | cable |
| **IWRM 06U9501/S35** | voltage output | 46 mm | connector M8 |

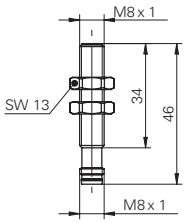
ANALOG

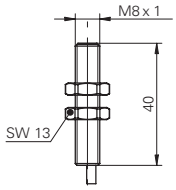
## Sd = 0 ... 2 mm

- Very high resolution
- Short response time

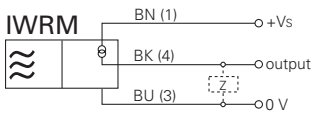
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 2 mm |
| resolution | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) |
| repeatability | < 0,02 mm |
| linearity error | ± 100 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 0,5 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 25 mA |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 mA |
| load resistance +Vs min. | < 910 Ohm |
| load resistance +Vs max. | < 2400 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | stainless steel |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | 10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |

### dimension drawings




### connection diagrams




| order reference | output circuit | housing length | connection types |
|---|---|---|---|
| **IWRM 08I9501** | current output | 40 mm | cable |
| **IWRM 08I9501/S35** | current output | 46 mm | connector M8 |
| **IWRM 08U9501** | voltage output | 40 mm | cable |
| **IWRM 08U9501/S35** | voltage output | 46 mm | connector M8 |

ANALOG

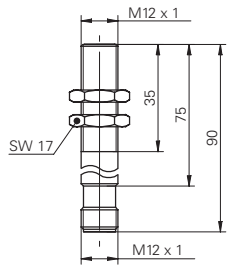
## Sd = 0 ... 2 mm

- Very high resolution
- High repeat accuracy
- Minimized temperature drift

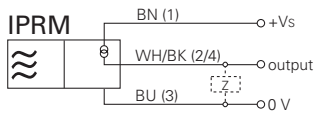
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring speed | < 1 mm / ms |
| measuring distance Sd | 0 ... 2 mm |
| resolution | < 0,0001 mm |
| linearity error | ± 60 µm |
| repeat accuracy S = 0 ... 1 mm | < 1 µm |
| repeat accuracy S = 0 ... 2 mm | < 5 µm |
| temperature drift S = 0 ... 1 mm | ± 10 µm |
| temperature drift S = 1 ... 2 mm | ± 40 µm |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 20 mA |
| output circuit | current output |
| output signal | 0 ... 20 mA |
| load resistance +Vs min. | < 100 Ohm |
| load resistance +Vs max. | < 330 Ohm |
| zero point offset | < 0,3 mA |
| voltage drop Vd | < 7 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| connection types | connector M12 |
| type | cylindrical threaded |
| dimension | 12 mm |
| housing length | 90 mm |
| housing material | steel (9 SMn (Pb) 28/36) |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

| order reference |
|---|
| **IPRM 12I9505/S14** |

**dimension drawing**




**connection diagram**

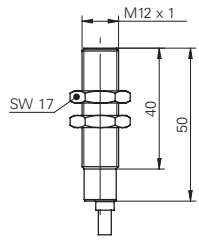


ANALOG

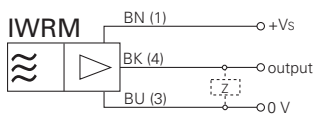
# Sd = 1 ... 2 mm

| general data | |
|---|---|
| mounting type | shielded |
| measuring speed | < 0,5 mm / ms |
| repeatability | < 0,02 mm |
| temperature coefficient | 1 µm / (K mm) |
| **electrical data** | |
| voltage supply range +Vs | 14 ... 30 VDC |
| current consumption max. | 20 mA |
| output circuit | voltage output |
| output signal | 1 ... 9 VDC |
| load resistance | > 1000 Ohm |
| residual output ripple | < 0,5 % Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 50 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |

## dimension drawing




## connection diagram




| order reference | measuring distance Sd | reference distance | linearity error |
|---|---|---|---|
| **IWRM 12U9501** | 1 ... 2 mm | 1,35 ... 1,65 mm | ± 80 µm |
| **IWRM 12U9502** | 1 ... 1,5 mm | 1,15 ... 1,35 mm | ± 60 µm |

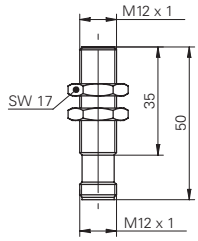
ANALOG

## Sd = 0 ... 4 mm

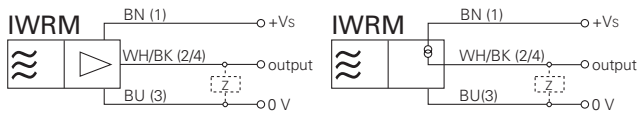
- Large measuring distance
- Very high resolution
- Short response time

| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 4 mm |
| linearity error | ± 160 µm |
| temperature drift | ± 4% (Full Scale) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 330 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 50 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

**dimension drawing**




**connection diagrams**




| order reference | resolution | repeatability | output circuit | response time (factory characteristic) |
|---|---|---|---|---|
| **IWRM 12I9704/S14** | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) | < 0,01 mm | current output | < 2 ms |
| **IWRM 12I9705/S14** | < 0,001 mm (dynam.)<br>< 0,0005 mm (stat.) | < 0,005 mm | current output | < 30 ms |
| **IWRM 12U9704/S14** | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) | < 0,01 mm | voltage output | < 2 ms |
| **IWRM 12U9705/S14** | < 0,0005 mm (stat.)<br>< 0,001 mm (dynam.) | < 0,005 mm | voltage output | < 30 ms |

ANALOG

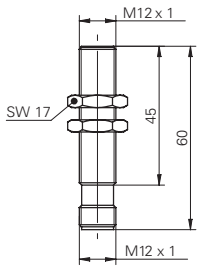
## Sd = 0 ... 4 mm

- External Teach-in
- Integrated Analog- and switching output
- Linear analog output

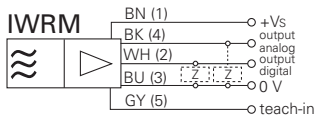
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 4 mm |
| resolution | < 0,005 mm (stat.),<br>< 0,005 mm (dynam.) |
| repeatability | < 0,01 mm |
| adjustment means | external Teach-in |
| linearity error | ± 16 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2,5 ms |
| response time (teach in characteristic) | < 3,1 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| current consumption max. | 20 mA |
| **analog output** | |
| output circuit | voltage output / PNP |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **digital output** | |
| output circuit | PNP normally closed (NO) |
| output current | < 10 mA |
| voltage drop Vd | < 5 VDC |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 60 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| teach-in-adapter | Nr. 141584 |
| connectors | ES 33C, ES 34C |

| order reference |
|---|
| **IWRM 12Z8704/S14C** |

**dimension drawing**




**connection diagram**

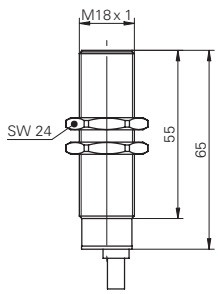


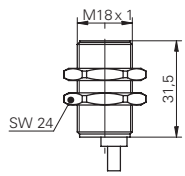
ANALOG

## Sd = 2 ... 5 mm

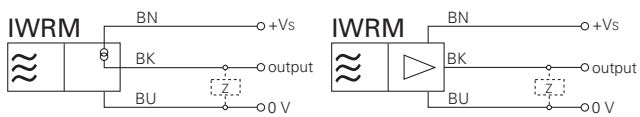
| general data | |
|---|---|
| mounting type | shielded |
| measuring speed | < 1 mm / ms |
| repeatability | < 0,02 mm |
| temperature coefficient | 1 µm / (K mm) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| residual output ripple | < 0,5 % Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 1 ... 9 VDC |
| **current output** | |
| current consumption max. | 35 mA |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 500 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 18 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |

### dimension drawings




### connection diagrams




| order reference | measuring distance Sd | reference distance | output circuit | housing length | linearity error | load resistance |
|---|---|---|---|---|---|---|
| **IWRM 18I9501** | 2 ... 5 mm | 3,25 ... 3,75 mm | current output | 65 mm | ± 100 µm | - |
| **IWRM 18I9502** | 2 ... 4 mm | 2,8 ... 3,2 mm | current output | 65 mm | ± 80 µm | - |
| **IWRM 18I9511** | 2 ... 5 mm | 3,25 ... 3,75 mm | current output | 31,5 mm | ± 100 µm | 500...1000 Ohm |
| **IWRM 18U9501** | 2 ... 5 mm | 3,25 ... 3,75 mm | voltage output | 65 mm | ± 100 µm | > 1000 Ohm |
| **IWRM 18U9502** | 2 ... 4 mm | 2,8 ... 3,2 mm | voltage output | 65 mm | ± 80 µm | > 1000 Ohm |
| **IWRM 18U9511** | 2 ... 5 mm | 3,25 ... 3,75 mm | voltage output | 31,5 mm | ± 100 µm | > 1000 Ohm |
| **IWRM 18U9512** | 2 ... 4 mm | 2,8 ... 3,2 mm | voltage output | 31,5 mm | ± 80 µm | > 1000 Ohm |

ANALOG

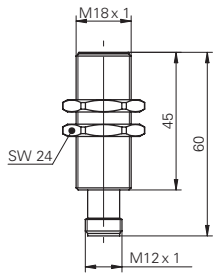
## Sd = 0 ... 8 mm

- Large measuring distance
- Short response time
- Extended immunity against electrical interference

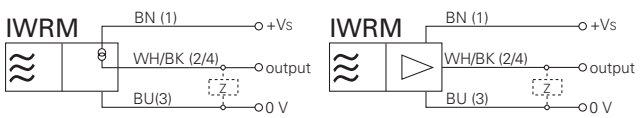
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 8 mm |
| resolution | < 0,005 mm (stat.)<br>< 0,01 mm (dynam.) |
| repeatability | < 0,015 mm |
| linearity error | ± 400 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 40 mA |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 330 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 18 mm |
| housing length | 60 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

| order reference | output circuit |
|---|---|
| **IWRM 18I9704/S14** | current output |
| **IWRM 18U9704/S14** | voltage output |

### dimension drawing




### connection diagrams



ANALOG

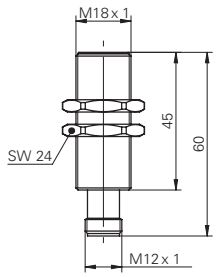
## Sd = 0 ... 8 mm

- External Teach-in
- Integrated Analog- and switching output
- Linear analog output

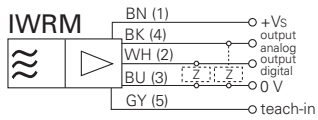
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 8 mm |
| resolution | < 0,010 mm (stat.),<br>< 0,010 mm (dynam.) |
| repeatability | < 0,015 mm |
| adjustment means | external Teach-in |
| linearity error | < 32 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2 ms |
| response time (teach in characteristic) | < 3,1 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| current consumption max. | 20 mA |
| **analog output** | |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **digital output** | |
| output circuit | PNP normally closed (NO) |
| output current | < 10 mA |
| voltage drop Vd | < 5 VDC |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 18 mm |
| housing length | 60 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| teach-in-adapter | Nr. 141584 |
| connectors | ESW 33, ESG 34 |

| order reference |
|---|
| **IWRM 18Z8704/S14C** |

**dimension drawing**




**connection diagram**

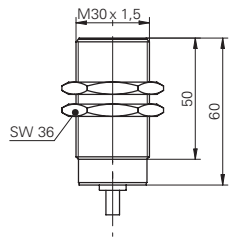


ANALOG

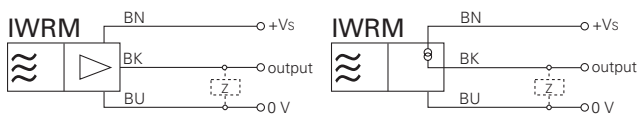
## Sd = 5 ... 10 mm

| general data | |
|---|---|
| mounting type | shielded |
| measuring speed | < 1,5 mm / ms |
| repeatability | < 0,02 mm |
| temperature coefficient | 1 µm / (K mm) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| residual output ripple | < 0,5 % Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 1 ... 9 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 35 mA |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 500 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 30 mm |
| housing length | 60 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |

### dimension drawing




### connection diagrams




| order reference | measuring distance Sd | reference distance | output circuit | linearity error |
|---|---|---|---|---|
| **IWRM 30I9501** | 5 ... 10 mm | 7,1 ... 7,9 mm | current output | ± 200 µm |
| **IWRM 30U9501** | 5 ... 10 mm | 7,1 ... 7,9 mm | voltage output | ± 200 µm |
| **IWRM 30U9502** | 5 ... 9 mm | 6,7 ... 7,3 mm | voltage output | ± 150 µm |

ANALOG

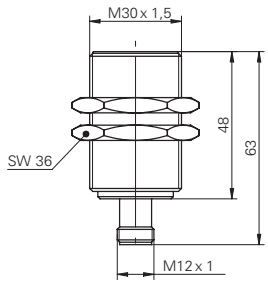
## Sd = 0 ... 16 mm

- Large measuring distance
- Short response time
- Extended immunity against electrical interference

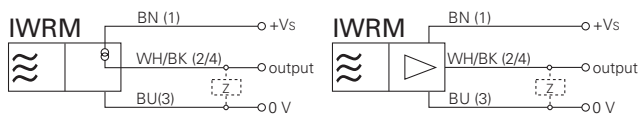
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 16 mm |
| resolution | < 0,005 mm (stat.)<br>< 0,01 mm (dynam.) |
| repeatability | < 0,015 mm |
| linearity error | ± 1600 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 40 mA |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 330 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 30 mm |
| housing length | 63 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

| order reference | output circuit |
|---|---|
| **IWRM 30I9704/S14** | current output |
| **IWRM 30U9704/S14** | voltage output |

**dimension drawing**




**connection diagrams**



ANALOG

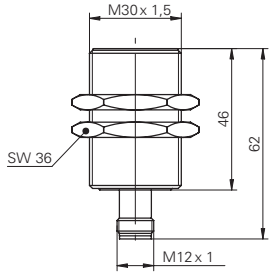
## Sd = 0 ... 16 mm

- External Teach-in
- Integrated Analog- and switching output
- Linear analog output

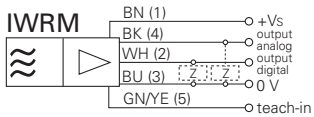
| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 16 mm |
| resolution | < 0,01 mm (stat.)<br>< 0,01 mm (dynam.) |
| repeatability | < 0,015 mm |
| adjustment | external Teach-in |
| linearity error | ± 160 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2,5 ms |
| response time (teach in characteristic) | < 3,1 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| current consumption max. | 20 mA |
| **analog output** | |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **digital output** | |
| output circuit | PNP normally closed (NO) |
| output current | < 10 mA |
| voltage drop Vd | < 5 VDC |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 30 mm |
| housing length | 62 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 33C, ES 34C |
| teach-in-adapter | Nr. 141584 |

| order reference |
|---|
| **IWRM 30Z8704/S14C** |

**dimension drawing**




**connection diagram**



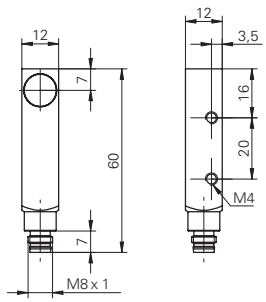
ANALOG

## Sd = 0 ... 4 mm

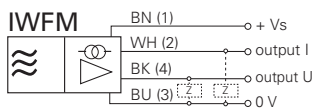
- Very high resolution
- Short response time
- Integrated current- and voltage output

| general data | |
|---|---|
| mounting type | shielded |
| measuring distance Sd | 0 ... 4 mm |
| linearity error | ± 160 µm |
| temperature drift | ± 4% (Full Scale) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 40 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **analog output 1** | |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **analog output 2** | |
| output circuit | current output |
| output signal | 4 ... 20 mA |
| load resistance at +Vs min. | < 300 Ohm |
| load resistance at +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 60 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

**dimension drawing**




**connection diagram**




| order reference | resolution | repeatability | response time (factory characteristic) |
|---|---|---|---|
| **IWFM 12L9504/S35A** | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) | < 0,01 mm | < 2 ms |
| **IWFM 12L9505/S35A** | < 0,0005 mm (stat.)<br>< 0,001 mm (dynam.) | < 0,005 mm | < 30 ms |

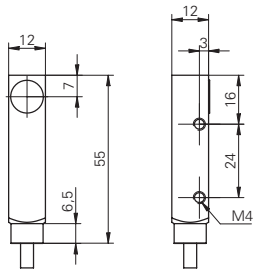
ANALOG

# Sd = 1 ... 2 mm

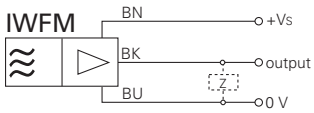
| general data | |
|---|---|
| mounting type | shielded |
| measuring distance Sd | 1 ... 2 mm |
| reference distance | 1,35 ... 1,65 mm |
| measuring speed | < 0,5 mm / ms |
| repeatability | < 0,02 mm |
| linearity error | ± 80 µm |
| temperature coefficient | 1 µm / (K mm) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 20 mA |
| output circuit | voltage output |
| output signal | 1 ... 9 VDC |
| load resistance | > 1000 Ohm |
| residual output ripple | < 0,5 % Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 55 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |

| order reference |
|---|
| **IWFM 12U9501/O1** |

**dimension drawing**




**connection diagram**



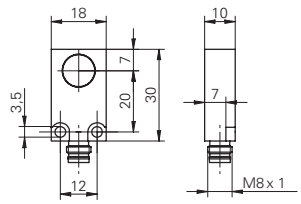
ANALOG

## Sd = 0 ... 4 mm

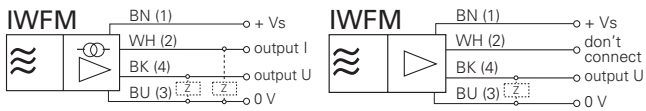
- Very high resolution
- Short response time

| general data | |
|---|---|
| mounting type | shielded |
| measuring distance Sd | 0 ... 4 mm |
| temperature drift | ± 5 % (Full Scale) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **analog output 1** | |
| output circuit | voltage output |
| output signal | 4 ... 20 mA |
| load resistance at +Vs min. | < 330 Ohm |
| load resistance at +Vs max. | < 1000 Ohm |
| **analog output 2** | |
| output circuit | current output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 18 mm |
| housing length | 30 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

**dimension drawing**




**connection diagrams**



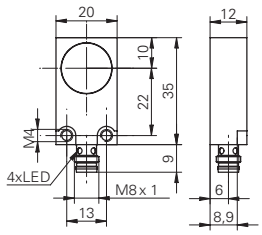

| order reference | resolution | repeatability | output circuit | response time (factory characteristic) | linearity error | current consumption max. |
|---|---|---|---|---|---|---|
| **IWFM 18L9504/S35A** | 0,001 mm (stat.)<br>0,005 mm (dynam.) | < 0,01 mm | voltage - / current output | < 2 ms | ± 160 µm | 40 mA |
| **IWFM 18L9505/S35A** | 0,0005 mm (stat.)<br>0,001 mm (dynam.) | < 0,05 mm | voltage - / current output | < 30 ms | ± 160 µm | 40 mA |
| **IWFM 18U7504/S35A** | 0,005 mm (stat.)<br>0,005 mm (dynam.) | < 0,01 mm | voltage output | < 2,5 ms | ± 16 µm (linear) | 20 mA |

ANALOG

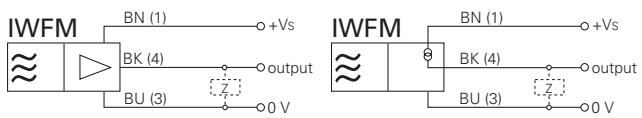
# Sd = 2 ... 5 mm

| general data | |
|---|---|
| mounting type | shielded |
| measuring speed | < 1 mm / ms |
| repeatability | < 0,01 mm |
| temperature coefficient | 1 µm / (K mm) |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| residual output ripple | < 0,5 % Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 20 mA |
| output signal | 1 ... 9 VDC |
| load resistance | > 1000 Ohm |
| **current output** | |
| current consumption max. | 35 mA |
| output signal | 4 ... 20 mA |
| load resistance +Vs min. | < 500 Ohm |
| load resistance +Vs max. | < 1000 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 35 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |

## dimension drawing




## connection diagrams




| order reference | measuring distance Sd | reference distance | output circuit | linearity error |
|---|---|---|---|---|
| **IWFM 20I9501/S35** | 2 ... 5 mm | 3,25 ... 3,75 mm | current output | ± 100 µm |
| **IWFM 20I9503/S35** | 2 ... 3 mm | 2,35 ... 2,65 mm | current output | ± 60 µm |
| **IWFM 20U9501/S35** | 2 ... 5 mm | 3,25 ... 3,75 mm | voltage output | ± 100 µm |
| **IWFM 20U9503/S35** | 2 ... 3 mm | 2,35 ... 2,65 mm | voltage output | ± 60 µm |

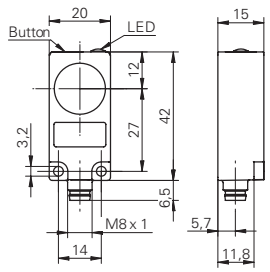
ANALOG

## Sd = 0 ... 10 mm

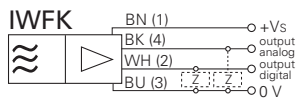
- Internal Teach-In
- Integrated Analog- and switching output
- Linear analog output

| general data | |
|---|---|
| mounting type | quasi shielded |
| measuring distance Sd | 0 ... 10 mm |
| resolution | < 0,01 mm (stat.)<br>< 0,01 mm (dynam.) |
| repeatability | < 0,015 mm |
| adjustment means | Teach-in |
| linearity error | ± 50 µm |
| temperature drift | ± 5% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 2,5 ms |
| response time (teach in characteristic) | < 3,1 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 20 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **analog output** | |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| **digital output** | |
| output circuit | PNP normally closed (NO) |
| output current | < 10 mA |
| voltage drop Vd | < 5 VDC |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| dimension | 20 mm |
| housing length | 42 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

**dimension drawing**




**connection diagram**




| order reference |
|---|
| **IWFK 20Z8704/S35A** |

ANALOG

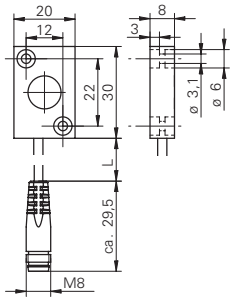
## Sd = 0 ... 2 mm

- Small linearity error
- Very short response time
- Thin housing

| general data | |
|---|---|
| mounting type | shielded |
| measuring distance Sd | 0 ... 2 mm |
| resolution | < 0,001 mm (stat.)<br>< 0,005 mm (dynam.) |
| repeatability | < 0,01 mm |
| linearity error | ± 40 µm |
| temperature drift | ± 2% (Full Scale) |
| **electrical data** | |
| response time (factory characteristic) | < 0,5 ms |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 20 mA |
| output circuit | voltage output |
| output signal | 0 ... 10 VDC |
| load resistance | > 1000 Ohm |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 30 mm |
| connection types | flylead connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +70 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

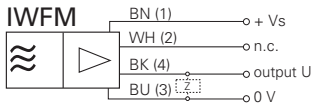
| order reference |
|---|
| **IWFM 20U9509/KS35AP** |

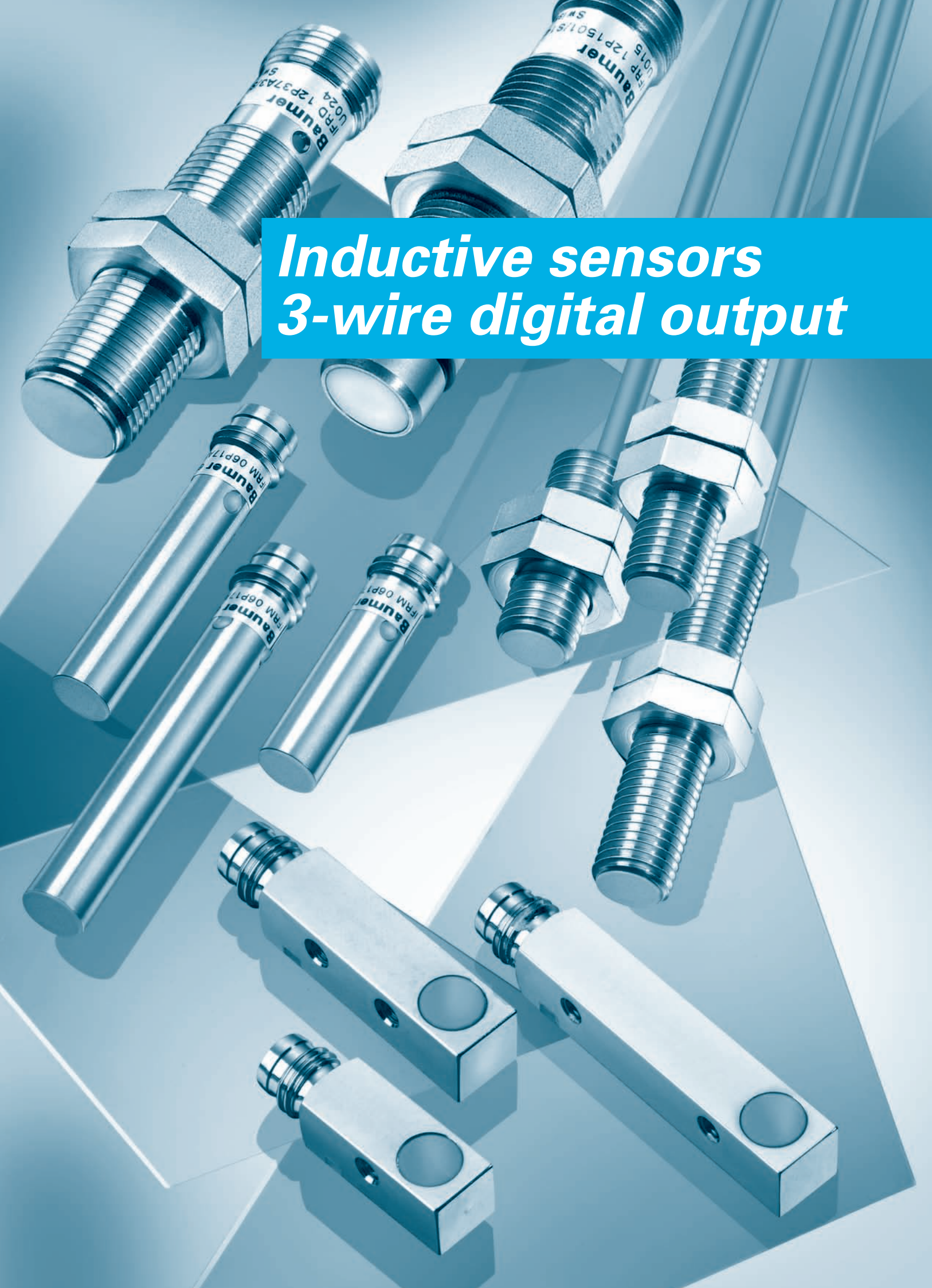
**dimension drawing**




standard cable length 200 mm

**connection diagram**





# Inductive sensors 3-wire digital output

## cylindrical designs

| product family | IFRM 03 | IFRM 03 | IFRM 04 | IFRM 04 | IFRM 04 | IFRM 04 | IFRM 04 |
|---|---|---|---|---|---|---|---|
| | |  | |  | |  | |
| shielded | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| quasi shielded | | | | | | | |
| nominal sensing distance Sn | 0,8 mm | 0,8 mm | 0,8 mm | 1 mm | 1 mm | 1 mm | 1 mm |
| housing length | 12 mm | 16 mm<br>22 mm | 22 mm | 15 mm | 20 mm<br>24 mm | 25 mm | 36 mm<br>45 mm |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | | ■ | ■ | | ■ | ■ | |
| flylead connector M8 | | ■ | ■ | | ■ | ■ | |
| wires | | ■ | | ■ | | | |
| connector M5 | | | | | ■ | | |
| connector M8 | ■ | | | | | | ■ |
| stainless steel | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |

## cylindrical designs

| product family | IFRM 06 | IFRM 08 | IFRM 08 | IFRM 08 | IFRM 08 | IFRM 08 | IFRM 08 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *GammaProx* | | | | | *GammaProx* | *GammaProx* |
| shielded | | ■ | ■ | ■ | ■ | | |
| unshielded | ■ | | | | | | ■ |
| quasi shielded | | | | | | ■ | |
| nominal sensing distance Sn | 6 mm | 2 mm | 2 mm | 2 mm | 2 mm | 3 mm | 6 mm |
| housing length | 40 mm<br>46 mm | 22 mm<br>28 mm | 30 mm<br>36 mm | 40 mm<br>46 mm | 50 mm<br>56 mm | 40 mm<br>46 mm | 40 mm<br>46 mm |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| flylead connector M8 | | ■ | ■ | ■ | ■ | | |
| connector M8 | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector M12 | | | | | | | |
| stainless steel | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| brass nickel plated | | | | | | | |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **80** | **81** | **82** | **83** | **84** | **85** | **86** |

| IFRM 05 | IFRM 05 | IFRM 05 | IFRM 05 | IFRM 06 | IFRM 06 | IFRM 06 | IFRM 06 | IFRM 06 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | *GammaProx* |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| | | | | | | | | ■ |
| 1 mm | 1 mm | 1 mm | 1 mm | 2 mm | 2 mm | 2 mm | 2 mm | 3 mm |
| 15 mm | 20 mm<br>24 mm | 25 mm | 36 mm<br>45 mm | 22 mm<br>28 mm | 30 mm<br>36 mm | 40 mm<br>46 mm | 50 mm<br>56 mm | 40 mm<br>46 mm |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | | ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | | ■ | ■ | ■ | ■ | |
| ■ | | | | | | | | |
| | ■ | | | | | | | |
| | | | ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | | | | |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** |

| IFRM 08 | IFRM 12 | IFRM 12 | IFRM 12 | IFRM 12 | IFRM 12 | IFRM 12 | IFRM 12 | IFRM 12 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | *GammaProx* | *GammaProx* | *GammaProx* | *GammaProx* | |
| ■ | ■ | ■ | ■ | | | | | ■ |
| | | | | | | ■ | ■ | |
| | | | | ■ | ■ | | | |
| 2 mm | 4 mm | 4 mm | 4 mm | 6 mm | 6 mm | 10 mm | 10 mm | 4 mm |
| 50 mm | 30,4 mm<br>40,4 mm | 40 mm<br>50 mm | 50 mm<br>60 mm | 40 mm<br>50 mm | 50 mm<br>60 mm | 40 mm<br>50 mm | 50 mm<br>60 mm | 50 mm |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| | | | | | | | | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| ■ | | | | | | | | |
| | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **87** | **88** | **89** | **90** | **91** | **92** | **93** | **94** | **95** |

## cylindrical designs

| product family | IFRK 12 | IFRM 18 | IFRM 18 | IFRM 18 | IFRM 18 | IFRM 18 | IFRM 18 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| shielded | | | | | | | |
| unshielded | ■ | | | | | | ■ |
| quasi shielded | | ■ | ■ | ■ | ■ | ■ | |
| nominal sensing distance Sn | 4 mm | 8 mm | 8 mm | 8 mm | 8 mm | 8 mm | 12 mm |
| housing length | 40 mm | 34,5 mm<br>45 mm | 49,5 mm<br>60 mm | 32 mm<br>45 mm | 50 mm<br>60 mm | 65 mm<br>78 mm | 39 mm<br>52,5 mm |
| NPN | ■ | ■ | ■ | ■ | ■ | | |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector M8 | | | | | | | |
| connector M12 | | ■ | ■ | ■ | ■ | ■ | ■ |
| brass nickel plated | | | | ■ | ■ | ■ | ■ |
| brass nickel plated / PC | | ■ | ■ | | | | |
| PBT | ■ | | | | | | |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | | | |
| **Page** | **96** | **97** | **98** | **99** | **100** | **101** | **102** |

## rectangular designs

| product family | IFFM 04 | IFFM 06 | IFFM 06 | IFFM 08 | IFFM 08 | IFFM 08 | IFFM 08 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| shielded | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| nominal sensing distance Sn | 0,8 mm | 1 mm | 1 mm | 2 mm | 2 mm | 2 mm | 2 mm |
| housing length | 22 mm | 20 mm<br>24 mm | 30 mm | 20 mm<br>27 mm | 28,5 mm<br>35,5 mm | 38,5 mm<br>45,5 mm | 16 mm |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| flylead connector M8 | | | | | | | ■ |
| connector M5 | | ■ | | | | | |
| connector M8 | | | | ■ | ■ | ■ | |
| stainless steel | ■ | | | | | | |
| brass nickel plated | | ■ | ■ | ■ | ■ | ■ | |
| PBT | | | | | | | |
| die-cast zinc nickel plated | | | | | | | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | | | |
| **Page** | **108** | **109** | **110** | **111** | **112** | **113** | **114** |

| IFRM 18 | IFRK 18 | IFRK 30 | IFRM 30 | IFRM 30 |
|---|---|---|---|---|
| | | | | |
| | | | ■ | |
| | ■ | ■ | | ■ |
| ■ | | | | |
| 8 mm | 8 mm | 15 mm | 10 mm | 15 mm |
| 50 mm | 80 mm | 80 mm | 60 mm<br>65 mm | 69,5 mm<br>74,4 mm |
| ■ | | | | |
| ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | ■ | ■ |
| ■ | | | | |
| | | | ■ | ■ |
| ■ | | | ■ | ■ |
| | | | | |
| | ■ | ■ | | |
| IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | |
| **103** | **104** | **105** | **106** | **107** |

| IFFK 08 | IFFM 08 | IFFM 12 | IFFM 20 | IFFM 20 |
|---|---|---|---|---|
| | | | | |
| ■ | ■ | ■ | ■ | ■ |
| 2 mm | 2 mm | 4 mm | 5 mm | 8 mm |
| 34 mm<br>42 mm | 24 mm<br>34 mm | 23,5 mm | 32 mm | 32 mm |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| ■ | | | | |
| | | | | |
| | ■ | ■ | | |
| ■ | | | ■ | ■ |
| | ■ | ■ | ■ | ■ |
| ■ | | | | |
| | | | | |
| IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | |
| **115** | **116** | **117** | **118** | **119** |

| product family | IFRD 06 | IFRD 08 | IFRD 12 | IFRD 18 | IFRW 12 / IFRW 18 | IFRP 12 | IFRP 16 / IFRP 18 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *DuroProx* | *DuroProx* | *DuroProx* | *DuroProx* | | | |
| full metal housing (*DuroProx*) | ■ | ■ | ■ | ■ | | | |
| high pressure | | | | | | ■ | ■ |
| welding and magnetic noise | | | | | ■ | | |
| shielded | | | | | ■ | ■ | ■ |
| quasi shielded | ■ | ■ | ■ | ■ | | | |
| nominal sensing distance Sn | 2 mm | 2 mm | 4 mm | 6 mm | 2 mm<br>5 mm | 2 mm | 2 mm |
| housing length | 46 mm | 46 mm | 50 mm | 60 mm | 50 mm<br>60 mm | 50 mm<br>70 mm | 60 mm |
| NPN | ■ | ■ | ■ | ■ | | | |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector M8 | ■ | ■ | | | | | |
| connector M12 | | | ■ | ■ | ■ | ■ | ■ |
| brass chromium plated | | | | | ■ | | |
| stainless steel | | | | | | ■ | ■ |
| stainless steel 1.4404 (A4) | ■ | ■ | ■ | ■ | | | |
| IP 67 | | | | | ■ | | |
| IP 68/67 (sensing face/sensor) | ■ | ■ | ■ | ■ | | ■ | ■ |
| IP 69 K (sensing face/sensor) | ■ | ■ | ■ | ■ | | | |
| | | | | | | | |
| **Page** | **120** | **121** | **122** | **123** | **124** | **125** | **126** |

| product family | IFRM 08 / IFRM 12 | IFRH 12 / IFRH 18 |
|---|---|---|
| | | |
| high temperature | ■ | ■ |
| shielded | ■ | ■ |
| nominal sensing distance Sn | 2 mm<br>4 mm | 2 mm<br>5 mm |
| housing length | 30 mm<br>40 mm | 30 mm<br>71 mm |
| NPN | ■ | |
| PNP | ■ | ■ |
| cable | ■ | ■ |
| stainless steel | ■ | ■ |
| brass nickel plated | ■ | ■ |
| IP 67 | ■ | ■ |
| | | |
| **Page** | **127** | **128** |

# Inductive 3-wire sensors in harsh industrial applications

3 WIRE

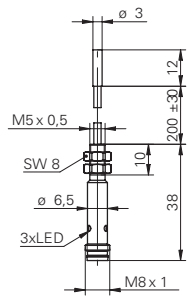
## Sn = 0,8 mm

- Sensing probe 12 mm long
- Remote cable amplifier
- M8 x 1 quick disconnect

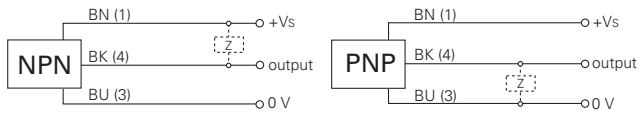
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 0,8 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | 3 port LED red |
| **electrical data** | |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | Acrylate mod. PUR |
| housing material | stainless steel |
| dimension | 3 mm |
| housing length | 12 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 137021 |
| connectors | ESG 32S, ESW 31S |

| order reference | output circuit |
|---|---|
| **IFRM 03N1505/CS35L** | NPN make function (NO) |
| **IFRM 03N3505/CS35L** | NPN break function (NC) |
| **IFRM 03P1505/CS35L** | PNP make function (NO) |
| **IFRM 03P3505/CS35L** | PNP break function (NC) |

### dimension drawing




### connection diagrams



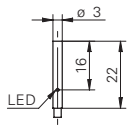
3 WIRE

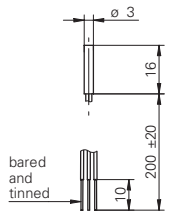
# Sn = 0,8 mm

- Smallest sensor housing size
- Fully contained electronics
- 16 mm long version with individual strands

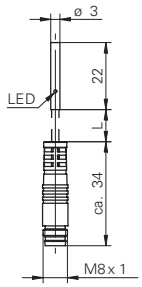
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 0,8 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | Acrylate mod. PUR |
| housing material | stainless steel |
| dimension | 3 mm |
| **cable** | |
| housing length | 22 mm |
| **flylead connector M8** | |
| housing length | 22 mm |
| **wires** | |
| housing length | 16 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 137021 |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

## dimension drawings



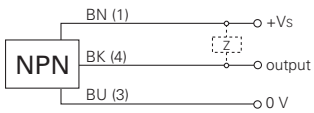



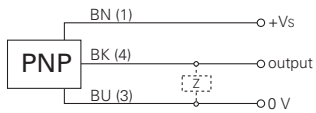

## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 03N1501/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 03N1501/L** | cable | NPN make function (NO) | LED red |
| **IFRM 03N1503/Q** | wires | NPN make function (NO) | - |
| **IFRM 03N3501/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 03N3501/L** | cable | NPN break function (NC) | LED red |
| **IFRM 03N3503/Q** | wires | NPN break function (NC) | - |
| **IFRM 03P1501/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 03P1501/L** | cable | PNP make function (NO) | LED red |
| **IFRM 03P1503/Q** | wires | PNP make function (NO) | - |
| **IFRM 03P3501/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 03P3501/L** | cable | PNP break function (NC) | LED red |
| **IFRM 03P3503/Q** | wires | PNP break function (NC) | - |

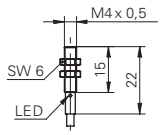
# Sn = 0,8 mm

3 WIRE

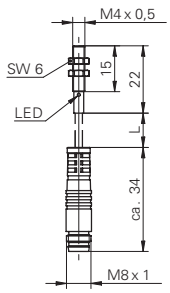
- Smallest diameter threaded housing sensor M4 x 0,5

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 0,8 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | Acrylate mod. PUR |
| housing material | stainless steel |
| dimension | 4 mm |
| housing length | 22 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

## dimension drawing

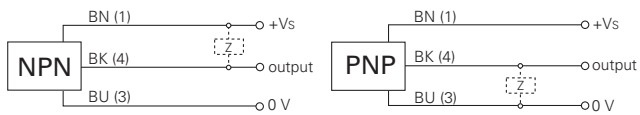



## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit |
|---|---|---|
| **IFRM 04N15B1/KS35PL** | flylead connector M8 | NPN make function (NO) |
| **IFRM 04N15B1/L** | cable | NPN make function (NO) |
| **IFRM 04N35B1/KS35PL** | flylead connector M8 | NPN break function (NC) |
| **IFRM 04N35B1/L** | cable | NPN break function (NC) |
| **IFRM 04P15B1/KS35PL** | flylead connector M8 | PNP make function (NO) |
| **IFRM 04P15B1/L** | cable | PNP make function (NO) |
| **IFRM 04P35B1/KS35PL** | flylead connector M8 | PNP break function (NC) |
| **IFRM 04P35B1/L** | cable | PNP break function (NC) |

3 WIRE

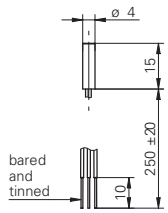
# Sn = 1 mm

- Fully contained electronics
- 3 individual strands
- 15 mm housing length

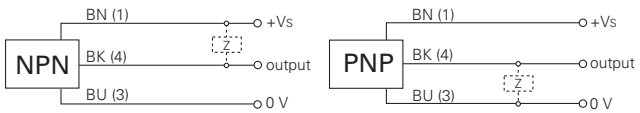
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 4 mm |
| housing length | 15 mm |
| connection types | wires |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 119345 |

| order reference | output circuit |
|---|---|
| **IFRM 04N15A5/Q** | NPN make function (NO) |
| **IFRM 04N35A5/Q** | NPN break function (NC) |
| **IFRM 04P15A5/Q** | PNP make function (NO) |
| **IFRM 04P35A5/Q** | PNP break function (NC) |

## dimension drawing




## connection diagrams



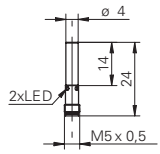
## Sn = 1 mm

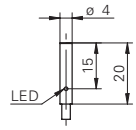
3 WIRE

- Fully contained electronics
- Miniature connector M5 x 0,5
- Integrated LED-status display

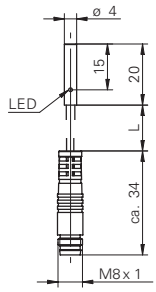
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 4 mm |
| **cable** | |
| housing length | 20 mm |
| **flylead connector M8** | |
| housing length | 20 mm |
| **connector M5** | |
| housing length | 24 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 119345 |
| **connector M5** | |
| connectors | ESG 05, ESW 05 |
| **flylead connector M8** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

### dimension drawings



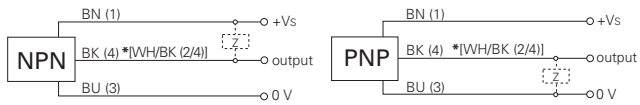




### flylead connector version




standard cable length 200 mm

### connection diagrams




* .../S05L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 04N15A3/KS35PL** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 04N15A3/L** | cable | NPN make function (NO) | LED red |
| **IFRM 04N15A3/S05L** | connector M5 | NPN make function (NO) | 2 port LED red |
| **IFRM 04N35A3/KS35PL** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 04N35A3/L** | cable | NPN break function (NC) | LED red |
| **IFRM 04N35A3/S05L** | connector M5 | NPN break function (NC) | 2 port LED red |
| **IFRM 04P15A3/KS35PL** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 04P15A3/L** | cable | PNP make function (NO) | LED red |
| **IFRM 04P15A3/S05L** | connector M5 | PNP make function (NO) | 2 port LED red |
| **IFRM 04P35A3/KS35PL** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 04P35A3/L** | cable | PNP break function (NC) | LED red |
| **IFRM 04P35A3/S05L** | connector M5 | PNP break function (NC) | 2 port LED red |

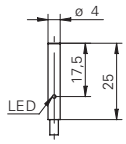
3 WIRE

# Sn = 1 mm

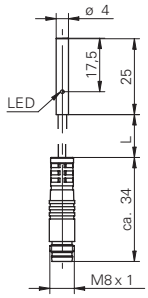
- Fully contained electronics
- Standard cable version
- Integrated LED-status display

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 4 mm |
| housing length | 25 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 119345 |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

## dimension drawing

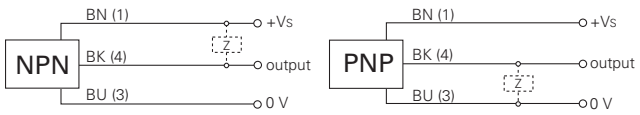



## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit |
|---|---|---|
| **IFRM 04N15A1/KS35PL** | flylead connector M8 | NPN make function (NO) |
| **IFRM 04N15A1/L** | cable | NPN make function (NO) |
| **IFRM 04N35A1/KS35PL** | flylead connector M8 | NPN break function (NC) |
| **IFRM 04N35A1/L** | cable | NPN break function (NC) |
| **IFRM 04P15A1/KS35PL** | flylead connector M8 | PNP make function (NO) |
| **IFRM 04P15A1/L** | cable | PNP make function (NO) |
| **IFRM 04P35A1/KS35PL** | flylead connector M8 | PNP break function (NC) |
| **IFRM 04P35A1/L** | cable | PNP break function (NC) |

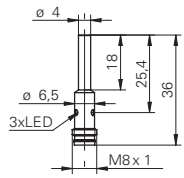
3 WIRE

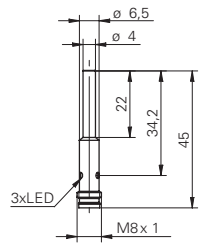
## Sn = 1 mm

- Robust metal housing
- M8 x 1 quick disconnect
- 3 port LED

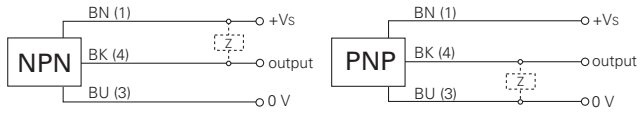
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | 3 port LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 4 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 119345 |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | output circuit | housing length |
|---|---|---|
| **IFRM 04N15A3/S35L** | NPN make function (NO) | 36 mm |
| **IFRM 04N35A3/S35L** | NPN break function (NC) | 36 mm |
| **IFRM 04P15A1/S35L** | PNP make function (NO) | 45 mm |
| **IFRM 04P15A3/S35L** | PNP make function (NO) | 36 mm |
| **IFRM 04P35A1/S35L** | PNP break function (NC) | 45 mm |
| **IFRM 04P35A3/S35L** | PNP break function (NC) | 36 mm |

# Sn = 1 mm

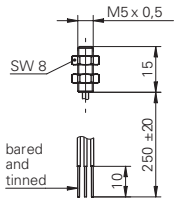
3 WIRE

- Fully contained electronics
- 3 individual strands
- 15 mm housing length

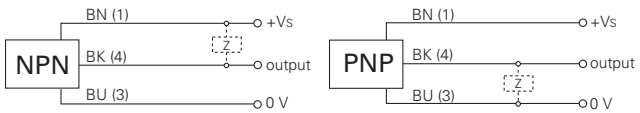
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 5 mm |
| housing length | 15 mm |
| connection types | wires |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **IFRM 05N15A5/Q** | NPN make function (NO) |
| **IFRM 05N35A5/Q** | NPN break function (NC) |
| **IFRM 05P15A5/Q** | PNP make function (NO) |
| **IFRM 05P35A5/Q** | PNP break function (NC) |

## dimension drawing




## connection diagrams



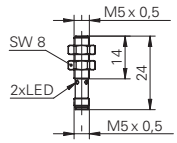
3 WIRE

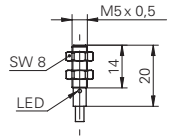
# Sn = 1 mm

- Fully contained electronics
- Miniature connector M5 x 0,5
- Integrated LED-status display

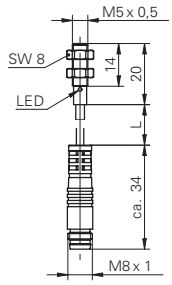
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 5 mm |
| **cable** | |
| housing length | 20 mm |
| **flylead connector M8** | |
| housing length | 20 mm |
| **connector M5** | |
| housing length | 24 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| **connector M5** | |
| connectors | ESG 05, ESW 05 |
| **flylead connector M8** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

## dimension drawings



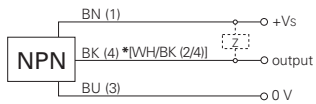




## flylead connector version




standard cable length 200 mm

## connection diagrams



* .../S05L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 05N15A3/KS35PL** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 05N15A3/L** | cable | NPN make function (NO) | LED red |
| **IFRM 05N15A3/S05L** | connector M5 | NPN make function (NO) | 2 port LED red |
| **IFRM 05N35A3/KS35PL** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 05N35A3/L** | cable | NPN break function (NC) | LED red |
| **IFRM 05N35A3/S05L** | connector M5 | NPN break function (NC) | 2 port LED red |
| **IFRM 05P15A3/KS35PL** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 05P15A3/L** | cable | PNP make function (NO) | LED red |
| **IFRM 05P15A3/S05L** | connector M5 | PNP make function (NO) | 2 port LED red |
| **IFRM 05P35A3/KS35PL** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 05P35A3/L** | cable | PNP break function (NC) | LED red |
| **IFRM 05P35A3/S05L** | connector M5 | PNP break function (NC) | 2 port LED red |

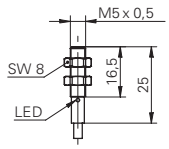
## Sn = 1 mm

3 WIRE

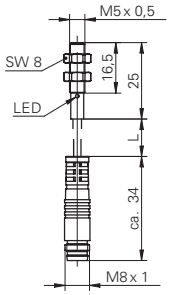
- Fully contained electronics
- Standard cable version
- Integrated LED-status display

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 5 mm |
| housing length | 25 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| PUR cable | |

### dimension drawing

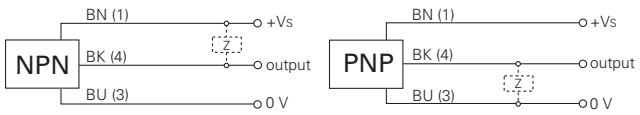



### flylead connector version




standard cable length 200 mm

### connection diagrams




| order reference | connection types | output circuit |
|---|---|---|
| **IFRM 05N15A1/KS35PL** | flylead connector M8 | NPN make function (NO) |
| **IFRM 05N15A1/L** | cable | NPN make function (NO) |
| **IFRM 05N35A1/KS35PL** | flylead connector M8 | NPN break function (NC) |
| **IFRM 05N35A1/L** | cable | NPN break function (NC) |
| **IFRM 05P15A1/KS35PL** | flylead connector M8 | PNP make function (NO) |
| **IFRM 05P15A1/L** | cable | PNP make function (NO) |
| **IFRM 05P35A1/KS35PL** | flylead connector M8 | PNP break function (NC) |
| **IFRM 05P35A1/L** | cable | PNP break function (NC) |

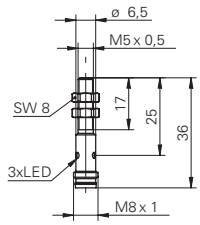
3 WIRE

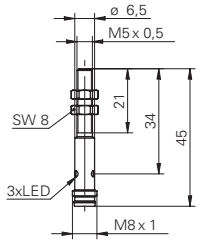
## Sn = 1 mm

- Robust metal housing
- M8 x 1 quick disconnect
- 3 port LED

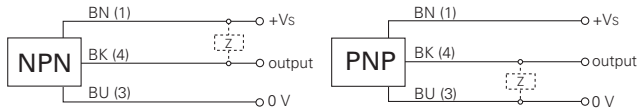
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | 3 port LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | LCP |
| housing material | stainless steel |
| dimension | 5 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | output circuit | housing length |
|---|---|---|
| **IFRM 05N15A3/S35L** | NPN make function (NO) | 36 mm |
| **IFRM 05N35A3/S35L** | NPN break function (NC) | 36 mm |
| **IFRM 05P15A1/S35L** | PNP make function (NO) | 45 mm |
| **IFRM 05P15A3/S35L** | PNP make function (NO) | 36 mm |
| **IFRM 05P35A1/S35L** | PNP break function (NC) | 45 mm |
| **IFRM 05P35A3/S35L** | PNP break function (NC) | 36 mm |

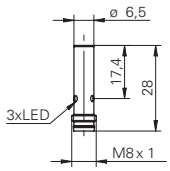
3 WIRE

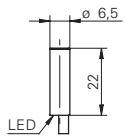
# Sn = 2 mm

- Robust metal housing
- Shortest version with M8 x 1 connector
- High switching frequency

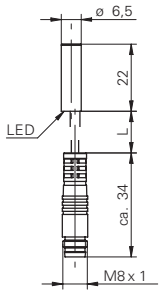
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 22 mm |
| **flylead connector M8** | |
| housing length | 22 mm |
| **connector M8** | |
| housing length | 28 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |

## dimension drawings



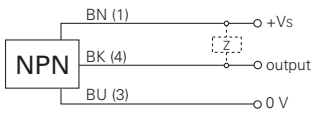



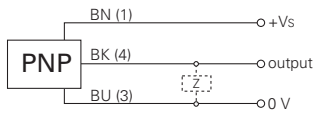

## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N1713/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 06N1713/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N17A5/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N3713/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 06N3713/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N37A5/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P1713/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 06P1713/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P17A5/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P3713/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 06P3713/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P37A5/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

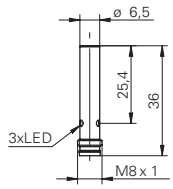
3 WIRE

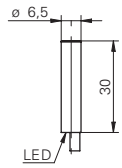
# Sn = 2 mm

- Robust metal housing
- High switching frequency
- Mounting with special support

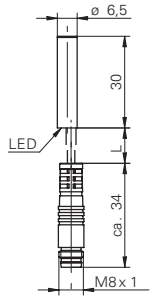
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 30 mm |
| **flylead connector M8** | |
| housing length | 30 mm |
| **connector M8** | |
| housing length | 36 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |

## dimension drawings



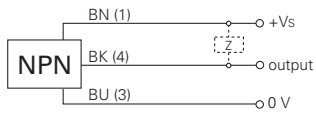



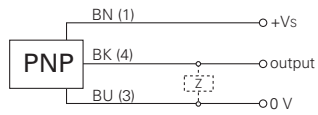

## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N1701/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 06N1701/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N17A3/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N3701/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 06N3701/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N37A3/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P1701/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 06P1701/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P17A3/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P3701/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 06P3701/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P37A3/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

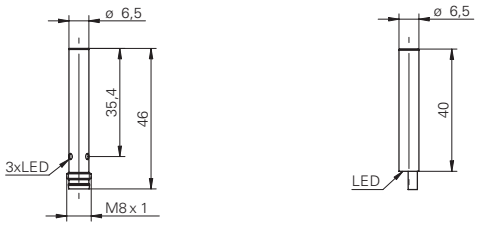
3 WIRE

# Sn = 2 mm

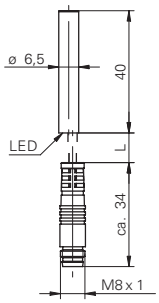
- Robust metal housing
- High switching frequency
- Mounting with special support

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 40 mm |
| **flylead connector M8** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |

## dimension drawings

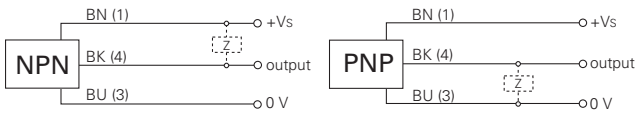



## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N17A1/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 06N17A1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N17A1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N37A1/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 06N37A1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N37A1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P17A1/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 06P17A1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P17A1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P37A1/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 06P37A1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P37A1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

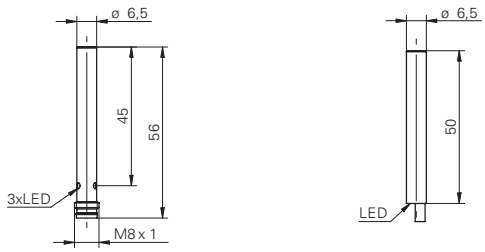
3 WIRE

## Sn = 2 mm

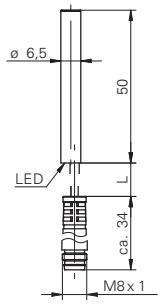
- Long, robust steel housings
- Cable and connector versions
- Mounting with special support

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 50 mm |
| **flylead connector M8** | |
| housing length | 50 mm |
| **connector M8** | |
| housing length | 56 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |

### dimension drawings

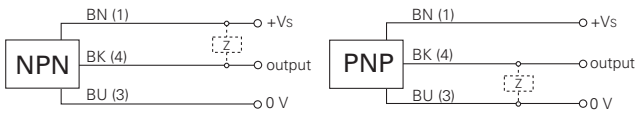



### flylead connector version




standard cable length 200 mm

### connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N17A4/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 06N17A4/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N17A4/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N37A4/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 06N37A4/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N37A4/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P17A4/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 06P17A4/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P17A4/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P37A4/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 06P37A4/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P37A4/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

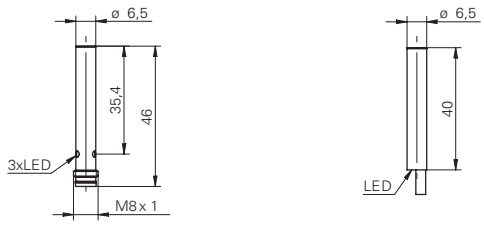
3 WIRE

## Sn = 3 mm

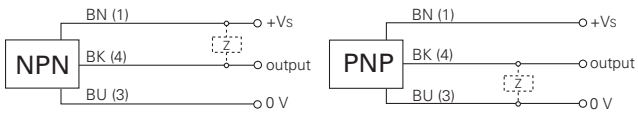
- Version with extended Sn *GammaProx*
- Quasi shielded mounting
- Robust metal housing

| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 3 mm |
| **electrical data** | |
| switching frequency | < 1 kHz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N17G1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N17G1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N37G1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N37G1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P17G1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P17G1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P37G1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P37G1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

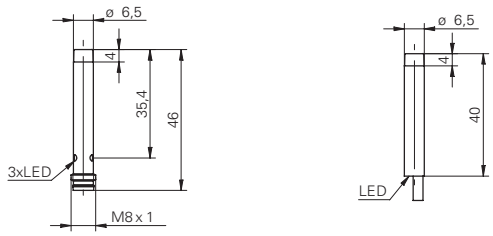
3 WIRE

## Sn = 6 mm

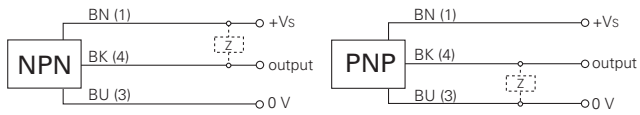
- Version with extended Sn *GammaProx*
- Non shielded mounting
- Robust metal housing

| general data | |
|---|---|
| mounting type | unshielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 6 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 6,5 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| support | Nr. 109474 |
| clamping nut | Nr. 117742 |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 06N13G1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 06N13G1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 06N33G1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 06N33G1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 06P13G1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 06P13G1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 06P33G1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 06P33G1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

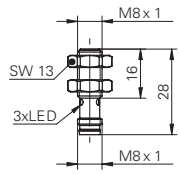
3 WIRE

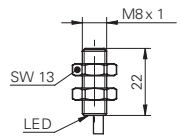
## Sn = 2 mm

- Shortest version with M8 x 1 connector
- High switching frequency
- Robust metal housing

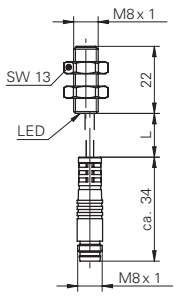
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 22 mm |
| **flylead connector M8** | |
| housing length | 22 mm |
| **connector M8** | |
| housing length | 28 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

### dimension drawings



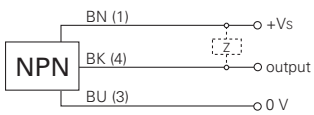



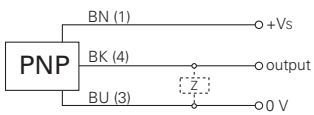

### flylead connector version




standard cable length 200 mm

### connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 08N1713/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 08N1713/L** | cable | NPN make function (NO) | LED red |
| **IFRM 08N17A5/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 08N3713/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 08N3713/L** | cable | NPN break function (NC) | LED red |
| **IFRM 08N37A5/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 08P1713/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 08P1713/L** | cable | PNP make function (NO) | LED red |
| **IFRM 08P17A5/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 08P3713/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 08P3713/L** | cable | PNP break function (NC) | LED red |
| **IFRM 08P37A5/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

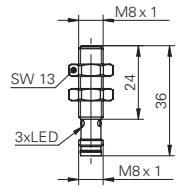
3 WIRE

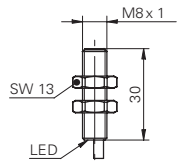
# Sn = 2 mm

- Robust metal housing
- High switching frequency

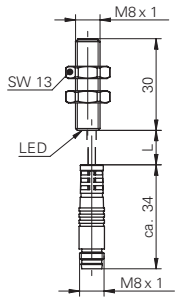
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 30 mm |
| **flylead connector M8** | |
| housing length | 30 mm |
| **connector M8** | |
| housing length | 36 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

## dimension drawings



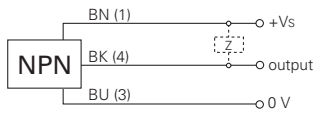



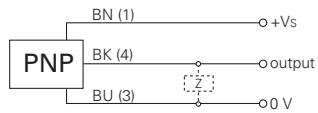

## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 08N1701/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 08N1701/L** | cable | NPN make function (NO) | LED red |
| **IFRM 08N17A3/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 08N3701/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 08N3701/L** | cable | NPN break function (NC) | LED red |
| **IFRM 08N37A3/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 08P1701/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 08P1701/L** | cable | PNP make function (NO) | LED red |
| **IFRM 08P17A3/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 08P3701/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 08P3701/L** | cable | PNP break function (NC) | LED red |
| **IFRM 08P37A3/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

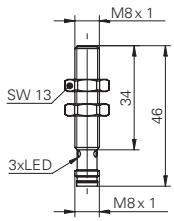
3 WIRE

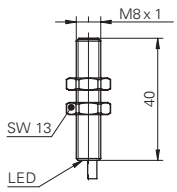
## Sn = 2 mm

- Robust metal housing
- High switching frequency

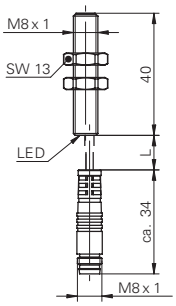
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 40 mm |
| **flylead connector M8** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

### dimension drawings



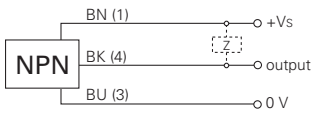



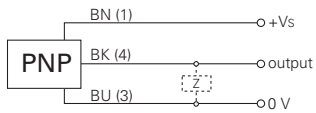

### flylead connector version




standard cable length 200 mm

### connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 08N17A1/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 08N17A1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 08N17A1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 08N37A1/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 08N37A1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 08N37A1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 08P17A1/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 08P17A1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 08P17A1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 08P37A1/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 08P37A1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 08P37A1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

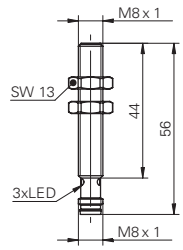
3 WIRE

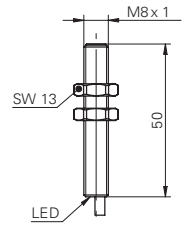
## Sn = 2 mm

- Robust metal housing
- High switching frequency

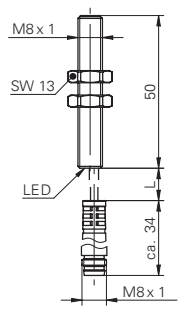
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 50 mm |
| **flylead connector M8** | |
| housing length | 50 mm |
| **connector M8** | |
| housing length | 56 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

### dimension drawings



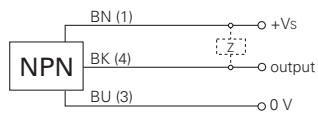



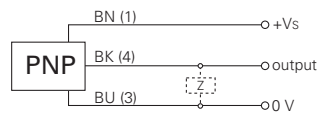

### flylead connector version




standard cable length 200 mm

### connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 08N17A4/KS35L** | flylead connector M8 | NPN make function (NO) | LED red |
| **IFRM 08N17A4/L** | cable | NPN make function (NO) | LED red |
| **IFRM 08N17A4/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 08N37A4/KS35L** | flylead connector M8 | NPN break function (NC) | LED red |
| **IFRM 08N37A4/L** | cable | NPN break function (NC) | LED red |
| **IFRM 08N37A4/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 08P17A4/KS35L** | flylead connector M8 | PNP make function (NO) | LED red |
| **IFRM 08P17A4/L** | cable | PNP make function (NO) | LED red |
| **IFRM 08P17A4/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 08P37A4/KS35L** | flylead connector M8 | PNP break function (NC) | LED red |
| **IFRM 08P37A4/L** | cable | PNP break function (NC) | LED red |
| **IFRM 08P37A4/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

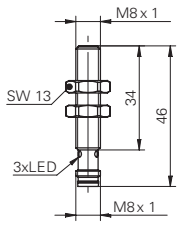
3 WIRE

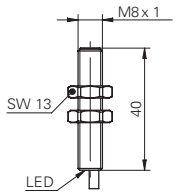
## Sn = 3 mm

- Version with extended Sn *GammaProx*
- Quasi shielded mounting
- Robust metal housing

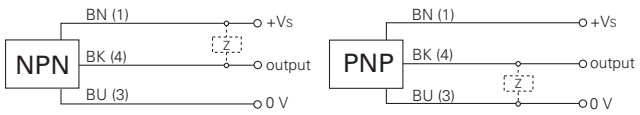
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 3 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 1 kHz |
| voltage supply range +Vs | 12 ... 30 VDC |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator | current consumption max. |
|---|---|---|---|---|
| **IFRM 08N17G1/L** | cable | NPN make function (NO) | LED red | 12 mA |
| **IFRM 08N17G1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red | 18 mA |
| **IFRM 08N37G1/L** | cable | NPN break function (NC) | LED red | 12 mA |
| **IFRM 08N37G1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red | 18 mA |
| **IFRM 08P17G1/L** | cable | PNP make function (NO) | LED red | 12 mA |
| **IFRM 08P17G1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red | 18 mA |
| **IFRM 08P37G1/L** | cable | PNP break function (NC) | LED red | 12 mA |
| **IFRM 08P37G1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red | 18 mA |

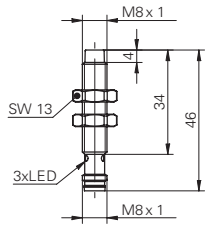
3 WIRE

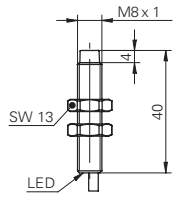
## Sn = 6 mm

- Version with extended Sn *GammaProx*
- Non shielded mounting
- Robust metal housing

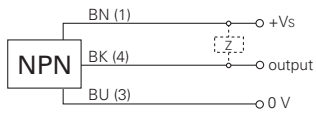
| general data | |
|---|---|
| mounting type | unshielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 6 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M8** | |
| housing length | 46 mm |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

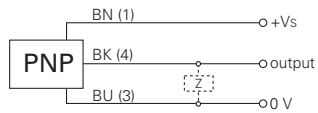
**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 08N13G1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 08N13G1/S35L** | connector M8 | NPN make function (NO) | 3 port LED red |
| **IFRM 08N33G1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 08N33G1/S35L** | connector M8 | NPN break function (NC) | 3 port LED red |
| **IFRM 08P13G1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 08P13G1/S35L** | connector M8 | PNP make function (NO) | 3 port LED red |
| **IFRM 08P33G1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 08P33G1/S35L** | connector M8 | PNP break function (NC) | 3 port LED red |

3 WIRE

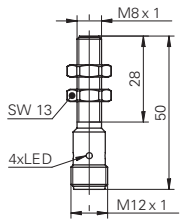
# Sn = 2 mm

- Robust metal housing
- High switching frequency
- M12 x 1 quick disconnect

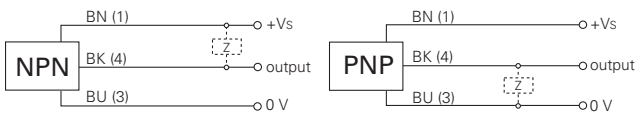
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | 4 port LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | stainless steel |
| dimension | 8 mm |
| housing length | 50 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

| order reference | output circuit |
|---|---|
| **IFRM 08N1703/S14L** | NPN make function (NO) |
| **IFRM 08N3703/S14L** | NPN break function (NC) |
| **IFRM 08P1703/S14L** | PNP make function (NO) |
| **IFRM 08P3703/S14L** | PNP break function (NC) |

## dimension drawing




## connection diagrams



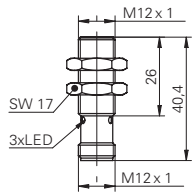
3 WIRE

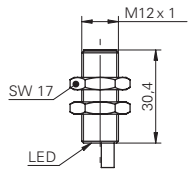
## Sn = 4 mm

- Shortest version with M12 x 1 connector
- High stability across entire temperature range

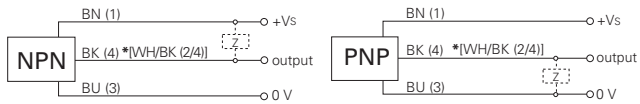
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 30,4 mm |
| **connector M12** | |
| housing length | 40,4 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

### dimension drawings




### connection diagrams




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N1701/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N1703/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N3701/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N3703/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P1701/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P1703/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P3701/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P3703/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

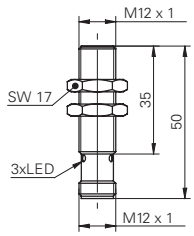
3 WIRE

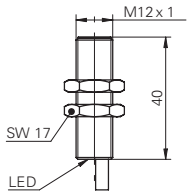
## Sn = 4 mm

- High stability across entire temperature range

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M12** | |
| housing length | 50 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

### dimension drawings




### connection diagrams

* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N1701/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N1702/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N3701/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12N3702/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12P1701/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P1702/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P3701/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |
| **IFRM 12P3702/L** | cable | PNP break function (NC) | LED red |

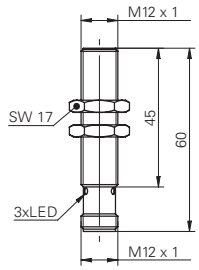
3 WIRE

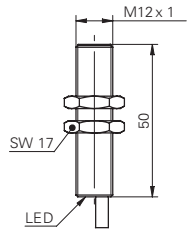
## Sn = 4 mm

- Extra long housings
- High stability across entire temperature range

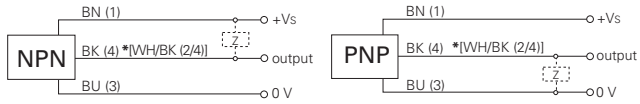
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 50 mm |
| **connector M12** | |
| housing length | 60 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N1704/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N1704/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N3704/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N3704/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P1704/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P1704/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P3704/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P3704/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

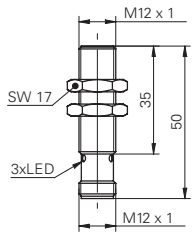
3 WIRE

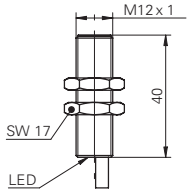
## Sn = 6 mm

- Version with extended Sn *GammaProx*
- Quasi shielded mounting

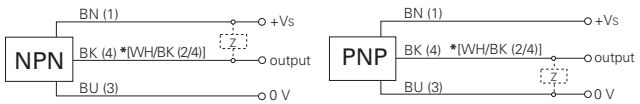
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 6 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M12** | |
| housing length | 50 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N17G3/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N17G3/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N37G3/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N37G3/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P17G3/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P17G3/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P37G3/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P37G3/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

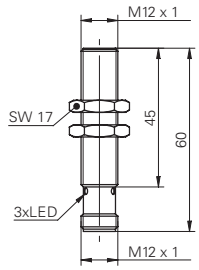
3 WIRE

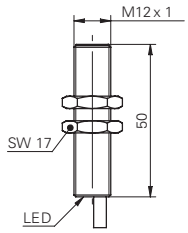
## Sn = 6 mm

- Version with extended Sn *GammaProx*
- Quasi shielded mounting

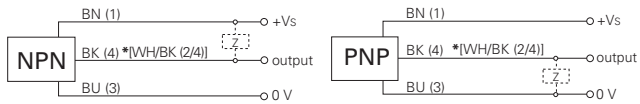
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 6 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 50 mm |
| **connector M12** | |
| housing length | 60 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N17G1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N17G1/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N37G1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N37G1/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P17G1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P17G1/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P37G1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P37G1/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

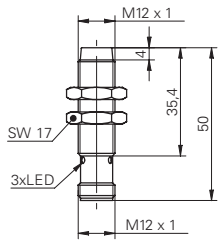
3 WIRE

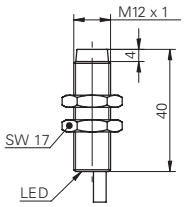
## Sn = 10 mm

- Version with extended Sn *GammaProx*
- Non shielded mounting

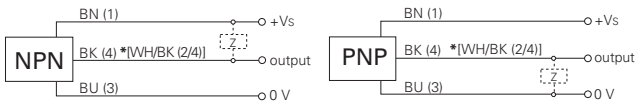
| general data | |
|---|---|
| mounting type | unshielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 10 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 40 mm |
| **connector M12** | |
| housing length | 50 mm |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N13G3/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N13G3/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N33G3/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N33G3/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P13G3/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P13G3/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P33G3/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P33G3/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

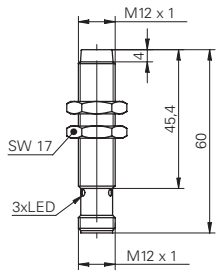
3 WIRE

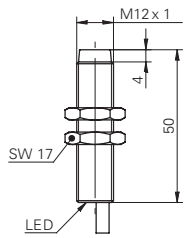
## Sn = 10 mm

- Version with extended Sn *GammaProx*
- Non shielded mounting

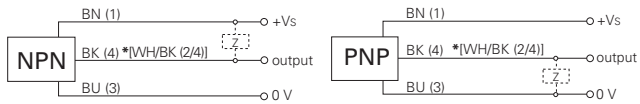
| general data | |
|---|---|
| mounting type | unshielded |
| special type | enhanced distance (*GammaProx*) |
| nominal sensing distance Sn | 10 mm |
| hysteresis | 2 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 400 Hz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **cable** | |
| housing length | 50 mm |
| **connector M12** | |
| housing length | 60 mm |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 12N13G1/L** | cable | NPN make function (NO) | LED red |
| **IFRM 12N13G1/S14L** | connector M12 | NPN make function (NO) | 3 port LED red |
| **IFRM 12N33G1/L** | cable | NPN break function (NC) | LED red |
| **IFRM 12N33G1/S14L** | connector M12 | NPN break function (NC) | 3 port LED red |
| **IFRM 12P13G1/L** | cable | PNP make function (NO) | LED red |
| **IFRM 12P13G1/S14L** | connector M12 | PNP make function (NO) | 3 port LED red |
| **IFRM 12P33G1/L** | cable | PNP break function (NC) | LED red |
| **IFRM 12P33G1/S14L** | connector M12 | PNP break function (NC) | 3 port LED red |

3 WIRE

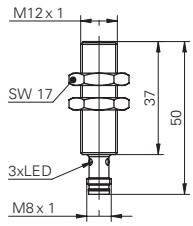
# Sn = 4 mm

- M8 x 1 quick disconnect
- High stability across entire temperature range

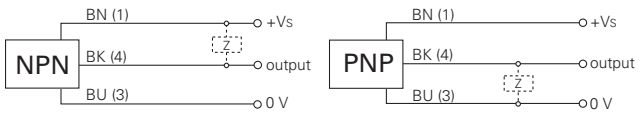
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 25 % of Sr |
| output indicator | 4 port LED red |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 50 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

| order reference | output circuit |
|---|---|
| **IFRM 12N1701/S35L** | NPN make function (NO) |
| **IFRM 12N3701/S35L** | NPN break function (NC) |
| **IFRM 12P1701/S35L** | PNP make function (NO) |
| **IFRM 12P3701/S35L** | PNP break function (NC) |

## dimension drawing




## connection diagrams



3 WIRE

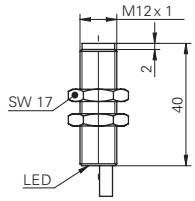
# Sn = 4 mm

- PBT plastic housing
- Non shielded mounting

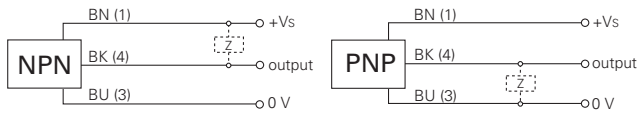
| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | PBT |
| dimension | 12 mm |
| housing length | 40 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **IFRK 12N1102/L** | NPN make function (NO) |
| **IFRK 12P1102/L** | PNP make function (NO) |

## dimension drawing




## connection diagrams



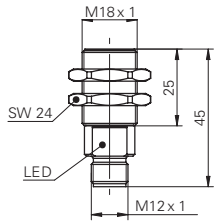
3 WIRE

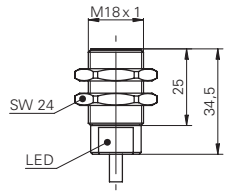
# Sn = 8 mm

- Quasi shielded mounting
- Improved EMC compatibility

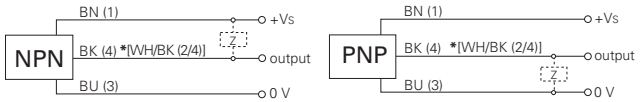
| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated / PC |
| dimension | 18 mm |
| **cable** | |
| housing length | 34,5 mm |
| **connector M12** | |
| housing length | 45 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

## dimension drawings




## connection diagrams




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit |
|---|---|---|
| **IFRM 18N17A5/L** | cable | NPN make function (NO) |
| **IFRM 18N17A5/S14L** | connector M12 | NPN make function (NO) |
| **IFRM 18N37A5/L** | cable | NPN break function (NC) |
| **IFRM 18N37A5/S14L** | connector M12 | NPN break function (NC) |
| **IFRM 18P17A5/L** | cable | PNP make function (NO) |
| **IFRM 18P17A5/S14L** | connector M12 | PNP make function (NO) |
| **IFRM 18P37A5/L** | cable | PNP break function (NC) |
| **IFRM 18P37A5/S14L** | connector M12 | PNP break function (NC) |

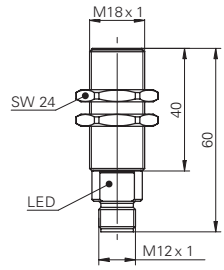
3 WIRE

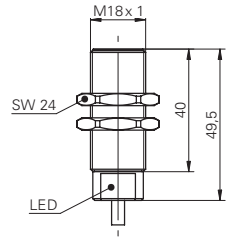
# Sn = 8 mm

- Quasi shielded mounting
- Improved EMC compatibility

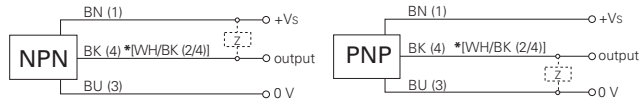
| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated / PC |
| dimension | 18 mm |
| **cable** | |
| housing length | 49,5 mm |
| **connector M12** | |
| housing length | 60 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

**dimension drawings**




**connection diagrams**




* .../S14L pin 2 & 4 electrically connected

| order reference | connection types | output circuit |
|---|---|---|
| **IFRM 18N17A3/L** | cable | NPN make function (NO) |
| **IFRM 18N17A3/S14L** | connector M12 | NPN make function (NO) |
| **IFRM 18N37A3/L** | cable | NPN break function (NC) |
| **IFRM 18N37A3/S14L** | connector M12 | NPN break function (NC) |
| **IFRM 18P17A3/L** | cable | PNP make function (NO) |
| **IFRM 18P17A3/S14L** | connector M12 | PNP make function (NO) |
| **IFRM 18P37A3/L** | cable | PNP break function (NC) |
| **IFRM 18P37A3/S14L** | connector M12 | PNP break function (NC) |

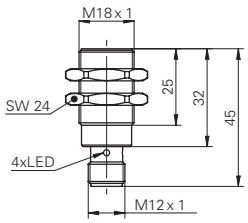
3 WIRE

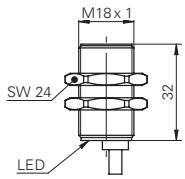
# Sn = 8 mm

- Quasi shielded mounting
- Voltage supply range +Vs 10 ... 50 VDC

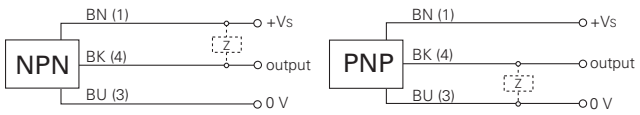
| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 18 mm |
| **cable** | |
| housing length | 32 mm |
| **connector M12** | |
| housing length | 45 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

## dimension drawings




## connection diagrams




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 18N1701/L** | cable | NPN make function (NO) | LED red |
| **IFRM 18N1703/S14L** | connector M12 | NPN make function (NO) | 4 port LED red |
| **IFRM 18N3701/L** | cable | NPN break function (NC) | LED red |
| **IFRM 18N3703/S14L** | connector M12 | NPN break function (NC) | 4 port LED red |
| **IFRM 18P1701/L** | cable | PNP make function (NO) | LED red |
| **IFRM 18P1703/S14L** | connector M12 | PNP make function (NO) | 4 port LED red |
| **IFRM 18P3701/L** | cable | PNP break function (NC) | LED red |
| **IFRM 18P3703/S14L** | connector M12 | PNP break function (NC) | 4 port LED red |

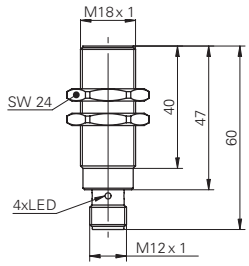
3 WIRE

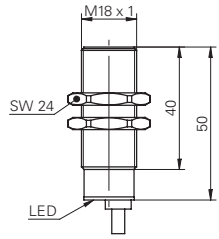
## Sn = 8 mm

- Voltage supply range +Vs 10 ... 50 VDC
- Quasi shielded mounting

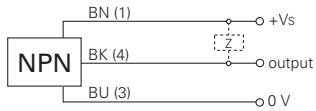
| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 18 mm |
| **cable** | |
| housing length | 50 mm |
| **connector M12** | |
| housing length | 60 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

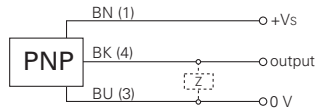
**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 18N1701/S14L** | connector M12 | NPN make function (NO) | 4 port LED red |
| **IFRM 18N1702/L** | cable | NPN make function (NO) | LED red |
| **IFRM 18N3701/S14L** | connector M12 | NPN break function (NC) | 4 port LED red |
| **IFRM 18N3702/L** | cable | NPN break function (NC) | LED red |
| **IFRM 18P1701/S14L** | connector M12 | PNP make function (NO) | 4 port LED red |
| **IFRM 18P1702/L** | cable | PNP make function (NO) | LED red |
| **IFRM 18P3701/S14L** | connector M12 | PNP break function (NC) | 4 port LED red |
| **IFRM 18P3702/L** | cable | PNP break function (NC) | LED red |

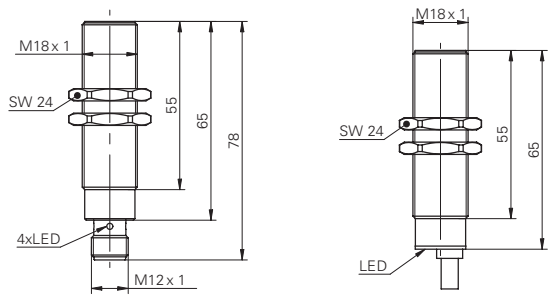
3 WIRE

## Sn = 8 mm

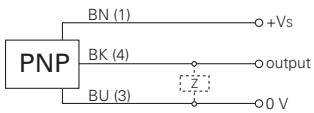
- Voltage supply range +Vs 10 ... 50 VDC
- Quasi shielded mounting
- Very long housing

| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 18 mm |
| **cable** | |
| housing length | 65 mm |
| **connector M12** | |
| housing length | 78 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

**dimension drawings**




**connection diagram**




| order reference | connection types | output indicator |
|---|---|---|
| **IFRM 18P1704/L** | cable | LED red |
| **IFRM 18P1704/S14L** | connector M12 | 4 port LED red |

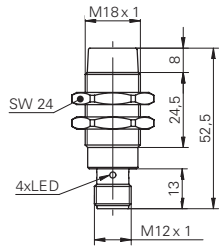
3 WIRE

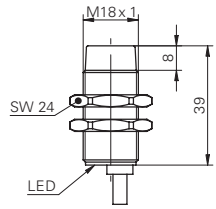
## Sn = 12 mm

- Increased sensing distance
- Non shielded mounting

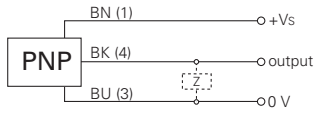
| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 12 mm |
| hysteresis | 3 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 18 mm |
| **cable** | |
| housing length | 39 mm |
| **connector M12** | |
| housing length | 52,5 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

**dimension drawings**




**connection diagram**




| order reference | connection types | output indicator |
|---|---|---|
| **IFRM 18P1301/L** | cable | LED red |
| **IFRM 18P1301/S14L** | connector M12 | 4 port LED red |

3 WIRE

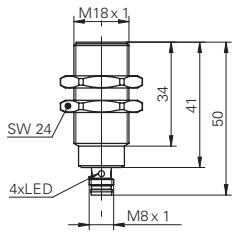
# Sn = 8 mm

- Voltage supply range +Vs 10 ... 50 VDC
- Quasi shielded mounting
- M8 x 1 quick disconnect

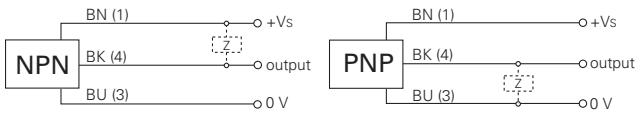
| general data | |
|---|---|
| mounting type | quasi shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 25 % of Sr |
| output indicator | 4 port LED red |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 18 mm |
| housing length | 50 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| For correct installation refer to chapter 1 “mounting instructions” | |

| order reference | output circuit |
|---|---|
| **IFRM 18N1701/S35L** | NPN make function (NO) |
| **IFRM 18N3701/S35L** | NPN break function (NC) |
| **IFRM 18P1701/S35L** | PNP make function (NO) |
| **IFRM 18P3701/S35L** | PNP break function (NC) |

## dimension drawing




## connection diagrams



3 WIRE

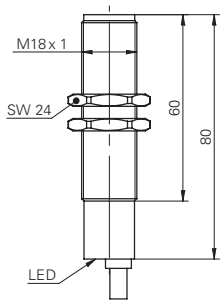
## Sn = 8 mm

- Voltage supply range +Vs 10 ... 50 VDC
- PBT plastic housing
- Non shielded mounting

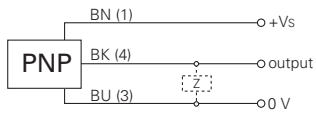
| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 1 kHz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | PBT |
| dimension | 18 mm |
| housing length | 80 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference |
|---|
| **IFRK 18P1104/L** |

**dimension drawing**




**connection diagram**



3 WIRE

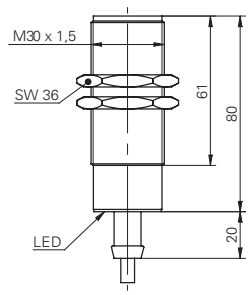
# Sn = 15 mm

- Voltage supply range +Vs 10 ... 50 VDC
- PBT plastic housing
- Non shielded mounting

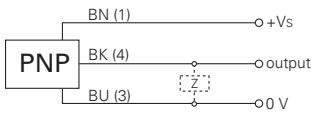
| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 15 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | PBT |
| dimension | 30 mm |
| housing length | 80 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference |
|---|
| **IFRK 30P1201/L** |

**dimension drawing**




**connection diagram**



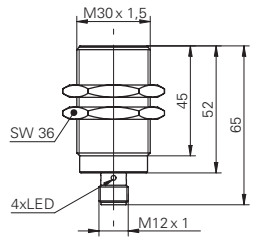
3 WIRE

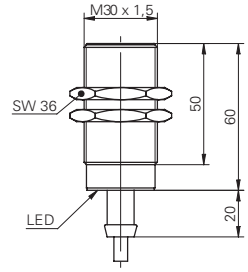
## Sn = 10 mm

- Voltage supply range +Vs 10 ... 50 VDC
- Shielded mounting
- M12 x 1 quick disconnect

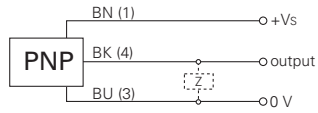
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 10 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 30 mm |
| **cable** | |
| housing length | 60 mm |
| **connector M12** | |
| housing length | 65 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

**dimension drawings**




**connection diagram**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 30P1501/S14L** | connector M12 | PNP make function (NO) | 4 port LED red |
| **IFRM 30P1601/L** | cable | PNP make function (NO) | LED red |
| **IFRM 30P3501/S14L** | connector M12 | PNP break function (NC) | 4 port LED red |
| **IFRM 30P3601/L** | cable | PNP break function (NC) | LED red |

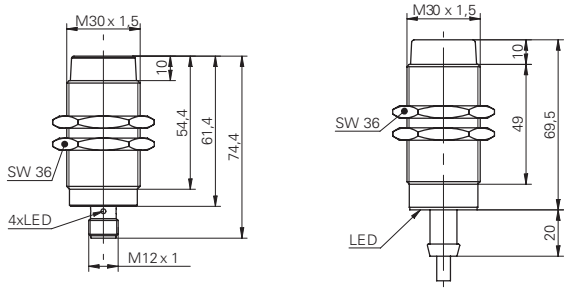
# Sn = 15 mm

3 WIRE

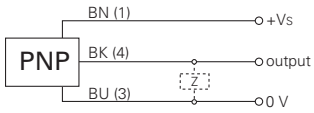
- Voltage supply range +Vs 10 ... 50 VDC
- Non shielded mounting
- M12 x 1 quick disconnect

| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 15 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 30 mm |
| **cable** | |
| housing length | 69,5 mm |
| **connector M12** | |
| housing length | 74,4 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 34S, ESW 33S |

## dimension drawings




## connection diagram




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFRM 30P1101/S14L** | connector M12 | PNP make function (NO) | 4 port LED red |
| **IFRM 30P1201/L** | cable | PNP make function (NO) | LED red |
| **IFRM 30P3101/S14L** | connector M12 | PNP break function (NC) | 4 port LED red |
| **IFRM 30P3201/L** | cable | PNP break function (NC) | LED red |

3 WIRE

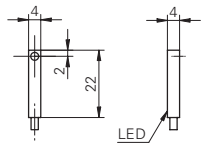
# Sn = 0,8 mm

- Smallest rectangular housing
- Stainless steel housing

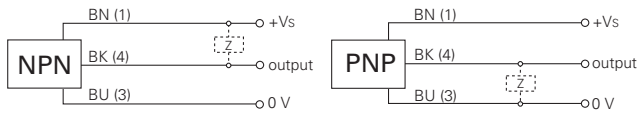
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 0,8 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red (backside) |
| **electrical data** | |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | EP |
| housing material | stainless steel |
| dimension | 4 mm |
| housing length | 22 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **IFFM 04N1501/O1L** | NPN make function (NO) |
| **IFFM 04N3501/O1L** | NPN break function (NC) |
| **IFFM 04P1501/O1L** | PNP make function (NO) |
| **IFFM 04P3501/O1L** | PNP break function (NC) |

**dimension drawing**




**connection diagrams**



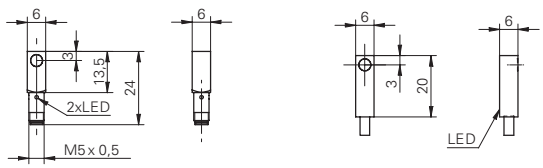
3 WIRE

# Sn = 1 mm

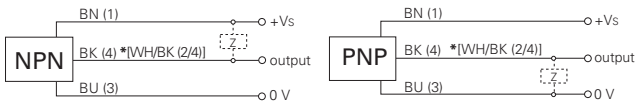
- Miniature connector M5 x 0,5
- Smallest rectangular housing with connector

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | LCP |
| housing material | brass nickel plated |
| dimension | 6 mm |
| **cable** | |
| housing length | 20 mm |
| **connector M5** | |
| housing length | 24 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 05, ESW 05 |

## dimension drawings




## connection diagrams




* .../S05L pin 2 & 4 electrically connected

| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFFM 06N15A3/O1L** | cable | NPN make function (NO) | LED red (backside) |
| **IFFM 06N15A3/O1S05L** | connector M5 | NPN make function (NO) | 2 port LED red |
| **IFFM 06N35A3/O1L** | cable | NPN break function (NC) | LED red (backside) |
| **IFFM 06N35A3/O1S05L** | connector M5 | NPN break function (NC) | 2 port LED red |
| **IFFM 06P15A3/O1L** | cable | PNP make function (NO) | LED red (backside) |
| **IFFM 06P15A3/O1S05L** | connector M5 | PNP make function (NO) | 2 port LED red |
| **IFFM 06P35A3/O1L** | cable | PNP break function (NC) | LED red (backside) |
| **IFFM 06P35A3/O1S05L** | connector M5 | PNP break function (NC) | 2 port LED red |

3 WIRE

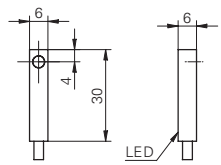
## Sn = 1 mm

- Standard cable version
- High switching frequency

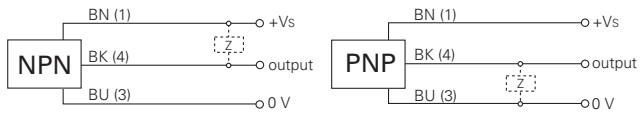
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red (backside) |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | LCP |
| housing material | brass nickel plated |
| dimension | 6 mm |
| housing length | 30 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **IFFM 06N15A1/O1L** | NPN make function (NO) |
| **IFFM 06N35A1/O1L** | NPN break function (NC) |
| **IFFM 06P15A1/O1L** | PNP make function (NO) |
| **IFFM 06P35A1/O1L** | PNP break function (NC) |

### dimension drawing




### connection diagrams



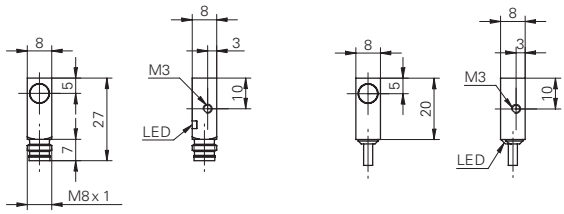
3 WIRE

# Sn = 2 mm

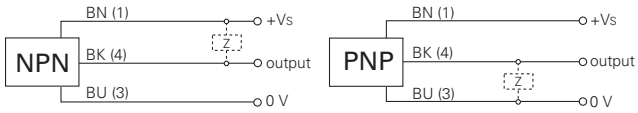
- Shortest rectangular design
- Cable and connector versions
- High switching frequency

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **cable** | |
| housing length | 20 mm |
| **connector M8** | |
| housing length | 27 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

## dimension drawings




## connection diagrams




| order reference | connection types | output circuit |
|---|---|---|
| **IFFM 08N1703/O1L** | cable | NPN make function (NO) |
| **IFFM 08N17A5/O1S35L** | connector M8 | NPN make function (NO) |
| **IFFM 08N3703/O1L** | cable | NPN break function (NC) |
| **IFFM 08N37A5/O1S35L** | connector M8 | NPN break function (NC) |
| **IFFM 08P1703/O1L** | cable | PNP make function (NO) |
| **IFFM 08P17A5/O1S35L** | connector M8 | PNP make function (NO) |
| **IFFM 08P3703/O1L** | cable | PNP break function (NC) |
| **IFFM 08P37A5/O1S35L** | connector M8 | PNP break function (NC) |

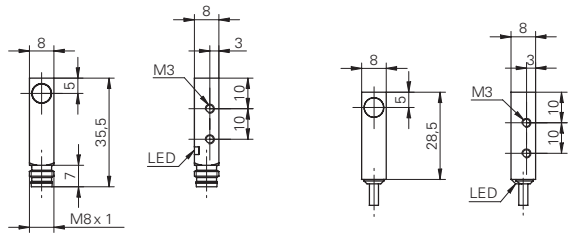
3 WIRE

# Sn = 2 mm

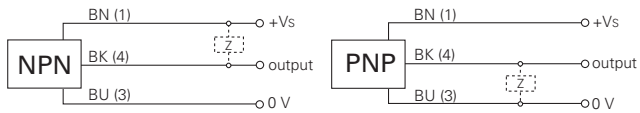
- High switching frequency
- Cable and connector versions

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **cable** | |
| housing length | 28,5 mm |
| **connector M8** | |
| housing length | 35,5 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit |
|---|---|---|
| **IFFM 08N1702/O1L** | cable | NPN make function (NO) |
| **IFFM 08N17A3/O1S35L** | connector M8 | NPN make function (NO) |
| **IFFM 08N3702/O1L** | cable | NPN break function (NC) |
| **IFFM 08N37A3/O1S35L** | connector M8 | NPN break function (NC) |
| **IFFM 08P1702/O1L** | cable | PNP make function (NO) |
| **IFFM 08P17A3/O1S35L** | connector M8 | PNP make function (NO) |
| **IFFM 08P3702/O1L** | cable | NPN break function (NC) |
| **IFFM 08P37A3/O1S35L** | connector M8 | PNP break function (NC) |

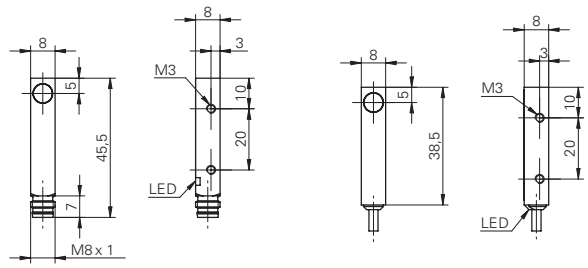
3 WIRE

## Sn = 2 mm

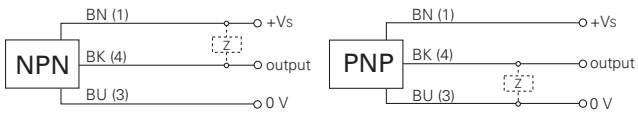
- High switching frequency
- Cable and connector versions

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **cable** | |
| housing length | 38,5 mm |
| **connector M8** | |
| housing length | 45,5 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit |
|---|---|---|
| **IFFM 08N1701/O1L** | cable | NPN make function (NO) |
| **IFFM 08N17A1/O1S35L** | connector M8 | NPN make function (NO) |
| **IFFM 08N3701/O1L** | cable | NPN break function (NC) |
| **IFFM 08N37A1/O1S35L** | connector M8 | NPN break function (NC) |
| **IFFM 08P1701/O1L** | cable | PNP make function (NO) |
| **IFFM 08P17A1/O1S35L** | connector M8 | PNP make function (NO) |
| **IFFM 08P3701/O1L** | cable | PNP break function (NC) |
| **IFFM 08P37A1/O1S35L** | connector M8 | PNP break function (NC) |

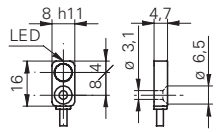
# Sn = 2 mm

3 WIRE

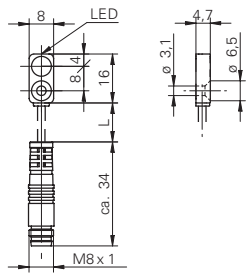
- Extra flat version
- Through bore for M3 screw
- Robust metal housing

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 2 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | die-cast zinc nickel plated |
| dimension | 8 mm |
| housing length | 16 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

## dimension drawing

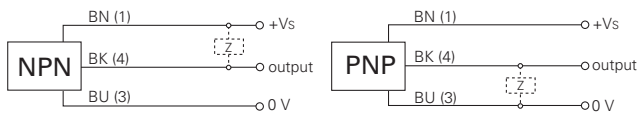



## flylead connector version




standard cable length 200 mm

## connection diagrams




| order reference | connection types | output circuit |
|---|---|---|
| **IFFM 08N17A6/KS35L** | flylead connector M8 | NPN make function (NO) |
| **IFFM 08N17A6/L** | cable | NPN make function (NO) |
| **IFFM 08N37A6/KS35L** | flylead connector M8 | NPN break function (NC) |
| **IFFM 08N37A6/L** | cable | NPN break function (NC) |
| **IFFM 08P17A6/KS35L** | flylead connector M8 | PNP make function (NO) |
| **IFFM 08P17A6/L** | cable | PNP make function (NO) |
| **IFFM 08P37A6/KS35L** | flylead connector M8 | PNP break function (NC) |
| **IFFM 08P37A6/L** | cable | PNP break function (NC) |

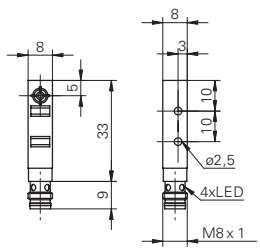
## Sn = 2 mm

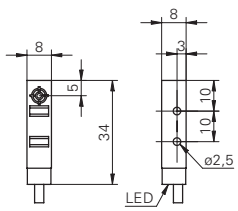
3 WIRE

- PBT plastic housing
- Installation with self tapping screws M3
- Shielded mounting

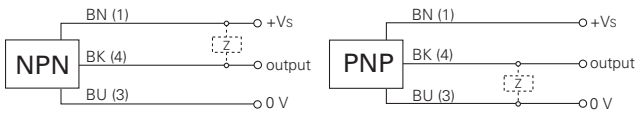
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 25 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 18 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | PBT |
| dimension | 8 mm |
| **cable** | |
| housing length | 34 mm |
| **connector M8** | |
| housing length | 42 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**




**connection diagrams**




| order reference | connection types | output circuit | output indicator |
|---|---|---|---|
| **IFFK 08N1703/O1L** | cable | NPN make function (NO) | LED red |
| **IFFK 08N1703/O1S35L** | connector M8 | NPN make function (NO) | 4 port LED red |
| **IFFK 08N3703/O1S35L** | connector M8 | NPN break function (NC) | 4 port LED red |
| **IFFK 08P1703/O1L** | cable | PNP make function (NO) | LED red |
| **IFFK 08P1703/O1S35L** | connector M8 | PNP make function (NO) | 4 port LED red |
| **IFFK 08P3703/O1S35L** | connector M8 | PNP break function (NC) | 4 port LED red |

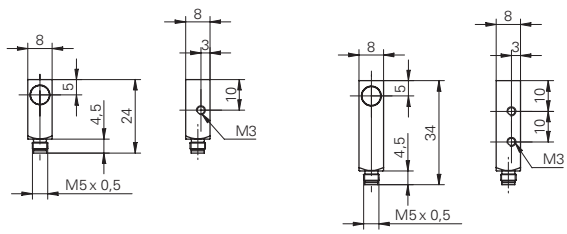
3 WIRE

## Sn = 2 mm

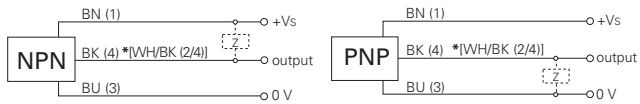
- High switching frequency
- Miniature connector M5 x 0,5

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 8 mm |
| connection types | connector M5 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 05, ESW 05 |

**dimension drawings**




**connection diagrams**




* .../S05L pin 2 & 4 electrically connected

| order reference | output circuit | housing length |
|---|---|---|
| **IFFM 08N17A3/O1S05** | NPN make function (NO) | 34 mm |
| **IFFM 08N17A5/O1S05** | NPN make function (NO) | 24 mm |
| **IFFM 08N37A3/O1S05** | NPN break function (NC) | 34 mm |
| **IFFM 08N37A5/O1S05** | NPN break function (NC) | 24 mm |
| **IFFM 08P17A3/O1S05** | PNP make function (NO) | 34 mm |
| **IFFM 08P17A5/O1S05** | PNP make function (NO) | 24 mm |
| **IFFM 08P37A3/O1S05** | PNP break function (NC) | 34 mm |
| **IFFM 08P37A5/O1S05** | PNP break function (NC) | 24 mm |

3 WIRE

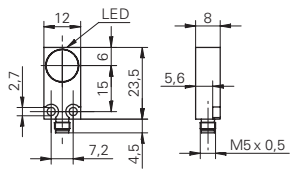
# Sn = 4 mm

- Extra flat version
- Miniature connector M5 x 0,5

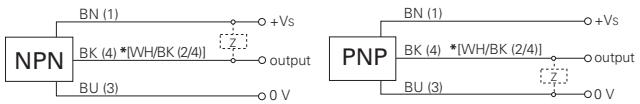
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 12 mm |
| housing length | 23,5 mm |
| connection types | connector M5 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 05, ESW 05 |

| order reference | output circuit |
|---|---|
| **IFFM 12N17A3/S05L** | NPN make function (NO) |
| **IFFM 12N37A3/S05L** | NPN break function (NC) |
| **IFFM 12P17A3/S05L** | PNP make function (NO) |
| **IFFM 12P37A3/S05L** | PNP break function (NC) |

## dimension drawing




## connection diagrams




* .../S05L pin 2 & 4 electrically connected

3 WIRE

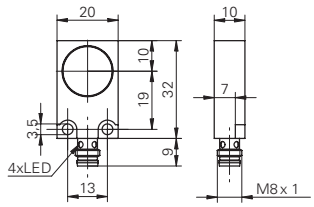
# Sn = 5 mm

- Voltage supply range +Vs 10 ... 50 VDC
- Extra flat version
- 4 port LED

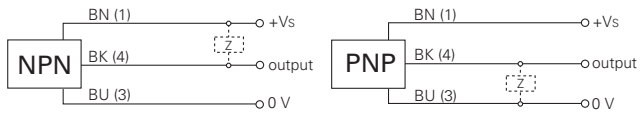
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 5 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | 4 port LED red |
| **electrical data** | |
| switching frequency | < 1 kHz |
| voltage supply range +Vs | 10 ... 50 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 32 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

| order reference | output circuit |
|---|---|
| **IFFM 20N1501/S35L** | NPN make function (NO) |
| **IFFM 20N3501/S35L** | NPN break function (NC) |
| **IFFM 20P1501/S35L** | PNP make function (NO) |
| **IFFM 20P3501/S35L** | PNP break function (NC) |

## dimension drawing




## connection diagrams



3 WIRE

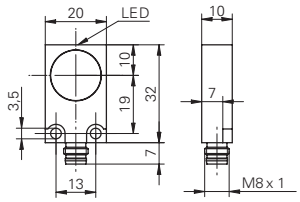
# Sn = 8 mm

- Increased sensing distance
- Extra flat version

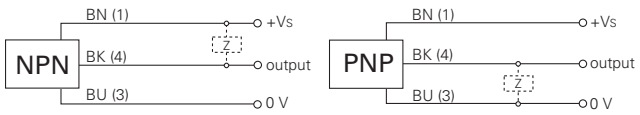
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 8 mm |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| switching frequency | < 500 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PBT |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 32 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

| order reference | output circuit |
|---|---|
| **IFFM 20N17A3/S35L** | NPN make function (NO) |
| **IFFM 20N37A3/S35L** | NPN break function (NC) |
| **IFFM 20P17A3/S35L** | PNP make function (NO) |
| **IFFM 20P37A3/S35L** | PNP break function (NC) |

## dimension drawing




## connection diagrams



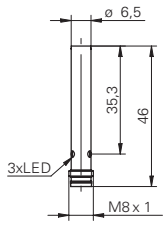
3 WIRE

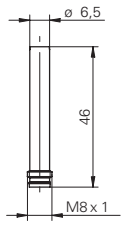
## Sn = 2 mm

- Full stainless steel housing 1.4404 (A4)
- Active face with 20 bar pressure rating
- Protection class IP 69K

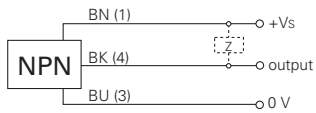
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | full metal housing (*DuroProx*) |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 150 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| voltage drop Vd | < 2 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical smooth |
| material (sensing face) | stainless steel 1.4404 (A4) |
| housing material | stainless steel 1.4404 (A4) |
| pressure static | < 20 bar |
| dimension | 6 mm |
| housing length | 46 mm |
| connection types | connector M8 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

**dimension drawings**




**connection diagrams**




| order reference | output circuit | operating temperature | protection class | output indicator | output current |
|---|---|---|---|---|---|
| **IFRD 06N17A1/S35L** | NPN make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 06N17T1/S35** | NPN make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 06N37A1/S35L** | NPN break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 06N37T1/S35** | NPN break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 06P17A1/S35L** | PNP make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 06P17T1/S35** | PNP make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 06P37A1/S35L** | PNP break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 06P37T1/S35** | PNP break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |

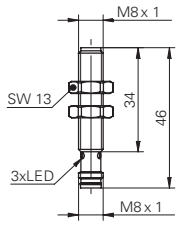
3 WIRE

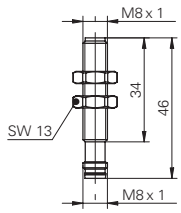
## Sn = 2 mm

- Full stainless steel housing 1.4404 (A4)
- Active face with 20 bar pressure rating
- Protection class IP 69K

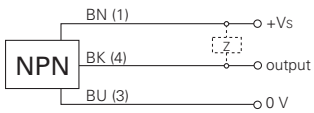
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | full metal housing (*DuroProx*) |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 150 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| voltage drop Vd | < 2 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | stainless steel 1.4404 (A4) |
| housing material | stainless steel 1.4404 (A4) |
| pressure static | < 20 bar |
| dimension | 8 mm |
| housing length | 46 mm |
| connection types | connector M8 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

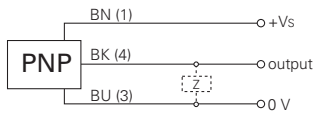
**dimension drawings**




**connection diagrams**




| order reference | output circuit | operating temperature | protection class | output indicator | output current |
|---|---|---|---|---|---|
| **IFRD 08N17A1/S35L** | NPN make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 08N17T1/S35** | NPN make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 08N37A1/S35L** | NPN break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 08N37T1/S35** | NPN break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 08P17A1/S35L** | PNP make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 08P17T1/S35** | PNP make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 08P37A1/S35L** | PNP break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 08P37T1/S35** | PNP break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |

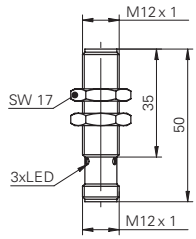
3 WIRE

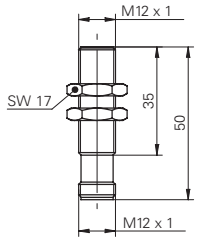
## Sn = 4 mm

- Full stainless steel housing 1.4404 (A4)
- Active face with 20 bar pressure rating
- Protection class IP 69K

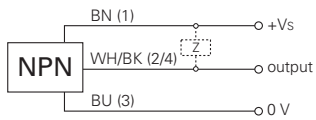
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | full metal housing (*DuroProx*) |
| nominal sensing distance Sn | 4 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 100 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 14 mA |
| voltage drop Vd | < 2 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | stainless steel 1.4404 (A4) |
| housing material | stainless steel 1.4404 (A4) |
| pressure static | < 20 bar |
| dimension | 12 mm |
| housing length | 50 mm |
| connection types | connector M12 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

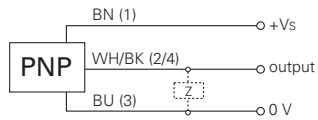
**dimension drawings**




**connection diagrams**




| order reference | output circuit | operating temperature | protection class | output indicator | output current |
|---|---|---|---|---|---|
| **IFRD 12N17A3/S14L** | NPN make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 12N17T3/S14** | NPN make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 12N37A3/S14L** | NPN break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 12N37T3/S14** | NPN break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 12P17A3/S14L** | PNP make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 12P17T3/S14** | PNP make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 12P37A3/S14L** | PNP break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 12P37T3/S14** | PNP break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |

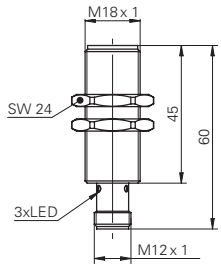
3 WIRE

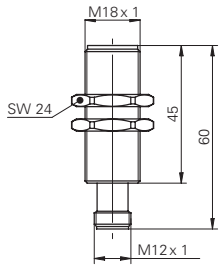
## Sn = 6 mm

- Full stainless steel housing 1.4404 (A4)
- Active face with 20 bar pressure rating
- Protection class IP 69K

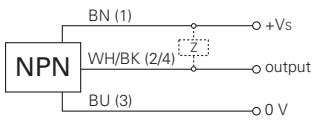
| general data | |
|---|---|
| mounting type | quasi shielded |
| special type | full metal housing (*DuroProx*) |
| nominal sensing distance Sn | 6 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 100 Hz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 14 mA |
| voltage drop Vd | < 2 VDC |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | stainless steel 1.4404 (A4) |
| housing material | stainless steel 1.4404 (A4) |
| pressure static | < 20 bar |
| dimension | 18 mm |
| housing length | 60 mm |
| connection types | connector M12 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |
| **remarks** | |
| For correct installation refer to chapter 1 "mounting instructions" | |

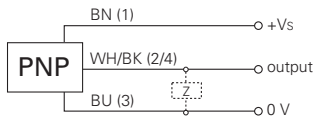
**dimension drawings**




**connection diagrams**




| order reference | output circuit | operating temperature | protection class | output indicator | output current |
|---|---|---|---|---|---|
| **IFRD 18N17A3/S14L** | NPN make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 18N17T3/S14** | NPN make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 18N37A3/S14L** | NPN break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 18N37T3/S14** | NPN break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 18P17A3/S14L** | PNP make function (NO) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 18P17T3/S14** | PNP make function (NO) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |
| **IFRD 18P37A3/S14L** | PNP break function (NC) | -25 ... +75 °C | IP 68/67 (sensing face/sensor) | 3 port LED red | < 200 mA |
| **IFRD 18P37T3/S14** | PNP break function (NC) | -25 ... +100 °C | IP 69 K (sensing face/sensor) | - | < 100 mA |

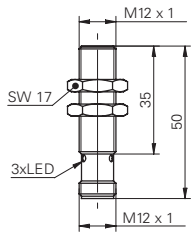
3 WIRE

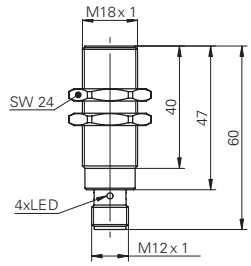
## Sn = 2 mm / 5 mm

- Teflon coated sensing face
- Housing made of chromium plated brass
- Resist welding spark induced damage

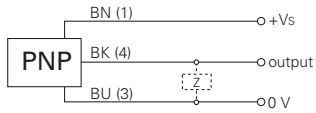
| general data | |
|---|---|
| mounting type | shielded |
| special type | welding and magnetic noise |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 1 VDC |
| output current | < 250 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | teflon coated |
| housing material | brass chromium plated |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

**dimension drawings**




**connection diagram**




| order reference | nominal sensing distance Sn | switching frequency | dimension | housing length | output indicator |
|---|---|---|---|---|---|
| **IFRW 12P1501/S14L** | 2 mm | < 1 kHz | 12 mm | 50 mm | 3 port LED red |
| **IFRW 18P1501/S14L** | 5 mm | < 500 Hz | 18 mm | 60 mm | 4 port LED red |

3 WIRE

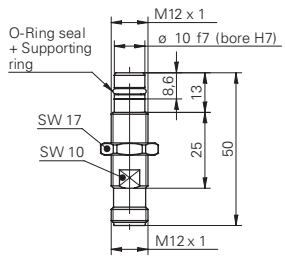
## Sn = 2 mm

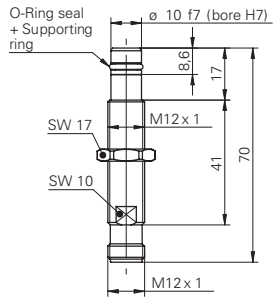
- Zirconium oxide $ZrO_2$ sensing face
- 500 bar/7000 psi pressure rating
- Sensing face sealed to IP 68

| general data | |
|---|---|
| mounting type | shielded |
| special type | high pressure |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | ceramic |
| housing material | stainless steel |
| pressure static | < 500 bar |
| pressure dynamic | < 350 bar |
| dimension | 12 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -25 ... +80 °C |
| protection class | IP 68/67 (sensing face/sensor) |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

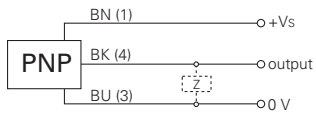
| order reference | housing length |
|---|---|
| **IFRP 12P1501/S14** | 50 mm |
| **IFRP 12P1504/S14** | 70 mm |

### dimension drawings




### connection diagram



3 WIRE

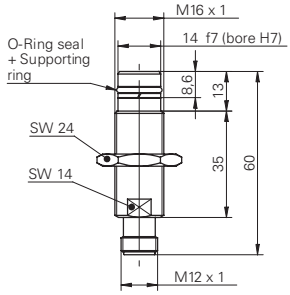
## Sn = 2 mm

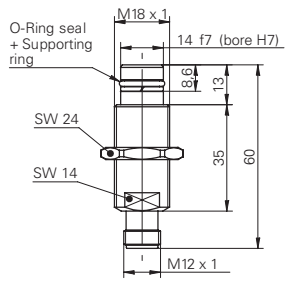
- Zirconium oxide $ZrO_2$ sensing face
- 500 bar/7000 psi pressure rating
- Sensing face sealed to IP 68

| general data | |
|---|---|
| mounting type | shielded |
| special type | high pressure |
| nominal sensing distance Sn | 2 mm |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | ceramic |
| housing material | stainless steel |
| pressure static | < 500 bar |
| pressure dynamic | < 350 bar |
| housing length | 60 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -25 ... +80 °C |
| protection class | IP 68/67 (sensing face/sensor) |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

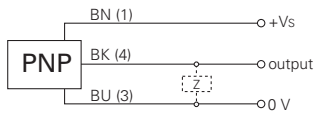
| order reference | dimension |
|---|---|
| **IFRP 16P1501/S14** | 16 mm |
| **IFRP 18P1501/S14** | 18 mm |

### dimension drawings




### connection diagram



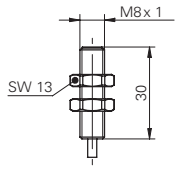
3 WIRE

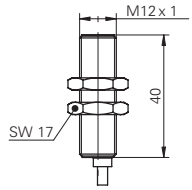
## Sn = 2 mm / 4 mm

- With integral electronics up to 100°C
- Teflon cable

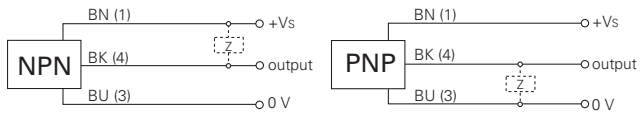
| general data | |
|---|---|
| mounting type | shielded |
| special type | high temperature |
| hysteresis | 3 ... 20 % of Sr |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 3 VDC |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +100 °C |
| protection class | IP 67 |

**dimension drawings**




**connection diagrams**




| order reference | nominal sensing distance Sn | switching frequency | output circuit | dimension | housing material | housing length |
|---|---|---|---|---|---|---|
| **IFRM 08N1707** | 2 mm | < 5 kHz | NPN make function (NO) | 8 mm | stainless steel | 30 mm |
| **IFRM 08P1707** | 2 mm | < 5 kHz | PNP make function (NO) | 8 mm | stainless steel | 30 mm |
| **IFRM 12N1707** | 4 mm | < 2 kHz | NPN make function (NO) | 12 mm | brass nickel plated | 40 mm |
| **IFRM 12P1707** | 4 mm | < 2 kHz | PNP make function (NO) | 12 mm | brass nickel plated | 40 mm |

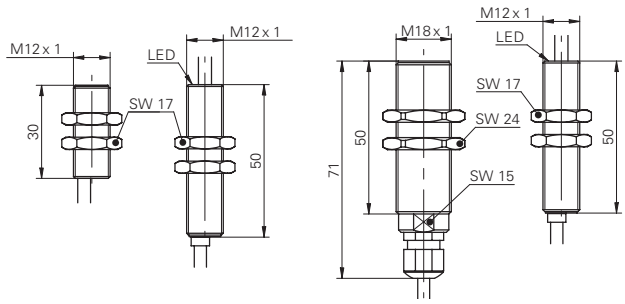
3 WIRE

## Sn = 2 mm / 5 mm

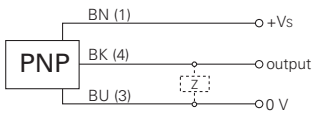
- Probe designed for use up to 180°C
- Active face made of LCP
- Detached cable amplifier

| general data | |
|---|---|
| mounting type | shielded |
| special type | high temperature |
| hysteresis | 2 ... 20 % of Sr |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 12 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +180 °C |
| protection class | IP 67 |

**dimension drawings**




**connection diagram**




| order reference | nominal sensing distance Sn | switching frequency | output circuit | dimension | housing material | housing length |
|---|---|---|---|---|---|---|
| **IFRH 12P1501/L** | 2 mm | < 2 kHz | PNP make function (NO) | 12 mm | brass nickel plated | 30 mm |
| **IFRH 12P3501/L** | 2 mm | < 2 kHz | PNP break function (NC) | 12 mm | brass nickel plated | 30 mm |
| **IFRH 18P1501/L** | 5 mm | < 1 kHz | PNP make function (NO) | 18 mm | stainless steel | 71 mm |
| **IFRH 18P3501/L** | 5 mm | < 1 kHz | PNP break function (NC) | 18 mm | stainless steel | 71 mm |

# Special executions

| product family | IZRM 18 / IZRM 30 | ILFK 12 | IARM 08 / IARM 12 | IHTP 2000 | IFFM360 |
|---|---|---|---|---|---|
| | | | | | |
| 2 adjustable switching points | ■ | | | | |
| dynamical operation | | | | ■ | ■ |
| high temperature proof | | | | ■ | |
| inductive code reader | | ■ | | | |
| with banking screw | | | ■ | | |
| shielded | ■ | ■ | ■ | ■ | |
| unshielded | | ■ | | | |
| nominal sensing distance Sn | | 2 mm<br>4 mm | 0,4 mm<br>1,2 mm | | 70 mm |
| operating range | 2 ... 5 mm<br>5 ... 10 mm | | | 0 ... 1 mm<br>(Measruing distance) | |
| housing length | 111 mm<br>114 mm | 38 mm<br>79 mm | 50,5 mm<br>56 mm | 63 mm | 360 mm<br>205 mm |
| NPN | ■ | | ■ | | |
| PNP | ■ | ■ | ■ | | ■ |
| cable | | ■ | | ■ | |
| screw connections | ■ | | | | |
| connector M8 | | | ■ | | |
| connector M12 | | | | | |
| brass nickel plated / PBT / PC | ■ | | | | ■ |
| PA 6 | | ■ | | | |
| Titan TiAl6V4 | | | | | |
| steel / hardened steel | | | ■ | | |
| IP 64 | | | | | ■ |
| IP 65 | ■ | | | | |
| IP 67 | | ■ | ■ | | |
| IP 68 | | | | ■ | |
| | | | | | |
| **Page** | **131** | **133** | **134** | **135** | **136** |

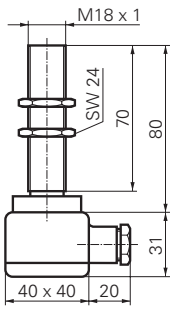
SPECIAL

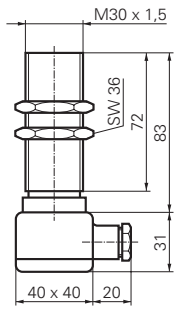
## Sr = 2 ... 5 mm / 5 ... 10 mm

- Two adjustable switching points
- Thresholds set by means of potentiometer

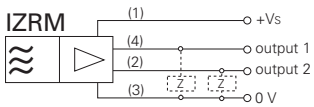
| general data | |
|---|---|
| mounting type | shielded |
| special type | 2 adjust. switching points |
| hysteresis | 1 ... 15 % of Sr |
| output indicator | LED red |
| **electrical data** | |
| voltage supply range +Vs | 14 ... 30 VDC |
| current consumption max. | 20 mA |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | brass nickel plated / PBT / PC |
| connection types | screw connections |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 65 |

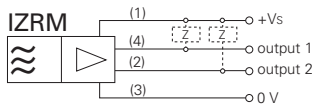
**dimension drawings**




**connection diagrams**



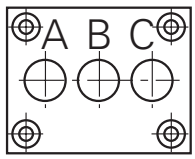




| order reference | operating range | switching frequency | output circuit | dimension | housing length |
|---|---|---|---|---|---|
| **IZRM 18N1501** | 2 ... 5 mm | < 1 kHz | NPN make function (NO) | 18 mm | 111 mm |
| **IZRM 18P1501** | 2 ... 5 mm | < 1 kHz | PNP make function (NO) | 18 mm | 111 mm |
| **IZRM 30N1501** | 5 ... 10 mm | < 500 Hz | NPN make function (NO) | 30 mm | 114 mm |
| **IZRM 30P1501** | 5 ... 10 mm | < 500 Hz | PNP make function (NO) | 30 mm | 114 mm |

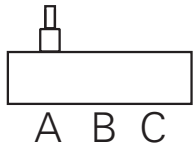
Inductive code readers are compact detection units available with 3-wire inductive proximity switches. The sensors have a common voltage supply but provide individual outputs.

A typical application for the code reader would be for identifying changeable tool heads on complex handling or machining units. Prior to the code reader, several individual sensors were needed, which required individual mounting and set up. Now the inductive code reader can be installed, bringing considerable cost savings in both installation and service.

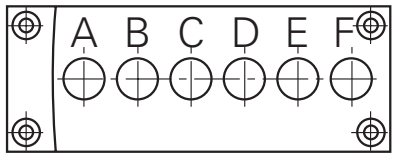
**Sensor outputs 3 heads**




| | |
|---|---|
| A | green |
| B | yellow |
| C | grey |
| +Vs | brown |
| 0 V | white |




**Sensor outputs 6 heads**




| | |
|---|---|
| A | white |
| B | pink |
| C | red |
| D | yellow |
| E | grey |
| F | green |
| +Vs | brown |
| 0 V | blue |

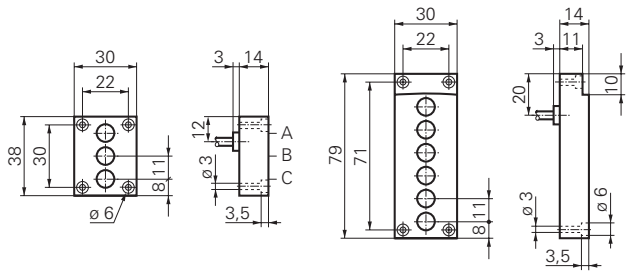
SPECIAL

## Sn = 2 mm / 4 mm

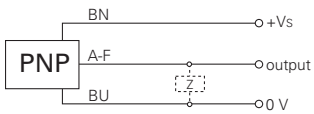
- 3 head and 6 head versions
- Common voltage supply
- Individual outputs

| general data | |
|---|---|
| special type | inductive code reader |
| hysteresis | 1 ... 20 % of Sr |
| **electrical data** | |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| output circuit | PNP make function (NO) |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| material (sensing face) | PA 6 |
| housing material | PA 6 |
| dimension | 30 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |

**dimension drawings**




**connection diagram**




| order reference | nominal sensing distance Sn | mounting type | housing length | current consumption max. |
|---|---|---|---|---|
| **ILFK 12P1101/I03** | 4 mm | unshielded | 38 mm | 10 mA |
| **ILFK 12P1101/I06** | 4 mm | unshielded | 79 mm | 20 mA |
| **ILFK 12P1501/I03** | 2 mm | shielded | 38 mm | 10 mA |
| **ILFK 12P1501/I06** | 2 mm | shielded | 79 mm | 20 mA |

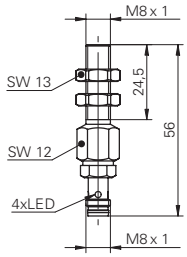
SPECIAL

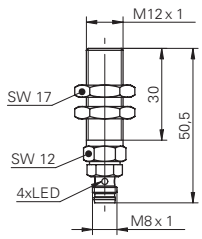
## Sn = 0,4 mm / 1,2 mm

- Face hardened steel 1.0737
- Output triggered on impact
- Quick and easy sensor replacement

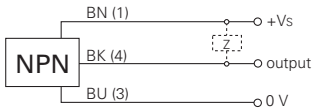
| general data | |
|---|---|
| mounting type | shielded |
| special type | with banking screw |
| hysteresis | 3 ... 20 % of Sr |
| output indicator | 4 port LED red |
| **electrical data** | |
| switching frequency | < 5 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 18 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical threaded |
| material (sensing face) | PBT |
| housing material | steel / hardened steel |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |

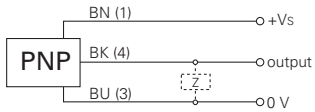
### dimension drawings




### connection diagrams




| order reference | nominal sensing distance Sn | output circuit | dimension | housing length | voltage drop Vd | output current |
|---|---|---|---|---|---|---|
| **IARM 08N1503/S35L** | 0,4 mm | NPN make function (NO) | 8 mm | 56 mm | < 2,5 VDC | < 100 mA |
| **IARM 08P1503/S35L** | 0,4 mm | PNP make function (NO) | 8 mm | 56 mm | < 2,5 VDC | < 100 mA |
| **IARM 12N1503/S35L** | 1,2 mm | NPN make function (NO) | 12 mm | 50,5 mm | < 3 VDC | < 200 mA |
| **IARM 12P1503/S35L** | 1,2 mm | PNP make function (NO) | 12 mm | 50,5 mm | < 3 VDC | < 200 mA |

SPECIAL

## Measuring distance = 0 ... 1 mm

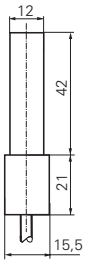
- Wide temperature range
- High pressure probe
- For the detection of dynamic targets

| technical data | |
|---|---|
| sensing distance | 0 ... 1 mm |
| sensing face material | Titan TiAl6V4 |
| collar material | stainless steel (1.4305) |
| cable material | chromium nickel steel (V2A)/ glass fabric |
| max. sensing face temperature (continuous) | -20 ... +350 °C |
| max. sensing face temperature (short term) | -20 ... +700 °C |
| max. sensor cable temperature | -20 ... +300 °C |
| max. pressure static / dynamic | -1 ... +2000 bar |
| protection class | IP 68 |

| remarks |
|---|
| Sensor probe material: titanium TiAl6V4 |
| Signal amplifier customer specific |

| order reference |
|---|
| IHTP 2000 |

**dimension drawing**




**amplifier**

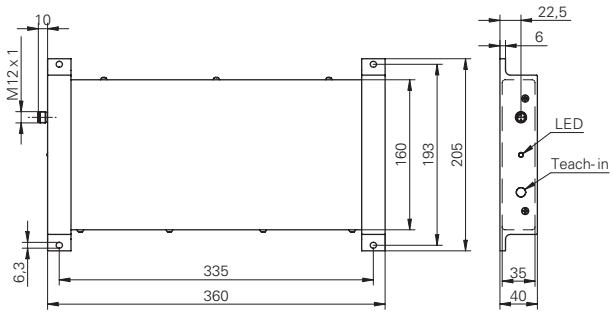
SPECIAL

## Sn = 70 mm

- Large sensing distance and detection area
- Sensing distance set by Teach-in
- For the detection of dynamic targets

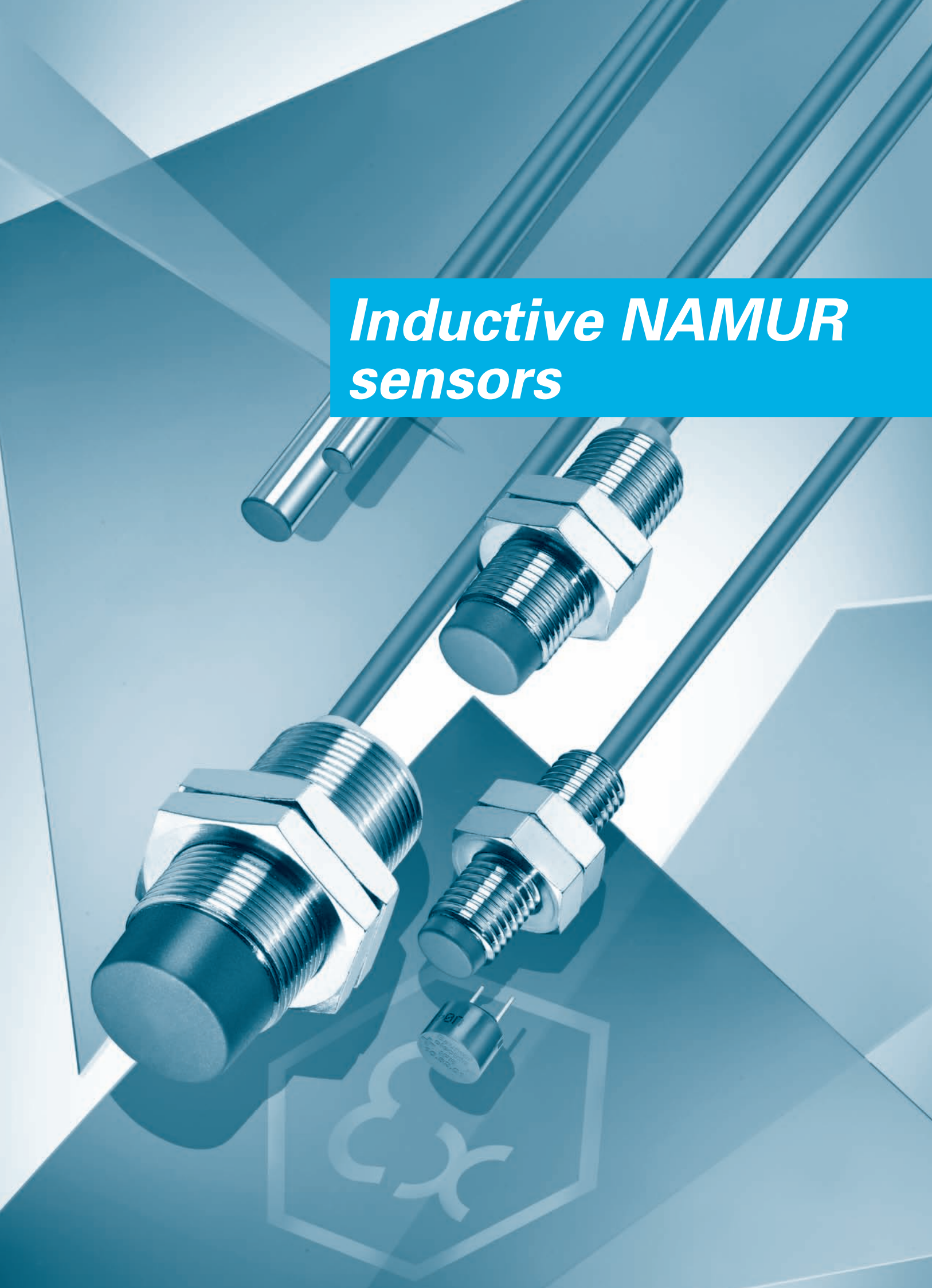
| technical data | |
|---|---|
| nominal sensing distance Sn | 70 mm |
| real sensing distance Sr | set by Teach-in |
| voltage supply range +Vs | 12 ... 30 VDC |
| output current | < 200 mA |
| output circuit | PNP normally open (NO) |
| current consumption max. | 200 mA |
| voltage drop Vd | < 3 VDC |
| **ambient available** | |
| operating temperature | +5 ... +50 °C |
| protection class | IP 64 |
| **remarks** | |
| material of sensor housing: aluminum and black PET | |

**dimension drawing**




| order reference |
|---|
| **IFFM360P13G1/S14L** |

# *Inductive NAMUR sensors*



## cylindrical designs

| product family | IFR 04 / IFR 05 | IFRM 06X | IFRM 08X | IFR 10 | IFRM 12X | IFRM 18X |
|---|---|---|---|---|---|---|
| |  | | |  | | |
| shielded | ■ | ■ | ■ | ■ | ■ | ■ |
| unshielded | | | ■ | ■ | ■ | ■ |
| nominal sensing distance Sn | 0,8 mm | 1,5 mm | 1,5 mm<br>2 mm | 2 mm<br>4 mm | 2 mm<br>4 mm | 5 mm<br>8 mm |
| housing length | 25 mm | 25 mm | 25 mm<br>27 mm | 6,5 mm | 30 mm<br>34 mm | 30 mm<br>38 mm |
| cable | ■ | ■ | ■ | | ■ | ■ |
| print | | | | ■ | | |
| stainless steel | ■ | | | | | |
| brass nickel plated | | ■ | ■ | | ■ | ■ |
| PBT | | | | ■ | | |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| | | | | | | |
| **Page** | **139** | **140** | **141** | **142** | **143** | **144** |

## rectangular designs

| product family | IFF 08 | IFFK 10E |
|---|---|---|
| | | |
| shielded | ■ | |
| unshielded | | ■ |
| nominal sensing distance Sn | 1,5 mm | 2 mm |
| housing length | 25 mm | 27,8 mm |
| cable | ■ | |
| spade lug | | ■ |
| brass nickel plated | ■ | |
| PBT | | ■ |
| protection class | IP 67 | IP 67 |
| **Page** | **145** | **146** |

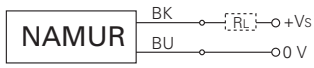
## Sn = 0,8 mm

- Smallest NAMUR type sensors
- High switching frequency
- Robust metal housing

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 0,8 mm |
| **electrical data** | |
| switching frequency | < 5 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| housing material | stainless steel |
| housing length | 25 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| clamping nut | Nr. 119345 |

**dimension drawings**

**connection diagram**




| order reference | type | dimension |
|---|---|---|
| **IFR 04.82.05** | cylindrical smooth | 4 mm |
| **IFR 05.82.05** | cylindrical threaded | 5 mm |

## Sn = 1,5 mm

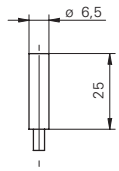
NAMUR

- High switching frequency

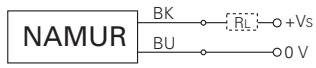
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1,5 mm |
| **electrical data** | |
| switching frequency | < 5 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | cylindrical smooth |
| housing material | brass nickel plated |
| dimension | 6,5 mm |
| housing length | 25 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **safe maximum values** | |
| EC-type-examination Certificate | PTB 03 ATEX 2146 |
| marking | II 1G EEx ia IIC T5/6 |
| current Ii | < 37 mA |
| voltage Ui | < 13,5 VDC |
| power Pi | < 0,125 W |
| internal capacitance Ci | < 50 nF |
| internal inductance Li | < 0,2 mH |
| operating temperature Ta (temp. class T5) | -20 ... +60 °C |
| operating temperature Ta (temp. class T6) | -20 ... +40 °C |
| **accessories** | |
| support | Nr. 109474 |

| order reference |
|---|
| **IFRM 06X9503** |

**dimension drawing**




**connection diagram**




**operating data according to EN 50227**

+Vs = 8,2 V
RL = 1 kΩ
T = 20 °C
Sn at 1,8 mA

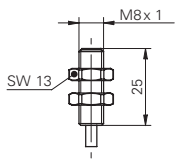
for applications in hazardous areas

## Sn = 1,5 mm / 2 mm

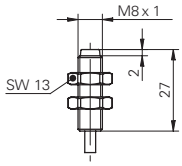
- Shielded and unshielded versions
- High switching frequency

| electrical data | |
|---|---|
| switching frequency | < 5 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 8 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **safe maximum values** | |
| EC-type-examination Certificate | PTB 03 ATEX 2146 |
| marking | II 1G EEx ia IIC T5/6 |
| current Ii | < 37 mA |
| voltage Ui | < 13,5 VDC |
| power Pi | < 0,125 W |
| internal capacitance Ci | < 50 nF |
| internal inductance Li | < 0,2 mH |
| operating temperature Ta (temp. class T5) | -20 ... +60 °C |
| operating temperature Ta (temp. class T6) | -20 ... +40 °C |
| **remarks** | |
| available with connector S35 | |

**dimension drawings**

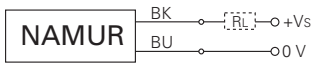



shielded




unshielded

**connection diagram**




**operating data according to EN 50227**

+Vs = 8,2 V
RL = 1 kΩ
T = 20 °C
Sn at 1,8 mA

for applications in hazardous areas

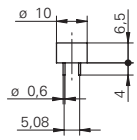
| order reference | nominal sensing distance Sn | mounting type | housing length |
|---|---|---|---|
| **IFRM 08X9103** | 2 mm | unshielded | 27 mm |
| **IFRM 08X9503** | 1,5 mm | shielded | 25 mm |

## Sn = 2 mm / 4 mm

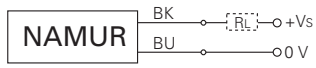
- Circuit board mountable
- Pin-spacing 5 mm
- Shielded and unshielded versions

| electrical data | |
|---|---|
| switching frequency | < 2 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | cylindrical smooth |
| housing material | PBT |
| dimension | 10 mm |
| housing length | 6,5 mm |
| connection types | print |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

**dimension drawing**




**connection diagram**



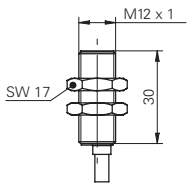

| order reference | nominal sensing distance Sn | mounting type |
|---|---|---|
| **IFR 10.82.01** | 4 mm | unshielded |
| **IFR 10.82.05** | 2 mm | shielded |

## Sn = 2 mm / 4 mm

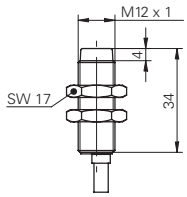
- Shielded and unshielded versions

| electrical data | |
|---|---|
| switching frequency | < 2 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 12 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **safe maximum values** | |
| EC-type-examination Certificate | PTB 03 ATEX 2146 |
| marking | II 1G EEx ia IIC T5/6 |
| current Ii | < 37 mA |
| voltage Ui | < 13,5 VDC |
| power Pi | < 0,125 W |
| internal capacitance Ci | < 50 nF |
| internal inductance Li | < 0,2 mH |
| operating temperature Ta (temp. class T5) | -20 ... +60 °C |
| operating temperature Ta (temp. class T6) | -20 ... +40 °C |

**dimension drawings**

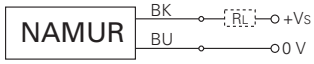



shielded




unshielded

**connection diagram**




**operating data according to EN 50227**

+Vs = 8,2 V
RL = 1 kΩ
T = 20 °C
Sn at 1,8 mA

for applications in hazardous areas

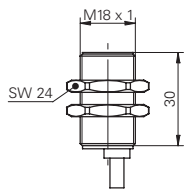
| order reference | nominal sensing distance Sn | mounting type | housing length |
|---|---|---|---|
| **IFRM 12X9103** | 4 mm | unshielded | 34 mm |
| **IFRM 12X9503** | 2 mm | shielded | 30 mm |

## Sn = 5 mm / 8 mm

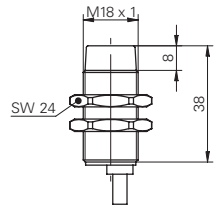
- Shielded and unshielded versions

| electrical data | |
|---|---|
| switching frequency | < 1 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | cylindrical threaded |
| housing material | brass nickel plated |
| dimension | 18 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **safe maximum values** | |
| EC-type-examination Certificate | PTB 03 ATEX 2146 |
| marking | II 1G EEx ia IIC T5/6 |
| current Ii | < 37 mA |
| voltage Ui | < 13,5 VDC |
| power Pi | < 0,125 W |
| internal capacitance Ci | < 50 nF |
| internal inductance Li | < 0,2 mH |
| operating temperature Ta (temp. class T5) | -20 ... +60 °C |
| operating temperature Ta (temp. class T6) | -20 ... +40 °C |

**dimension drawings**

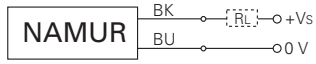



shielded




unshielded

**connection diagram**




**operating data according to EN 50227**

+Vs = 8,2 V
RL = 1 kΩ
T = 20 °C
Sn at 1,8 mA

for applications in hazardous areas

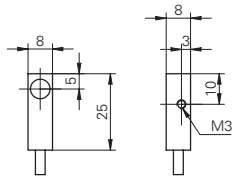
| order reference | nominal sensing distance Sn | mounting type | housing length |
|---|---|---|---|
| **IFRM 18X9103** | 8 mm | unshielded | 38 mm |
| **IFRM 18X9503** | 5 mm | shielded | 30 mm |

# Sn = 1,5 mm

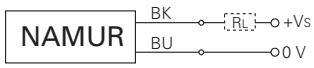
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 1,5 mm |
| **electrical data** | |
| switching frequency | < 5 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 8 mm |
| housing length | 25 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |

| order reference |
|---|
| IFF 08.82.05 |

## dimension drawing




## connection diagram

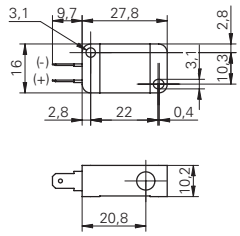


# Sn = 2 mm

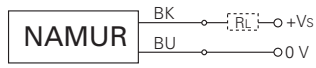
| general data | |
|---|---|
| mounting type | unshielded |
| nominal sensing distance Sn | 2 mm |
| **electrical data** | |
| switching frequency | < 5 kHz |
| normal operating voltage | 8,2 VDC |
| voltage supply range +Vs | 5 ... 30 VDC |
| current consumption undamped | > 4 mA |
| current consumption damped | < 1 mA |
| current consumption max. | 10 mA |
| residual ripple | < 10% Vs |
| **mechanical data** | |
| type | rectangular |
| housing material | PBT |
| dimension | 16 mm |
| housing length | 27,8 mm |
| connection types | spade lug |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 67 |
| **remarks** | |
| spade plug 4,8 x 0,5 mm | |

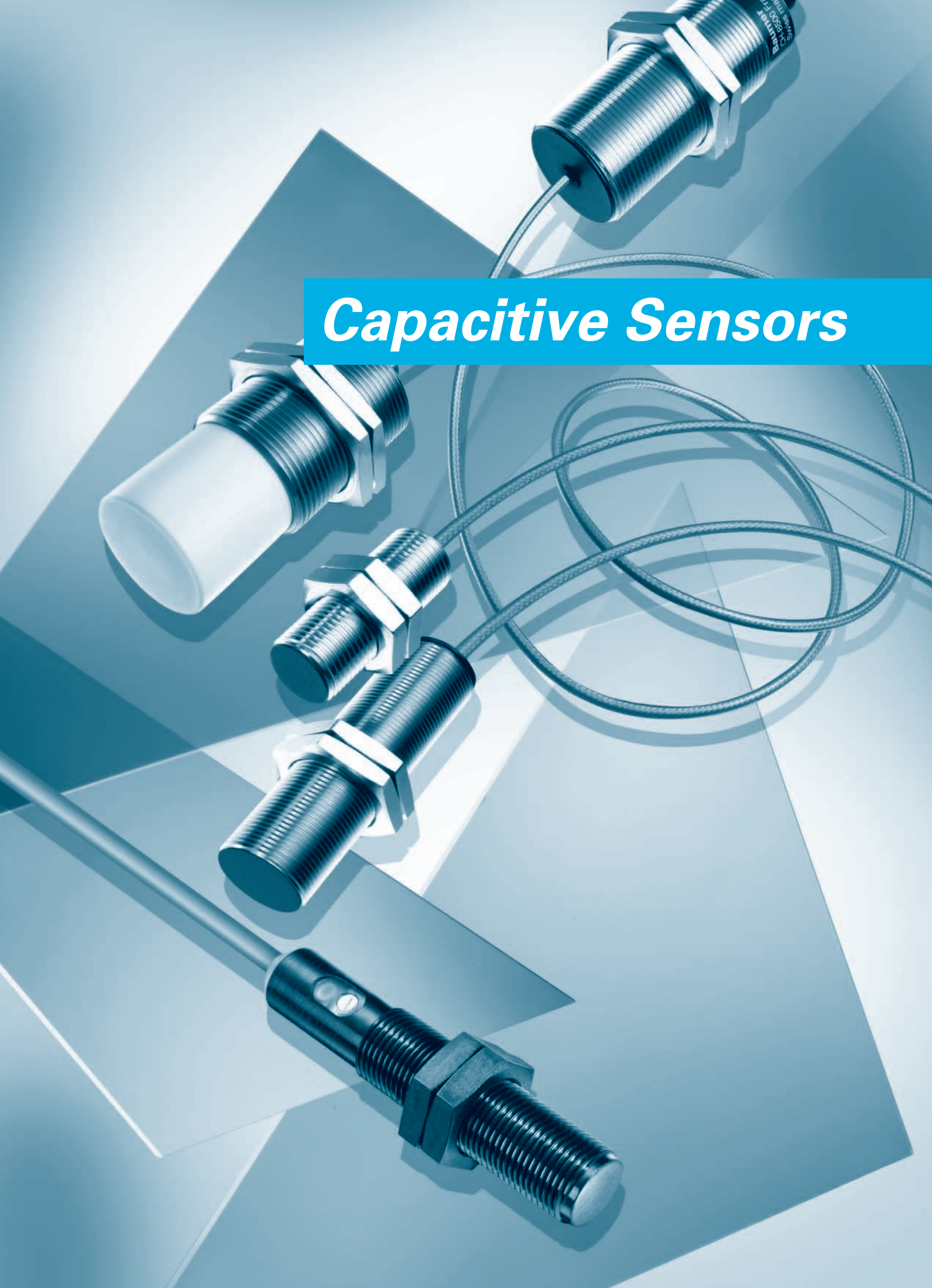
| order reference |
|---|
| **IFFK 10E9101** |

**dimension drawing**




**connection diagram**





# Capacitive Sensors

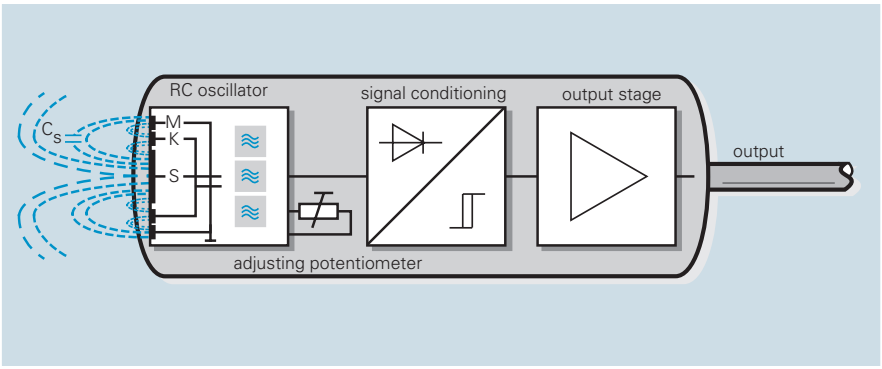
## cylindrical designs

| product family | CFAM 12 | CFAM 18 | CFBM 20 | CFAM 30 | CFAK 12 | CFAK 18 | CFAK 30 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| shielded | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| nominal sensing distance Sn | 4 mm | 8 mm | 10 mm | 15 mm | 4 mm | 8 mm | 15 mm |
| housing length | 60 mm<br>76 mm | 64 mm<br>78,5 mm | 80 mm | 71 mm<br>82 mm | 60 mm | 64 mm | 71 mm |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector M12 | ■ | ■ | | ■ | | | |
| brass nickel plated | ■ | ■ | ■ | ■ | | | |
| PBT | | | | | ■ | ■ | ■ |
| Pot, 270° | ■ | | | | ■ | | |
| Pot, 10 turn | | ■ | | | | ■ | |
| Pot, 18 rev | | | ■ | ■ | | | ■ |
| protection class | IP 65 | IP 65 | IP 65 | IP 65 | IP 65 | IP 65 | IP 65 |
| **Page** | **151** | **152** | **153** | **154** | **155** | **156** | **157** |

## cylindrical / rectangular designs

| product family | CFAK 12P | CFDM 20 | CFDK 30 | CFAH 30 |
|---|---|---|---|---|
| | | | | |
| liquid level sensor | ■ | | | |
| sensor for high temperatures | | | | ■ |
| shielded | | ■ | ■ | |
| unshielded | ■ | | | ■ |
| nominal sensing distance Sn | 0,5 mm | 5 mm | 15 mm | 15 mm |
| housing length | 39,5 mm | 35 mm | 65 mm<br>75 mm | 65 mm |
| NPN | | ■ | ■ | |
| PNP | ■ | ■ | ■ | ■ |
| cable | ■ | | ■ | |
| connector M8 | | ■ | | |
| connector M12 | | | ■ | ■ |
| brass nickel plated | | ■ | | |
| PBT | ■ | | ■ | |
| V2A/PTFE | | | | ■ |
| Pot | | | | ■ |
| Pot, 18 rev | | | ■ | |
| protection class | IP 67 | IP 65 | IP 65 | IP 67 |
| **Page** | **159** | **160** | **161** | **163** |

## Theory of operation




The RC oscillator starts up when the sensitive capacitance Cs of the sensing element is affected by an external object. The internal change in current is detected by an adjustable trigger which controls the sensor output.

### Cause of change in capacitance Cs

• Proximity to **conductive objects**

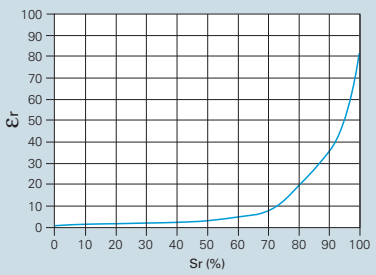
If an object of conductive material is located within the sensing distance of the sensor, it will form two series connected capacitances with sensor areas S and M. The series connected capacitances are much larger than the capacitance of the undamped oscillator. Maximum sensing distance can be achieved with conductive objects like metals, water etc..

| Material | Relative permittivity ($\varepsilon_r$) |
|---|---|
| Air, vacuum | 1 |
| Paper | 1,2 - 3 |
| Paraffin oil | 2,2 |
| PVC | 3 |
| Glass | 3 - 5 |
| Wood | 2 - 7 |
| Marble | 8,4 - 14 |
| Alcohol | 25 |
| Methanol | 33,5 |
| Water | 81 |

• of **non-conductive objects**

If a non-conductive object is moved into the sensor field, the field will be amplified in relation to the relative permittivity ($\varepsilon_r$) of the material to be detected and thus increase capacitance Cs. As from a relative permittivity of $\varepsilon_r$ = 81 (water), sensing distances can be achieved that are equivalent to those for conductive materials. The sensing distance is reduced for materials with a lower $\varepsilon_r$.

Sensing distance in relation to $\varepsilon_r$




### Close range shielding

The capacitive sensor responds to all materials whose relative permittivity $\varepsilon_r$ is greater than 1 (air, vacuum). This means that dirt deposits and moisture on the sensor surface are also detected. In order to avoid this unwanted effect, Baumer sensors have been equipped with an additional compensating electrode (K).

This electrode is used to generate an electric field close to the sensor surface which counteracts the main field. A field free area is produced in proximity to the electrode in which objects may be located without being detected by the sensor. Although this design is a very effective solution to the problem of unwanted switching it is not completely foolproof.

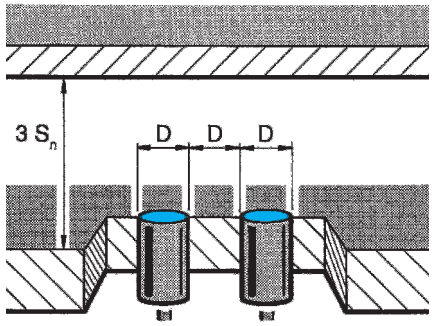
## Mounting instructions

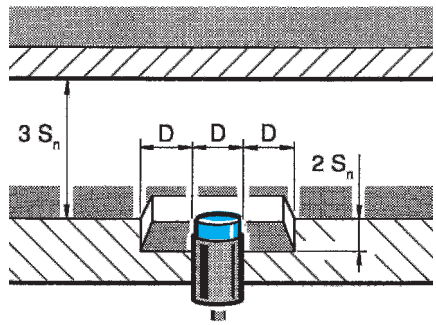
● shielded (flush) mounting

Shielded capacitive sensors may be flush-mounted in metal and other materials. They are especially suited for the detection of non-conductive target materials, such as plastics, wood, glass, etc. As compared to unshielded versions, shielded sensors have a slightly increased sensitivity to soiling and condensation on the sensor's face.

○ unshielded (non-flush) mounting

When installing unshielded capacitive sensors, they must be mounted such that there is no interfering material within a certain perimeter around the active face. This perimeter has a radius of 1,5 x the diameter of the sensing head. Unshielded capacitive sensors are insensitive to soiling as well as condensation on the sensing head. They are especially suited for the detection of conductive target materials like metals, water etc.



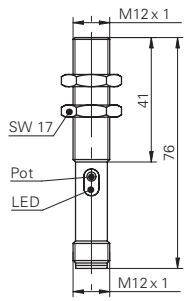
CAPACITIVE

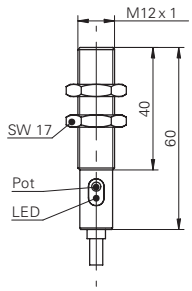
# Sn = 4 mm

- Sensitivity adjustment via pot

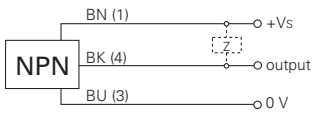
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| nominal sensing distance Sn adjustable | 0,5 ... 4 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 270° |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| dimension | 12 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

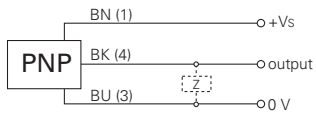
## dimension drawings




## connection diagrams




| order reference | housing length | output circuit | connection types |
|---|---|---|---|
| **CFAM 12N1600** | 60 mm | NPN make function (NO) | cable |
| **CFAM 12N1600/S14** | 76 mm | NPN make function (NO) | connector M12 |
| **CFAM 12N3600** | 60 mm | NPN break function (NC) | cable |
| **CFAM 12N3600/S14** | 76 mm | NPN break function (NC) | connector M12 |
| **CFAM 12P1600** | 60 mm | PNP make function (NO) | cable |
| **CFAM 12P1600/S14** | 76 mm | PNP make function (NO) | connector M12 |
| **CFAM 12P3600** | 60 mm | PNP break function (NC) | cable |
| **CFAM 12P3600/S14** | 76 mm | PNP break function (NC) | connector M12 |

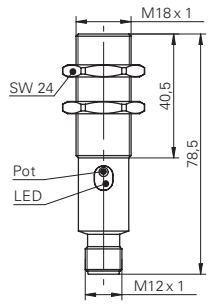
CAPACITIVE

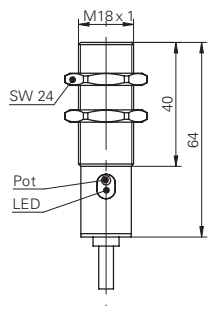
## Sn = 8 mm

- Sensitivity adjustment via pot

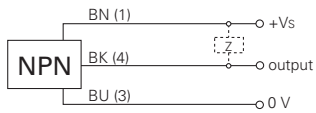
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 8 mm |
| nominal sensing distance Sn adjustable | 2 ... 8 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 10 turn |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| dimension | 18 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

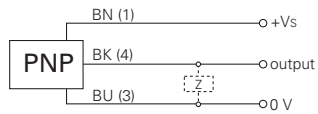
**dimension drawings**




**connection diagrams**




| order reference | housing length | output circuit | connection types |
|---|---|---|---|
| **CFAM 18N1600** | 64 mm | NPN make function (NO) | cable |
| **CFAM 18N1600/S14** | 78,5 mm | NPN make function (NO) | connector M12 |
| **CFAM 18N3600** | 64 mm | NPN break function (NC) | cable |
| **CFAM 18N3600/S14** | 78,5 mm | NPN break function (NC) | connector M12 |
| **CFAM 18P1600** | 64 mm | PNP make function (NO) | cable |
| **CFAM 18P1600/S14** | 78,5 mm | PNP make function (NO) | connector M12 |
| **CFAM 18P3600** | 64 mm | PNP break function (NC) | cable |
| **CFAM 18P3600/S14** | 78,5 mm | PNP break function (NC) | connector M12 |

CAPACITIVE

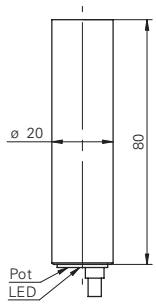
# Sn = 10 mm

- Sensitivity adjustment via pot

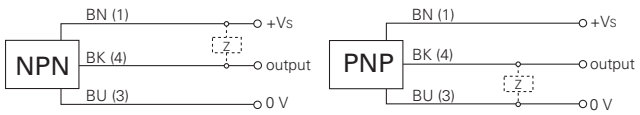
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 10 mm |
| nominal sensing distance Sn adjustable | 2 ... 10 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 18 rev |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 80 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |

| order reference | output circuit |
|---|---|
| **CFBM 20N1600** | NPN make function (NO) |
| **CFBM 20N3600** | NPN break function (NC) |
| **CFBM 20P1600** | PNP make function (NO) |
| **CFBM 20P3600** | PNP break function (NC) |

## dimension drawing




## connection diagrams



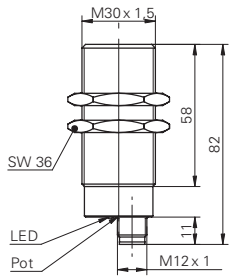
CAPACITIVE

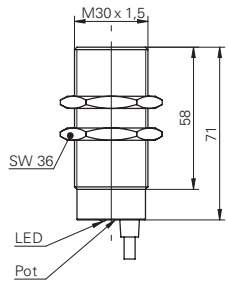
## Sn = 15 mm

- Sensitivity adjustment via pot

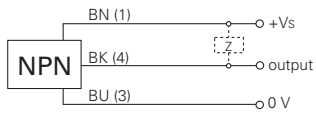
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 15 mm |
| nominal sensing distance Sn adjustable | 4 ... 15 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 18 rev |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| dimension | 30 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

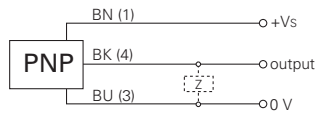
**dimension drawings**




**connection diagrams**




| order reference | housing length | output circuit | connection types |
|---|---|---|---|
| **CFAM 30N1600** | 71 mm | NPN make function (NO) | cable |
| **CFAM 30N1600/S14** | 82 mm | NPN make function (NO) | connector M12 |
| **CFAM 30N3600** | 71 mm | NPN break function (NC) | cable |
| **CFAM 30N3600/S14** | 82 mm | NPN break function (NC) | connector M12 |
| **CFAM 30P1600** | 71 mm | PNP make function (NO) | cable |
| **CFAM 30P1600/S14** | 82 mm | PNP make function (NO) | connector M12 |
| **CFAM 30P3600** | 71 mm | PNP break function (NC) | cable |
| **CFAM 30P3600/S14** | 82 mm | PNP break function (NC) | connector M12 |

CAPACITIVE

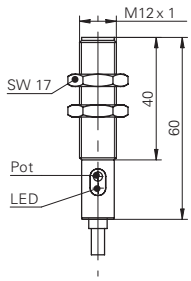
# Sn = 4 mm

- Sensitivity adjustment via pot
- Completely sealed housing

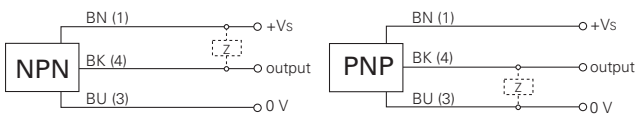
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 4 mm |
| nominal sensing distance Sn adjustable | 0,5 ... 4 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 270° |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | PBT |
| dimension | 12 mm |
| housing length | 60 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |

| order reference | output circuit |
|---|---|
| **CFAK 12N1600** | NPN make function (NO) |
| **CFAK 12N3600** | NPN break function (NC) |
| **CFAK 12P1600** | PNP make function (NO) |
| **CFAK 12P3600** | PNP break function (NC) |

## dimension drawing




## connection diagrams



CAPACITIVE

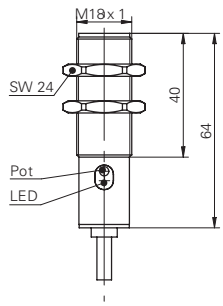
## Sn = 8 mm

- Sensitivity adjustment via pot
- Completely sealed housing

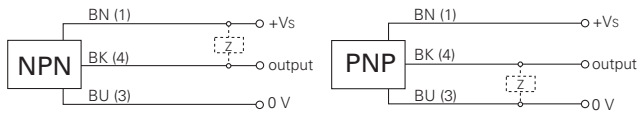
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 8 mm |
| nominal sensing distance Sn adjustable | 2 ... 8 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 10 turn |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | PBT |
| dimension | 18 mm |
| housing length | 64 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |

| order reference | output circuit |
|---|---|
| **CFAK 18N1600** | NPN make function (NO) |
| **CFAK 18N3600** | NPN break function (NC) |
| **CFAK 18P1600** | PNP make function (NO) |
| **CFAK 18P3600** | PNP break function (NC) |

**dimension drawing**




**connection diagrams**



CAPACITIVE

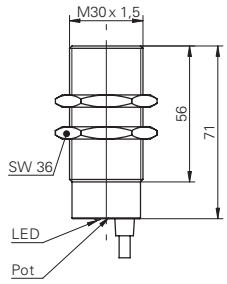
# Sn = 15 mm

- Sensitivity adjustment via pot
- Completely sealed housing

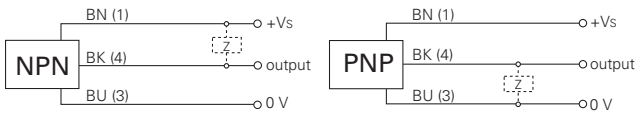
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 15 mm |
| nominal sensing distance Sn adjustable | 4 ... 15 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 18 rev |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | PBT |
| dimension | 30 mm |
| housing length | 71 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |

| order reference | output circuit |
|---|---|
| **CFAK 30N1600** | NPN make function (NO) |
| **CFAK 30N3600** | NPN break function (NC) |
| **CFAK 30P1600** | PNP make function (NO) |
| **CFAK 30P3600** | PNP break function (NC) |

## dimension drawing




## connection diagrams



# Capacitive fill level sensor

## Reliable detection of liquid levels

The new capacitive fill level sensor for electrically conductive liquids and aqueous solutions reliably detects liquid fill levels even under the most difficult ambient conditions. The compact M12 x 40 mm device is IP 67 sealed and is available in PBT, PVDF, PA 12 and PP plastic enclosures. The availability of various housing materials covers a wide range of fill level monitoring applications ranging from the chemical industry to the food processing industry. The non-flush sensor has been specifically designed so that soiling and condensation on the sensor's face do not cause false triggers. The product, featuring an EMI immunity far exceeding the limits specified by the applicable CE sensor norm, offers an excellent price to performance ratio. Some of Baumer's photoelectric, pressure and ultrasonic products can also be used as fill level sensors. Please consult our application engineers or ask for our special literature.

CAPACITIVE

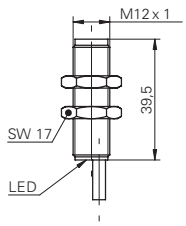
# Sn = 0,5 mm

- Completely sealed housing
- Compact design
- Fill level monitoring

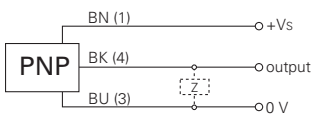
| general data | |
|---|---|
| special type | liquid level sensor |
| mounting type | unshielded |
| nominal sensing distance Sn | 0,5 mm |
| nominal sensing distance Sn adjustable | 0,25 ... 0,75 mm |
| temperature drift | ± 20% |
| sensitivity adjustment | no |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 10 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2,5 VDC |
| switching frequency | < 15 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | PBT |
| dimension | 12 mm |
| housing length | 39,5 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | 0 ... +70 °C |
| protection class | IP 67 |

| order reference |
|---|
| **CFAK 12P1103** |

**dimension drawing**




**connection diagram**



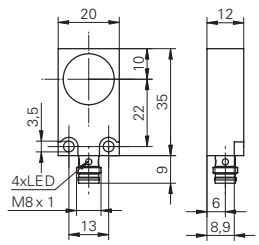
CAPACITIVE

# Sn = 5 mm

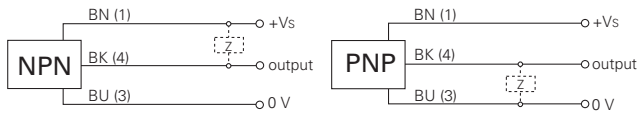
| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 5 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | no |
| output indicator | 4 port LED |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | brass nickel plated |
| dimension | 20 mm |
| housing length | 35 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |
| **accessories** | |
| connectors | ESW 31S, ESG 32S |

| order reference | output circuit |
|---|---|
| **CFDM 20N1500/S35L** | NPN make function (NO) |
| **CFDM 20N3500/S35L** | NPN break function (NC) |
| **CFDM 20P1500/S35L** | PNP make function (NO) |
| **CFDM 20P3500/S35L** | PNP break function (NC) |

## dimension drawing




## connection diagrams

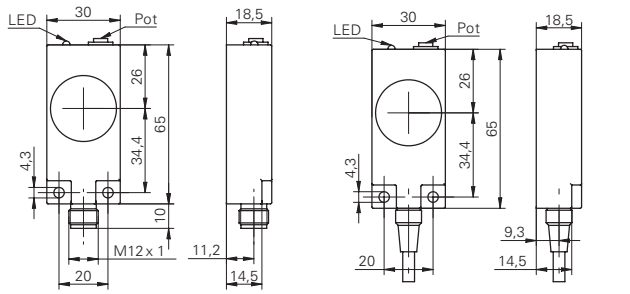


CAPACITIVE

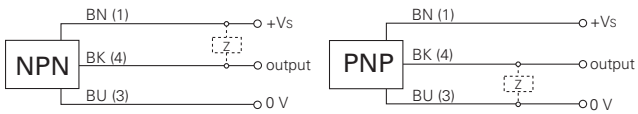
# Sn = 15 mm

| general data | |
|---|---|
| mounting type | shielded |
| nominal sensing distance Sn | 15 mm |
| nominal sensing distance Sn adjustable | 4 ... 15 mm |
| temperature drift | ± 15% (+10 ... +70 °C) |
| sensitivity adjustment | Pot, 18 rev |
| output indicator | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| output current | < 200 mA |
| voltage drop Vd | < 1,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | PBT |
| dimension | 30 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +75 °C |
| protection class | IP 65 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33S, ESG 34S |

## dimension drawings




## connection diagrams




| order reference | housing length | output circuit | connection types |
|---|---|---|---|
| **CFDK 30N1600** | 65 mm | NPN make function (NO) | cable |
| **CFDK 30N1600/S14** | 75 mm | NPN make function (NO) | connector M12 |
| **CFDK 30N3600** | 65 mm | NPN break function (NC) | cable |
| **CFDK 30N3600/S14** | 75 mm | NPN break function (NC) | connector M12 |
| **CFDK 30P1600** | 65 mm | PNP make function (NO) | cable |
| **CFDK 30P1600/S14** | 75 mm | PNP make function (NO) | connector M12 |
| **CFDK 30P3600** | 65 mm | PNP break function (NC) | cable |
| **CFDK 30P3600/S14** | 75 mm | PNP break function (NC) | connector M12 |

# Capacitive high temperature sensor -40...+250 °C

## Some like it hot - some do not!

Many applications demand process temperatures of up to +200 °C and more. These high temperatures spell disaster for most electronic devices. Not so for our high temperature capacitive sensors from the CFAH series! These sensors are right "at home" when things get hot. Target materials such as liquids, granulates, pastes and similar substances can be detected reliably even at very high ambient temperatures. Since conventional electronic components cannot stand temperatures of +100 °C or more over longer periods, this sensor has simply been "split" into hot and cold components. The actual "hot" sensor head, which can be used at an ambient temperature of -40 to +200 °C (optional up to +250 °C), is made of chemical-resistant Teflon and stainless steel. The high temperature sensor CFAH is the ideal substitute for mechanical sensors in a wide range of applications. Due to its high chemical resistance, it can also be used in chemically harsh environments. This sensor will operate in nearly any environment and not even break a sweat.

CAPACITIVE

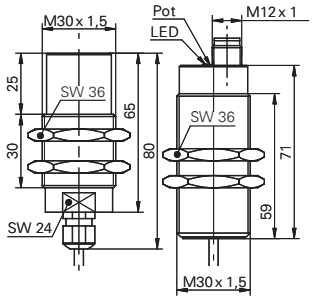
# Sn = 15 mm

- High temperature proof to +250 °C
- Resistant against a number of chemicals
- Probe made of stainless steel & teflon (anti-adherence)

| general data | |
|---|---|
| special type | sensor for high temperatures |
| mounting type | unshielded |
| nominal sensing distance Sn | 15 mm |
| nominal sensing distance Sn adjustable | 4 ... 15 mm |
| sensitivity adjustment | Pot |
| output indicator | LED |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 20 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2,5 VDC |
| switching frequency | < 50 Hz |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| **processing electronics** | |
| type | cylindrique |
| housing material | brass nickel plated |
| dimension | 30 mm |
| housing length | 71 mm |
| connection types | connector M12 |
| **sensing head** | |
| type | cylindrique |
| housing material | V2A/PTFE |
| dimension | 30 mm |
| housing length | 65 mm |
| **ambient conditions** | |
| **processing electronics** | |
| operating range | -25 ... +75 °C |
| temperature drift | ± 15% (+10 ... +70 °C) |
| protection class | IP 65 |
| **sensing head** | |
| operating range | -40 ... +200 °C<br>(+250 °C on request) |
| temperature drift | ± 0,02 mm/°C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ES 18, ESW 33A,<br>ESG 34A |

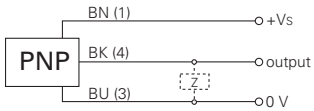
| order reference |
|---|
| **CFAH 30P1200/S14** |

## dimension drawing



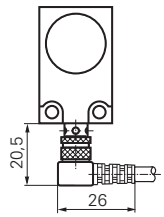

Teflon cable dia 3,7 mm L = 1 m

## connection diagram

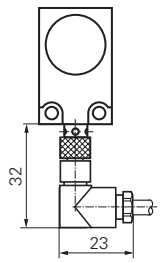


Series 20
rectangular

**ESW 31**

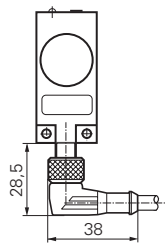



**ES 22**

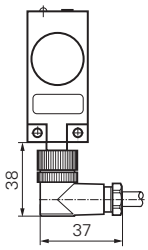



Series 30
rectangular

**ESW 33**




**ES 14**

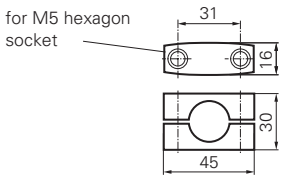



**Color code DC**

| wire color | short name | signal |
|---|---|---|
| blue | BU | 0 V |
| black | BK | output |
| brown | BN | +Vs |

**Support bracket (2x) 143377**

for 20 mm diameter proximity switches
material plastic (PA 6.6. black)




**Test set**

**Part No. 115437**

# Safety sensor system

# Inductive safety sensor system SUVA registration number E 6334.d

Your safety is important to us

The safety sensor is a non-contact position switch that performs safety functions. The safety sensor is comprised of an inductive safety switch with a special mating component and safety amplifier. Based on the inductive proximity principle, the correctly wired circuit meets the applicable increased safety requirements according to EN 941-1, category 3 (please see datasheet on following pages for more detailed information).
This safety device has been designed for monitoring protective enclosures on punching machines, presses, packaging machines etc. It protects expensive tools and work pieces from damage and eventual destruction, but above all, prevents operators from being hurt in the process. Mechanical safety devices, which are often cumbersome and difficult to operate, can be eliminated using this inductive safety switch. Safety doors and other protective grids may now be assembled without the need to incorporate complicated mechanical locking devices.
The safety proximity switch responds only to the special mating component manufactured by Baumer, therefore chips and other metallic contaminants do not impair the performance of the safety proximity switch. The inadvertent closing of contacts due to metallic contamination is impossible. Faults such as cable break, short circuit, power failure, welding of relay contacts etc., immediately cuts off at least one of the output relays and stops the machine.

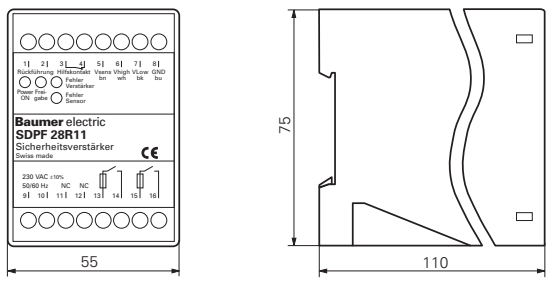
SAFETY

- For elevated safety requirements
- SUVA and BIA registered
- EN 954-1 cat. 3 (1996), EN 60947-5-3, PDF-S (1999)

| technical data | |
|---|---|
| norms | EN 954 category 3 and EN 60947-5-3, PDF-s (1999) |
| voltage supply + Vs | 230 VAC ±10 % 50/60 Hz |
| relay output | 2 x NO, forced guided / 1 additional contact |
| contact fuse | 2 x 1,25 A time-lag |
| additional contact | 1 x NC |
| max. load voltage | 250 VAC |
| max. load current | 1A |
| max. release time | 250 msec |
| fault recognition | yes |
| max. switching frequency | 10 Hz |
| mechanical life time | 2 x $10^6$ switchings |
| temperature range | 0 ... +55 °C |
| protection class | IP 20 |
| **displays** | |
| voltage supply | LED green |
| release load circuit | LED yellow |
| fault recognition sensor | LED red |
| fault recognition amplifier | LED red |

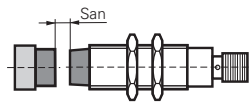
| order reference |
|---|
| **SDPF 28R11** |

## dimension drawing

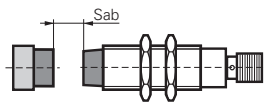



Provided with snap-on mechanism for 35 mm DIN EN 50022 mounting

## sensing distance San / Sab




San = special target present




Sab = special target not present

## safety considerations

- **In order to prevent accidental misuse of the safety switch, installation must be carried out in accordance with EN 292-1, 1993.**
- **Note: before proceeding with a new installation, please consult the user manual, Part. No 132810, which is attached to every safety switch. This contains important information to ensure correct installation.**

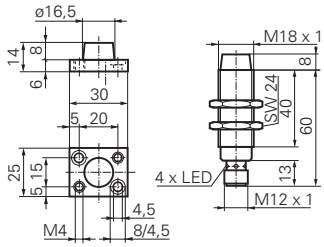
SAFETY

- Only recognizes special target
- Does not sense metal objects
- Use only with amplifier SDPF 28R11

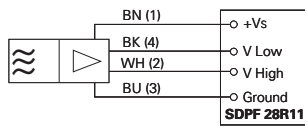
| technical data | |
|---|---|
| sensing distance San (target present) | ≤ 1,6 mm |
| sensing distance San (target not present) | ≤ 2,9 mm |
| supply voltage | 8,2 V ±5 % |
| supply current | < 12 mA |
| output | analog |
| output current | 425 uA / 670 uA ±5 % |
| reverse polarity protection (supply) | yes |
| short circuit protection | yes |
| switching frequency | 10 Hz |
| direction of approach | axial |
| min. displacement required | 1,3 mm |
| mounting style | unshielded |
| temperature range | -25 ... +75 °C |
| housing material | brass nickel plated |
| protection class | IP 65 |
| **accessories connectors** | |
| 2 m PUR, straight, shielded* | ES 34AP2B |
| 5 m PUR, straight, shielded* | ES 34AP5B |
| 2 m PUR, angular, shielded* | ES 33AP2B |
| 5 m PUR, angulat, shielded* | ES 33AP5B |
| * the sensor cable is shielded and must be grounded at the sensor end | |

| order reference | |
|---|---|
| sensor and target | **ISRM 18N9101/S14** |

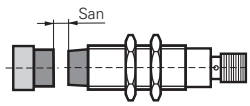
## dimension drawing



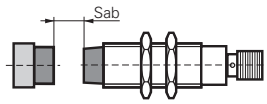

## connection diagram




## mounting instructions




When designing such a safety switch into a machine, it is important to ensure that the proper sensing distances for damped (San) and undamped (Sab) are maintained as specified at all times!




direction of approach axial

Always approach the sensor head-on!

# Peripheral devices

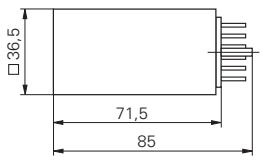
PERIPHERAL

- For NAMUR 2-wire devices
- For PNP/NPN 3-wire devices
- Switching amplifier for mains connection

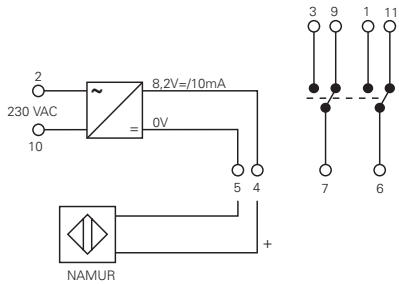
| technical data | |
|---|---|
| power consumption | approx. 4 VA |
| test voltage | 2,5 kV |
| switching element | relay changeover |
| switching capacity | 250 VAC 4 A, AC-1 |
| switch state | LED yellow |
| operating temperature range | -25 ... +50 °C |
| storage temperature range | -40 ... +85 °C |
| protection class | IP 20 |
| **For NAMUR 2-wire devices** | |
| input | acc. to EN 50227 |
| sensor voltage supply | 8,2 VDC ± 10 % |
| internal resistance | 1 kOhm |
| switching point | > 1,8 mA |
| **For PNP/NPN 3-wire devices** | |
| input | 3-wire devices |
| sensor voltage supply | 24 VDC ± 10 % |
| sensor supply current | max. 50 mA |
| switching point | 12 VDC ± 10 % |
| **accessories** | |
| socket base | ZKR 118 |

| order reference | output |
|---|---|
| **SVN 110.24.2** | NPN 110 VAC |
| **SVN 220.24.2** | NPN 220 VAC |
| **SVN 110.82.2** | NAMUR 110 VAC |
| **SVN 220.82.2** | NAMUR 220 VAC |
| **SVP 110.24.2** | PNP 110 VAC |
| **SVP 220.24.2** | PNP 220 VAC |

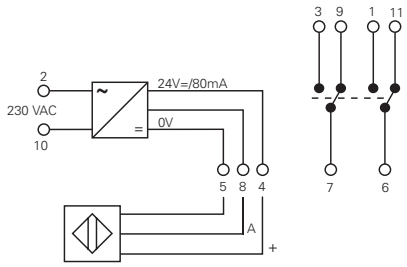
## dimension drawing



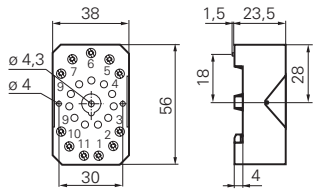

## block diagram 2-wire device




## block diagram 3-wire device

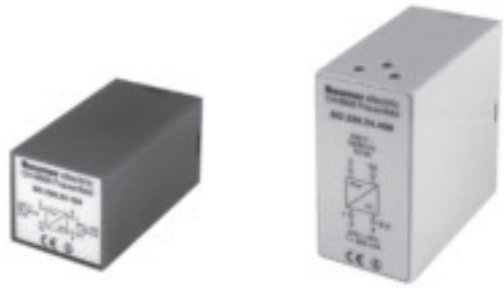



## socket base and pin assignment ZKR 118



PERIPHERAL

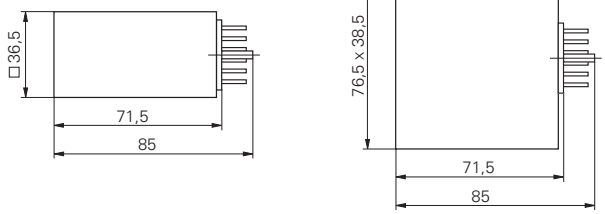
- 24 VDC / 90 mA output
- 24 VDC / 300 mA output
- Short circuit protected output



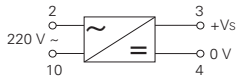
| technical data | |
|---|---|
| mains frequency | 50/60 Hz |
| output voltage | 24 VDC ± 2 / 10 % |
| residual ripple | ≤ 5 % |
| **24 VDC / 90 mA output** | |
| power consumption | 3,5 VA |
| output current | max. 90 mA |
| **24 VDC / 300 mA output** | |
| power consumption | approx. 10 VA |
| output current | max. 300 mA |
| short circuit protection | yes |
| **accessories** | |
| socket base | ZKR 118 |

| order reference | output | voltage |
|---|---|---|
| **SG 110.24.120** | 90 mA | 115 VAC±10% |
| **SG 110.24.400** | 300 mA | 115 VAC±10% |
| **SG 220.24.120** | 90 mA | 230 VAC±10% |
| **SG 220.24.400** | 300 mA | 230 VAC±10% |

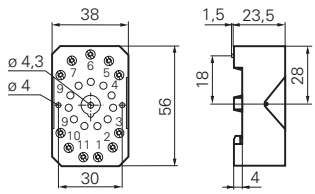
## dimension drawing

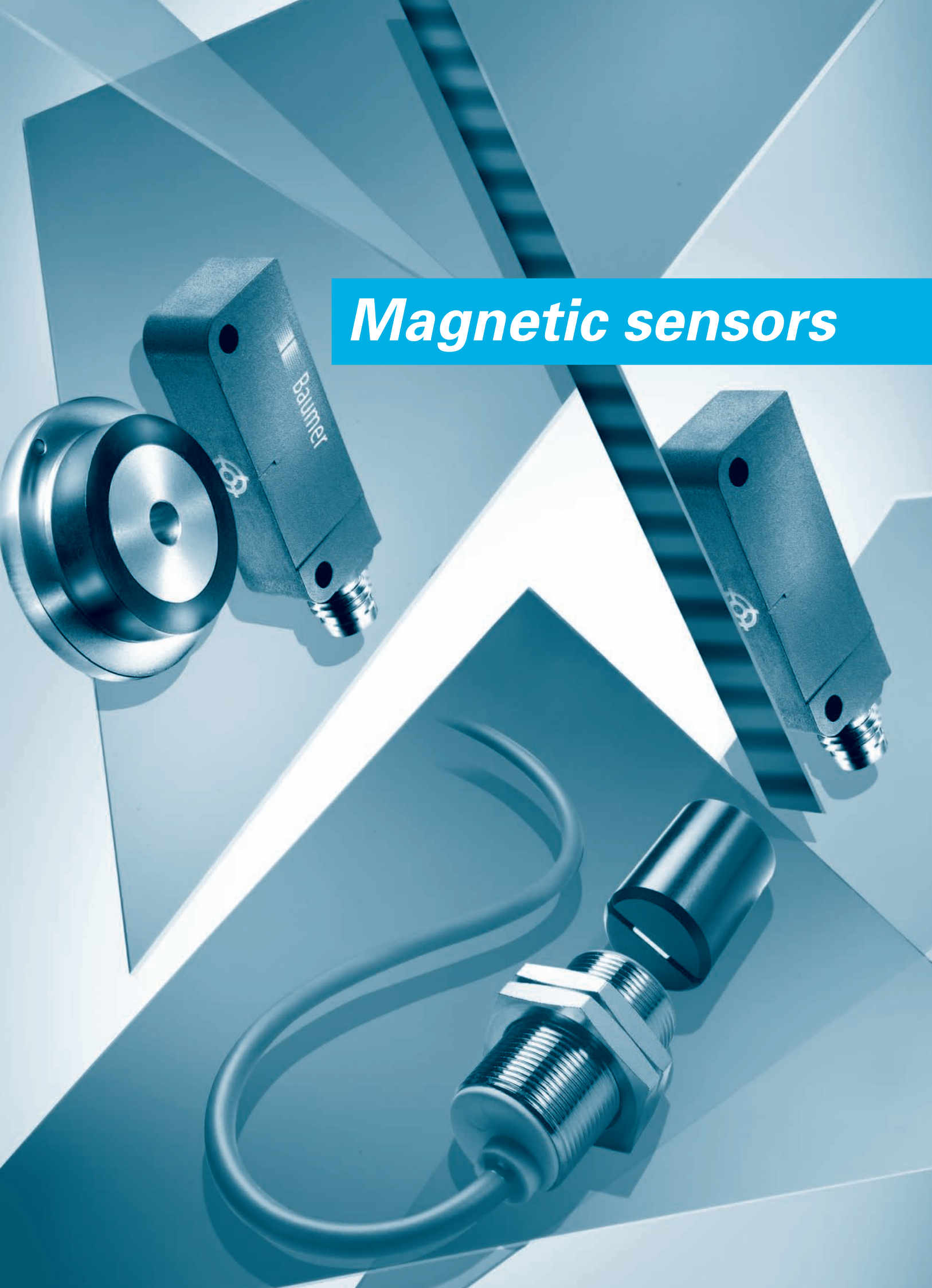



## connection diagram




## socket base and pin assignment ZKR 118






# Magnetic sensors

# Hall sensors
# Magnetic sensors

| | | | |
|---|---|---|---|
| **type** | **IHRM/MHRM** | **MDFM** | **MDRM** |
| typical use | hall sensor to sense moving ferromagnetic objects such as toothed wheels, gears or toothed racks | as non-contact electronic potentiometer magnetic scanning principle | as non-contact electronic potentiometer magnetic scanning principle |
| features | protection class IP 68<br>temperature range<br>-40...+85 °C<br>-40...+120 °C | rectangular construction with plug | cylindrical construction with cable<br>I and U output |
| voltage supply | 8 - 28 VDC | 5 VDC ±5% | 5 / 24 VDC ±5% |
| output signals | A & B | 2 Vpp (sin, cos) | 2 Vpp (sin, cos) / lin 120°, 160° |
| max. resolution / min. gear size | module 1 | 10 bit | 10 bit |
| max. switching frequency | 1 - 20'000 Hz | 20 kHz | 20 kHz |
| dimensions housing (mm) | M12 x 1 | 20 x 32 | M18 x 1 |
| depth (mm) | 50/60 | 10 | 30 |
| **page** | **176 / 177** | **178** | **178 / 180** |

| | | | |
|---|---|---|---|
| **type** | **MDFK 08 / MLFK 08** | **MDFK 10 / MLFK 10** | |
| typical use | **MDFK 08** to capture rotational speed as well as direction of rotation<br><br>**MLFK 08** to capture linear movement as well as direction of movement | **MDFK 10** to capture rotational speed as well as direction of rotation<br><br>**MLFK 10** to capture linear movement as well as direction of movement | |
| features | 2 and 3 channel versions | max. resolution 5µm | |
| voltage supply | 5 VDC / 8 - 30 VDC | 5 VDC / 8 - 28 VDC | |
| output signals | square pulses | square pulses | |
| max. resolution / min. gear size | 512 Imp. / 25 Imp. | 2'048 Imp. / 100 Imp. | |
| max. switching frequency | 3,2 MHz | 1 MHz / 400 kHz | |
| dimensions housing (mm) | 45 x 8 | 40 x 10 | |
| depth (mm) | 15 | 15 | |
| **page** | **182 / 184 / 186** | **188 / 190** | |

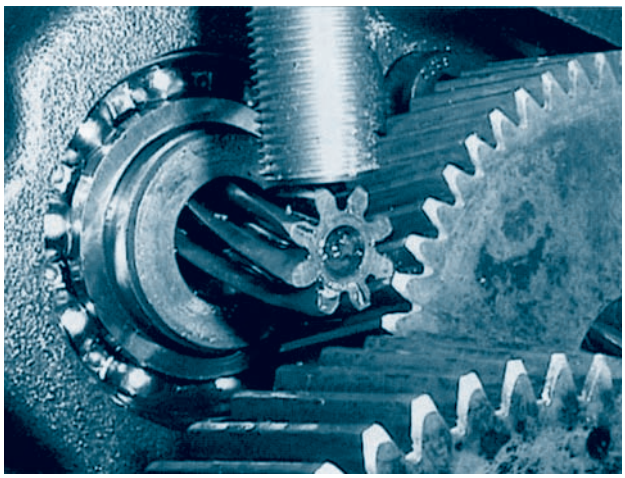
## features

- for sensing moving ferromagnetic objects
- detects toothed wheels, gears and toothed racks

## description

IHRM sensors employ a magnetically biased semiconductor Hall element to sense moving ferromagnetic objects. They are preferably used to scan toothed racks as well as gear wheels in gear boxes. The housing made of stainless steel 1.4305 protects the electronics against external influences such as oil and general aggressive environments.

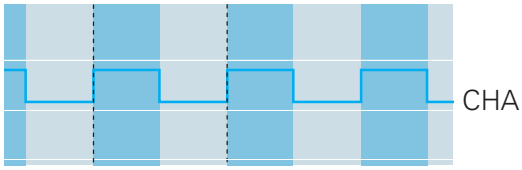
## application



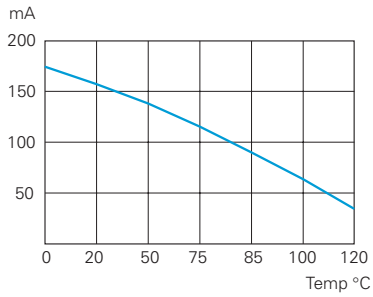
Hall sensors are used, for instance, as tachometer generators in the following situations:

- in dusty and damp environments, e.g. outdoor use, in agriculture, building machinery, etc.
- in textile, tobacco and cement processing (dust, vibration, smoke)
- integrated in portable devices, because of low power consumption, compact construction and shock resistance

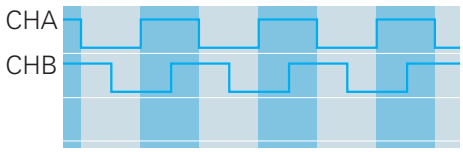
## output signal IHRM (One channel)



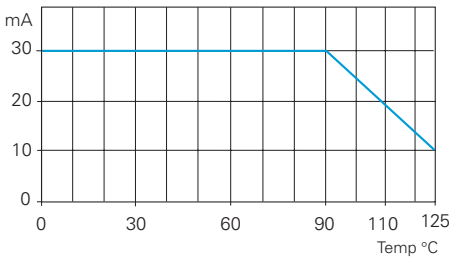

**load current reduction (IHRM 12P1501)**



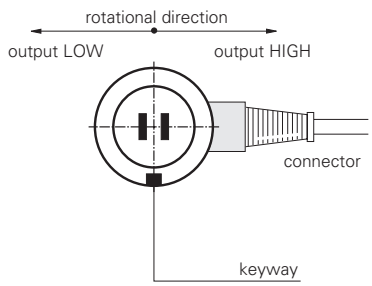

## output signal MHRM (Two channel)




**load current reduction (MHRM 12G2501)**



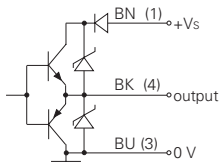

## rotational direction




The Hall sensors with keyway must be mounted in the specified orientation.

# Hall sensors
# MHRM

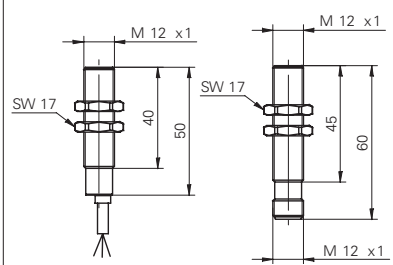
| dimensions | 12 mm | |
|---|---|---|
| air gap for module 2 | 1,8 mm | |

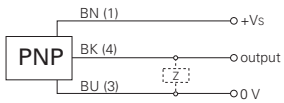
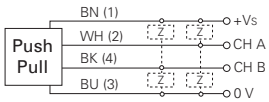
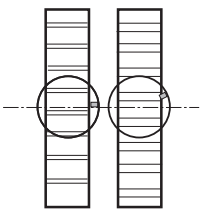
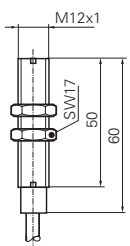
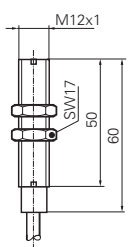



Push-Pull

| push-pull | MHRM 12G5501 | MHRM 12G5501/S14 |
|---|---|---|
| output | 1 channel | |

| technical data | | |
|---|---|---|
| voltage supply | 8 - 28 VDC | |
| supply current | 20 mA | |
| max. switching current | 30 mA | |
| max. switching frequency | 0 - 15'000 Hz | |
| voltage drop | < 5 VDC ($I_{OUT}$=20mA) | |
| short-circuit protection | yes | |
| reverse polarity protection | yes, against GND | |
| | | |
| min. gear size | module 1 | |
| air gap for module 1 | 0,7 mm | |
| air gap for module 2 | 1,8 mm | |
| gear material | ferrous metal | |
| alignment aid | non defined mounting | |
| | | |
| temperature range | -40...+85 °C | |
| housing material | brass nickel plated | |
| connection cable | PUR | |
| protection class | IP 67 | |
| | | |
| | | |
| connector options | | ES 14, ES 18, ESW 33, ESG 34 |

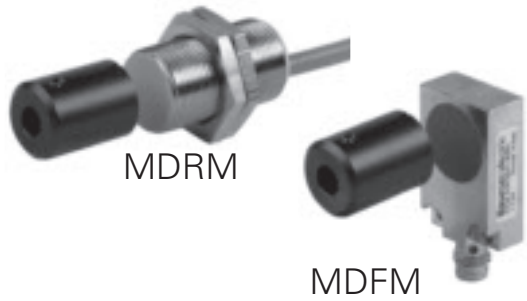


| dimensions | 12 mm | 12 mm |
|---|---|---|
| Air gap for module 3 | 2,5 mm | 1,0 mm |
| **IHRM 12P1501**<br>  <br>**output NPN (IOUT = 20 mA) possible**<br>**MHRM 12G2501**<br>  | | |
| **PNP** | **IHRM 12P1501** | **MHRM 12G2501** |
| **output** | **1 channel** | **2 channel** |
| **technical data** | | |
| voltage supply | 8 - 28 VDC | 8 - 28 VDC |
| supply current | 20 mA | 20 mA |
| max. switching current | see load current reduction diagram | see load current reduction diagram |
| max. switching frequency | 1 - 20'000 Hz | 0 - 15'000 Hz |
| voltage drop | < 3 VDC | < 5 VDC |
| output A (CH A) | PNP | push-pull |
| output B (CH B) | - | push-pull |
| short-circuit protection | yes | yes |
| reverse polarity protection | yes | yes, against GND |
| | | |
| min. gear size | module 1 | module 1 |
| air gap for module 1 | 1 mm | 0,5 mm |
| air gap for module 3 | 2,5 mm | 1,0 mm |
| gear material | ferrous metal | ferrous metal |
| installation aid | keyway | keyway |
| temperature range | -40...+120 °C | -40...+120 °C |
| housing material | stainless steel (1.4305) | stainless steel (1.4305) |
| connection cable | teflon | teflon |
| protection class sensing face | IP 68 / 20 bar | IP 68 / 20 bar |
| protection class sensor | IP 67 | IP 67 |
| | | |
| **mounting MHRM 12G2501**<br>**Mod 1 Mod 2**<br>  |  |  |

# Magnetic sensors
# MDRM/MDFM

## features

- can replace mechanical potentiometers
- sine/cosine output signals
- high protection class
- cylindrical and rectangular design




## description

The MDRM/MDFM miniature encoders have been designed to replace mechanical potentiometers in certain motion control applications. They are magnetically controlled by a small rotor closely positioned in front of the active sensing face. The encoders provide 2 sinusoidal signals. Further processing of the signals, having a maximum resolution of 10 bits, is easily accomplished using a standard PLC. The non-contact potentiometers offer IP 67 protection which makes them ideal components for an array of applications in harsh industrial environments involving wide working temperature ranges. The products can be provided either in threaded barrel type housings or in rectangular enclosures.

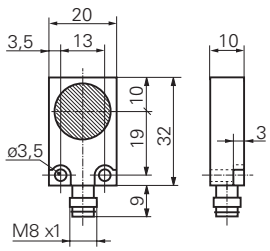
## part numbers

| | |
|---|---|
| output signals sine/cos<br>cylindrical design M18 x 1 | **MDRM 18U4501**<br>**MDFM 20U4501/S35A** |
| magnetic rotor | **123344** |

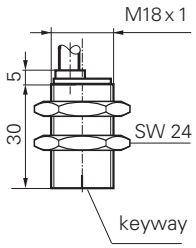
| technical data | sine/cos | | | |
|---|---|---|---|---|
| voltage supply | 5 VDC ±5% | | | |
| supply range | typ. 10 mA | | | |
| output signals | 2 Vpp<br>(sine, 2 periods per rev.) | | | |
| load | ≥ 400 Ω | | | |
| offset voltage | 2,5 VDC ±5% | | | |
| linearity error | typ. 2,5% | | | |
| temperature range | -20...+85 °C | | | |
| temperature coefficient | -0,3%/K | | | |
| max. switching frequency | 20 kHz | | | |
| housing size | M18 x 1 x 30<br>32 x 20 x 10 | | | |
| mounting rotor | hollow shaft<br>ø 6 x 15 mm | | | |
| installation tolerance | longitudinal ±0,5 mm<br>horizontal ±0,5 mm | | | |
| zero point adjustment | coarse: by keyway<br>fine: electronically | | | |
| protection class | IP 67 | | | |
| material sensor<br>material rotor | brass nickel plated<br>aluminium anodized | | | |

## dimensions

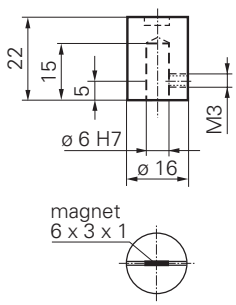
**MDFM**
**sine/cos**



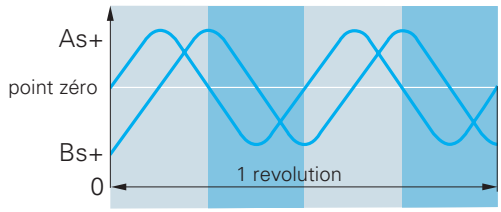

**MDRM**
**sine/cos**




**rotor**



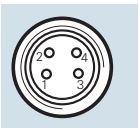

## output signals sine/cos




| cable assignment | | sine/cos |
|---|---|---|
| color | abbreviation | signals |
| brown | BN | +Vs |
| black | BK | As+ |
| blue | BU | 0 V |
| white | WH | Bs+ |

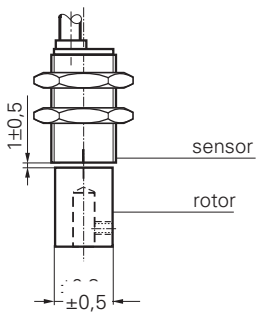
## assignment connector

for connector version **/S35A** (MDFM only)

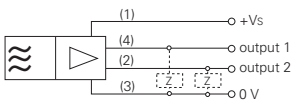



| pin nr. | signals |
|---|---|
| 1 | +Vs |
| 2 | output Bs+ |
| 3 | 0 V |
| 4 | output As+ |

## mounting




## connection diagram




## accessories

| | |
|---|---|
| connector 2 m PUR, halogen-free | |
| right angle | part nr. ESW 31AH0200 |
| straight | part nr. ESG 32AH0200 |
| rotor | part nr. 123344 |
| | see end of chapter |

# Magnetic sensors
# MDRM

## features

- can replace mechanical potentiometers
- linear output signals
- high protection class
- cylindrical design

## description

The MDRM miniature encoders have been designed to replace mechanical potentiometers in certain motion control applications. They are magnetically controlled by a small rotor closely positioned in front of the active sensing face. The encoders provide a DC voltage signal which is linear over +/- 80° (+/- 60° for current output). Further processing of the signals, having a maximum resolution of 10 bits, is easily accomplished using a standard PLC. The non-contact potentiometers offer IP 67 protection which makes them ideal components for an array of applications in harsh industrial environments involving wide working temperature ranges.

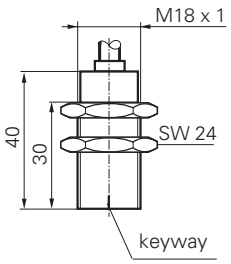
## part numbers

| output signals linear<br>cylindrical design M18 x 1 | |
|---|---|
| +Vs 5 VDC / Vout 0,5 - 4,5 VDC | **MDRM 18U9501** |
| +Vs 24 VDC / Vout 1 - 9 VDC | **MDRM 18U9524** |
| +Vs 24 VDC / Iout 4 - 20 mA | **MDRM 18I9524** |
| magnetic rotor | **123344** |

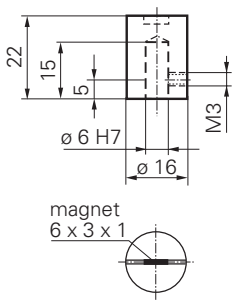
| technical data | MDRM 18U9501 | MDRM 18U9524 | MDRM 18I9524 |
|---|---|---|---|
| voltage supply | 5 VDC ±5% | 12 - 30 VDC | 10 - 30 VDC |
| supply current | < 20 mA | < 30 mA | < 50 mA |
| output signals | 0,3 - 4,7 VDC | 1 - 9 VDC | 4 - 20 mA |
| load | ≥ 400 Ω | > 3,3 k Ω | 0,5 k Ω @ 15 VDC<br>1 k Ω @ 25 VDC |
| linearity | ±80° linear | ±80° linear | ±60° linear |
| linearity error | 2,5% | ±2,5% | ±2,5% |
| temperature range | -20...+85 °C | -25...+85 °C | -25...+85 °C |
| temperature drift full scale (FS) | ±2% | ±2% | ±2% |
| max. switching frequency | 20 kHz | 20 kHz | 20 kHz |
| housing size | M18 x 1 x 40 | M18 x 1 x 40 | M18 x 1 x 40 |
| mounting rotor | hollow shaft ø 6 x 15 mm | hollow shaft ø 6 x 15 mm | hollow shaft ø 6 x 15 mm |
| installation | longitudinal ±0,3 mm<br>horizontal ±0,3 mm | longitudinal ±0,5 mm<br>horizontal ±0,5 mm | longitudinal ±0,5 mm<br>horizontal ±0,5 mm |
| zero point adjustment | coarse: by keyway<br>fine: electronically | coarse: by keyway<br>fine: electronically | coarse: by keyway<br>fine: electronically |
| protection class | IP 67 | IP 67 | IP 67 |
| material sensor<br>material rotor | brass nickel plated<br>alu anodized | brass nickel plated<br>alu anodized | brass nickel plated<br>alu anodized |

## dimensions

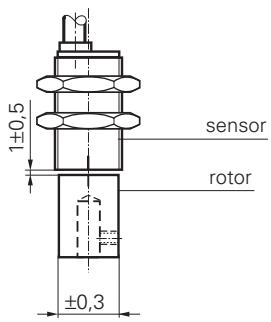
### sensor



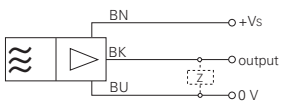

### rotor



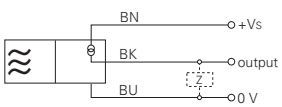

## mounting




## connection diagrams

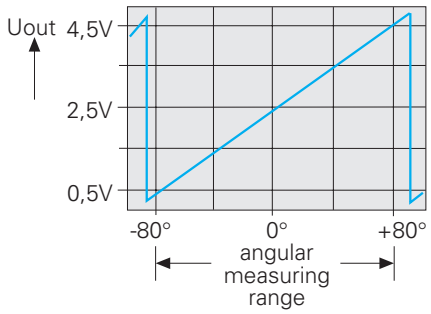



voltage output

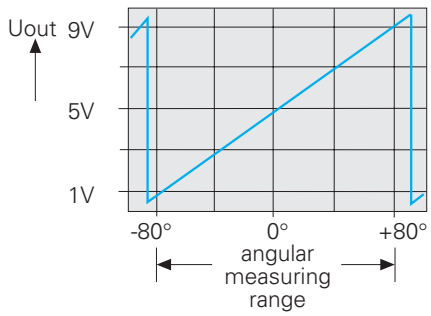



current output

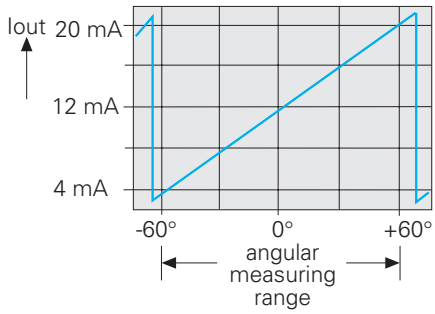
## linear output signal 0,5 - 4,5 VDC




## linear output signal 1 - 9 VDC




## linear output signal 4 - 20 mA




| cable assignment | | linear |
|---|---|---|
| color | abbreviation | signals |
| brown | BN | +Vs |
| black | BK | Out |
| blue | BU | 0 V |
| white | WH | - |

## accessory

| | |
|---|---|
| magnetic rotor | part nr. 123344<br>see end of chapter |

# Magnetic sensors for rotary applications
# MDFK 08, 2 channel

## features

- competitively priced angular measurement solution using ring magnet or magnetic rotor
- 2 channel version
- channel A/B 90° shifted
- 8-/16-fold interpolation

## description

Magnet encoders provide angular information by non-contact tracking of a multi-pole ring magnet based on a magneto resistive sensor. Depending on the angle between the sensor and the magnetic field, the device generates analog signals containing the angular information. These signals are further fed into an electronics circuit for additional conditioning and processing. The rugged and easy to mount sensor generates 4'096 steps when used in conjunction with a ring magnet of 64 poles. Angular resolution of the device can be partly determined by selecting appropriate ring magnets. The IP 67 protected sensor contains absolutely no moving parts and is not subject to any wear when in operation. Air gap between magnet and sensor can be up to 0,8 mm without sacrificing system accuracy.

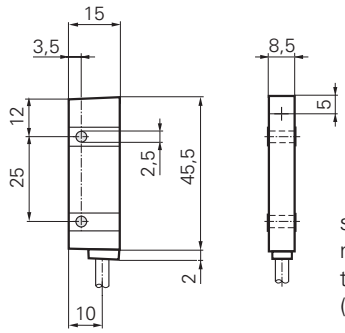
## part numbers

| | |
|---|---|
| 8-fold interpolation | |
| 2 channel push-pull | **MDFK 08G2101** |
| 2 channel complementary RS 422 | **MDFK 08T7101** |
| 16-fold interpolation | |
| 2 channel push-pull | **MDFK 08G2124/N16** |
| 2 channel complementary RS 422 | **MDFK 08T7105/N16** |

| technical data | MDFK 08G2101 | MDFK 08T7101 | MDFK 08G2124/N16 | MDFK 08T7105/N16 |
|---|---|---|---|---|
| | **push-pull** | **RS 422** | **push-pull** | **RS 422** |
| voltage supply | 8 - 30 VDC | 5 VDC ±5% | 8 - 28 VDC | 5 VDC ±5% |
| supply current | 35 mA | 55 mA | 30 mA | 20 mA |
| switching current | 30 mA | RS 422 | 50 mA | RS 422 |
| max. switching frequency | 160 kHz | 160 kHz | 3,2 MHz | 3,2 MHz |
| voltage drop | < 4 VDC ($I_{OUT}$ = 20 mA) | RS 422 | < 2 VDC ($I_{OUT}$ = 20 mA) | RS 422 |
| output circuit A/B | push-pull | TTL (RS 422) | push-pull | TTL (RS 422) |
| output signal | CH A/B | CH A/$\overline{A}$/B/$\overline{B}$ | CH A/B | CH A/$\overline{A}$/B/$\overline{B}$ |
| air gap | max. 0,8 mm | max. 0,8 mm | max. 0,6 mm | max. 0,6 mm |
| resolution | 256 ppr ring magnet 32 poles | 256 ppr ring magnet 32 poles | 512 ppr ring magnet 32 poles | 512 ppr ring magnet 32 poles |
| interpolation | 8-fold* | 8-fold* | 16-fold* | 16-fold* |
| max. measuring steps | 1'024 steps | 1'024 steps | 2'048 steps | 2'048 steps |
| short-circuit protection | yes | yes | yes | yes |
| reverse polarity protection | yes | no | yes | no |
| temperature range | -25...+85 °C | -25...+85 °C | -25...+85 °C | -25...+85 °C |
| housing material | PC | PC | PC | PC |
| max. protection class | IP 67 | IP 67 | IP 67 | IP 67 |
| connection cable PUR | 4 x 0,25 mm² | 6 x 0,14 mm² | 4 x 0,25 mm² | 6 x 0,14 mm² |

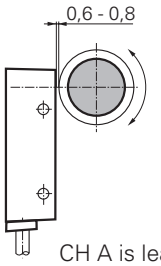
*lower interpolation rates on request

## dimensions



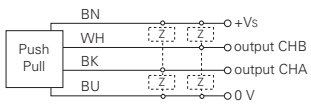

sensor can also be mounted with self-tapping special screws (M3)

## mounting and sense of rotation

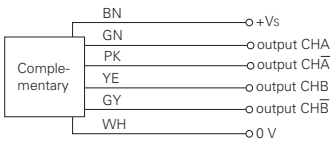



CH A is leading CH B by 90° when rotating CW.

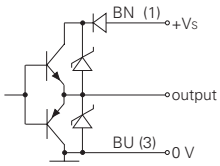
## 2 channel push-pull



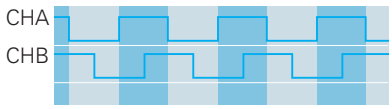

## 2 channel complementary RS 422



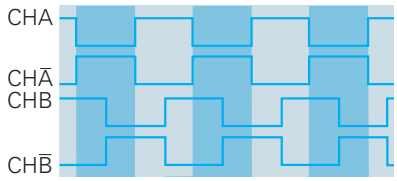

## connection diagram push-pull




## pin assignment 2 channel push-pull




## pin assignment 2 channel RS 422




## pin assignment 2 channel push-pull

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| blue | BU | GND |
| black | BK | CH A |
| white | WH | CH B |

## pin assignment 2 channel complementary RS 422

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| pink | PK | CH Ā |
| yellow | YE | CH B |
| grey | GY | CH B̄ |
| white | WH | GND |

## accessories

see end of chapter

# Magnetic sensors for rotary applications
# MDFK 08, 3 channel

## features

- competitively priced angular measurement solution using ring magnet or magnetic rotor
- 3 channel version
- channel A/B 90° shifted and zero pulse
- 10-/16-fold interpolation

## description

Magnet encoders provide angular information by non-contact tracking of a multi-pole ring magnet based on a magneto resistive sensor. Depending on the angle between the sensor and the magnetic field, the device generates analog signals containing the angular information. These signals are further fed into an electronics circuit for additional conditioning and processing. The rugged and easy to mount sensor generates 2'048 steps when used in conjunction with a ring magnet of 32 poles. Angular resolution of the device can be partly determined by selecting appropriate ring magnets. The IP 67 protected sensor contains absolutely no moving parts and is not subject to any wear when in operation. Air gap between magnet and sensor can be up to 0,5 mm without sacrificing system accuracy.

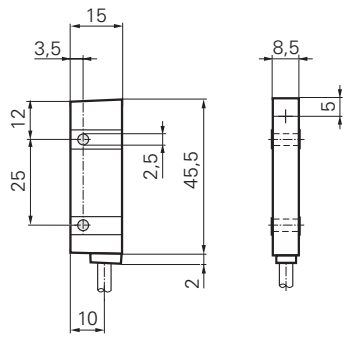
## part numbers

| | |
|---|---|
| 3 channel push-pull | **MDFK 08G8124** |
| 3 channel complementary RS 422 | **MDFK 08T8101** |

| technical data | MDFK 08G8124 | MDFK 08T8101 | | |
|---|---|---|---|---|
| | **push-pull** | **RS 422** | | |
| voltage supply | 8 - 28 VDC | 5 VDC ±5% | | |
| supply current | 30 mA | 30 mA | | |
| switching current | 50 mA | RS 422 | | |
| max. switching frequency | 3,2 MHz | 160 kHz | | |
| voltage drop | < 2 VDC ($I_{OUT}$ = 50 mA) | RS 422 | | |
| output circuit A/B | push-pull | TTL (RS 422) | | |
| output signal | CH A/B/N | CH A/$\overline{A}$/B/$\overline{B}$/N/$\overline{N}$ | | |
| air gap | max. 0,5 mm | max. 0,5 mm | | |
| resolution | 512 ppr<br>ring magnet<br>32 poles | 320 ppr<br>ring magnet<br>32 poles | | |
| interpolation | 16-fold* | 10-fold* | | |
| max. measuring steps | 2'048 steps | 1'280 steps | | |
| short-circuit protection | yes | yes | | |
| reverse polarity protection | yes | no | | |
| temperature range | -25...+85 °C | -25...+85 °C | | |
| housing material | PC | PC | | |
| max. protection class | IP 67 | IP 67 | | |
| connection cable PUR | 5 x 0,14 mm² | 8 x 0,14 mm² | | |

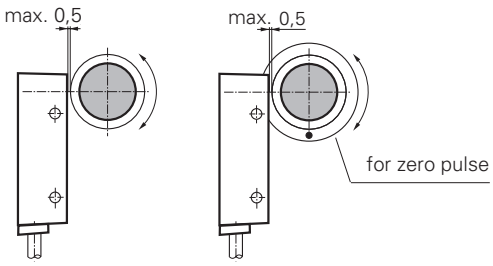
*lower interpolation rates on request

## dimensions



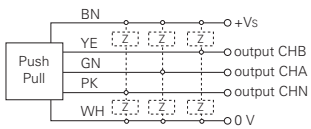

sensor can also be mounted with self-tapping special screws (M3)

## montage and sense of rotation

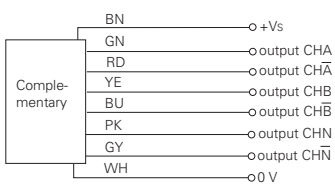



CH A is leading CH B by 90° when rotating CW.

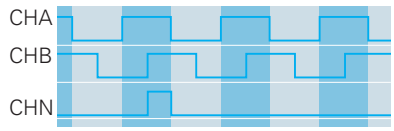
## 3 channel push-pull (with zero pulse)



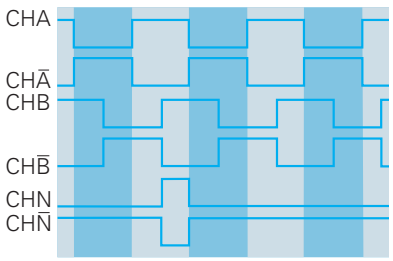

## 3 channel complementary RS 422 (with zero pulse)




## output signals 3 channel push-pull




## output signals 3 channel RS 422




3 channel version with zero-pulse (CHN/CHN̄)

## pin assignment 3 channel push-pull

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| yellow | YE | CH B |
| pink | PK | CH N |
| white | WH | GND |

## pin assignment 3 channel complementary RS 422

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| red | RD | CH Ā |
| yellow | YE | CH B |
| blue | BU | CH B̄ |
| pink | PK | CH N |
| grey | GY | CH N̄ |
| white | WH | GND |

## accessories

| | |
|---|---|
| magnet rotor 32 poles (zero pulse) | part nr. 132124<br>see end of chapter |
| magnet rotor 64 poles (zero pulse) | part nr. 150984<br>see end of chapter |
| mounting bracket | part nr. 134683<br>see end of chapter |

# Magnetic sensors for linear applications
# MLFK 08, 2 channel

## features

- non-contact, magnetic linear measuring sensor
- low cost alternative to linear encoders
- max. resolution 10 µm with external quadrature electronics
- 2 channel version
- max. displacement speed 40 m/s

## description

MLFK magnet encoders provide linear position information by non- contact tracking of a magnetic strip based on a magneto resistive sensor. Depending on the angle between the sensor and the magnetic field, the device generates analog signals containing the angular information. These signals are further fed into an electronics circuit for additional conditioning and processing. The rugged and easy to mount linear encoder generates 25 pulses per pole (1 mm width) when used in conjunction with a magnetic strip. The IP 67 protected sensor contains absolutely no moving parts and is not subject to wear when in operation.

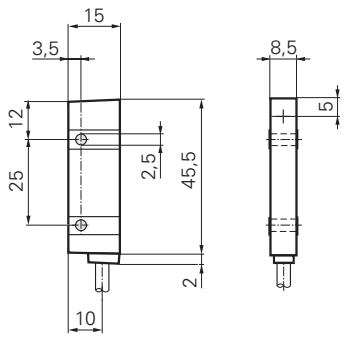
## part numbers

| | |
|---|---|
| 2 channel push-pull | **MLFK 08G2101** |
| 2 channel complementary (RS 422) | **MLFK 08T7101** |
| 2 channel complementary (RS 422) high resolution | **MLFK 08T7105/N16X** |
| 2 channel complementary (RS 422) very high resolution | **MLFK 08T7105/N25X** |

| technical data | MLFK 08G2101 | MLFK 08T7101 | MLFK 08T7105/N16X | MLFK 08T7105/N25X |
|---|---|---|---|---|
| | **push-pull** | **RS 422** | **RS 422** | **RS 422** |
| voltage supply | 8 - 30 VDC | 5 VDC ±5% | 5 VDC ±5%** | 5 VDC ±5%** |
| supply current | 35 mA | 55 mA | 20 mA | 20 mA |
| switching current | 30 mA | RS 422 | RS 422 | RS 422 |
| max. switching frequency | 160 kHz | 160 kHz | 3,2 MHz | 3,2 MHz |
| voltage drop | < 4 VDC ($I_{OUT}$ = 20 mA) | RS 422 | RS 422 | RS 422 |
| output circuit A/B | push-pull | TTL (RS 422) | TTL (RS 422) | TTL (RS 422) |
| output signal | CH A/B | CH A/$\overline{A}$/B/$\overline{B}$ | CH A/$\overline{A}$/B/$\overline{B}$ | CH A/$\overline{A}$/B/$\overline{B}$ |
| air gap | max. 1,0 mm | max. 1,0 mm | max. 0,3 mm | max. 0,3 mm |
| resolution | 8 ppr | 8 ppr | 16 ppr | 25 ppr |
| interpolation | 8-fold* | 8-fold* | 16-fold* | 25-fold* |
| max. measuring steps | 32 steps | 32 steps | 64 steps | 100 steps |
| short-circuit protection | yes | yes | yes | yes |
| reverse polarity protection | yes Vs to GND | no | no | no |
| temperature range | -25...+85 °C | -25...+85 °C | -25...+85 °C | -10...+65 °C |
| housing material | PC | PC | PC | PC |
| max. protection class | IP 67 | IP 67 | IP 67 | IP 67 |
| connection cable PUR | 4 x 0,25 mm² | 6 x 0,14 mm² | 6 x 0,14 mm² | 6 x 0,14 mm² |
| matching magnetic strip | 128606 | 128606 | 147044 | 147044 |

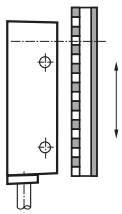
*lower interpolation rates on request **24 VDC version on request

## dimensions

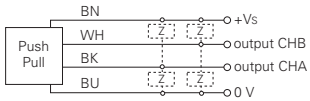



sensor can also be mounted with special self-tapping screws (M3)

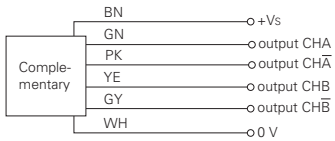
## mounting and direction of travel



## 2 channel push-pull

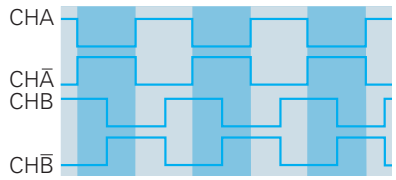



## 2 channel complementary RS 422




## output signals 2 channel push-pull

## output signals 2 channel RS 422




## pin assignment 2 channel push-pull

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| blue | BU | GND |
| black | BK | CH A |
| white | WH | CH B |

## pin assignment 2 channel complementary RS 422

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| pink | PK | CH Ā |
| yellow | YE | CH B |
| grey | GY | CH B̄ |
| white | WH | GND |

## accessories

magnetic strip

pole width 2 mm, strip width 10 mm, height max. 1,4 mm

| length | |
|---|---|
| 50 mm | part nr. 128662 |
| 150 mm | part nr. 128663 |
| 300 mm | part nr. 128664 |
| cut to length | part nr. 128606 |

pole width 1 mm, strip width 10 mm, height max. 1,4 mm

| length | |
|---|---|
| cut to length | part nr. 147044 |

for more information see end of chapter

# Magnetic sensors for rotary applications
# MDFK 10, 3 channel

## features

- competitively priced angular measurement solution using ring magnet or magnetic rotor
- 3 channel version
- channel A/B 90° shifted
- 64-fold interpolation

## description

Magnet encoders provide angular information by non-contact tracking of a multi-pole ring magnet based on a magneto resistive sensor. Depending on the angle between the sensor and the magnetic field, the device generates analog signals containing the angular information. These signals are further fed into an electronics circuit for additional conditioning and processing. The rugged and easy to mount sensor generates 8'196 steps when used in conjunction with a ring magnet of 32 poles. The MDFK 10 range of sensors provides a high degree of installation flexibility due to the position of the magneto-resistive pick-up being at the center of the device's face. An important fact when space is at a premium. All 10-series sensors feature a screened PUR cable.

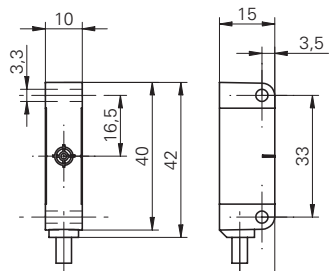
## part numbers

| | |
|---|---|
| 64-fold interpolation | |
| 3 channel push-pull | **MDFK 10G8124/N64** |
| 3 channel complementary RS 422 | **MDFK 10T8105/N64** |

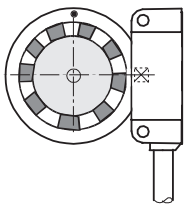
| technical data | MDFK 10G8124/N64 | MDFK 10T8105/N64 | | |
|---|---|---|---|---|
| | **push-pull** | **RS 422** | | |
| voltage supply | 8 - 28 VDC | 5 VDC ±5% | | |
| supply current | 40 mA | 40 mA | | |
| switching current | 50 mA | 50 mA | | |
| max. switching frequency | 1 MHz | 1 MHz | | |
| voltage drop | < 4 VDC<br>($I_{OUT}$ = 20 mA) | – | | |
| output circuit A/B | 3 channel, push-pull | RS 422 | | |
| output signal | A/B/N | CH A/$\overline{A}$/B/$\overline{B}$/N/$\overline{N}$ | | |
| air gap | max. 0,6 mm | max. 0,6 mm | | |
| resolution | 2048 ppr<br>ring magnet<br>32 poles | 2048 ppr<br>ring magnet<br>32 poles | | |
| interpolation | 64-fold* | 64-fold* | | |
| max. measuring steps | 8192 steps | 8192 steps | | |
| short-circuit protection | yes | yes | | |
| reverse polarity protection | yes<br>Vs to GND | no | | |
| temperature range | -25...+85 °C | -25...+85 °C | | |
| housing material | PA6 | PA6 | | |
| max. protection class | IP 67 | IP 67 | | |
| connection cable PUR | 5 x 0,14 mm$^2$ | 6 x 0,14 mm$^2$ | | |

*lower interpolation rates on request

## dimensions

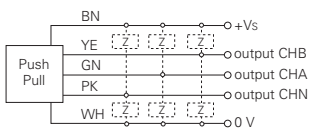



## mounting and sense of rotation

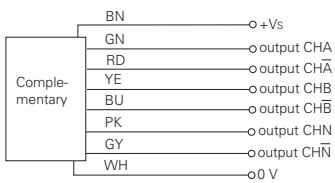


CH A is leading CH B by 90°
when rotating CW.

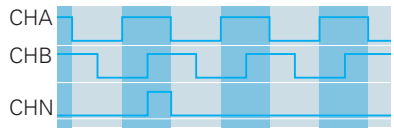
## 3 channel push-pull (with zero pulse)



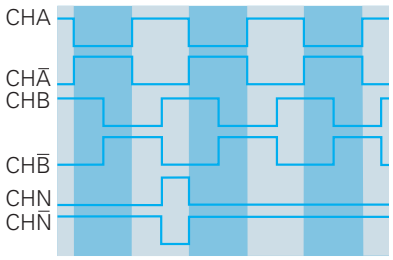

## 3 channel complementary RS 422 (with zero pulse)




## pin assignment 3 channel push-pull




## pin assignment 3 channel RS 422




## pin assignment 3 channel push-pull

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CHA |
| yellow | YE | CHB |
| pink | PK | CHN |
| white | WH | GND |

## pin assignment 3 channel complementary RS 422

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| red | RD | CHĀ |
| yellow | YE | CHB |
| blue | BU | CHB̄ |
| pink | PK | CHN |
| grey | GY | CHN̄ |
| white | WH | GND |

## accessories

| | |
|---|---|
| magnet rotor 32 poles (zero pulse) | part nr. 132124<br>see end of chapter |
| magnet rotor 64 poles (zero pulse) | part nr. 150984<br>see end of chapter |

# Magnetic sensors for linear applications
# MLFK 10, 2 channel

## features

- non-contact, magnetic linear measuring sensor
- low cost alternative to linear encoders
- max. resolution 10 µm with external quadrature electronics
- 2 channel version
- max. displacement speed 40 m/s

## description

Magnet encoders provide angular information by non-contact tracking of a multi-pole ring magnet based on a magneto resistive sensor. Depending on the angle between the sensor and the magnetic field, the device generates analog signals containing the angular information. A resolution of 5µ can be achieved when using a magnetic strip of 2 mm pole width and external signal quadrature. The MDFK 10 range of sensors provides a high degree of installation flexibility due to the position of the magneto-resistive pick-up being at the center of the device's face. An important fact when space is at a premium. All 10-series sensors feature a screened PUR cable.

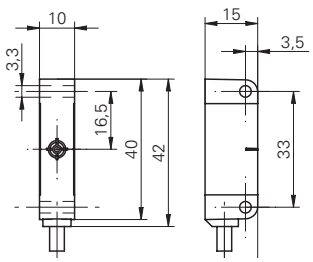
## part numbers

| | |
|---|---|
| 2 channel push-pull | **MLFK 10G2124/N100** |
| 2 channel (RS 422) | **MLFK 10T7105/N100** |

| technical data | MLFK 10G2124/N100 | MLFK 10T7105/N100 | | |
|---|---|---|---|---|
| | **push-pull** | **RS 422** | | |
| voltage supply | 8 - 28 VDC | 5 VDC ±5% | | |
| supply current | 30 mA | 20 mA | | |
| switching current | 50 mA | 50 mA | | |
| max. switching frequency | 400 kHz | 400 kHz | | |
| voltage drop | 2 VDC ($I_{OUT}$ = 20 mA) | RS 422 | | |
| output circuit A/B | 2 channel, push-pull | RS 422 | | |
| output signal | CH A/B | CH A/$\overline{A}$/B/$\overline{B}$ | | |
| air gap | 0,8 mm | 0,8 mm | | |
| resolution | 100 ppr | 100 ppr | | |
| interpolation | 100-fold* | 100-fold* | | |
| max. measuring steps | 400 steps | 400 steps | | |
| short-circuit protection | yes | yes | | |
| reverse polarity protection | yes Vs to GND | no | | |
| temperature range | -25...+85 °C | -25...+85 °C | | |
| housing material | PA6 | PA6 | | |
| max. protection class | IP 67 | IP 67 | | |
| connection cable PUR | 4 x 0,25 mm² | 6 x 0,14 mm² | | |
| matching magnetic strip | 128606 | 128606 | | |

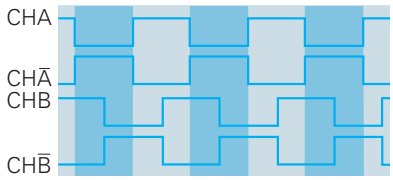
*lower interpolation rates on request

## dimensions

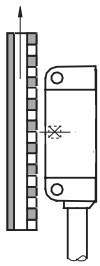



## output signals 2 channel push-pull

## output signals 2 channel RS 422



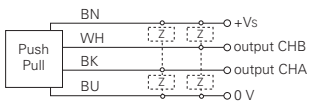

## mounting and direction of travel



## pin assignment 2 channel push-pull

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| blue | BU | GND |
| black | BK | CH A |
| white | WH | CH B |

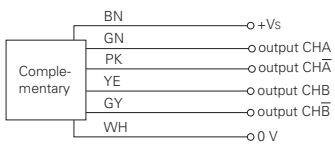
## 2 channel push-pull




## pin assignment 2 channel complementary RS 422

| color | abbreviation | signals |
|---|---|---|
| brown | BN | +Vs |
| green | GN | CH A |
| pink | PK | CH Ā |
| yellow | YE | CH B |
| grey | GY | CH B̄ |
| white | WH | GND |

## 2 channel complementary RS 422




## accessories

magnetic strip
pole width 2 mm, strip width 10 mm, height max. 1,4 mm

| length | |
|---|---|
| 50 mm | part nr. 128662 |
| 150 mm | part nr. 128663 |
| 300 mm | part nr. 128664 |
| cut to length | part nr. 128606 |

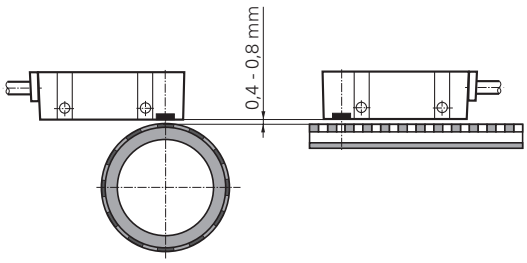
# Mounting instructions
# Linear and rotary magnetic sensors
# MDFK / MLFK

## instructions

Magnetic sensors must be mounted in a defined position in relation to ring magnets or magnetic strips. Always maintain air gap, angular and axial misalignment within specifications in order to prevent negative effects on the measuring accuracy.

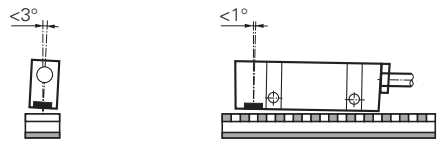
Small misalignments within specifications result in minor system related measuring inaccuracies caused by ring magnets or magnetic strips (inaccuracy of magnetization, glued magnetic strip, true running of ring magnets). Ring magnets or magnetic strips should not be exposed to strong external magnetic fields, excessive ambient temperatures or heavy mechanical abuse like direct hits with hard objects. Also, be certain that ring magnets or magnetic strips are never placed near ferromagnetic parts, as this could cause magnetization resulting in signal distortion.

## air gap

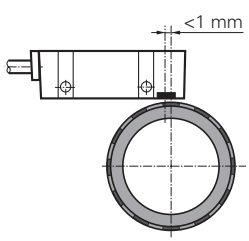


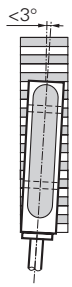

## angular misalignment

(applies to applications with both ring magnets and magnetized strips)



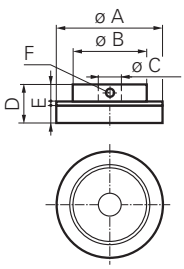

## axial misalignment



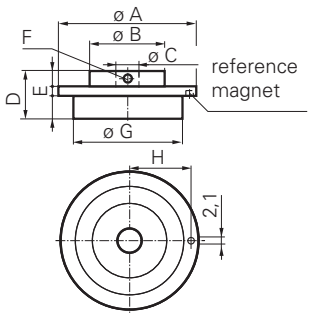
## magnet rotor

part nr. see chart



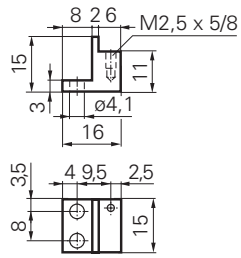

## magnet rotor (zero pulse)

part nr. see chart




## mounting bracket MDFK 08

part number 134683



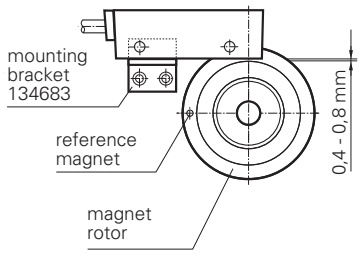

## dimension without zero pulse

| | 32 poles | 36 poles | 64 poles |
|---|---|---|---|
| **A** | 30,5 | 30,5 | 56 |
| **B** | 20 | 20 | 35 |
| **C** | 6H7 | 6H7 | 25E7 |
| **D** | 14 | 14 | 15 |
| **E** | 7 / 5 | 7 / 5 | 8 / 6 |
| **F** | M3 | M3 | M4 |
| **G** | – | – | – |
| **H** | – | – | – |
| **material** | alu | alu | alu |
| **part number** | 134061 | 157948 | 143924 |

## dimension with zero pulse

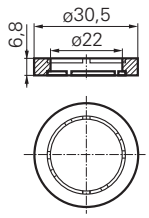
| | 32 poles | 36 poles | 64 poles |
|---|---|---|---|
| **A** | 40 | 40 | 66 |
| **B** | 20 | 20 | 66 |
| **C** | 6H7 | 6H7 | 25E7 |
| **D** | 17 | 17 | 18 |
| **E** | 8 / 5 | 8 / 5 | 9 / 9 |
| **F** | M3 | M3 | M4 |
| **G** | 30,5 | 30,5 | 56 |
| **H** | 18 | 18 | 31,3 |
| **material** | alu | alu | alu |
| **part number** | 132124 | 147433 | 150984 |

## mounting MDFK 08 (0-pulse)



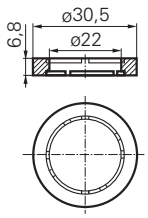

## ring magnet 32 poles

part number 156640



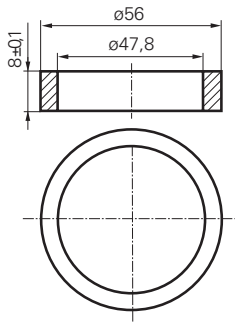

## ring magnet 36 poles

part number 147431




## ring magnet 64 poles

part number 143920

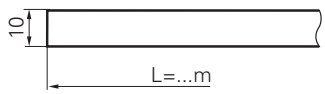



Ring magnet can be designed to meet application specific requirements.

# Accessories
# Magnetic sensors

## magnetic strip for MLFK

| length | part number |
|---|---|
| 50 mm | 128662 |
| 150 mm | 128663 |
| 300 mm | 128664 |
| L= (cut to length) | 128606 |

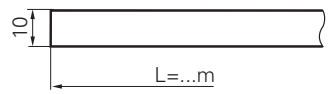



pole width 2 mm
strip thickness 1,4 mm

## magnetic strip for MLFK

| length | part number |
|---|---|
| L= (cut to length) | 147044 |

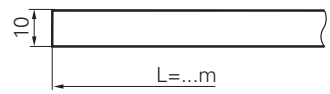
**for MLFK with suffix X only**




pole width 1 mm
strip thickness 1,4 mm

## self-adhesive protective tape

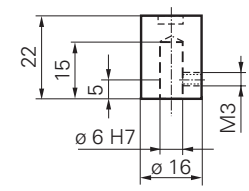
| part number | 157164 |
|---|---|




strip thickness 0,25 mm

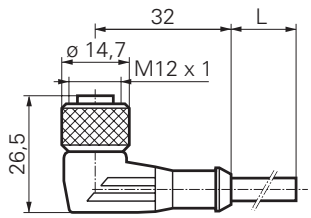
## rotor

| part number | 123344 |
|---|---|



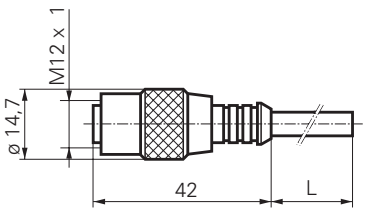

## connector ESW 33A

| part number | | cable length |
|---|---|---|
| ESW 33AH0200 | 4-pin | 2 m PUR |
| ESW 33AH0500 | 4-pin | 5 m PUR |
| ESW 33AH1000 | 4-pin | 10 m PUR |
| halogen-free | | |




## connector ESG 34A

| part number | | cable length |
|---|---|---|
| ESG 34AH0200 | 4-pin | 2 m PUR |
| ESG 34AH0500 | 4-pin | 5 m PUR |
| ESG 34AH1000 | 4-pin | 10 m PUR |
| halogen-free | | |

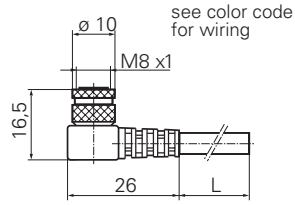



## pin-assignment con. 4-pin (M12)

| pin nr. | color |
|---|---|
| 1 | BN (brown) |
| 2 | WH (white) |
| 3 | BU (blue) |
| 4 | BK (black) |

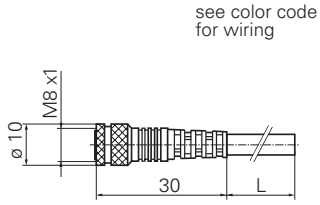
## connector ESW 31A

| part number | | cable length |
|---|---|---|
| ESW 31AH0200 | 4-pin | 2 m PUR |
| ESW 31AH0500 | 4-pin | 5 m PUR |
| ESW 31AH1000 | 4-pin | 10 m PUR |
| halogen-free | | |

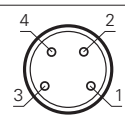



## connector ESG 32A

| part number | | cable length |
|---|---|---|
| ESG 32AH0200 | 4-pin | 2 m PUR |
| ESG 32AH0500 | 4-pin | 5 m PUR |
| ESG 32AH1000 | 4-pin | 10 m PUR |
| halogen-free | | |



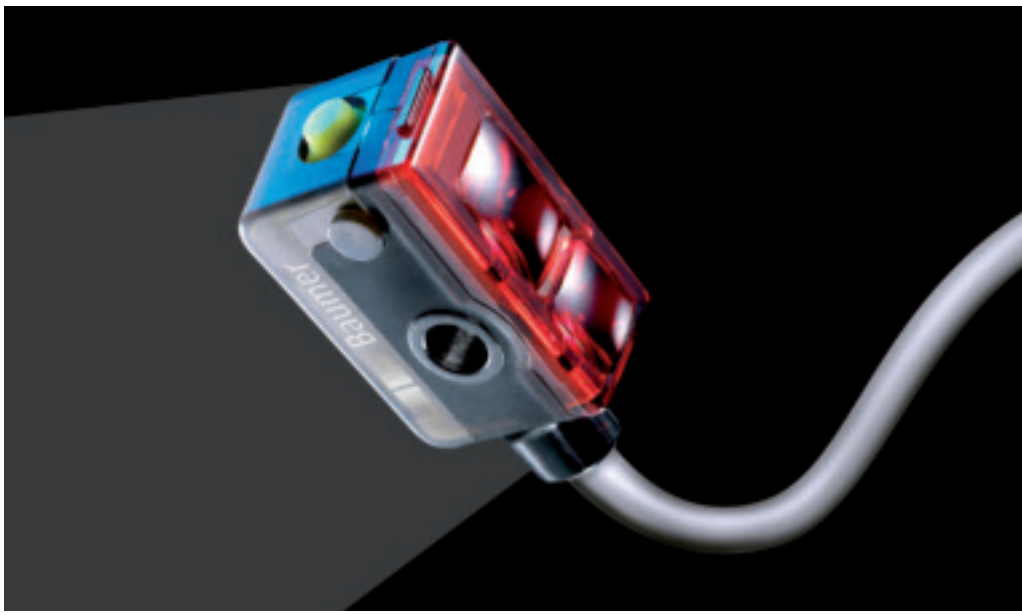

## pin-assignment con. 4-pin (M8)




| pin nr. | color |
|---|---|
| 1 | BN (brown) |
| 2 | WH (white) |
| 3 | BU (blue) |
| 4 | BK (black) |

Baumer

# Precise, measurably better. Photoelectric sensors. Fiber optics and fiber optic sensors. Vision sensors.




Sensor Solutions
Motion Control
Vision Technologies

No newspaper, no chocolate, no car, no computer, no cell phone could be manufactured today, no letters or parcels would reach their recipients and no bottle of beer could be filled if optical sensors could not detect parts, measure distances, determine colors, count components and detect levels.

**State of the art:**

Modern technology makes it possible to build compact photoelectric sensors with which objects can be detected reliably and precisely even in rough, industrial environments.

Even easy set up smart vision sensors are capable of solving applications in a 2-dimensional area.

**Photoelectric sensors from Baumer:**

Baumer provides a large range of photoelectric sensors for many different applications.

- Light barriers and diffuse types and such as with background suppression, available also in the smallest versions on the market
- Almost every sensor is available with visible laser light, even the small ones
- Large range of fiber optic sensors and fibers
- Distance measuring laser sensors with high resolution down to 2 µm and measuring distance up to 1 m provide absolute distance information
- Fully contained line sensors for webcontrol or to detect parts in a 2-dimensional area or providing an absolute distance information
- Compact vision sensors for position control, control of completeness and control of part presence
- Sensors for special applications such as the laser copy counter *SCATEC*

Special custom solutions are available for OEM requirements.

In almost every automation process photoelectric sensors play an essential role.

Baumer is the right partner to provide you with competitive and effective solutions for your photo-electric sensing needs.

**Please ask us!**

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# *Miniature sensors – an enormous part of Baumer's domain!*

Miniaturization is an unstoppable trend. Faster processes, better quality and highly integrated machines demand more and more efficient miniaturized sensors.
Our unique miniature sensors have solved many applications where it seemed impossible to detect the object in its position.

No space is too small; no application is too difficult to be solved by a miniature sensor from Baumer.

- FHDK 04: smallest diffuse sensor with background suppression on the market (4x5x45mm)
- The sensor family with the smallest housing and adjustable sensing distance (*MINOS*)
- Smallest laser sensor with adjustable background suppression (OHDK 10)
- Series F10: widest product range with best performance

- Either a Teach-in facility or an adjusting button, even on the smallest sensor, makes it possible to adjust the sensor easily and accurately to your application

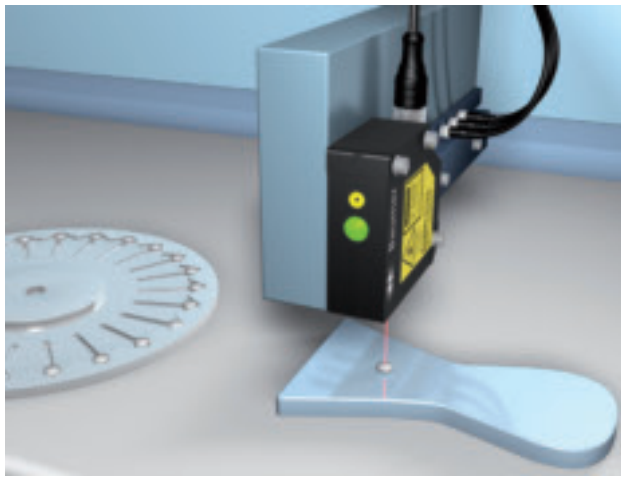
- Beam size of 0,1 mm to detect very small parts or detect larger objects very precisely independent of any background
- Smallest fully contained distance measuring laser sensor with a resolution down to +/- 2 µm (OADM 12) and measuring distance up to 550mm (OADM 13)

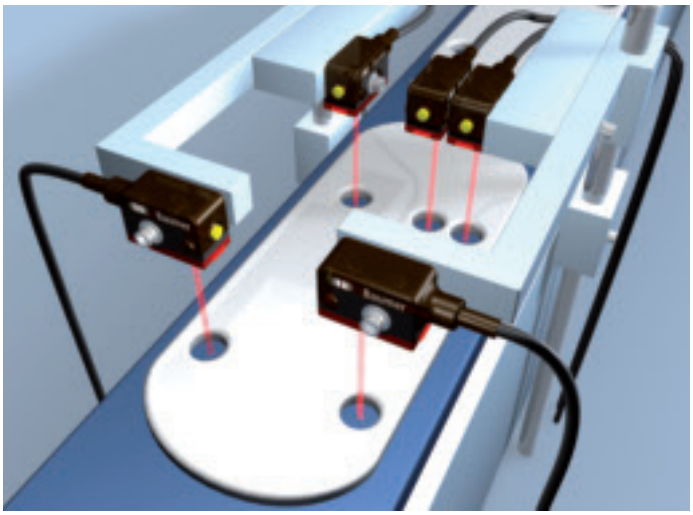
- Large range of plastic and glass fiber optics to solve even the most difficult applications
- Customized fibers
- Broad range of amplifiers: From the easy adjustable to the teachable, high performance one

# Miniature sensor applications

**Laser distance sensor**

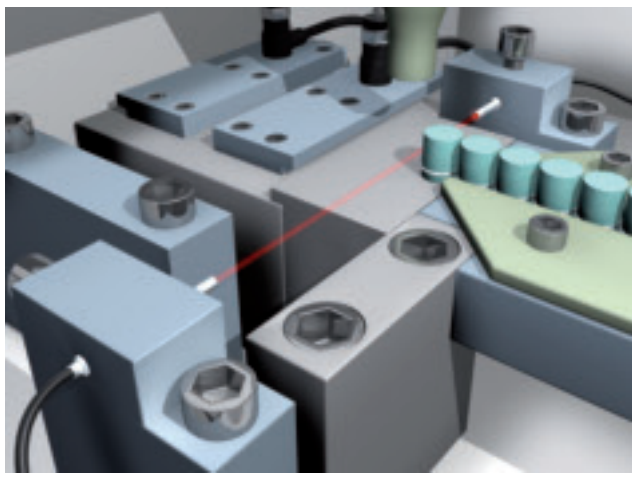
- Thickness measurement of tablets.





**Diffuse sensor with background suppression**

- Drill hole inspection.



**Small fiber optic head**

- Detection of small parts in an automatic handling machine.

# Distance measuring sensors

In many applications more information is needed than just object presence. Our sensors measure in the micron, millimeter or, depending on the application, in the meter range. They measure distances, width, heights and diameters with great accuracy and are not deterred by difficult surfaces.

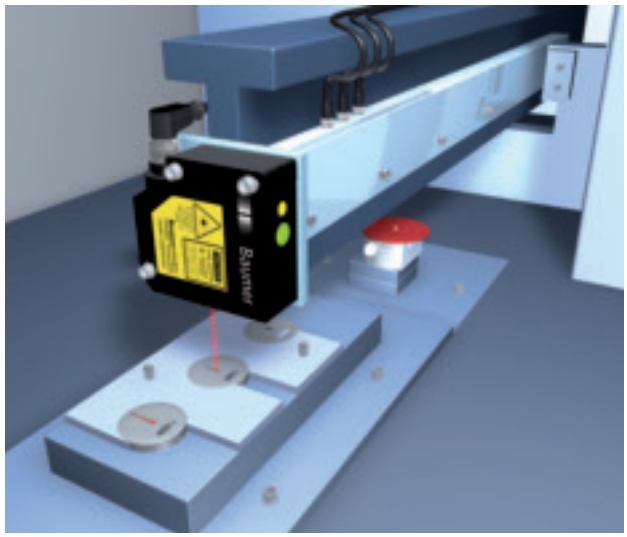
- Fully contained CCD line sensors in a compact housing
- *ParCon* measures position or size of an object in a range of 24 mm
- *PosCon* measures the edge of a web in ranges from 50 mm up to 350 mm
- *PosCon* with key pads for simple set-up for your application
- Highest resolution 0,03 mm

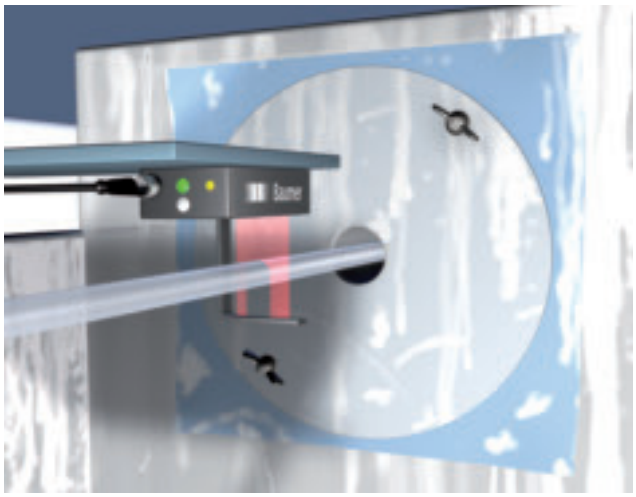
- Laser distance measuring sensors are fully contained in compact housings
- Measuring distances from 0,02 m up to 1 m
- Highest resolution ±0,002 mm
- Shortest response time 0,9 ms
- Teachable measuring ranges for optimized resolution
- Measures distances independent of colors or surfaces

# Distance measuring sensor applications

**Laser distance sensor** (OADM 12)

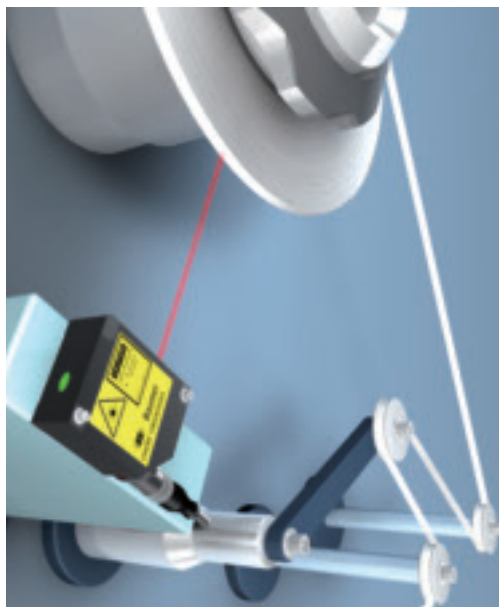
- Distance measurement on the face of a clock to determine the correct pressing depth of the hands.





**Line sensor** *(ParCon)*

- Inspection of the diameter directly after the extruder.



**Laser distance sensor** (OADM 20)

- Measurement of the quantity remaining on a paper reel.

# *Laser sensors – fast and accurate!*

You want to detect very fine and thin objects? Or should the sensor be guided through a small hole or aperature? The small and energetic laser spot allows large sensing distances with diffuse, through-beam and retro-reflective laser sensors.

- Small, visible light spot
- Laser class 1 or 2
- Laser diodes with a lifetime up to 100'000 hours

- Smallest diffuse laser sensor with adjustable background suppression (OHDM 10)
- Single optic retro-reflective laser sensors
- Smallest, fully contained distance measuring sensor (OADM 12)
- Large range of distance measuring sensors in different housings

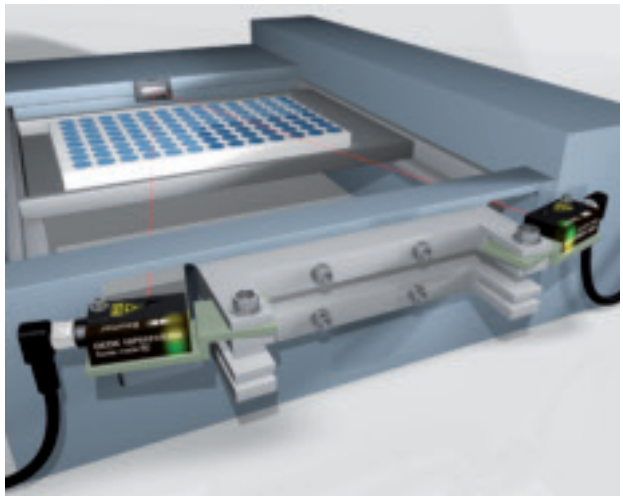
- Fast and precise detection of objects
- High repeatability in detecting and measuring
- Best in class diffuse laser sensor with background suppression (OHDM 12)

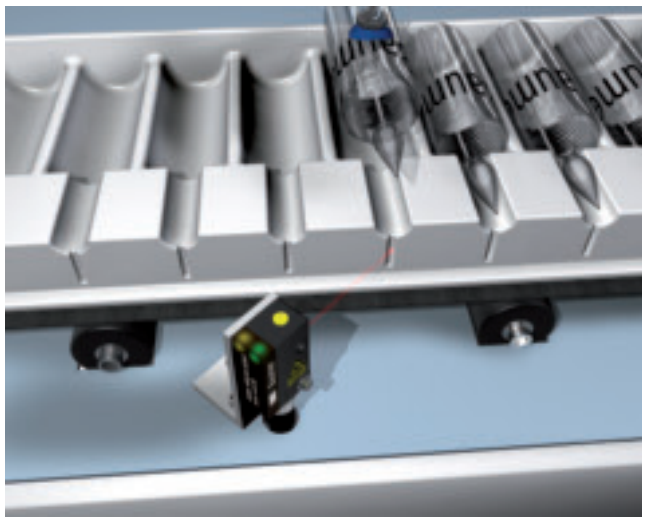
- Laser copy counter (*SCATEC*) counts up to 3 million copies per hour
- Counting single sheets down to 0,1 mm thickness
- Available with CAN and serial interfaces

# Laser sensor applications

**Through beam laser sensor**
(OSDK/OEDK 10 with deflector mirror)

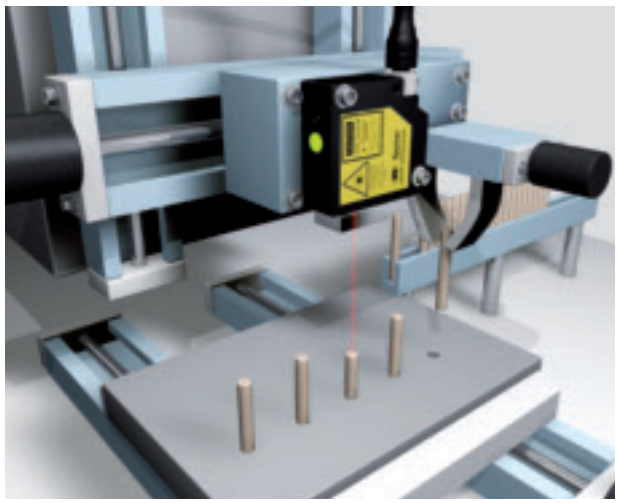
- Position checking of the test tube holder.





**Diffuse sensor** (OZDK 10)

- Position checking, detected by the notches.



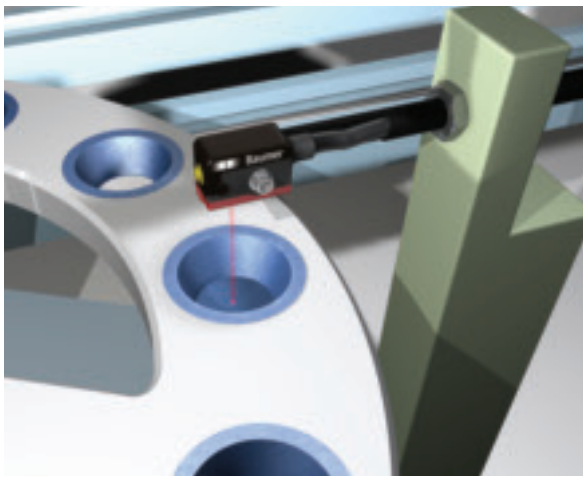
**Difference sensor** (OBDM 12)

- Height comparison of the inserted shafts.

# Successful in many industries

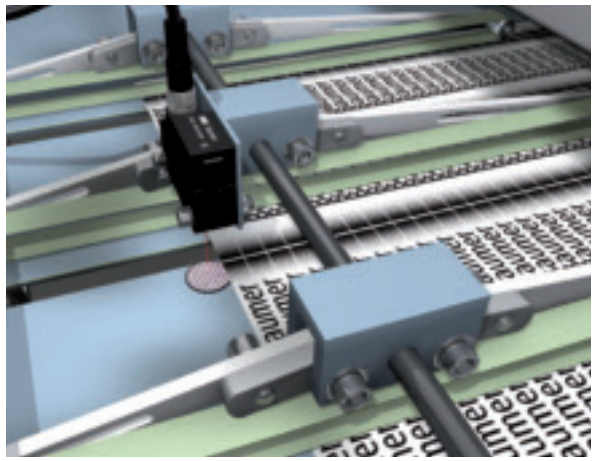
The Baumer product range has grown consistantly through the years. To provide a suitable solution to every measuring problem, the standard range of photoelectric sensors has become almost as diverse as the applications of our customers.

Our diffuse sensors and retro-reflective sensors have proved their value many times in the graphic, semiconductor, textiles, packaging and special machine industries as well as in laboratory automation or electronic manufacturing.



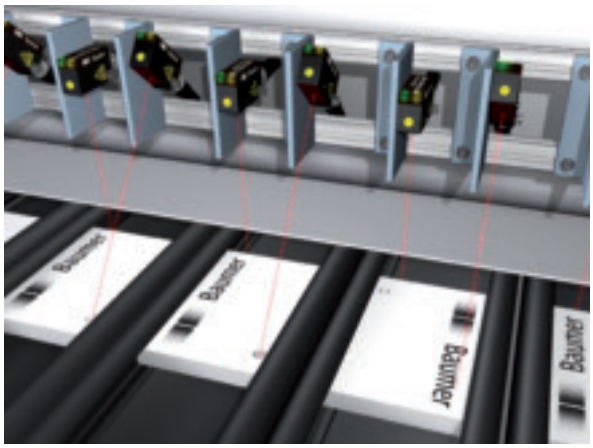
**Diffuse sensor** *(MINOS)*

- Placement verification for filter papers.



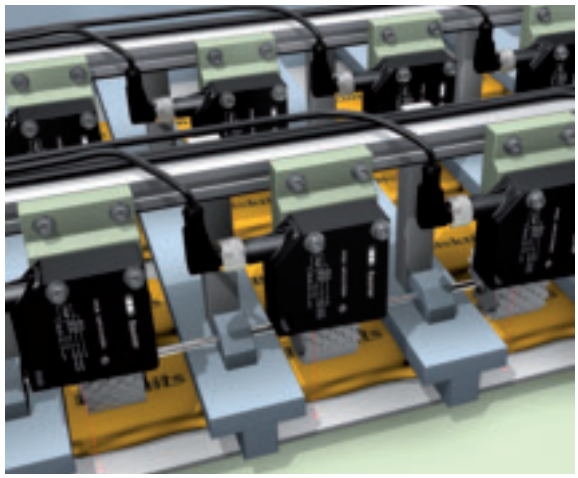
**Retro-reflective sensor** (FPDK 14)

- Detection of the front edges of paper sheets.



**Diffuse sensor with background suppression** (FHDK 10)

- Position checking of tablet packages.



**Diffuse sensor with foreground suppression**

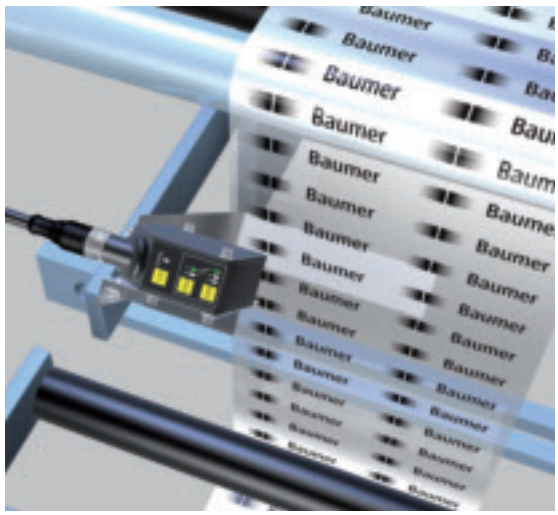
- Counting biscuit packages on a conveyor belt.

# Special requirements demand special solutions



**Line sensor** *(PosCon)*

- Web edge control of a transparent film.

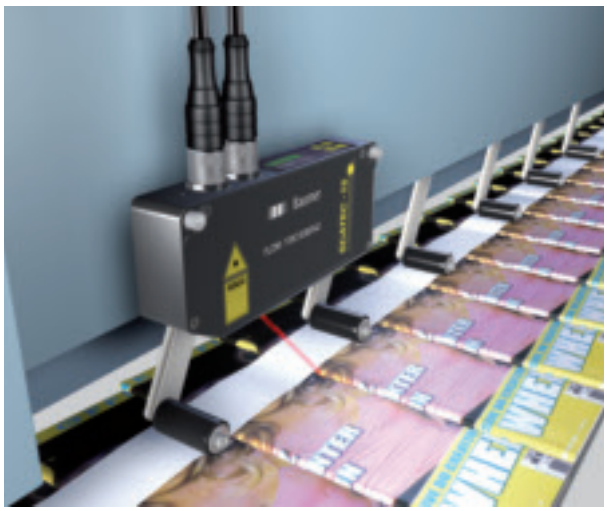


**Color sensor** *(LOGIPAL)*

- Detection of color codes on plugs.

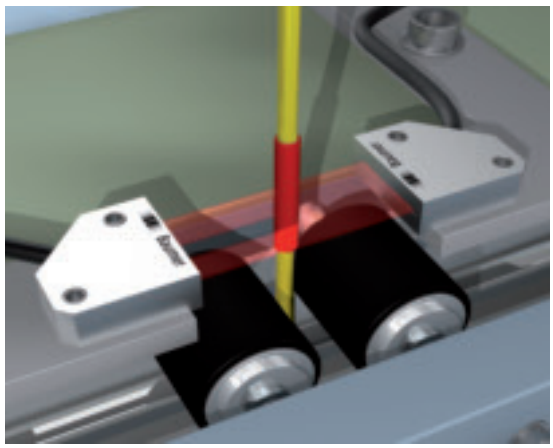
High-power LEDs, laser diodes, CCD receivers, FPGAs, ASICs, SMD, flip-chips – innovative components and technology which we rigorously employ in modern sensors and systems. This makes applications viable which were previously impossible.

In our search to always find the best solution for the customer many special sensors are created, from which standard sensors for specific industries are then developed.



**Copy counter** *(SCATEC)*

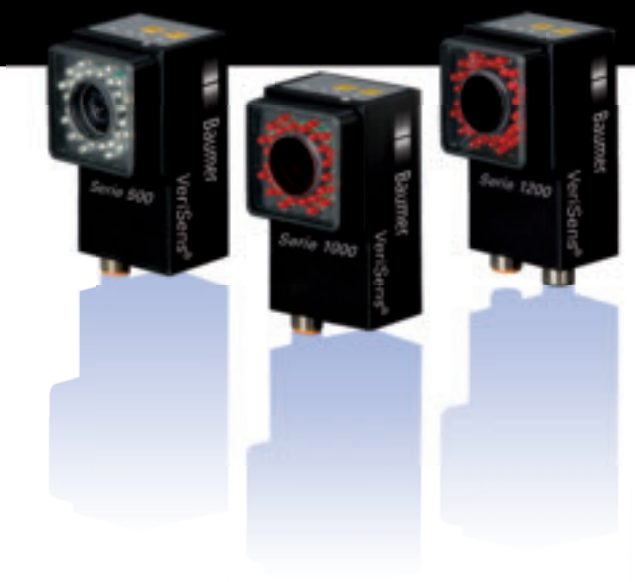
- Counting high-gloss magazines.



**Fiber optic array** (FSE 200C6)

- Detection of a splice by changes in diameter.

# *VeriSens*® – the vision sensors for automation technology




The new image processing vision sensors *VeriSens*® from Baumer closes the gap between traditional optical sensors and complex vision systems. Their high-resolution image sensor permits 2-dimensional inspection of objects. For this purpose *VeriSens*® vision sensors offer comprehensive functions, thus supporting numerous inspection and acquisition tasks in an automated production:

- Control of part completeness
- Control of part presence
- Control / Acquisition of part location
- Control / Acquisition of correct position

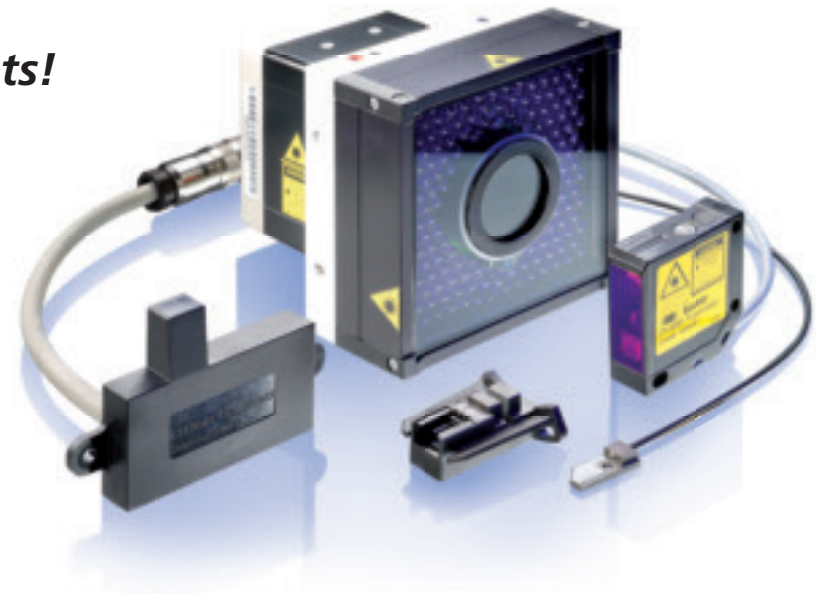
Experience the difference!

## *Special solutions for individual requirements!*

No product range will ever be large enough to provide the optimum solution for every application. Occasionally, requirements exist which cannot be satisfied by available market solutions. For this reason, our development engineers cooperate closely with our customers. In our search for the optimum solution for specific requirements, customer-specific sensors are constantly being created.

Special solutions span from special mechanical shapes to completely new sensor systems. An innovative sensor solution can help you to attain a significant competitive advantage.

We would be happy to advise you!



# Distance and intensity-based

| product family | OADM 12 | OADM 13 | OADM 13 | OADM 20 | OADM 20 |
|---|---|---|---|---|---|
| | | | | | |
| width / diameter | 12,4 mm | 13,4 mm | 13,4 mm | 20,6 mm | 20,6 mm |
| measuring distance Sd | 16 ... 26 mm<br>16 ... 120 mm | 50 ... 350 mm<br>50 ... 550 mm | 50 ... 350 mm<br>50 ... 550 mm | 30 ... 50 mm<br>30 ... 130 mm<br>50 ... 250 mm | 100 ... 500 mm<br>200 ... 1000 mm |
| resolution | 0,002 ... 0,005 mm<br>0,002 ... 0,12 mm | 0,01 ... 0,4 mm<br>0,01 ... 1,1 mm | 0,01 ... 0,4 mm<br>0,01 ... 1,1 mm | < 0,01 mm<br>< 0,06 mm<br>< 0,3 mm | < 0,5 mm<br>< 3 mm |
| linearity error | ± 0,006 ... ± 0,015 mm<br>± 0,015 ... ± 0,35 mm | ± 0,05 ... ± 1,2 mm<br>± 0,08 ... ± 3,5 mm | ± 0,05 ... ± 1,2 mm<br>± 0,08 ... ± 3,5 mm | ± 0,03 mm<br>± 0,2 mm<br>± 0,9 mm | ± 1,5 mm<br>± 12 mm |
| response time / release time | < 0,9 ms | < 0,9 ms<br>< 1,5 ms | < 0,9 ms<br>< 1,5 ms | < 10 ms | < 10 ms |
| adjustment | Teach-in: button / external | Teach-in: button / external | Teach-in: button / external | no | no |
| output circuit | analog | analog | analog | analog | analog |
| connection types | connector | connector | connector | connector | connector |
| housing material | metal | metal | metal | metal | metal |
| **Page** | **212** | **214** | **216** | **218** | **220** |

| product family | OADM 20 | OADM 20 | OADM 20 | OADM 20 | OADM 21 |
|---|---|---|---|---|---|
| | | | | | |
| width / diameter | 20,6 mm | 20,6 mm | 20,6 mm | 20,6 mm | 20,4 mm |
| measuring distance Sd | 30 ... 50 mm<br>30 ... 130 mm<br>50 ... 250 mm | 100 ... 500 mm<br>200 ... 1000 mm | 30 ... 70 mm<br>30 ... 130 mm<br>50 ... 300 mm | 100 ... 600 mm<br>200 ... 1000 mm | 200 ... 1000 mm |
| resolution | < 0,01 mm<br>< 0,06 mm<br>< 0,3 mm | < 0,5 mm<br>< 3 mm | 0,004 ... 0,02 mm<br>0,005 ... 0,06 mm<br>0,01 ... 0,33 mm | 0,015 ... 0,67 mm<br>0,12 ... 3 mm | 0,02 ... 0,5 mm |
| linearity error | ± 0,03 mm<br>± 0,2 mm<br>± 0,9 mm | ± 1,5 mm<br>± 12 mm | ± 0,012 ... ± 0,06 mm<br>± 0,015 ... ± 0,2 mm<br>± 0,03 ... ± 1 mm | ± 0,05 ... ± 2 mm<br>± 0,48 ... ± 12 mm | ± 0,08 ... ± 2 mm |
| response time / release time | < 10 ms | < 10 ms | < 0,9 ms | < 0,9 ms<br>< 2,8 ms | < 10 ms |
| adjustment | no | no | Teach-in: button / external | Teach-in: button / external | Teach-in: button / external |
| output circuit | RS 485 | RS 485 | analog | analog | analog |
| connection types | connector | connector | connector | connector | connector |
| housing material | metal | metal | metal | metal | metal |
| **Page** | **222** | **224** | **226** | **228** | **230** |

## General information

OADM is a range of laser distance sensors with products covering the measuring range from 16 to 1000 mm. The compact sensors with integrated microcontrollers produce an accurate output signal proportional to the measured distance. Intelligent internal signal analysis permits the sensor to operate accurately regardless of the color and most surfaces. The sensor can always be easily and precisely aligned with the small, visible spot of light. Distances to rough surfaces can be reliably measured by using a fine laser line in place of the laser spot, so that a wider area is monitored.

## Typical applications

This family of sensors, with its wide selection of measuring ranges, can be used in many applications.

Typical applications are:

- Applications in which the production process is continuously monitored by the sensor to detect slow changes at an early stage and thereby achieve a reduction of rejects and costs.
- Automation of test points and test equipment permits increased productivity.
- Automation of format settings permits multifunctional machines and rapid, precise reconfiguration.

In some other applications, objects with rough and uneven surfaces must be measured. Sometimes, the surface of the object even has small holes or gaps. Such objects can be easily measured using a laser line optical system, which supplies a fine laser line in place of a focused laser beam.

## Characteristics and advantages

### Response time
Measuring cycles as short as 0,9 ms permit accurate measurements even on moving parts.

### Integrated microcontroller
The integrated microcontroller makes an external processing device unnecessary and makes it simple to place the sensor wherever it is needed.

### High resolution and linearity
By the use of a photodiode line, a very high linearity of ±0.006 mm is achieved at a resolution of up to 0.002 mm.

### Laser spot or laser line
Distances, even to rough surfaces, are reliably measured by using a laser line instead of the laser spot.

### Any surface
Intelligent signal processing improves the measurements made on critical surfaces by the photodiode line.

### Teach-in function
The measuring range can be adjusted within the maximum measuring range by the user with the Teach-in button or via the Teach-in cable. The analog output has its full span within this taught-in range. The factory setting is the maximum measuring range. The taught-in range has a minimum extent. The resolution and linearity change when the measuring range is changed. The closer the furthest point of the measuring range is to the sensor, the better the resolution.

## Characteristics and advantages

Synchronization/hold function

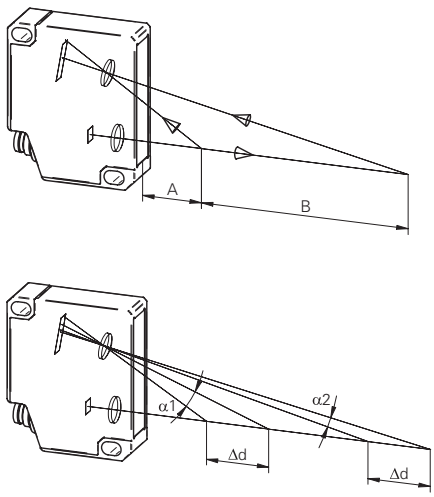
The measurements of several sensors can be synchronized using the synch input, or the last value can be held and the laser diode switched off.

Insensitivity to external light

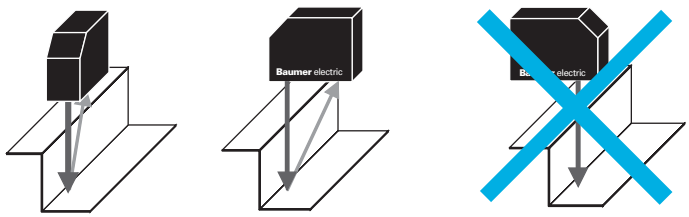
An algorithm makes the sensor insensitive to external light sources.

## Technology and operation

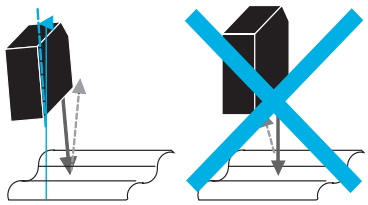
The distance measurement is based on the triangulation principle. The laser beam strikes the object as a small point. The receiver of the sensor (photodiode line) detects the position of this point. The angle of incidence changes according to the distance, and thereby the position of the laser point on the receiver. The photodiode line is read by an integrated microcontroller. The controller accurately calculates the angle from the light distribution on the photodiode line and then calculates the distance to the object from this. This distance is either issued at the serial port or converted into an output current proportional to the distance. The microcontroller guarantees a high degree of linearity and measuring precision. The combination of a photodiode line and a microcontroller permits interfering reflections to be suppressed and thereby provides reliable data from critical surfaces. The sensor adapts to different colors by adjusting its internal sensitivity, making it virtually independent of the color of the object. A digital output is activated if there is no object within the measuring range or if insufficient light is received to correctly detect the object, e.g. if the sensor is dirty. The possible resolution and accuracy change with the distance. The same distance $\Delta$d which causes a large change in the angle $\alpha$1 close to the sensor produces a much smaller change in the angle $\alpha$2 at a greater distance (see drawing). This non-linear behavior is corrected by the microcontroller, so that the output signal remains linear to the distance.



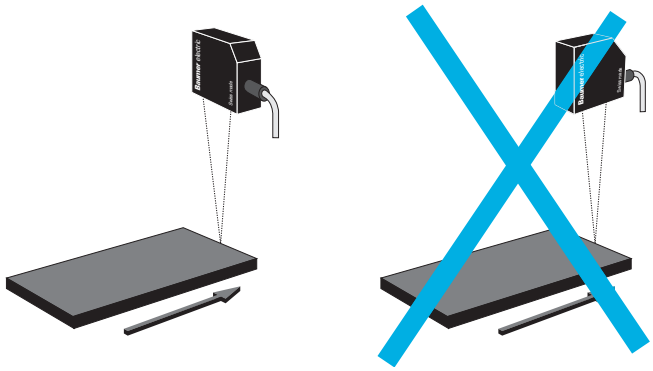
## Mounting and adjustment



With all triangulation sensors, it must be ensured that the laser spot can be seen directly by the optical system of the receiver and that no obstructions are in front of the receiver.



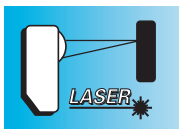
With glossy or reflective objects, the direct reflection must not impinge on the receiver. This can be avoided by slightly tilting the sensor.



For optimum measurement results, the sensor must be installed perpendicular to the movement of the object.

A simple rule applies that the distance between the sensor and the object should be kept as small as possible for each application. The shorter the range, the better (more than proportional) the resolution and accuracy.

Note on electromagnetic compatibility: ground the sensor and use a shielded connecting cable.

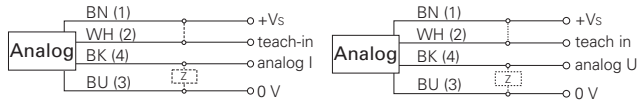



# Sd = 16 ... 120 mm

- Pocket-size design
- teachable measuring range
- resolution up to 2 µm

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | Teach-in: button / external |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| beam type | point |
| interference suppression | < 30 ms |
| **measuring distance Sd = 16 ... 26 mm** | |
| Teach-in range min. | > 1 mm |
| resolution | 0,002 ... 0,005 mm |
| linearity error | ± 0,006 ... ± 0,015 mm |
| beam diameter | 0,5 ... 0,2 mm |
| **measuring distance Sd = 16 ... 120 mm** | |
| Teach-in range min. | > 2 mm |
| resolution | 0,002 ... 0,12 mm |
| linearity error | ± 0,015 ... ± 0,35 mm |
| beam diameter | 0,9 ... 0,5 mm |
| **electrical data** | |
| response time / release time | < 0,9 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 100 mA |
| output circuit | analog |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**




| connectors | | |
|---|---|---|
| ESG 32AP0500G | 4 pin | 5 m straight (shielded) |
| ESW 31AP0500G | 4 pin | 5 m angular (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

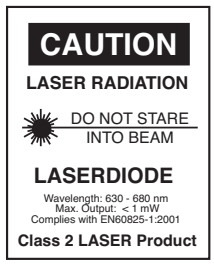
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

**remarks**

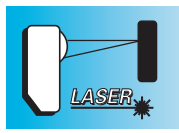
For objects with a reflectivity < 4%, the response time / release time is increased automatically up to max. 1,5 ms.

Missed measurement up to 30 cycles (30 ms) will be suppressed. During this time the analog output stays on hold.

**laser warning**

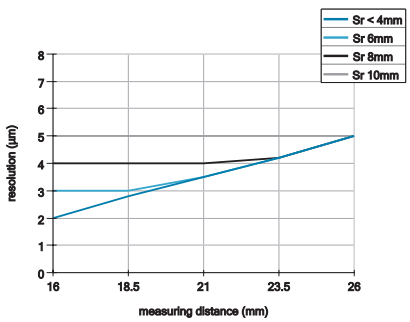



| order reference | measuring distance Sd | output signal | load resistance |
|---|---|---|---|
| **OADM 12I6430/S35A** | 16 ... 26 mm | 4 ... 20 mA | < (+Vs - 6 V) / 0,02 A |
| **OADM 12I6460/S35A** | 16 ... 120 mm | 4 ... 20 mA | < (+Vs - 6 V) / 0,02 A |
| **OADM 12U6430/S35A** | 16 ... 26 mm | 0 ... 10 VDC | > 100 kOhm |
| **OADM 12U6460/S35A** | 16 ... 120 mm | 0 ... 10 VDC | > 100 kOhm |

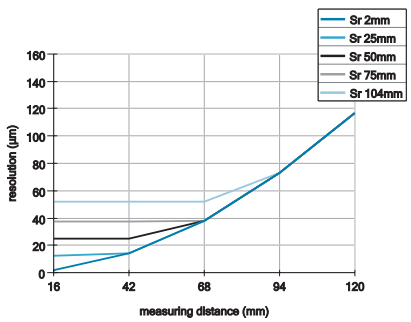



## resolution

Sr = 16 ... 26 mm

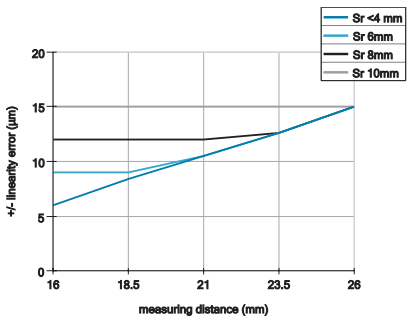



Sr = 16 ... 120 mm

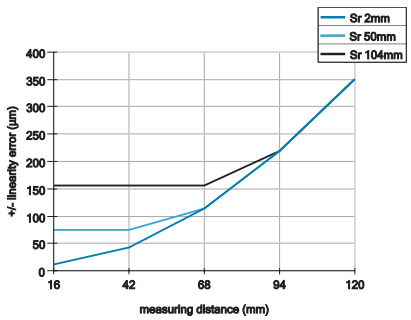



## linearity error

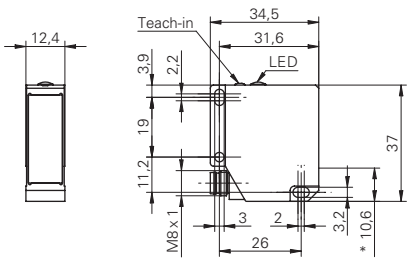
Sr = 16 ... 26 mm



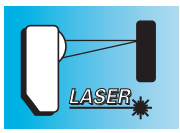

Sr = 16 ... 120 mm




## dimension drawing




* emitter axis

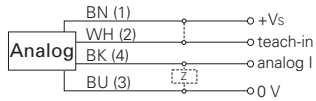



# Sd = 50 ... 550 mm

- compact housing, current output
- teachable measuring range
- resolution up to 10 µm

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | Teach-in: button / external |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| interference suppression | < 30 ms |
| **measuring distance Sd = 50 ... 350 mm** | |
| Teach-in range min. | > 5 mm |
| resolution | 0,01 ... 0,4 mm |
| linearity error | ± 0,05 ... ± 1,2 mm |
| **measuring distance Sd = 50 ... 550 mm** | |
| Teach-in range min. | > 10 mm |
| resolution | 0,01 ... 1,1 mm |
| linearity error | ± 0,08 ... ± 3,5 mm |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 100 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA |
| load resistance | < (+Vs - 6 V) / 0,02 A |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **measuring distance Sd = 50 ... 350 mm** | |
| response time / release time | < 0,9 ms |
| **measuring distance Sd = 50 ... 550 mm** | |
| response time / release time | < 1,5 ms |
| **mechanical data** | |
| width / diameter | 13,4 mm |
| height / length | 48,2 mm |
| depth | 40 mm |
| type | rectangular |
| housing material | aluminum |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**




| connectors | | |
|---|---|---|
| ESG 32AP0500G | 4 pin | 5 m straight (shielded) |
| ESW 31AP0500G | 4 pin | 5 m angular (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

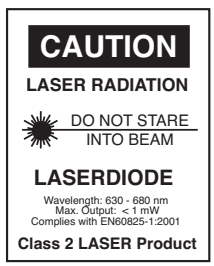
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 161829 |
| mounting bracket | 161695 |
| for details, see accessories section | |

**remarks**

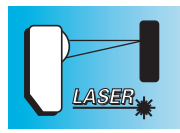
For objects with a reflectivity < 10%, the response time / release time is increased automatically up to max. 3 ms (OADM 13x6x75/S35A) resp. 5 ms (OADM 13x6x80/S35A).

Missed measurement up to 30 cycles (30 ms) will be suppressed. During this time the analog output stays on hold.

**laser warning**

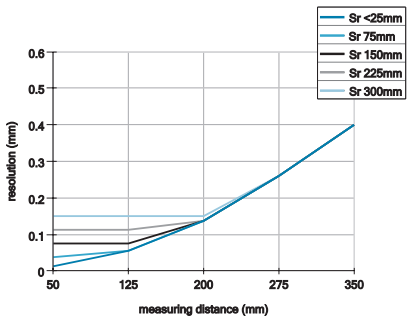



| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 13I6475/S35A** | 50 ... 350 mm | point | - | - | 1 mm |
| **OADM 13I6480/S35A** | 50 ... 550 mm | point | - | - | 1 mm |
| **OADM 13I6575/S35A** | 50 ... 350 mm | line | 2 mm | 4 ... 9 mm | - |
| **OADM 13I6580/S35A** | 50 ... 550 mm | line | 2 mm | 4 ... 13 mm | - |

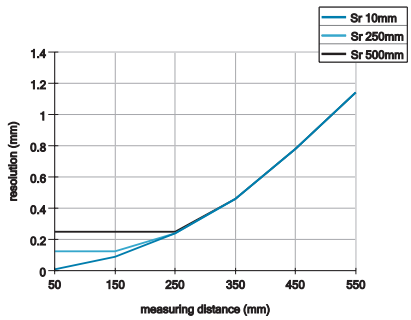



## resolution

Sr = 50 ... 350 mm

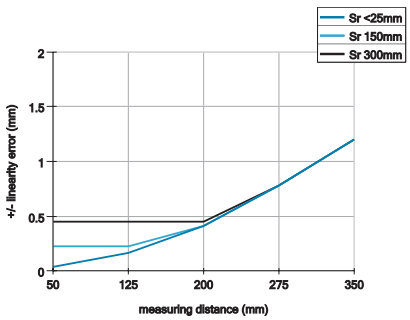



Sr = 50 ... 550 mm

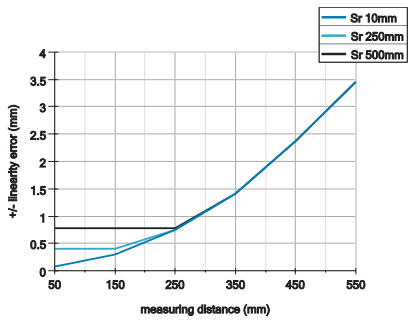



## linearity error

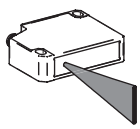
Sr = 50 ... 350 mm



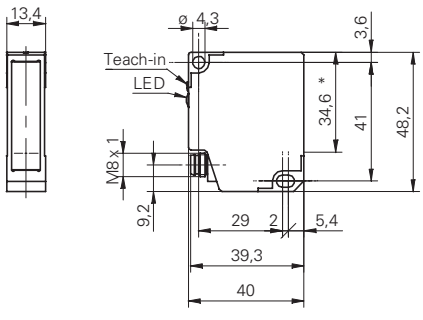

Sr = 50 ... 550 mm



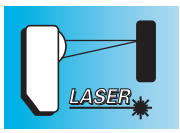

## beam alignment (line)



## dimension drawing




* emitter axis

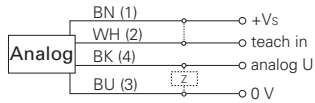



# Sd = 50 ... 550 mm

- compact housing, voltage output
- teachable measuring range
- resolution up to 10 µm

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | Teach-in: button / external |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| interference suppression | < 30 ms |
| **measuring distance Sd = 50 ... 350 mm** | |
| Teach-in range min. | > 5 mm |
| resolution | 0,01 ... 0,4 mm |
| linearity error | ± 0,05 ... ± 1,2 mm |
| **measuring distance Sd = 50 ... 550 mm** | |
| Teach-in range min. | > 10 mm |
| resolution | 0,01 ... 1,1 mm |
| linearity error | ± 0,08 ... ± 3,5 mm |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| output circuit | analog |
| output signal | 0 ... 10 VDC |
| load resistance | > 100 kOhm |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **measuring distance Sd = 50 ... 350 mm** | |
| response time / release time | < 0,9 ms |
| **measuring distance Sd = 50 ... 550 mm** | |
| response time / release time | < 1,5 ms |
| **mechanical data** | |
| width / diameter | 13,4 mm |
| height / length | 48,2 mm |
| depth | 40 mm |
| type | rectangular |
| housing material | aluminum |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**




| connectors | | |
|---|---|---|
| ESG 32AP0500G | 4 pin | 5 m straight (shielded) |
| ESW 31AP0500G | 4 pin | 5 m angular (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

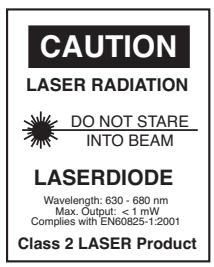
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 161829 |
| mounting bracket | 161695 |
| for details, see accessories section | |

**remarks**

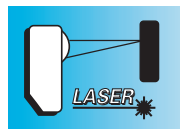
For objects with a reflectivity < 10%, the response time / release time is increased automatically up to max. 3 ms (OADM 13x6x75/S35A) resp. 5 ms (OADM 13x6x80/S35A).

Missed measurement up to 30 cycles (30 ms) will be suppressed. During this time the analog output stays on hold.

**laser warning**

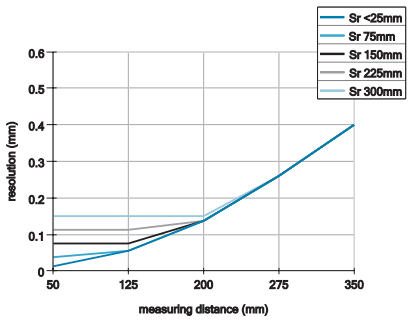



| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 13U6475/S35A** | 50 ... 350 mm | point | - | - | 1 mm |
| **OADM 13U6480/S35A** | 50 ... 550 mm | point | - | - | 1 mm |
| **OADM 13U6575/S35A** | 50 ... 350 mm | line | 2 mm | 4 ... 9 mm | - |
| **OADM 13U6580/S35A** | 50 ... 550 mm | line | 2 mm | 4 ... 13 mm | - |

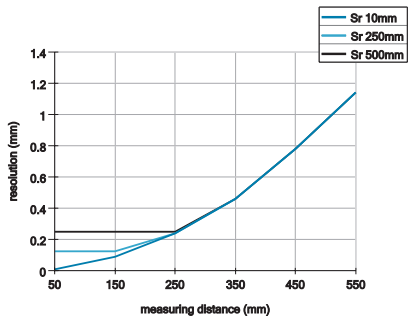



## resolution

Sr = 50 ... 350 mm

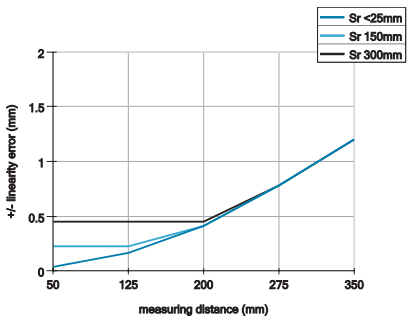



Sr = 50 ... 550 mm

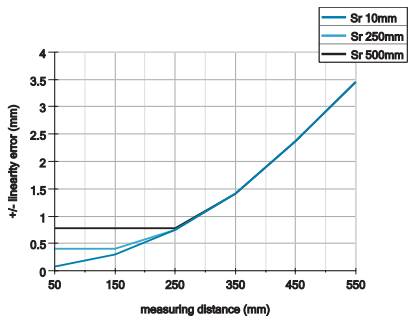



## linearity error

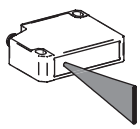
Sr = 50 ... 350 mm



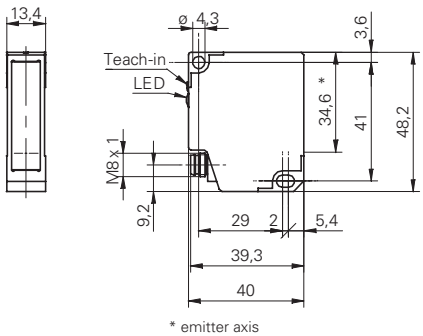

Sr = 50 ... 550 mm



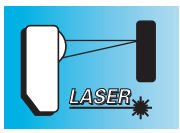

## beam alignment (line)



## dimension drawing




* emitter axis

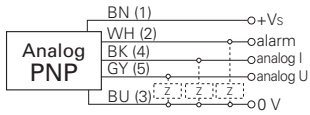



# Sd = 30 ... 250 mm

- current or voltage output
- resolution up to 10 µm
- with laser line for rough surfaces

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | no |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 30 ... 50 mm** | |
| resolution | < 0,01 mm |
| linearity error | ± 0,03 mm |
| **measuring distance Sd = 30 ... 130 mm** | |
| resolution | < 0,06 mm |
| linearity error | ± 0,2 mm |
| **measuring distance Sd = 50 ... 250 mm** | |
| resolution | < 0,3 mm |
| linearity error | ± 0,9 mm |
| **electrical data** | |
| response time / release time | < 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA / 0 ... 10 VDC |
| load resistance (analog I) | < (+Vs - 6 V) / 0,02 A |
| load resistance (analog U) | > 100 kOhm |
| output current | < 100 mA |
| alarm output | PNP |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 5 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**




**connectors**

| | | |
|---|---|---|
| ES 34CP2B | 5 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

**accessories**

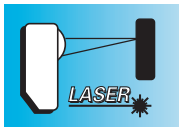
| | |
|---|---|
| mounting bracket | 131521 |
| for details, see accessories section | |

**remarks**

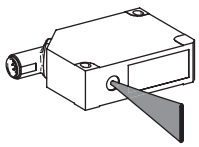
While switching-on the sensor, it checks if there is a current at current output BK (4). If so, the current output is activated. If not, the voltage output GY (5) is activated after 100 ms.

**laser warning**

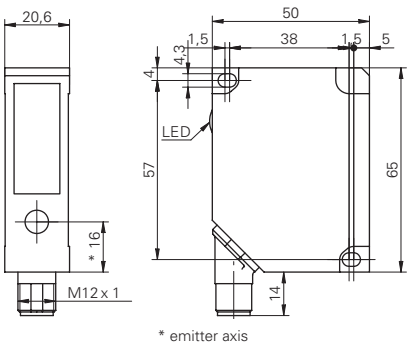
| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20I4440/S14C** | 30 ... 50 mm | point | - | - | 1 ... 0,4 mm |
| **OADM 20I4460/S14C** | 30 ... 130 mm | point | - | - | 2 ... 1 mm |
| **OADM 20I4470/S14C** | 50 ... 250 mm | point | - | - | 2 mm |
| **OADM 20I4540/S14C** | 30 ... 50 mm | line | 1 ... 0,4 mm | 2 mm | - |
| **OADM 20I4560/S14C** | 30 ... 130 mm | line | 2 ... 1 mm | 3 ... 5 mm | - |
| **OADM 20I4570/S14C** | 50 ... 250 mm | line | 2,5 mm | 4 ... 10 mm | - |

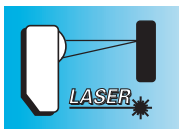



## beam alignment (line)



## dimension drawing



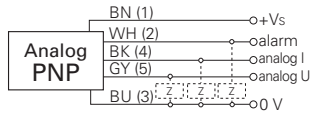



## Sd = 100 ... 1000 mm

- current or voltage output
- resolution up to 0,5 mm
- with laser line for rough surfaces

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | no |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 100 ... 500 mm** | |
| resolution | < 0,5 mm |
| linearity error | ± 1,5 mm |
| **measuring distance Sd = 200 ... 1000 mm** | |
| resolution | < 3 mm |
| linearity error | ± 12 mm |
| **electrical data** | |
| response time / release time | < 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA / 0 ... 10 VDC |
| load resistance (analog I) | < (+Vs - 6 V) / 0,02 A |
| load resistance (analog U) | > 100 kOhm |
| output current | < 100 mA |
| alarm output | PNP |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 5 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**




**connectors**

| | | |
|---|---|---|
| ES 34CP2B | 5 pin | 2 m straight (shielded) |

additional cable connectors and field wireable connectors, see accessories

**accessories**

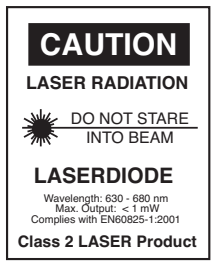
| | |
|---|---|
| mounting bracket | 131521 |

for details, see accessories section

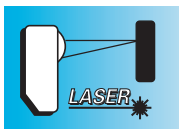
**remarks**

While switching-on the sensor, it checks if there is a current at current output BK (4). If so, the current output is activated. If not, the voltage output GY (5) is activated after 100 ms.

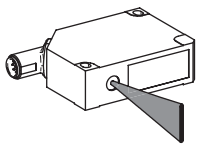
**laser warning**



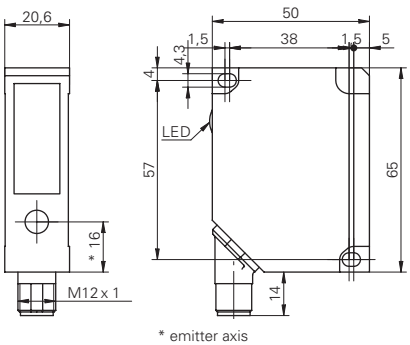

| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20I4471/S14C** | 100 ... 500 mm | point | - | - | 2 mm |
| **OADM 20I4481/S14C** | 200 ... 1000 mm | point | - | - | 2 mm |
| **OADM 20I4571/S14C** | 100 ... 500 mm | line | 2,5 mm | 5,5 ... 18 mm | - |
| **OADM 20I4581/S14C** | 200 ... 1000 mm | line | 2,5 mm | 8,5 ... 35 mm | - |

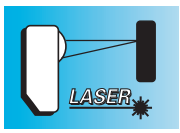



## beam alignment (line)



## dimension drawing



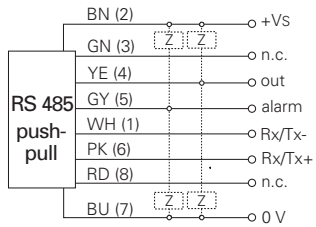



# Sd = 30 ... 250 mm

- serial interface RS 485
- resolution up to 10 µm
- with laser line for rough surfaces

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | no |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 30 ... 50 mm** | |
| resolution | < 0,01 mm |
| linearity error | ± 0,03 mm |
| **measuring distance Sd = 30 ... 130 mm** | |
| resolution | < 0,06 mm |
| linearity error | ± 0,2 mm |
| **measuring distance Sd = 50 ... 250 mm** | |
| resolution | < 0,3 mm |
| linearity error | ± 0,9 mm |
| **electrical data** | |
| response time / release time | < 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | RS 485 |
| output current | < 100 mA |
| alarm output | push-pull |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**




**connectors**

| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |

additional cable connectors and field wireable connectors, see accessories

**accessories**

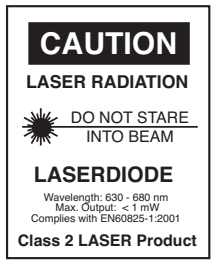
| | |
|---|---|
| mounting bracket | 131521 |

for details, see accessories section

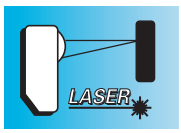
**remarks**

The sensor has a switching output (out) that is activated when the measurement is determined within the range between threshold 1 and threshold 2. Both thresholds can be set via interface.

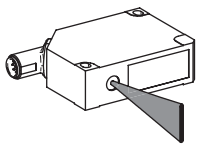
**laser warning**



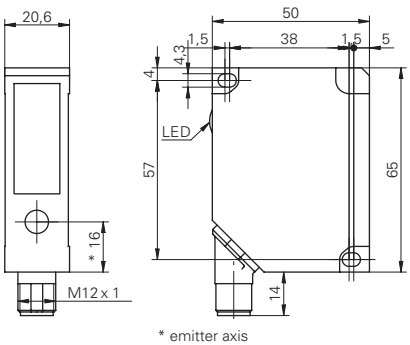

| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20S4440/S14F** | 30 ... 50 mm | point | - | - | 1 ... 0,4 mm |
| **OADM 20S4460/S14F** | 30 ... 130 mm | point | - | - | 2 ... 1 mm |
| **OADM 20S4470/S14F** | 50 ... 250 mm | point | - | - | 2 mm |
| **OADM 20S4540/S14F** | 30 ... 50 mm | line | 1 ... 0,4 mm | 2 mm | - |
| **OADM 20S4560/S14F** | 30 ... 130 mm | line | 2 ... 1 mm | 3 ... 5 mm | - |
| **OADM 20S4570/S14F** | 50 ... 250 mm | line | 2,5 mm | 4 ... 10 mm | - |

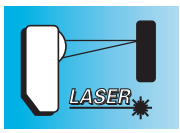



## beam alignment (line)



## dimension drawing



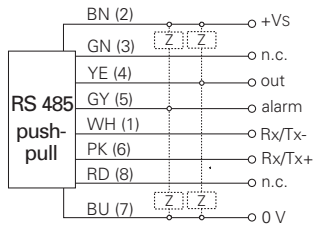



# Sd = 100 ... 1000 mm

- measuring ranges from 30 to 1000 mm
- resolution up to 0,5 mm
- with laser line for rough surfaces

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | no |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 100 ... 500 mm** | |
| resolution | < 0,5 mm |
| linearity error | ± 1,5 mm |
| **measuring distance Sd = 200 ... 1000 mm** | |
| resolution | < 3 mm |
| linearity error | ± 12 mm |
| **electrical data** | |
| response time / release time | < 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | RS 485 |
| output current | < 100 mA |
| alarm output | push-pull |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

## connection diagram




## connectors

| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |

additional cable connectors and field wireable connectors, see accessories

## accessories

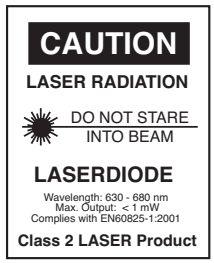
| | |
|---|---|
| mounting bracket | 131521 |

for details, see accessories section

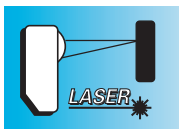
## remarks

The sensor has a switching output (out) that is activated when the measurement is determined within the range between threshold 1 and threshold 2. Both thresholds can be set via interface.

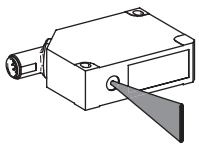
## laser warning



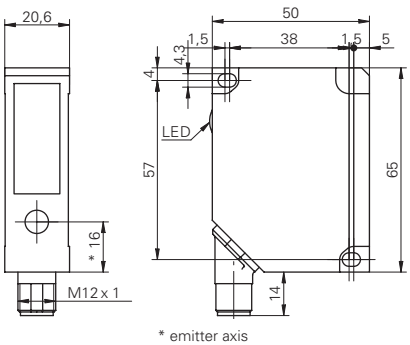

| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20S4471/S14F** | 100 ... 500 mm | point | - | - | 2 mm |
| **OADM 20S4481/S14F** | 200 ... 1000 mm | point | - | - | 2 mm |
| **OADM 20S4571/S14F** | 100 ... 500 mm | line | 2,5 mm | 5,5 ... 18 mm | - |
| **OADM 20S4581/S14F** | 200 ... 1000 mm | line | 2,5 mm | 8,5 ... 35 mm | - |

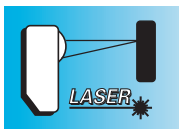



## beam alignment (line)



## dimension drawing



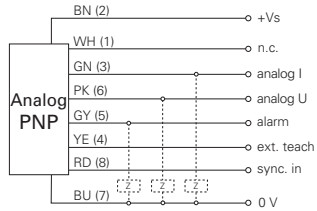



# Sd = 30 ... 300 mm

- synchronization input
- teachable measuring range
- resolution up to 4 µm

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | Teach-in: button / external |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 30 ... 70 mm** | |
| Teach-in range min. | > 2 mm |
| resolution | 0,004 ... 0,02 mm |
| linearity error | ± 0,012 ... ± 0,06 mm |
| **measuring distance Sd = 30 ... 130 mm** | |
| Teach-in range min. | > 3 mm |
| resolution | 0,005 ... 0,06 mm |
| linearity error | ± 0,015 ... ± 0,2 mm |
| **measuring distance Sd = 50 ... 300 mm** | |
| Teach-in range min. | > 5 mm |
| resolution | 0,01 ... 0,33 mm |
| linearity error | ± 0,03 ... ± 1 mm |
| **electrical data** | |
| response time / release time | < 0,9 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA / 0 ... 10 VDC |
| load resistance (analog I) | < (+Vs - 6 V) / 0,02 A |
| load resistance (analog U) | > 100 kOhm |
| output current | < 100 mA |
| alarm output | PNP |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**



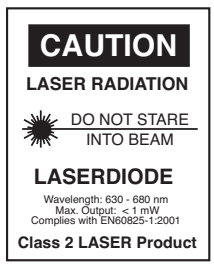

**connectors**

| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

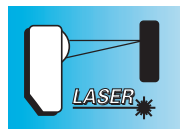
**accessories**

| | |
|---|---|
| mounting bracket | 131521 |
| for details, see accessories section | |

**laser warning**

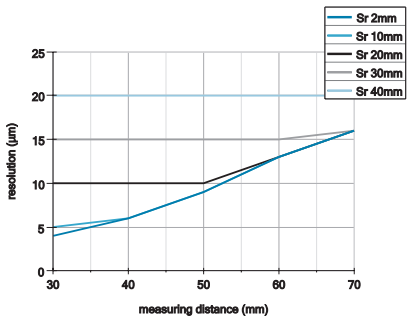



| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20I6441/S14F** | 30 ... 70 mm | point | - | - | 1 ... 0,2 mm |
| **OADM 20I6460/S14F** | 30 ... 130 mm | point | - | - | 2 ... 1 mm |
| **OADM 20I6472/S14F** | 50 ... 300 mm | point | - | - | 2 mm |
| **OADM 20I6541/S14F** | 30 ... 70 mm | line | 1 ... 0,2 mm | 2 mm | - |
| **OADM 20I6560/S14F** | 30 ... 130 mm | line | 2 ... 1 mm | 3 ... 5 mm | - |
| **OADM 20I6572/S14F** | 50 ... 300 mm | line | 2,5 mm | 4 ... 12 mm | - |

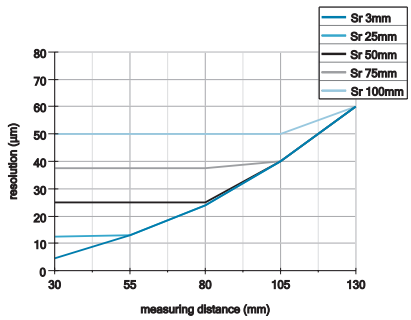



## resolution

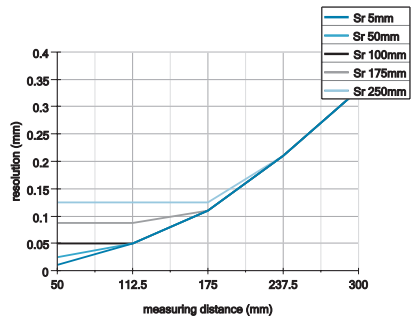
Sr = 30 ... 70 mm




Sr = 30 ... 130 mm

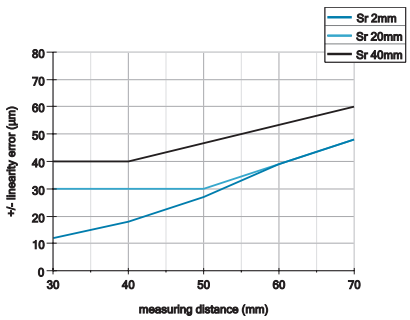



Sr = 50 ... 300 mm

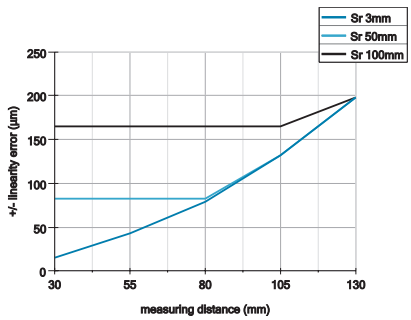



## linearity error

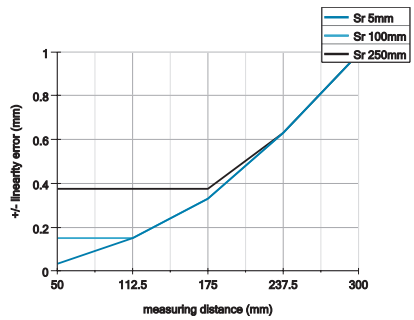
Sr = 30 ... 70 mm



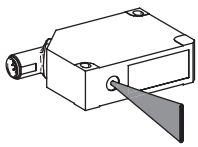

Sr = 30 ... 130 mm



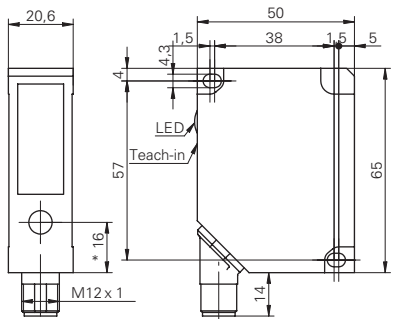

Sr = 50 ... 300 mm

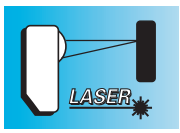



## beam alignment (line)



## dimension drawing



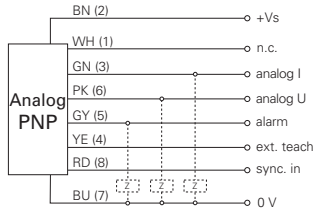



# Sd = 100 ... 1000 mm

- synchronization input
- teachable measuring range
- resolution up to 15 µm

| general data | |
|---|---|
| sensing element | photoelectric array |
| adjustment | Teach-in: button / external |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **measuring distance Sd = 100 ... 600 mm** | |
| Teach-in range min. | > 10 mm |
| resolution | 0,015 ... 0,67 mm |
| linearity error | ± 0,05 ... ± 2 mm |
| **measuring distance Sd = 200 ... 1000 mm** | |
| Teach-in range min. | > 20 mm |
| resolution | 0,12 ... 3 mm |
| linearity error | ± 0,48 ... ± 12 mm |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA / 0 ... 10 VDC |
| load resistance (analog I) | < (+Vs - 6 V) / 0,02 A |
| load resistance (analog U) | > 100 kOhm |
| output current | < 100 mA |
| alarm output | PNP |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **measuring distance Sd = 100 ... 600 mm** | |
| response time / release time | < 0,9 ms |
| **measuring distance Sd = 200 ... 1000 mm** | |
| response time / release time | < 2,8 ms |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

**connection diagram**



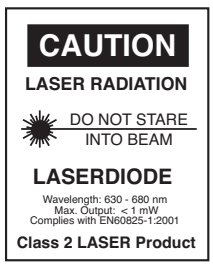

**connectors**

| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

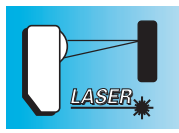
**accessories**

| | |
|---|---|
| mounting bracket | 131521 |
| for details, see accessories section | |

**laser warning**

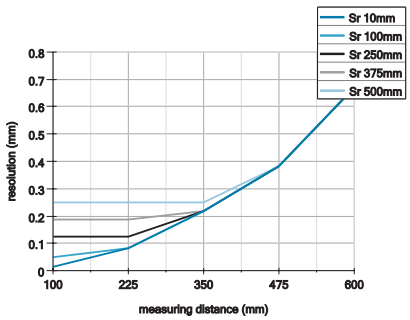



| order reference | measuring distance Sd | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|---|
| **OADM 20I6480/S14F** | 100 ... 600 mm | point | - | - | 2 mm |
| **OADM 20I6481/S14F** | 200 ... 1000 mm | point | - | - | 2 mm |
| **OADM 20I6580/S14F** | 100 ... 600 mm | line | 2,5 mm | 5,5 ... 21 mm | - |
| **OADM 20I6581/S14F** | 200 ... 1000 mm | line | 2,5 mm | 8,5 ... 35 mm | - |

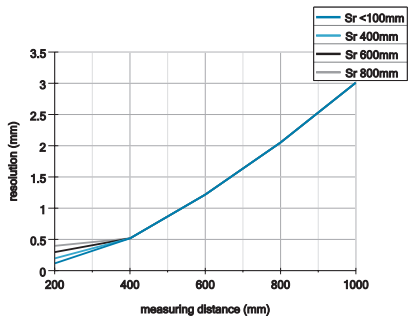



## resolution

Sr = 100 ... 600 mm

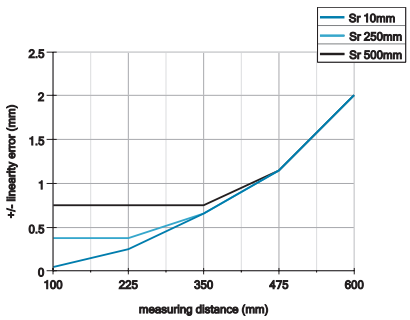



Sr = 200 ... 1000 mm

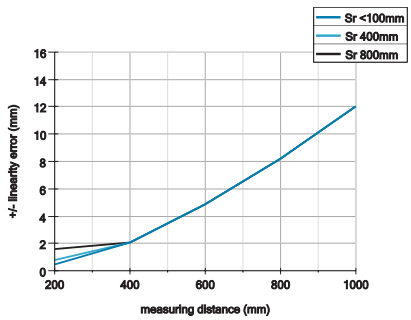



## linearity error

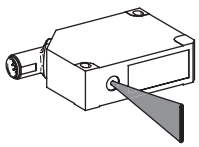
Sr = 100 ... 600 mm



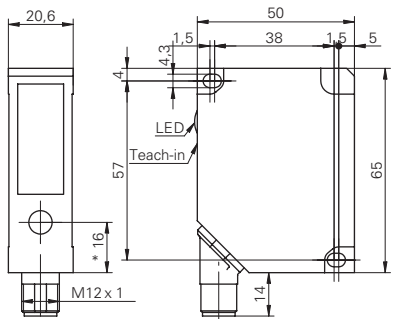

Sr = 200 ... 1000 mm

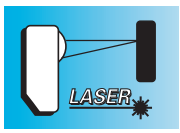



## beam alignment (line)



## dimension drawing






## Sd = 200 ... 1000 mm

- teachable measuring range
- resolution up to 20 µm
- synchronization input

| general data | |
|---|---|
| sensing element | photoelectric array |
| measuring distance Sd | 200 ... 1000 mm |
| adjustment | Teach-in: button / external |
| Teach-in range min. | > 10 mm |
| power on indication | LED green |
| soiled lens indicator | LED red / LED red blinking |
| resolution | 0,02 ... 0,5 mm |
| linearity error | ± 0,08 ... ± 2 mm |
| light source | pulsed red laser diode |
| wave length | 675 nm |
| laser class | 2 |
| **electrical data** | |
| response time / release time | < 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA / 0 ... 10 VDC |
| load resistance (analog I) | < (+Vs - 6 V) / 0,02 A |
| load resistance (analog U) | > 100 kOhm |
| output current | < 100 mA |
| alarm output | PNP |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,4 mm |
| height / length | 135 mm |
| depth | 45 mm |
| housing material | aluminum |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

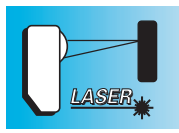
### connection diagram

### connectors

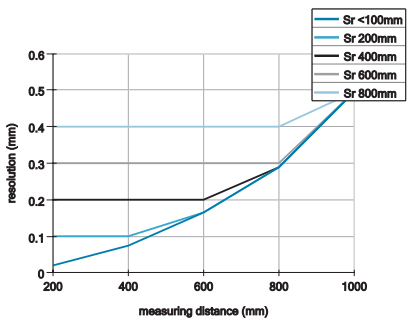
| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

### laser warning

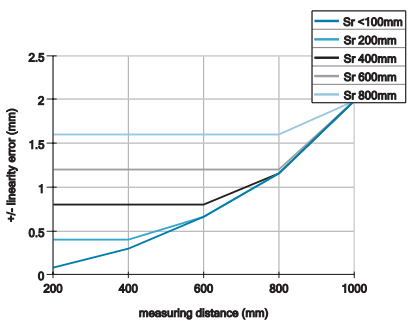
| order reference | beam type | beam width | beam height | beam diameter |
|---|---|---|---|---|
| **OADM 21I6481/S14F** | point | - | - | 2 mm |
| **OADM 21I6581/S14F** | line | 2,5 mm | 6 ... 20 mm | - |



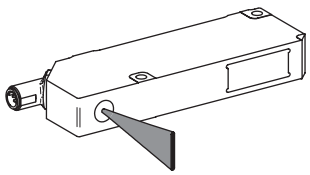

## resolution



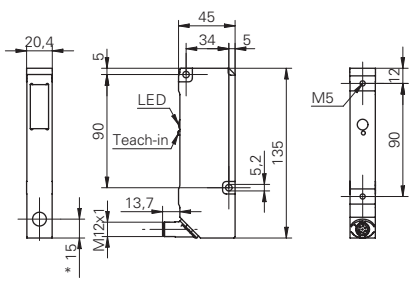

## linearity error




## beam alignment (line)



## dimension drawing




* emitter axis

| product family | OBDM 12 | OBDM 12 | OBDM 12 | OBDM 12 | OBDM 12 |
|---|---|---|---|---|---|
| | | | | | |
| type | step analysis | min./max. analysis | tolerance analysis | window analysis | 2-point comparison |
| width / diameter | 12,4 mm | 12,4 mm | 12,4 mm | 12,4 mm | 12,4 mm |
| sensing distance Tw | 16 ... 120 mm | 16 ... 120 mm | 16 ... 120 mm | 16 ... 120 mm | 16 ... 120 mm |
| response time | < 5 ms | < 1 ms | < 1 ms | < 1 ms | < 1 ms |
| NPN | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ |
| connection types | connector | connector | connector | connector | connector |
| housing material | metal | metal | metal | metal | metal |
| | | | | | |
| **Page** | **237** | **238** | **239** | **240** | **241** |

# Difference sensors

## General information

The range of difference sensors opens new perspectives in the field of sensing. The patented functions provide the user with new, innovative solutions in the detection of objects, monitoring of tolerances or the comparison of object sizes and object positions. With the fine laser beam and the high insensitivity of the sensor to colors, objects are accurately detected. Five different sensors with different functions are available according to the application.

Difference sensors with:
- Step analysis
- Window analysis
- Tolerance analysis
- Min./max. analysis
- 2-point comparisons

## Characteristics and advantages

**Difference evaluation**
Distance-measuring sensors with integrated logic for distance difference evaluation. Complex evaluation by the connected controller is no longer necessary, saving time and costs.

**Nominal difference teachable**
With the standardized Teach-in process of Baumer electric, the nominal difference can be quickly and easily programmed.

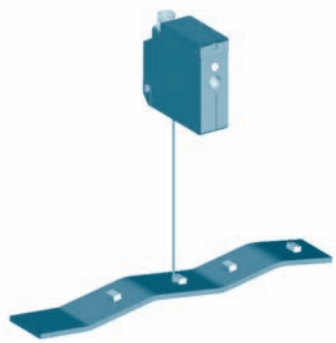
**Switching output**
The comparison of the actual and nominal difference is made internally by the sensors and is issued at the switching output as a simply assessed pass/fail signal.

In some other applications, objects with rough and uneven surfaces must be measured. Sometimes, the surface of the object even has small holes or gaps. Such objects can be easily measured using a laser line optical system, which supplies a fine laser line in place of a focused laser beam.

## Applications and functions

**Difference sensors with step analysis**
In step analysis, objects are detected by their height difference (stage) and reported in the form of a digital output signal.

The sensor evaluates the positive or negative height difference within a specified time window of max. 5 ms. If the height difference is greater than 50% of the taught-in value, an impulse of at least 10 ms is issued at the output. When the value is less than 50%, the sensor switches back to the OFF state. If height differences are smaller than 50% of the taught value within the time window (e.g. fluctuation of the conveyor belt), the sensor remains in the OFF state.



- The stage / edge from which the objects are detected can be adjusted (minimum object height 0,2 mm)
- Defined output impulse of 10 ms (can also be read by a normal PLC)

- Detection of objects on a fluctuation conveyor belt
- Detection of stages or edges
- Positioning of objects by an edge, regardless of the distance

## Applications and functions

Difference sensors with min./max. analysis

With min./max. analysis, objects can be inspected and monitored according to their scanned contour or shape. The scanning of the objects is activated by an external control signal. At the end of a detection sequence, the measured values are evaluated and the difference between the minimum and maximum values is determined. If the difference exceeds a nominal difference previously taught into the sensor, this is reported in the form of an ON signal. This signal remains active until a new detection sequence is started. When this starts, the output returns to the OFF state. If the difference is smaller than the nominal difference, the output remains in the OFF state.

- Difference is detected regardless of the distance
- Start and stop of the measuring cycle can be determined independently
- Easily evaluated pass/fail signal

- Round true running or knock of wheels / discs can be checked regardless of the distance
- Deformation of plastic parts after cooling can be checked

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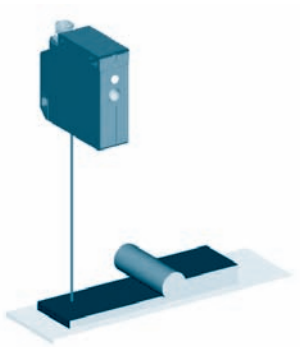
Difference sensors with tolerance analysis

The dimensional tolerance of objects can be determined by tolerance analysis. In the continuous detection of object distances, all measured values are checked to determine if it is between the specified maximum and minimum tolerances. In the case of if being between, an ON signal is issued at the output. If the distance remains within the tolerance range, the sensor remains in the OFF state.



- Sensor form of a caliper gauge
- Simple monitoring of a distance with a tolerance range (pass/fail information)
- Tolerance range and nominal distance can be taught in separately

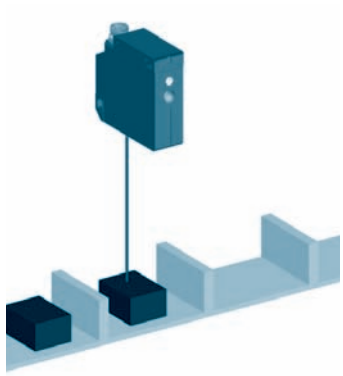
- Material thickness checking after a roller mill
- Material thickness checking for extruders

## Applications and functions

**Difference sensors with window analysis**
With window analysis, objects can be classified by a specified switching window.

For this purpose, the switching window is specified in a simple Teach-in procedure with upper and lower limits. If an object is outside the defined limits, this is reported at the switching output.

- Foreground and background suppression in a single sensor

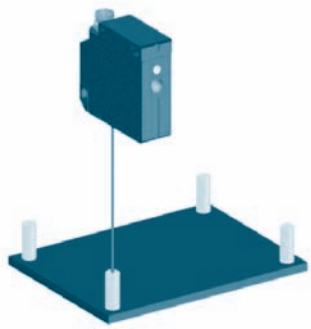


- Positions can be taught in separately
- Smallest window 0,45 mm

- Interfering objects in the foreground and background can be suppressed
- Objects can be detected on a segmented conveyor belt

**Difference sensors with 2-point comparison**
In a 2-point comparison, two distances detected at two specifically chosen times are measured and compared.

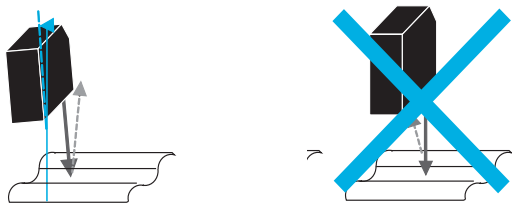
The choice of the time is made using a sync signal. The first distance is measured at the rising flank of the signal and the second distance at the falling flank of the signal. After the second distance has been measured, the sensor evaluates the difference between the two distances and compares this with a previously taught-in maximum permissible deviation. If this is exceeded, the output assumes the ON state.



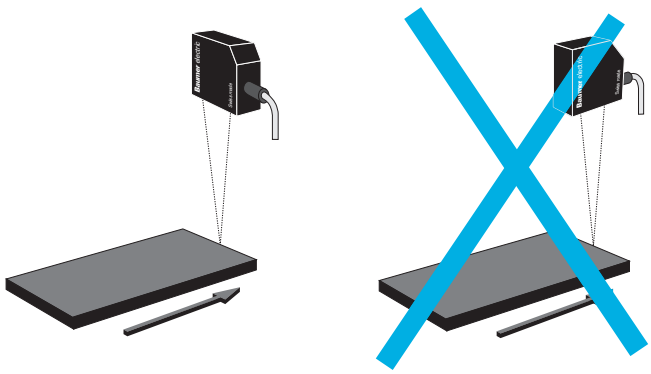
- Object heights can be compared regardless of the distance
- Deviation can be taught in (min. 0,3 mm)
- Measuring time can be determined separately by an external signal

- Checking the pressing depth of pins
- Comparison of the distances/heights of objects with a reference value

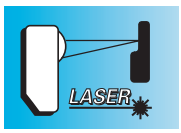
## Mounting and adjustment



The direct reflection from glossy or reflective objects must not impinge on the receiver. This can be avoided by slightly tilting the sensor.



For optimum measurement results, the sensor must be installed perpendicular to the movement of the object.



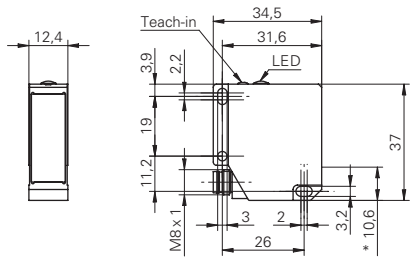

# Tw = 16 ... 120 mm

- detection of edges/steps independent of the distance
- reference steps adjustable
- min. output pulse 10 ms

| general data | |
|---|---|
| type | step analysis |
| sensing distance Tw | 16 ... 120 mm |
| Teach-in range min. | > 0,2 mm |
| adjustment | Teach-in |
| power on indication | LED green |
| output indicator | LED red |
| light source | pulsed red laser diode |
| laser class | 2 |
| wave length | 675 nm |
| beam diameter | 0,5 ... 0,2 |
| **electrical data** | |
| response time | < 5 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| output current | < 100 mA |
| output pulse length | 10 ms |
| voltage drop Vd | < 2,8 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| front (optics) | glass |
| housing material | die-cast zinc |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

| order reference | output circuit |
|---|---|
| **OBDM 12N6910/S35A** | NPN |
| **OBDM 12P6910/S35A** | PNP |

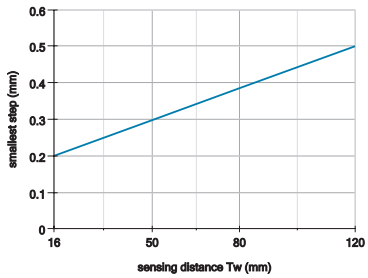
## dimension drawing



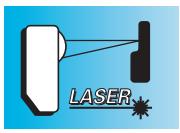

* emitter axis

## connection diagrams

## min. detectable difference




## laser warning



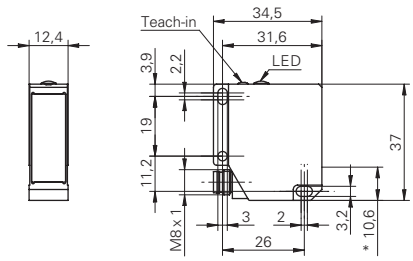

# Tw = 16 ... 120 mm

- analysis of distance differences (min./max.)
- max. difference tolerance adjustable
- measuring time selectable

| general data | |
|---|---|
| type | min./max. analysis |
| sensing distance Tw | 16 ... 120 mm |
| Teach-in range min. | > 0,3 mm |
| adjustment | Teach-in |
| power on indication | LED green |
| output indicator | LED red |
| light source | pulsed red laser diode |
| laser class | 2 |
| wave length | 675 nm |
| beam diameter | 0,5 ... 0,2 |
| **electrical data** | |
| response time | < 1 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| output current | < 100 mA |
| voltage drop Vd | < 2,8 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| front (optics) | glass |
| housing material | die-cast zinc |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

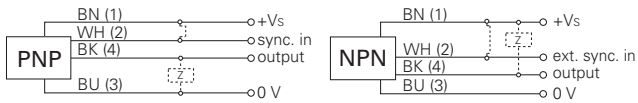
| order reference | output circuit |
|---|---|
| **OBDM 12N6920/S35A** | NPN |
| **OBDM 12P6920/S35A** | PNP |

## dimension drawing

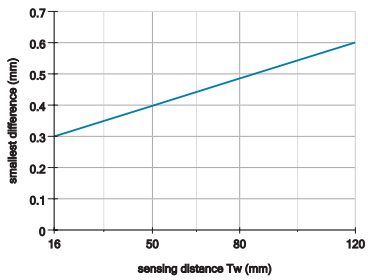



* emitter axis

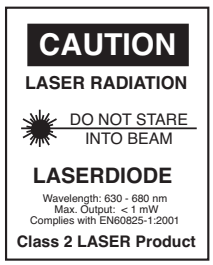
## connection diagrams

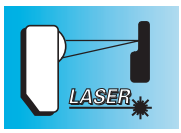



## min. detectable difference




## laser warning





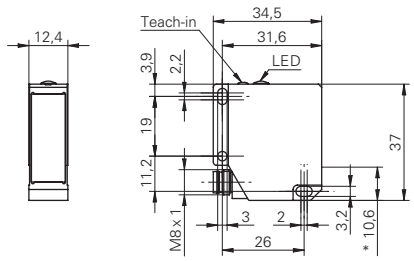

# Tw = 16 ... 120 mm

- distance monitoring within a tolerance band
- nominal distance
- adjustable tolerance band

| general data | |
|---|---|
| type | tolerance analysis |
| sensing distance Tw | 16 ... 120 mm |
| Teach-in range min. | > 0,4 mm |
| adjustment | Teach-in |
| power on indication | LED green |
| output indicator | LED red |
| light source | pulsed red laser diode |
| laser class | 2 |
| wave length | 675 nm |
| beam diameter | 0,5 ... 0,2 |
| **electrical data** | |
| response time | < 1 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| output current | < 100 mA |
| voltage drop Vd | < 2,8 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| front (optics) | glass |
| housing material | die-cast zinc |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

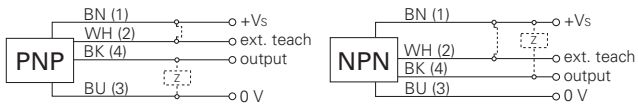
| order reference | output circuit |
|---|---|
| **OBDM 12N6930/S35A** | NPN |
| **OBDM 12P6930/S35A** | PNP |

## dimension drawing

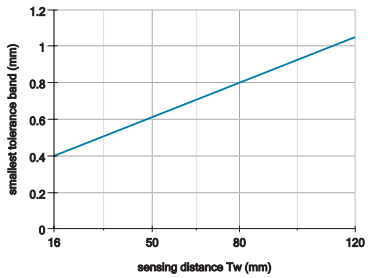



* emitter axis

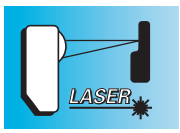
## connection diagrams




## min. detectable difference




## laser warning



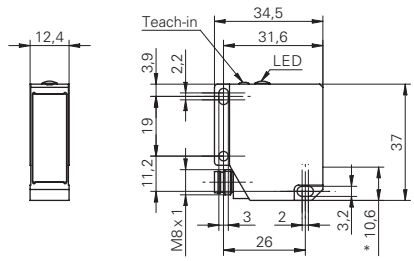

# Tw = 16 ... 120 mm

- range switch (foreground / background suppression)
- adjustable window

| general data | |
|---|---|
| type | window analysis |
| sensing distance Tw | 16 ... 120 mm |
| Teach-in range min. | > 0,4 mm |
| adjustment | Teach-in |
| power on indication | LED green |
| output indicator | LED red |
| light source | pulsed red laser diode |
| laser class | 2 |
| wave length | 675 nm |
| beam diameter | 0,5 ... 0,2 |
| **electrical data** | |
| response time | < 1 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| output current | < 100 mA |
| voltage drop Vd | < 2,8 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| front (optics) | glass |
| housing material | die-cast zinc |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

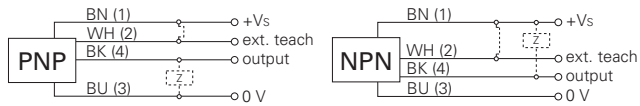
| order reference | output circuit |
|---|---|
| **OBDM 12N6940/S35A** | NPN |
| **OBDM 12P6940/S35A** | PNP |

## dimension drawing

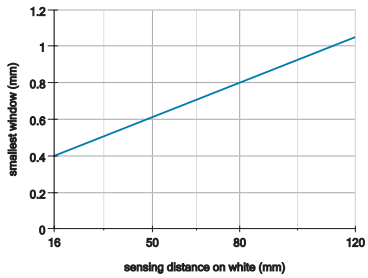



* emitter axis

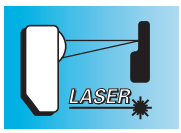
## connection diagrams




## min. detectable difference




## laser warning



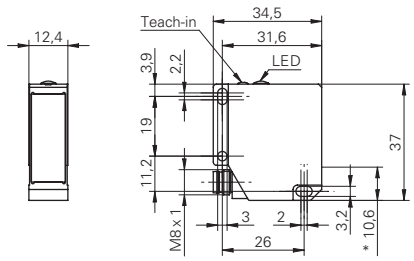

# Tw = 16 ... 120 mm

- comparison of two distances
- max. tolerance adjustable
- specific measuring moment selectable

| general data | |
|---|---|
| type | 2-point comparison |
| sensing distance Tw | 16 ... 120 mm |
| Teach-in range min. | > 0,3 mm |
| adjustment | Teach-in |
| power on indication | LED green |
| output indicator | LED red |
| light source | pulsed red laser diode |
| laser class | 2 |
| wave length | 675 nm |
| beam diameter | 0,5 ... 0,2 |
| **electrical data** | |
| response time | < 1 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| output current | < 100 mA |
| voltage drop Vd | < 2,8 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| front (optics) | glass |
| housing material | die-cast zinc |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

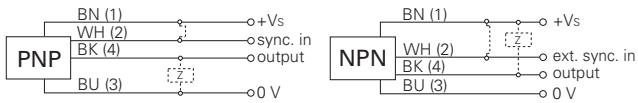
| order reference | output circuit |
|---|---|
| **OBDM 12N6950/S35A** | NPN |
| **OBDM 12P6950/S35A** | PNP |

## dimension drawing

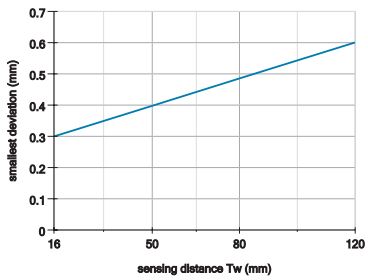



* emitter axis

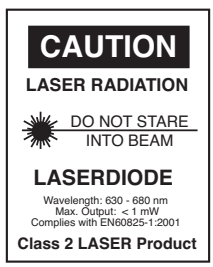
## connection diagrams




## min. detectable difference




## laser warning



## red light LED version

| product family | FHDK 04 | FHCK 07 | FHDK 07 | FHDK 10 | FHDK 10 | FHDK 10 | FHDK 10 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | *MINOS* | *MINOS* | | | | |
| | IO-Link | | | | | | |
| for glass detection | | | | | | | ■ |
| version | | | | | | line beam | |
| width / diameter | 4 mm | 8 mm | 8 mm | 10,4 mm | 10,4 mm | 10,4 mm | 10,4 mm |
| sensing distance Tw | 30 mm ±2 mm<br>50 mm ±3 mm | 10 ... 60 mm | 10 ... 60 mm | 30 mm ±3 mm<br>50 mm ±2 mm<br>80 mm ±8 mm | 20 ... 120 mm | 20 ... 80 mm | 10 ... 30 mm |
| response time / release time | < 0,5 ms | < 0,5 ms | < 0,5 ms | < 1 ms | < 1 ms | < 1 ms | < 1 ms |
| sensing distance adjustment | | Teach-in | Teach-in | | mechanical,<br>5 turn | mechanical,<br>5 turn | mechanical,<br>5 turn |
| push-pull | ■ | | | ■ | | | |
| NPN | | ■ | ■ | | ■ | ■ | ■ |
| PNP | | ■ | ■ | | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | |
| connector | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | plastic | plastic | plastic | plastic |
| | | | | | | | |
| **Page** | **246** | **248** | **250** | **252** | **254** | **256** | **258** |

## laser version

| product family | OHDK 10 | OHDM 12 | OHDK 14 | OHDM 16 | OHDM 16 | OHDM 20 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | IO-Link | | | | IO-Link |
| Wafer mapping sensor | | | | | ■ | |
| width / diameter | 10,4 mm | 12,4 mm | 14,8 mm | 15,4 mm | 15,4 mm | 20,6 mm |
| sensing distance Tw | 22 ... 130 mm | 17 ... 120 mm | 20 ... 350 mm | 25 ... 300 mm | 123 ... 143 mm | 210 ... 1500 mm |
| response time / release time | < 0,25 ms | | < 0,5 ms | < 0,1 ms<br>< 0,6 ms | < 5 ms | |
| response time | | < 1 ms | | | | < 6 ms |
| release time | | < 2,7 ms | | | | < 18 ms |
| sensing distance adjustment | mechanical,<br>5 turn | Teach-in | mechanical,<br>9 turn | mechanical,<br>8 turn | no | Teach-in |
| NPN | ■ | ■ | ■ | ■ | ■ | |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | | | ■ | ■ | |
| connector | ■ | ■ | ■ | ■ | | ■ |
| housing material | plastic | metal | plastic | metal | metal | metal |
| | | | | | | |
| **Page** | **260** | **264** | **270** | **274** | **276** | **280** |

| FHDM 12 | FHDK 14 | FHDK 14 | FHDM 16 | FHDK 20 | FHDK 26 |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | IO-Link | | | |
| | | | | | |
| 12,4 mm | 14,8 mm | 14,8 mm | 15,4 mm | 20 mm | 25 mm |
| 15 ... 300 mm | 20 ... 350 mm<br>30 ... 500 mm | 40 ... 200 mm | 20 ... 450 mm<br>20 ... 600 mm | 30 ... 200 mm | 120 ... 400 mm |
| < 1 ms | < 1 ms<br>< 5 ms | < 0,5 ms | < 1 ms<br>< 5 ms | < 0,5 ms | < 1 ms |
| mechanical,<br>5 turn | mechanical,<br>10 turn | Teach-in | mechanical,<br>5 turn | Teach-in | mechanical,<br>9 turn |
| | | | | | |
| ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | | | ■ | | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ |
| metal | plastic | plastic | metal | plastic | plastic |
| | | | | | |
| **262** | **266** | **268** | **272** | **278** | **282** |

# Diffuse sensors with background suppression

## General information

Diffuse sensors with background suppression using the triangulation principle not only measure the light intensity reflected by the target, but also determine the distance of the object from the sensor. In this way, objects with the minimum size of the light beam located within the adjustable sensing distance can be detected regardless of their color and surface.

The diffuse sensors with background suppression and laser light source were developed specifically for applications in which exact positioning is important. With the finely focused beam, even very small objects such as the wires of a resistor or threads can be clearly detected or counted.

## Applications

- Detection of boxes, metal and plastic parts lying on a base such as a conveyor belt, table or transport trolley from above
- Detection of bulk materials or other non-transparent materials in a container
- Counting of different-colored objects such as plastic bottles or printed packages
- Reliable presence monitoring of assembly parts, even with objects moving in the background

## Characteristics and advantages

Adjustable sensing distance
The switching point can be adjusted accurately between the object and the interfering background using a set screw or teach-in method

Largely independent of color
The sensing distance remains constant even if the color of the objects changes. Readjustment is therefore unnecessary. Objects changing in the background also have no effect.

Small spot size
Laser sensors can detect objects with a size of just 0,1 mm. Sensors with pinpoint diodes have a spot of only 2 mm diameter at the focus.

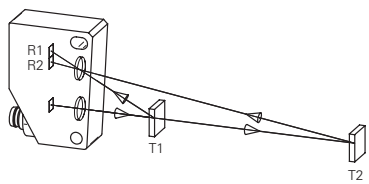
Red light emitters
Visible red light permits simple adjustment of the sensor to small objects by eye.

Short response time
Small, quickly moving objects are reliably detected due to the short response time.

## Technology and operation

The sensors are based on the triangulation principle. Only the angle of the light reflected back from the object determines the distance at which the sensor responds. The amount of reflected light is far less important.

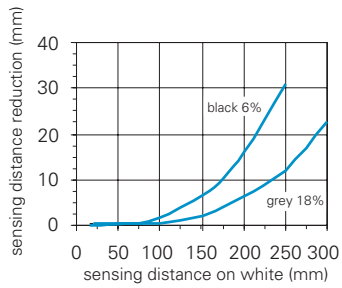
The schematic sketch below shows that receiver R1 receives the light reflected back from the object T1 (acute angle of incidence) and receiver R2 the light reflected back from the background (shallow angle of incidence). The transition from R1 to R2 determines the sensing distance.

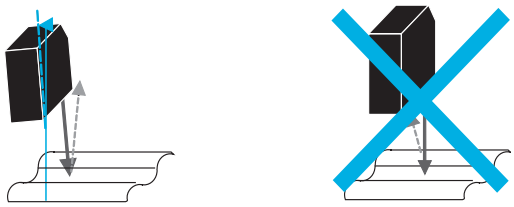


## Mounting and adjustment

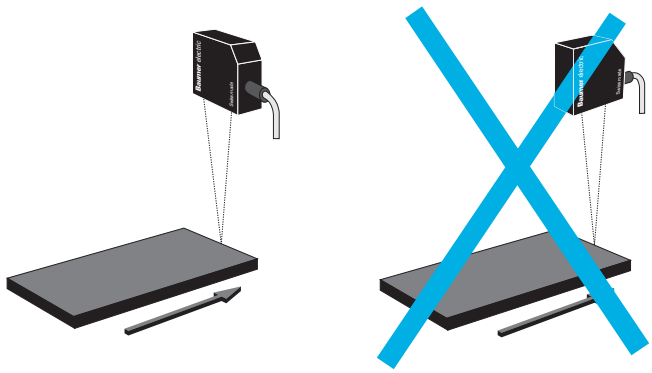
The diffuse sensor must be aimed at the object. The sensing distance must be set to a distance between the target and the background. The background must be located behind the adjusted sensing distance by at least the distance of the sensing distance reduction of the sensor to black.

For diffuse sensors with background suppression, the sensing range diagram is specified for the optimum adjustment. This indicates the sensing range reduction as a function of the sensing range to white for different degrees of remission. This means the distance by which the sensing distance to black or gray is reduced in comparison with white. When the adjusted sensing range to white is entered on the X axis of the diagram, the reduction of the sensing distance to black or gray can be read off on the Y axis. The sensing distance reduction also indicates the minimum distance a black or gray object must be separated from a white background.

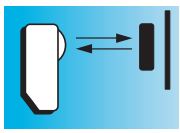


The direct reflection from glossy or reflective objects must not impinge on the receiver. This can be avoided by slightly tilting the sensor.



It should be ensured that the object to be detected approaches the active area of the sensor from the side, which avoids malfunctions caused by deflection of the light beam at edges.



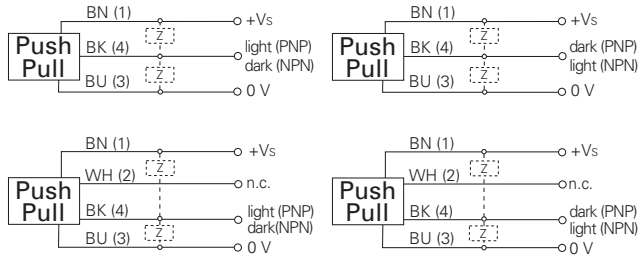
# Tw = 50 mm

IO-Link

- subminiature housing
- fixed sensing distance
- push-pull output

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed point source LED |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 11 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | push-pull |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes, supply only |
| **mechanical data** | |
| width / diameter | 4 mm |
| height / length | 44,8 mm |
| depth | 6,2 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 65 |

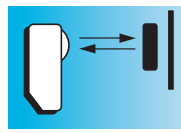
**connection diagrams**




| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

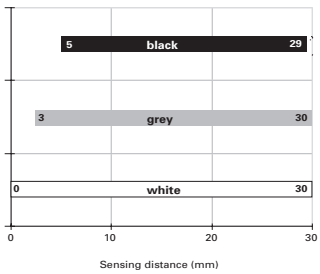
| accessories | |
|---|---|
| mounting brad | 162920 |
| for details, see accessories section | |

| order reference | sensing distance Tw | connection types | output function |
|---|---|---|---|
| **FHDK 04G6101** | 30 mm ±2 mm | cable 3 pin | light operate |
| **FHDK 04G6101/KS35A** | 30 mm ±2 mm | flylead connector M8, 4 pin | light operate |
| **FHDK 04G6102** | 50 mm ±3 mm | cable 3 pin | light operate |
| **FHDK 04G6102/KS35A** | 50 mm ±3 mm | flylead connector M8, 4 pin | light operate |
| **FHDK 04G6111** | 30 mm ±2 mm | cable 3 pin | dark operate |
| **FHDK 04G6111/KS35A** | 30 mm ±2 mm | flylead connector M8, 4 pin | dark operate |
| **FHDK 04G6112** | 50 mm ±3 mm | cable 3 pin | dark operate |
| **FHDK 04G6112/KS35A** | 50 mm ±3 mm | flylead connector M8, 4 pin | dark operate |

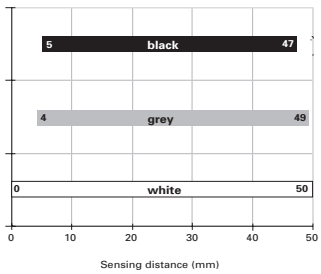


## sensing distance diagram

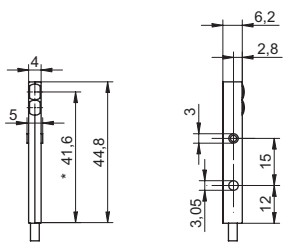
**Tw = 30 mm ±2 mm**



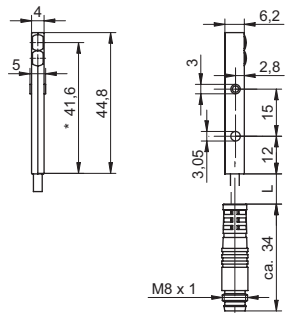

**Tw = 50 mm ±3 mm**



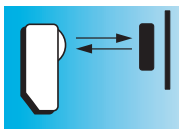

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

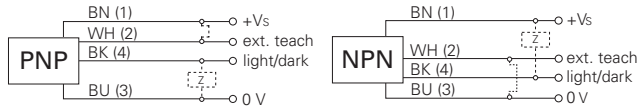


## Tw = 10 ... 60 mm

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing distance Tw | 10 ... 60 mm |
| sensing range Tb (at Tw max.) | 2 ... 60 mm |
| sensing range Tb (at Tw min.) | 5 ... 10 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

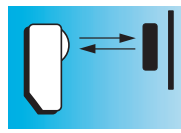
**connection diagrams**



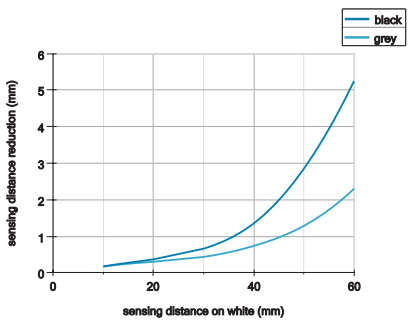

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

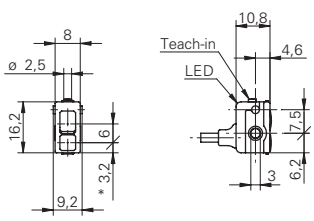
| order reference | connection types | output circuit |
|---|---|---|
| **FHCK 07N6901** | cable rear side | NPN |
| **FHCK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FHCK 07P6901** | cable rear side | PNP |
| **FHCK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



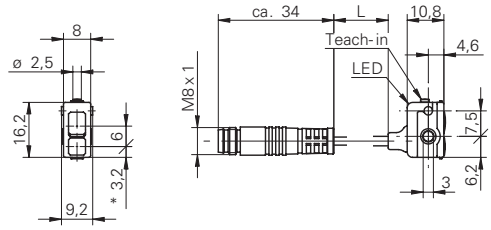
## sensing distance diagram



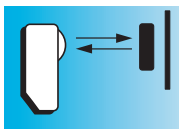

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

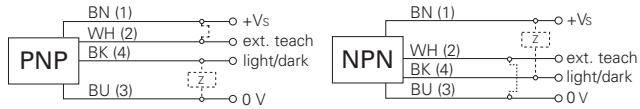


## Tw = 10 ... 60 mm

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing distance Tw | 10 ... 60 mm |
| sensing range Tb (at Tw max.) | 2 ... 60 mm |
| sensing range Tb (at Tw min.) | 5 ... 10 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

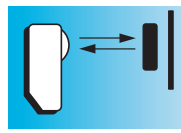
**connection diagrams**



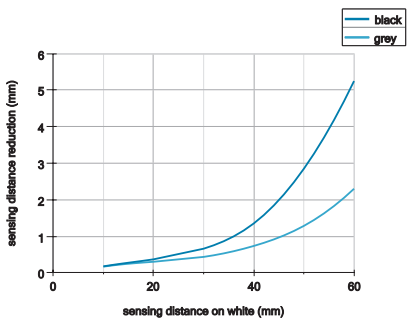

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

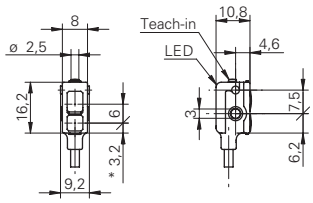
| order reference | connection types | output circuit |
|---|---|---|
| **FHDK 07N6901** | cable bottom side | NPN |
| **FHDK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FHDK 07P6901** | cable bottom side | PNP |
| **FHDK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



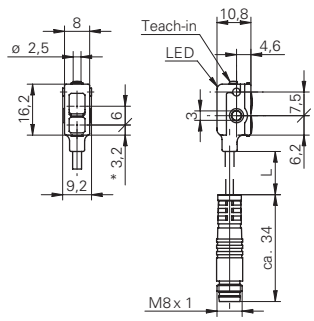
## sensing distance diagram



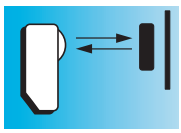

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

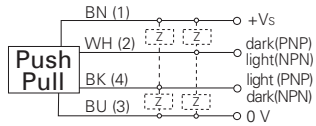


## Tw = 80 mm

- subminiature housing
- fixed sensing distance
- push-pull output

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 18 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output circuit | push-pull |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14,7 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

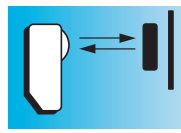
**connection diagram**




| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

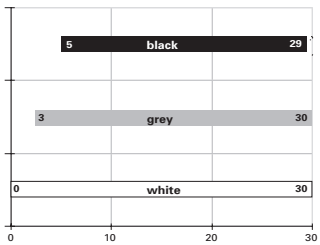
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

| order reference | sensing distance Tw | connection types | protection class |
|---|---|---|---|
| **FHDK 10G5120** | 30 mm ±2 mm | cable 4 pin | IP 65 |
| **FHDK 10G5120/S35A** | 30 mm ±2 mm | connector M8, 4 pin | IP 67 |
| **FHDK 10G5121** | 50 mm ±3 mm | cable 4 pin | IP 65 |
| **FHDK 10G5121/S35A** | 50 mm ±3 mm | connector M8, 4 pin | IP 67 |
| **FHDK 10G5122** | 80 mm ±8 mm | cable 4 pin | IP 65 |
| **FHDK 10G5122/S35A** | 80 mm ±8 mm | connector M8, 4 pin | IP 67 |



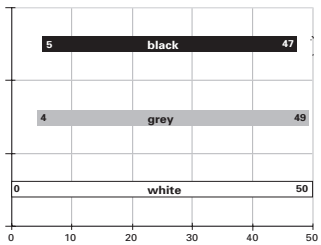
## sensing distance diagram

**Tw = 30 mm ±2 mm**



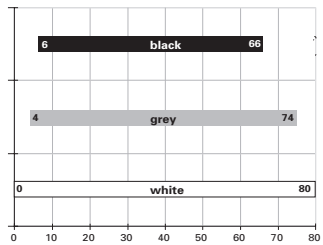

sensing distance (mm)

**Tw = 50 mm ±3 mm**



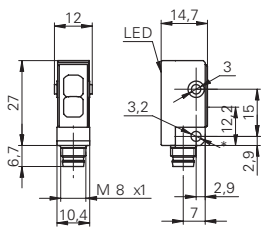

sensing distance (mm)

**Tw = 80 mm ±8 mm**

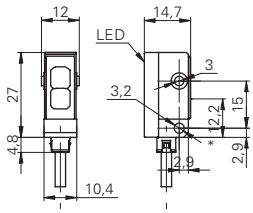



sensing distance (mm)

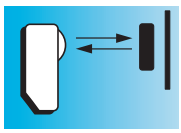
## dimension drawings




* emitter axis




* emitter axis

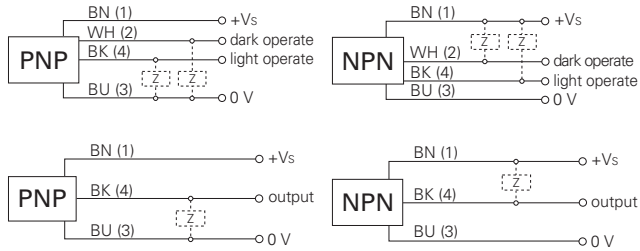


## Tw = 20 ... 120 mm

- subminiature housing
- large sensing range
- sensing distance adjustable via potentiometer

| general data | |
|---|---|
| type | background suppression |
| sensing distance Tw | 20 ... 120 mm |
| sensing range Tb (at Tw max.) | 5 ... 120 mm |
| sensing range Tb (at Tw min.) | 5 ... 20 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

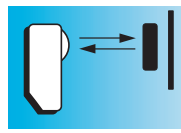
**connection diagrams**



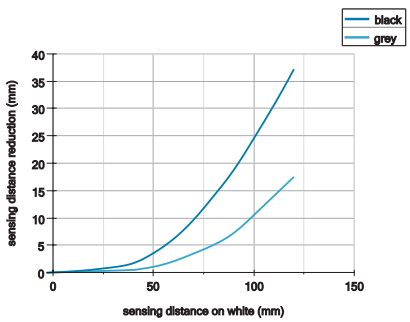

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

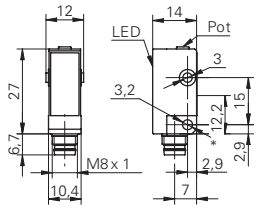
| order reference | connection types | output circuit | output function | light source | beam diameter | protection class |
|---|---|---|---|---|---|---|
| **FHDK 10N1101/KS35** | flylead connector M8, 3 pin | NPN | light operate | pulsed red LED | 4 mm | IP 65 |
| **FHDK 10N5101** | cable 4 pin | NPN | light / dark operate | pulsed red LED | 4 mm | IP 65 |
| **FHDK 10N5101/S35A** | connector M8, 4 pin | NPN | light / dark operate | pulsed red LED | 4 mm | IP 67 |
| **FHDK 10N5110** | cable 4 pin | NPN | light / dark operate | pulsed point source LED | 2 mm | IP 65 |
| **FHDK 10N5110/S35A** | connector M8, 4 pin | NPN | light / dark operate | pulsed point source LED | 2 mm | IP 67 |
| **FHDK 10P1101/KS35** | flylead connector M8, 3 pin | PNP | light operate | pulsed red LED | 4 mm | IP 65 |
| **FHDK 10P5101** | cable 4 pin | PNP | light / dark operate | pulsed red LED | 4 mm | IP 65 |
| **FHDK 10P5101/S35A** | connector M8, 4 pin | PNP | light / dark operate | pulsed red LED | 4 mm | IP 67 |
| **FHDK 10P5110** | cable 4 pin | PNP | light / dark operate | pulsed point source LED | 2 mm | IP 65 |



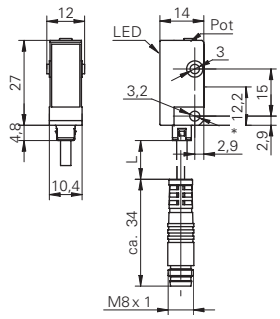
## sensing distance diagram



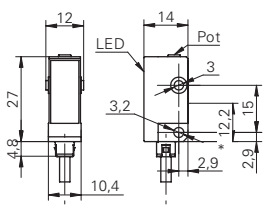

## dimension drawings



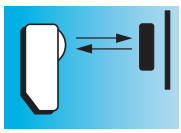

* emitter axis




* emitter axis cable length L = 200 mm




* emitter axis



## Tw = 20 ... 80 mm

- subminiature housing
- with line beam
- sensing distance adjustable via potentiometer

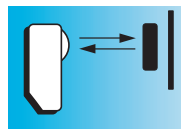
| general data | |
|---|---|
| type | background suppression |
| version | line beam |
| light source | pulsed red LED |
| sensing distance Tw | 20 ... 80 mm |
| sensing range Tb (at Tw max.) | 5 ... 80 mm |
| sensing range Tb (at Tw min.) | 5 ... 20 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

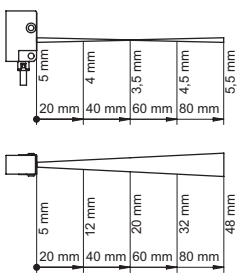
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **FHDK 10N5150** | cable 4 pin | NPN | IP 65 |
| **FHDK 10N5150/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **FHDK 10P5150** | cable 4 pin | PNP | IP 65 |
| **FHDK 10P5150/S35A** | connector M8, 4 pin | PNP | IP 67 |

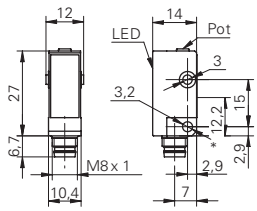




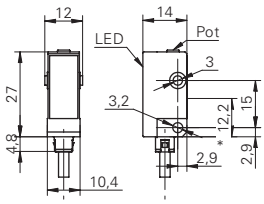
## beam characteristic



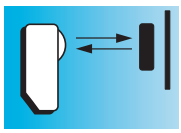

## dimension drawings




* emitter axis




* emitter axis



## Tw = 10 ... 30 mm

- subminiature housing
- optimized for glass detection
- sensing distance adjustable via potentiometer

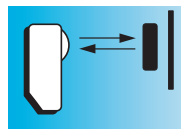
| general data | |
|---|---|
| type | background suppression |
| special type | for glass detection |
| light source | pulsed red LED |
| sensing distance Tw | 10 ... 30 mm |
| sensing range Tb (at Tw max.) | 3 ... 30 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **FHDK 10N5160/S35A** | NPN |
| **FHDK 10P5160/S35A** | PNP |

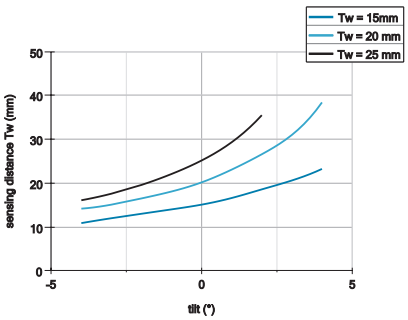
**connection diagrams**

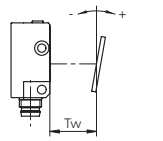
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket | 133792 |
| for details, see accessories section | |



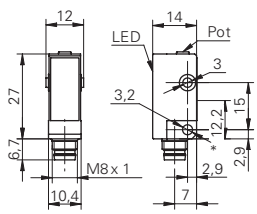
## sensing distance diagram



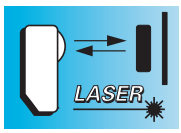




sensor object (mirror)

## dimension drawing




* emitter axis




# Tw = 22 ... 130 mm

- subminiature housing
- high repeatability
- sensing distance adjustable via potentiometer

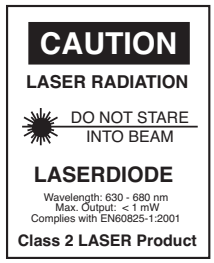
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 22 ... 130 mm |
| sensing range Tb (at Tw max.) | 3 ... 130 mm |
| sensing range Tb (at Tw min.) | 3 ... 22 mm |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensing distance adjustment | mechanical, 5 turn |
| laser class | 2 |
| distance to laser focus | 40 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,25 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 16,3 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |

**connection diagrams**

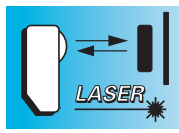
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

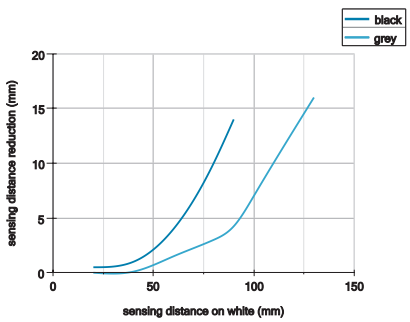
**laser warning**



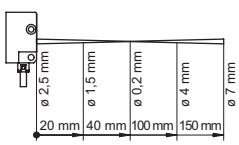

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **OHDK 10N5101** | cable 4 pin | NPN | IP 65 |
| **OHDK 10N5101/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **OHDK 10P5101** | cable 4 pin | PNP | IP 65 |
| **OHDK 10P5101/S35A** | connector M8, 4 pin | PNP | IP 67 |



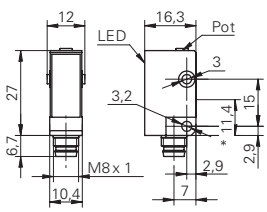

## sensing distance diagram



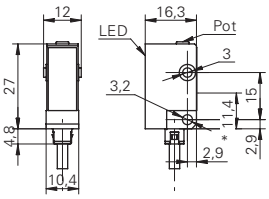

## beam characteristic



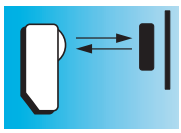

## dimension drawings




* emitter axis




* emitter axis



## Tw = 15 ... 300 mm

- rugged miniature metal housing
- sensing distance adjustable via potentiometer
- suppression of mutual optical interference

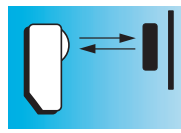
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing distance Tw | 15 ... 300 mm |
| sensing range Tb (at Tw max.) | 15 ... 300 mm |
| sensing range Tb (at Tw min.) | 5 ... 15 mm |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

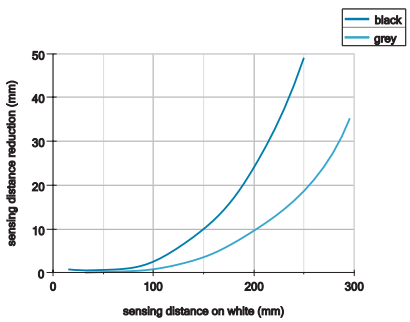
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

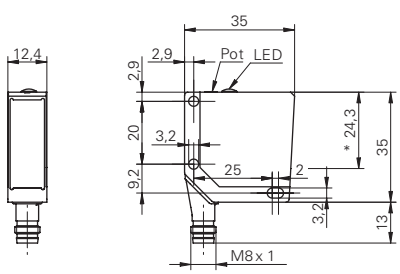
| order reference | connection types | output circuit |
|---|---|---|
| **FHDM 12N5001** | cable 4 pin | NPN |
| **FHDM 12N5001/S35A** | connector M8, 4 pin | NPN |
| **FHDM 12P5001** | cable 4 pin | PNP |
| **FHDM 12P5001/S35A** | connector M8, 4 pin | PNP |



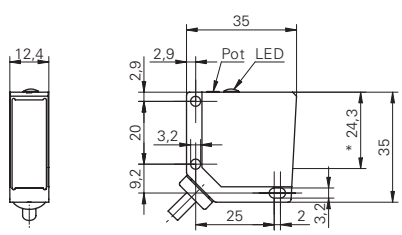
## sensing distance diagram



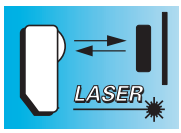

## dimension drawings




* emitter axis




* emitter axis




# Tw = 17 ... 120 mm

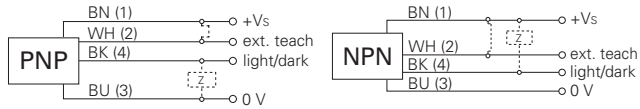
IO-Link

- rugged miniature metal housing
- negligible black/white difference
- teachable sensing distance

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 17 ... 120 mm |
| sensing range Tb (at Tw max.) | 16 ... 120 mm |
| sensing range Tb (at Tw min.) | 16 ... 17 mm |
| light indicator | LED red |
| power on indication | LED green |
| sensing distance adjustment | Teach-in |
| laser class | 2 |
| beam diameter | 0,9 ... 0,5 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time | < 1 ms |
| release time | < 2,7 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 80 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 2,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 37 mm |
| depth | 34,5 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **OHDM 12N6901/S35A** | NPN |
| **OHDM 12P6901/S35A** | PNP |

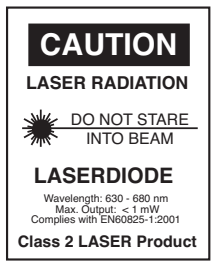
**connection diagrams**

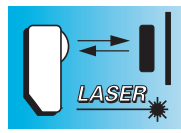



| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

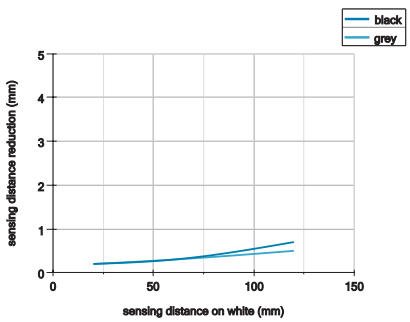
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

**laser warning**

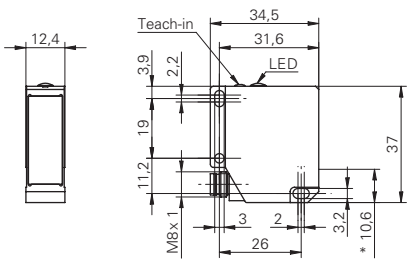




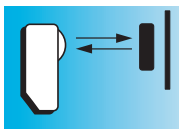

## sensing distance diagram




## dimension drawing




* emitter axis



## Tw = 20 ... 500 mm

- long sensing range
- sensing distance adjustable via potentiometer
- suppression of mutual opt. interferene

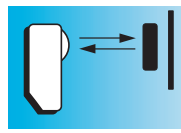
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 10 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **sensing distance Tw = 20 ... 350 mm** | |
| sensing range Tb (at Tw max.) | 20 ... 350 mm |
| sensing range Tb (at Tw min.) | 5 ... 20 mm |
| **sensing distance Tw = 30 ... 500 mm** | |
| sensing range Tb (at Tw max.) | 30 ... 500 mm |
| sensing range Tb (at Tw min.) | 5 ... 30 mm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

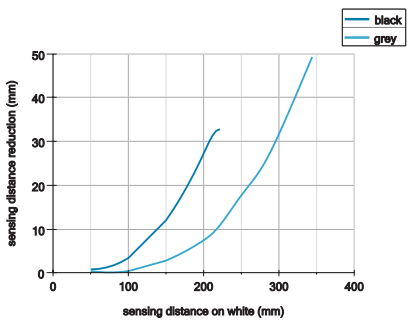
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

| order reference | sensing distance Tw | output circuit | response time / release time |
|---|---|---|---|
| **FHDK 14N5101/S35A** | 20 ... 350 mm | NPN | < 1 ms |
| **FHDK 14N5104/S35A** | 30 ... 500 mm | NPN | < 5 ms |
| **FHDK 14P5101/S35A** | 20 ... 350 mm | PNP | < 1 ms |
| **FHDK 14P5104/S35A** | 30 ... 500 mm | PNP | < 5 ms |

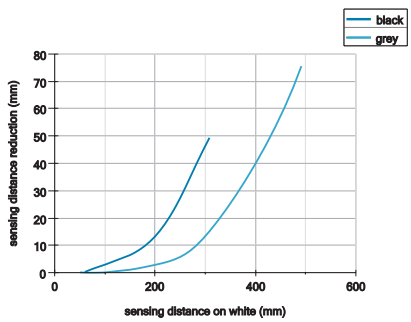


## sensing distance diagram

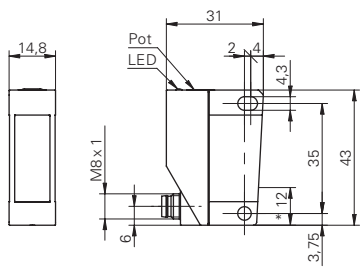
Tw = 20 ... 350 mm



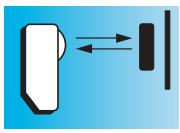

Tw = 30 ... 500 mm




## dimension drawing




* emitter axis



## Tw = 40 ... 200 mm

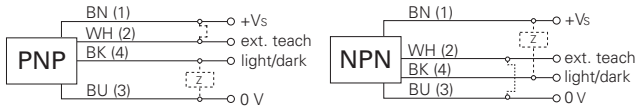
IO-Link

- short response time
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing distance Tw | 40 ... 200 mm |
| sensing range Tb (at Tw max.) | 2 ... 200 mm |
| sensing range Tb (at Tw min.) | 12 ... 40 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 40 mA |
| current consumption typ. | 35 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

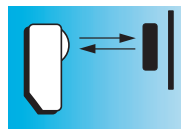
| order reference | output circuit |
|---|---|
| **FHDK 14N6901/S35A** | NPN |
| **FHDK 14P6901/S35A** | PNP |

**connection diagrams**

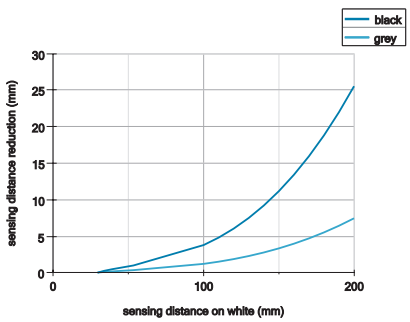



| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

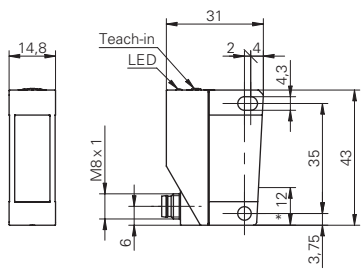
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |



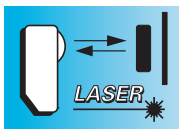
## sensing distance diagram




## dimension drawing




* emitter axis




# Tw = 20 ... 350 mm

- short response time
- high repeatability
- sensing distance adjustable via potentiometer

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 20 ... 350 mm |
| sensing range Tb (at Tw max.) | 20 ... 350 mm |
| sensing range Tb (at Tw min.) | 5 ... 20 mm |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensing distance adjustment | mechanical, 9 turn |
| laser class | 2 |
| distance to laser focus | 115 mm |
| wave length | 650 nm |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 2,2 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

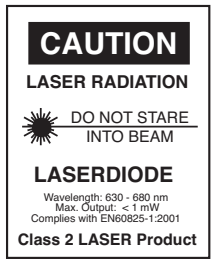
| order reference | output circuit |
|---|---|
| **OHDK 14N5101/S35A** | NPN |
| **OHDK 14P5101/S35A** | PNP |

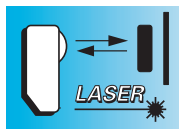
**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

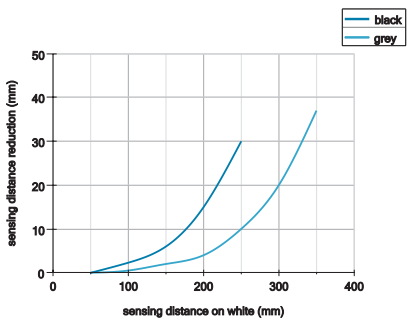
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

**laser warning**

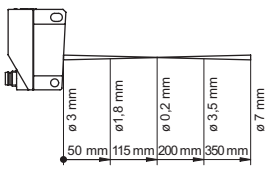




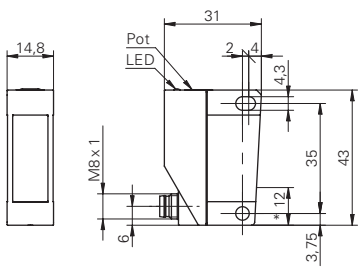

## sensing distance diagram



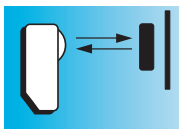

## beam characteristic




## dimension drawing




* emitter axis



## Tw = 20 ... 600 mm

- rugged metal housing
- sensing distance adjustable via potentiometer
- suppression of mutual optical interference

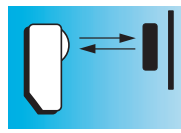
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing range Tb (at Tw min.) | 5 ... 20 mm |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **sensing distance Tw = 20 ... 450 mm** | |
| sensing range Tb (at Tw max.) | 20 ... 450 mm |
| **sensing distance Tw = 20 ... 600 mm** | |
| sensing range Tb (at Tw max.) | 20 ... 600 mm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 41 mA |
| current consumption typ. | 29 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

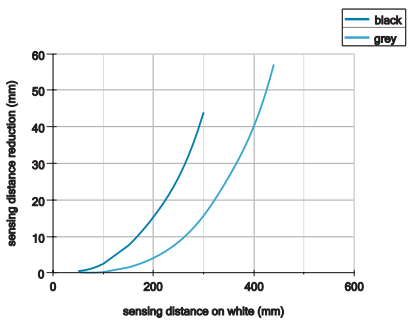
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| for details, see accessories section | |

| order reference | sensing distance Tw | connection types | output circuit | response time / release time |
|---|---|---|---|---|
| **FHDM 16N5001** | 20 ... 450 mm | cable 4 pin | NPN | < 1 ms |
| **FHDM 16N5001/S14** | 20 ... 450 mm | connector M12, 4 pin | NPN | < 1 ms |
| **FHDM 16N5004** | 20 ... 600 mm | cable 4 pin | NPN | < 5 ms |
| **FHDM 16N5004/S14** | 20 ... 600 mm | connector M12, 4 pin | NPN | < 5 ms |
| **FHDM 16P5001** | 20 ... 450 mm | cable 4 pin | PNP | < 1 ms |
| **FHDM 16P5001/S14** | 20 ... 450 mm | connector M12, 4 pin | PNP | < 1 ms |
| **FHDM 16P5004/S14** | 20 ... 600 mm | connector M12, 4 pin | PNP | < 5 ms |
| **FHDM 16P5004** | 20 ... 600 mm | cable 4 pin | PNP | < 5 ms |

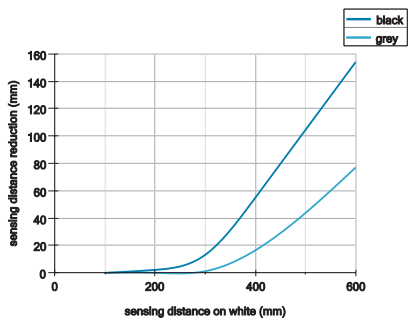


## sensing distance diagram

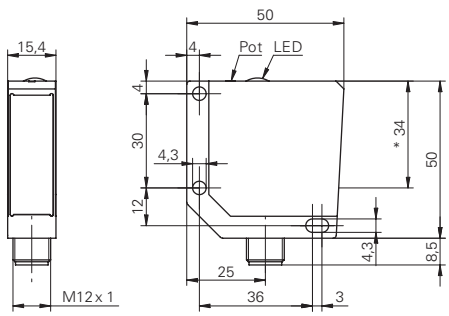
Tw = 20 ... 450 mm



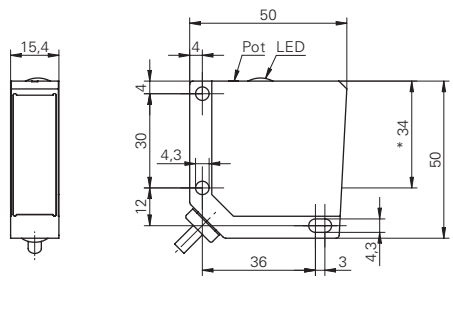

Tw = 20 ... 600 mm



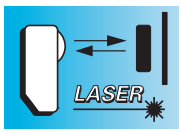

## dimension drawings




* emitter axis




* emitter axis




## Tw = 25 ... 300 mm

- rugged metal housing
- long sensing range
- high repeatability

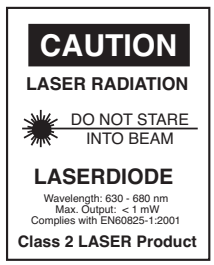
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 25 ... 300 mm |
| sensing range Tb (at Tw max.) | 40 ... 300 mm |
| sensing range Tb (at Tw min.) | 5 ... 25 mm |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| sensing distance adjustment | mechanical, 8 turn |
| laser class | 2 |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**

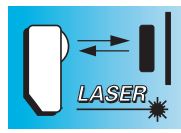
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

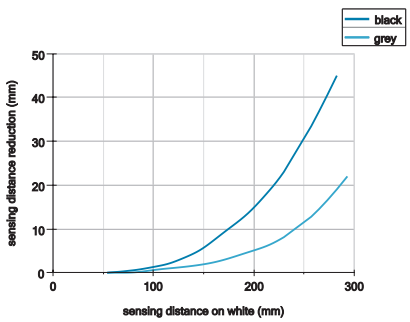
**laser warning**




| order reference | connection types | output circuit | response time / release time | wave length | distance to laser focus | suppression of reciprocal influence |
|---|---|---|---|---|---|---|
| **OHDM 16N5001** | cable 4 pin | NPN | < 0,6 ms | 650 nm | 80 mm | yes |
| **OHDM 16N5001/S14** | connector M12, 4 pin | NPN | < 0,6 ms | 650 nm | 80 mm | yes |
| **OHDM 16P5001** | cable 4 pin | PNP | < 0,6 ms | 650 nm | 80 mm | yes |
| **OHDM 16P5001/S14** | connector M12, 4 pin | PNP | < 0,6 ms | 650 nm | 80 mm | yes |
| **OHDM 16P5002/S14** | connector M12, 4 pin | PNP | < 0,6 ms | 675 nm | 40 mm | yes |
| **OHDM 16P5012** | cable 4 pin | PNP | < 0,1 ms | 650 nm | 60 mm | - |
| **OHDM 16P5012/S14** | connector M12, 4 pin | PNP | < 0,1 ms | 650 nm | 60 mm | - |

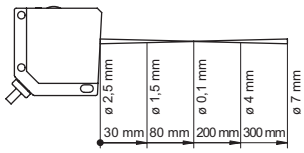



## sensing distance diagram

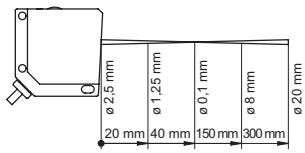



## beam characteristic

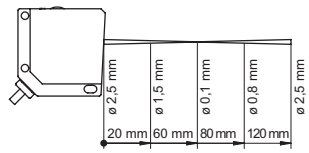
**distance to laser focus = 80 mm**



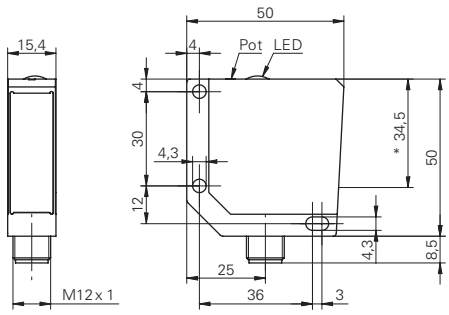

**distance to laser focus = 40 mm**



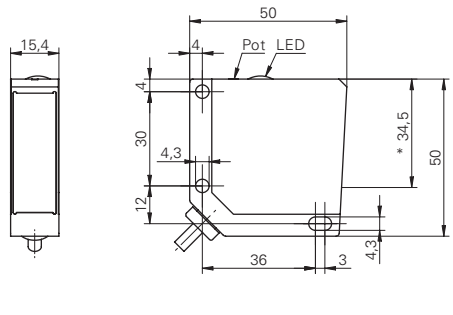

**distance to laser focus = 60 mm**



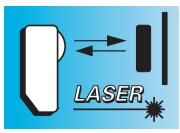

## dimension drawings




* emitter axis




* emitter axis

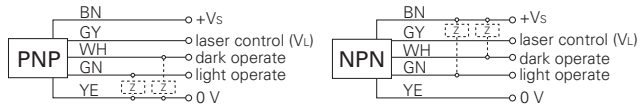



# Tw = 133 mm

- for lateral detection of wafer edges
- very long range
- laser sensor in rugged metal housing

| general data | |
|---|---|
| type | background suppression |
| special type | Wafer mapping sensor |
| light source | pulsed red laser diode |
| sensing distance Tw | 123 ... 143 mm |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| power on indication | LED green |
| sensing distance adjustment | no |
| laser class | 2 |
| wave length | 650 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | cable 5 pin |
| **ambient conditions** | |
| operating temperature | -5 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**

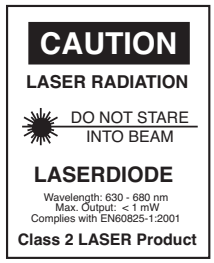



| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

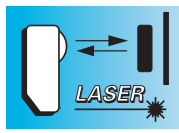
**remarks**

Function laser control - input:
- Laser diode on VL < 1 V
- Laser diode off VL > Vs - 4 V or open

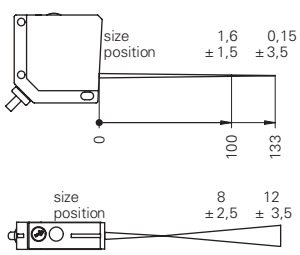
**laser warning**



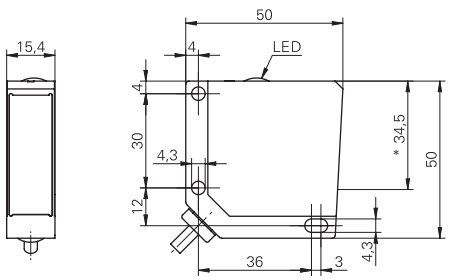

| order reference | output circuit |
|---|---|
| **OHDM 16N5651** | NPN |
| **OHDM 16P5651** | PNP |



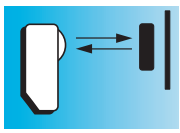

## beam characteristic




## dimension drawing




* emitter axis



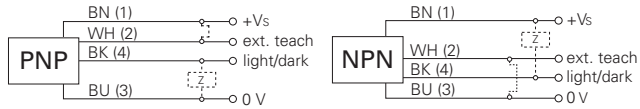
## Tw = 30 ... 200 mm

- cross-technology housing concept
- sensing distance adjustable via Teach-in
- small mounting depth

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red LED |
| sensing distance Tw | 30 ... 200 mm |
| sensing range Tb (at Tw max.) | 2 ... 200 mm |
| sensing range Tb (at Tw min.) | 12 ... 30 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 48 mA |
| current consumption typ. | 28 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | plastic (PBT-ASA) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

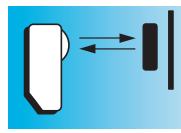
| order reference | output circuit |
|---|---|
| **FHDK 20N6901/S35A** | NPN |
| **FHDK 20P6901/S35A** | PNP |

**connection diagrams**

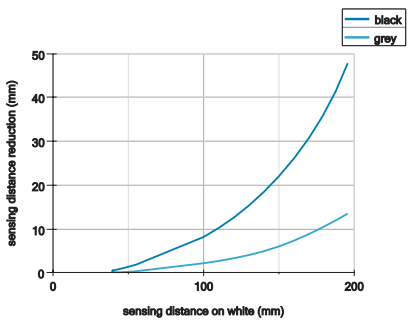



| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

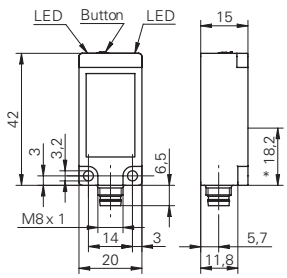
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| for details, see accessories section | |



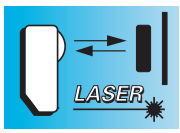
## sensing distance diagram




## dimension drawing




* emitter axis



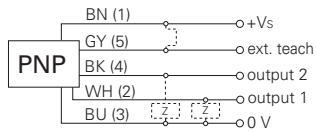

## Tw = 210 ... 1500 mm

IO-Link

- large range
- negligible black/white difference
- two teachable sensing distances

| general data | |
|---|---|
| type | background suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 210 ... 1500 mm |
| sensing range Tb (at Tw max.) | 200 ... 1500 mm |
| sensing range Tb (at Tw min.) | 200 ... 210 mm |
| light indicator | LED red |
| power on indication | LED green |
| sensing distance adjustment | Teach-in |
| laser class | 2 |
| beam diameter | 2 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time | < 6 ms |
| release time | < 18 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 100 mA |
| voltage drop Vd | < 5 VDC |
| output function | light / dark operate |
| output circuit | PNP |
| output current | < 20 mA |
| short circuit protection | yes |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 20,6 mm |
| height / length | 65 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 5 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 67 |

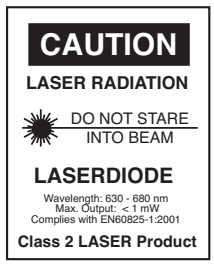
**connection diagram**



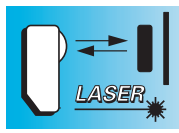

| connectors | | |
|---|---|---|
| ES 34CP2 | 5 pin | 2 m straight |
| ES 33CP2 | 5 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| mounting bracket | 131521 |
| for details, see accessories section | |

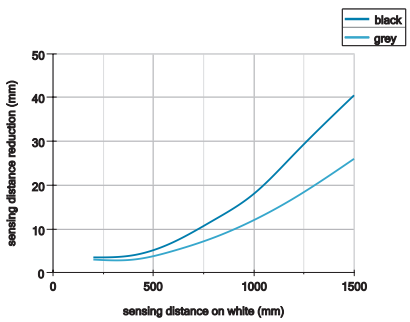
**laser warning**



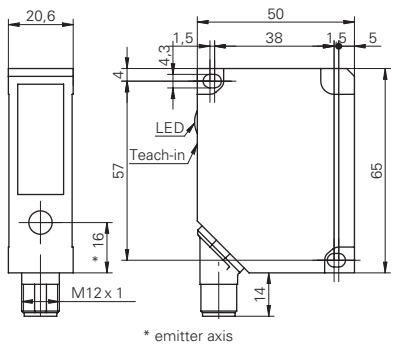

| order reference |
|---|
| **OHDM 20P6990/S14C** |

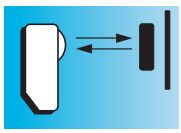



## sensing distance diagram




## dimension drawing





## Tw = 120 ... 400 mm

- sensing distance adjustable via potentiometer
- small blind range

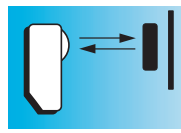
| general data | |
|---|---|
| type | background suppression |
| light source | pulsed infrared diode |
| sensing distance Tw | 120 ... 400 mm |
| sensing range Tb (at Tw max.) | 10 ... 400 mm |
| sensing range Tb (at Tw min.) | 8 ... 120 mm |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 9 turn |
| wave length | 880 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 35 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 25 mm |
| height / length | 80 mm |
| depth | 58 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

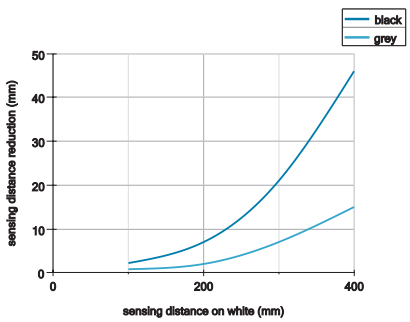
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| mounting bracket | 112477 |
| for details, see accessories section | |

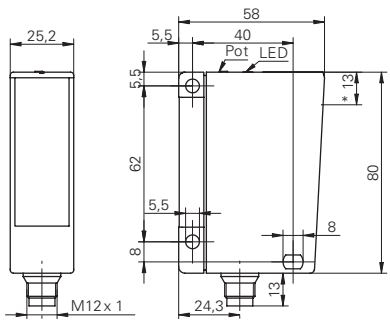
| order reference | connection types | output circuit |
|---|---|---|
| **FHDK 26N5001/S14** | connector M12, 4 pin | NPN |
| **FHDK 26P5001** | cable 4 pin | PNP |
| **FHDK 26P5001/S14** | connector M12, 4 pin | PNP |

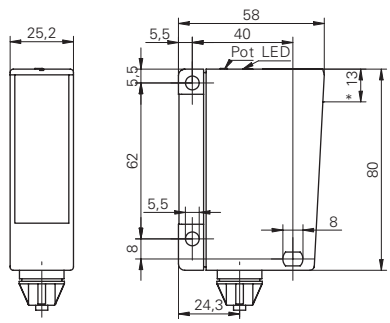


## sensing distance diagram




## dimension drawings



## red light LED version

| product family | FNCK 07 | FNDK 07 | FNDM 12 | FNDK 14 |
|---|---|---|---|---|
| | | | | |
| | *MINOS* | *MINOS* | | |
| width / diameter | 8 mm | 8 mm | 12,4 mm | 14,8 mm |
| sensing distance Tw | 10 ... 45 mm | 10 ... 45 mm | 20 ... 80 mm | 55 ... 200 mm |
| response time / release time | < 0,5 ms | < 0,5 ms | < 1 ms | < 0,5 ms |
| sensing distance adjustment | Teach-in | Teach-in | mechanical, 5 turn | Teach-in |
| NPN | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | |
| connector | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | metal | plastic |
| | | | | |
| **Page** | **288** | **290** | **292** | **294** |

## laser version

| product family | ONDM 16 |
|---|---|
| | |
| width / diameter | 15,4 mm |
| sensing distance Tw | 25 ... 200 mm |
| response time / release time | < 0,6 ms |
| sensing distance adjustment | mechanical, 8 turn |
| PNP | ■ |
| cable | ■ |
| connector | ■ |
| housing material | metal |
| | |
| **Page** | **296** |

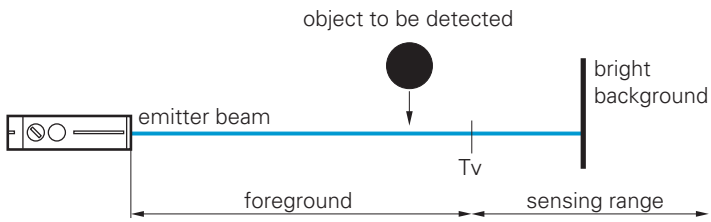
# Diffuse sensors with foreground suppression

## General information

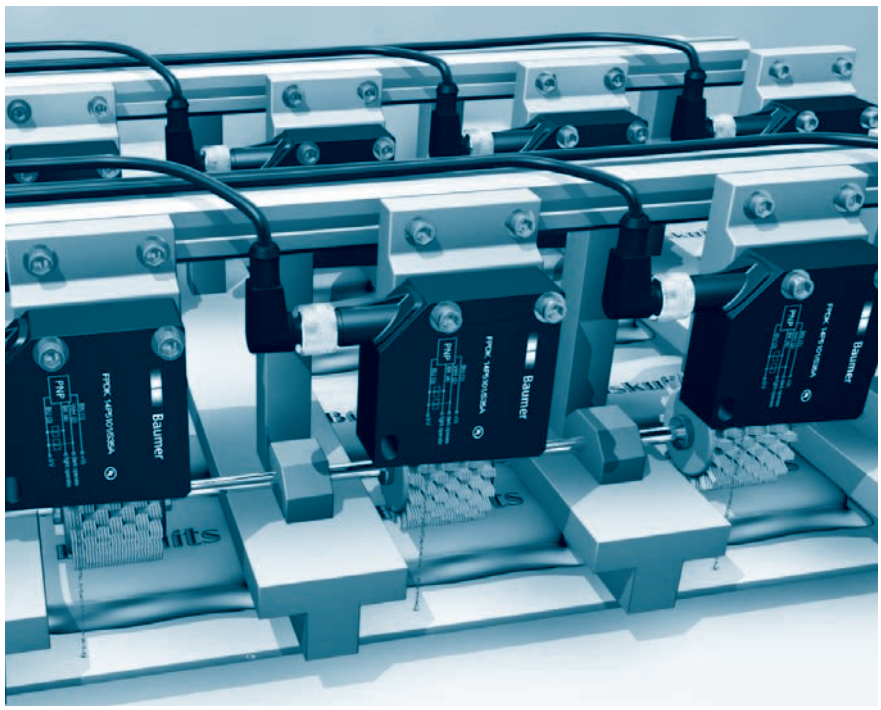
Diffuse sensors with foreground suppression using the triangulation principle not only measure the light intensity reflected by the target, but also determine the distance of the object from the sensor. In this way, objects with the minimum size of the light beam located within the adjustable sensing distance can be detected regardless of their color and surface. Objects moving through the light beam in the adjustable foreground are suppressed.

## Applications

- Detection of thin, poorly-reflecting objects on a reflective conveyor belt (if black/white offset of the diffuse sensor with background suppression becomes a problem)
- Detection of objects without a blind region. The sensor must be adjusted to a defined background, which then operates as a «reflector» (see sketch).




sensor must see background, object breaks beam in the foreground



# Diffuse sensors with foreground suppression



## Characteristics and advantages

**Adjustable foreground distance**
The foreground distance or, expressed otherwise, the beginning of the sensing distance, can be precisely adjusted by a set screw or Teach-in.

**Insensitive to color**
The beginning of the sensing distance remains largely constant even if the color of the objects changes. Readjustment is therefore unnecessary.

**Small spot size**
Laser sensors can detect objects with a size of just 0,1 mm.

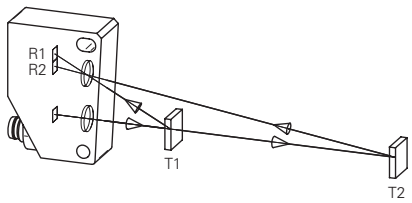
**Short response time**
Small, quickly moving objects are reliably detected due to the short response time.

## Technology and operation

The sensors are based on the triangulation principle. The beginning of the sensing distance is only determined by the angle of the light reflected back from the object. The amount of reflected light is far less important.

The schematic sketch below shows that receiver R1 receives the light reflected back from the object T1 (foreground) and receiver R2 the light reflected back from object T2. The transition from R1 to R2 determines the sensing distance.

Inside the sensing distance, the sensor operates as a normal diffuse sensor, i.e. the max. range depends on the reflectivity of the object.

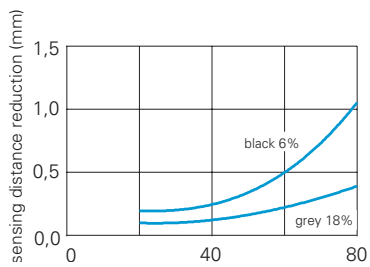


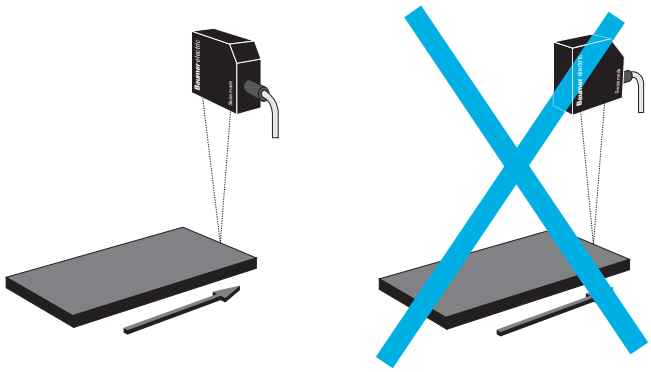
## Mounting and adjustment

The diffuse sensor must be aimed at the object. The beginning of the sensing distance must be set to a distance between the target and the object in the foreground.

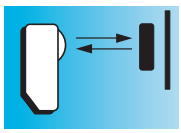
For diffuse sensors with foreground suppression, the sensing distance diagram is specified. This indicates the sensing distance expansion as a function of the beginning of the sensing distance to white for different degrees of remission. This means the distance by which the beginning of the sensing distance to black or gray is increased in comparison with white. When the adjusted beginning of the sensing distance to white is entered on the X axis of the diagram, the increase of the sensing distance to black or gray can be read off on the Y axis.

The sensing distance increase also indicates how far a black or gray object may be located behind the adjusted sensing distance for the object to be correctly detected.



It should be ensured that the object to be detected approaches the active area of the sensor from the side, which avoids malfunctions.

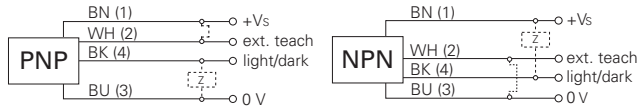


## Tw = 10 ... 45 mm

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual opt. Interferene

| general data | |
|---|---|
| type | foreground suppression |
| light source | pulsed red LED |
| sensing distance Tw | 10 ... 45 mm |
| sensing range Tb (at Tw max.) | 45 ... 150 mm |
| sensing range Tb (at Tw min.) | 10 ... 150 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

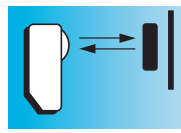
**connection diagrams**



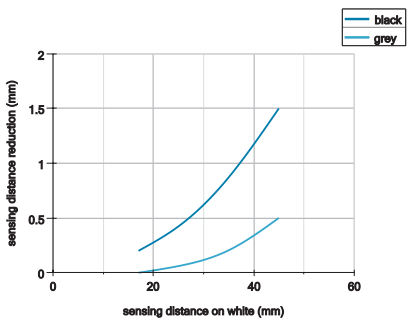

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

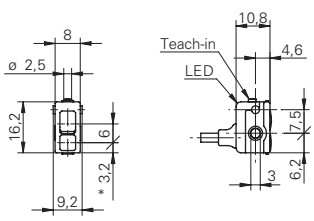
| order reference | connection types | output circuit |
|---|---|---|
| **FNCK 07N6901** | cable rear side | NPN |
| **FNCK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FNCK 07P6901** | cable rear side | PNP |
| **FNCK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



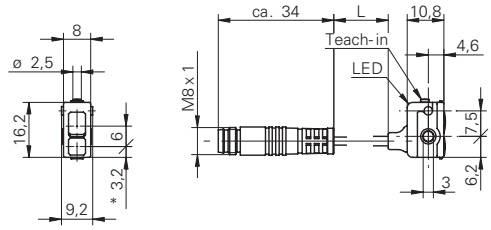
## sensing distance diagram



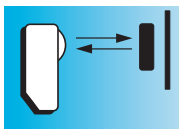

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

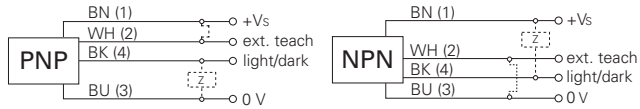


## Tw = 10 ... 45 mm

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | foreground suppression |
| light source | pulsed red LED |
| sensing distance Tw | 10 ... 45 mm |
| sensing range Tb (at Tw max.) | 45 ... 150 mm |
| sensing range Tb (at Tw min.) | 10 ... 150 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

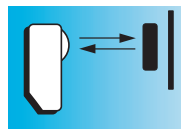
**connection diagrams**



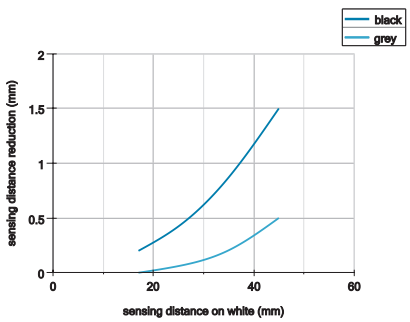

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

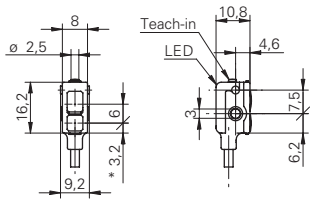
| order reference | connection types | output circuit |
|---|---|---|
| **FNDK 07N6901** | cable bottom side | NPN |
| **FNDK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FNDK 07P6901** | cable bottom side | PNP |
| **FNDK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



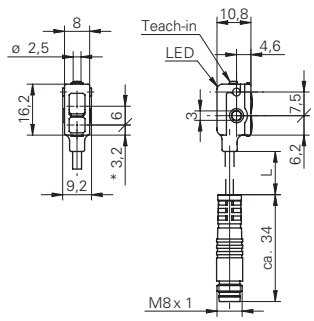
## sensing distance diagram



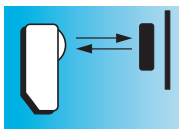

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm



## Tw = 20 ... 80 mm

- rugged miniature metal housing
- sensing distance adjustable via potentiometer

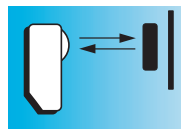
| general data | |
|---|---|
| type | foreground suppression |
| light source | pulsed red LED |
| sensing distance Tw | 20 ... 80 mm |
| sensing range Tb (at Tw max.) | 80 ... 160 mm |
| sensing range Tb (at Tw min.) | 20 ... 30 mm |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 5 turn |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

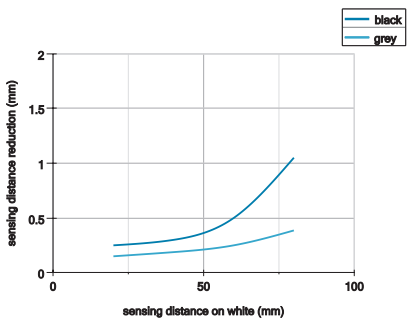
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

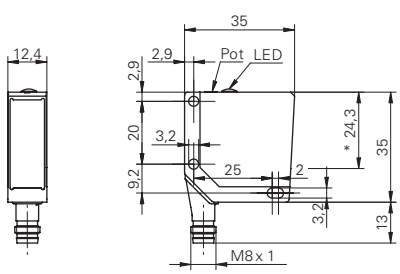
| order reference | connection types | output circuit |
|---|---|---|
| **FNDM 12N5001** | cable 4 pin | NPN |
| **FNDM 12N5001/S35A** | connector M8, 4 pin | NPN |
| **FNDM 12P5001** | cable 4 pin | PNP |
| **FNDM 12P5001/S35A** | connector M8, 4 pin | PNP |



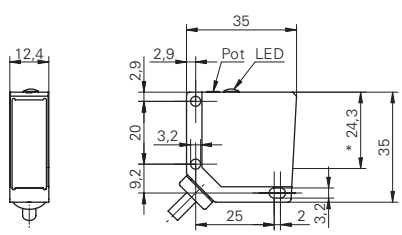
## sensing distance diagram



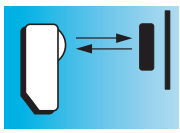

## dimension drawings




* emitter axis




* emitter axis

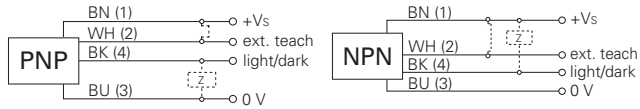


## Tw = 55 ... 200 mm

- short response time
- sensing distance adjustable via Teach-in

| general data | |
|---|---|
| type | foreground suppression |
| light source | pulsed red LED |
| sensing distance Tw | 55 ... 200 mm |
| sensing range Tb (at Tw max.) | 200 ... 350 mm |
| sensing range Tb (at Tw min.) | 55 ... 350 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| output indicator | LED yellow |
| sensing distance adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 40 mA |
| current consumption typ. | 35 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

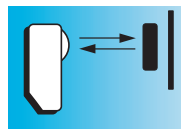
**connection diagrams**



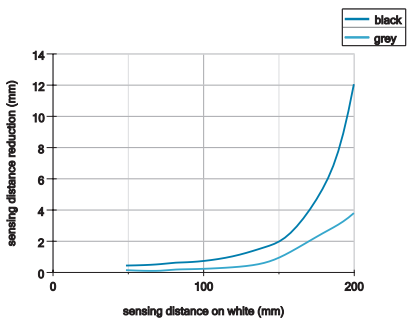

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

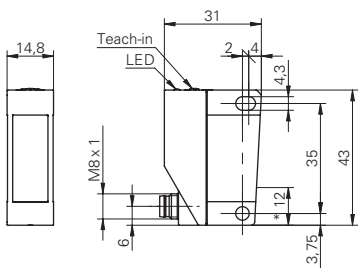
| order reference | output circuit |
|---|---|
| **FNDK 14N6901/S35A** | NPN |
| **FNDK 14P6901/S35A** | PNP |



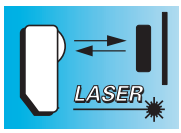
## sensing distance diagram




## dimension drawing




* emitter axis



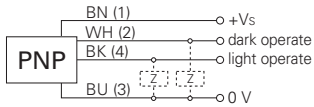

# Tw = 25 ... 200 mm

- rugged metal housing
- high repeatability

| general data | |
|---|---|
| type | foreground suppression |
| light source | pulsed red laser diode |
| sensing distance Tw | 25 ... 200 mm |
| sensing range Tb (at Tw max.) | 200 ... 500 mm |
| sensing range Tb (at Tw min.) | 25 ... 45 mm |
| repeatability | < 0,1 mm at laser focus |
| light indicator | LED yellow |
| sensing distance adjustment | mechanical, 8 turn |
| laser class | 2 |
| distance to laser focus | 80 mm |
| wave length | 650 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,6 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

| order reference | connection types |
|---|---|
| **ONDM 16P5101** | cable 4 pin |
| **ONDM 16P5101/S14** | connector M12, 4 pin |

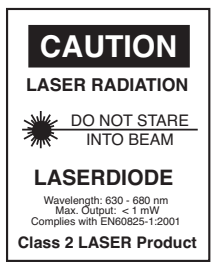
**connection diagram**

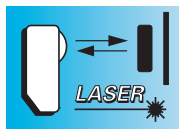



| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

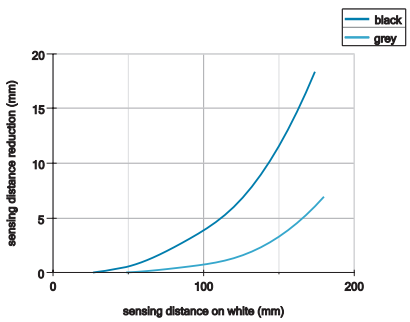
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

**laser warning**

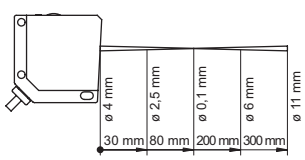




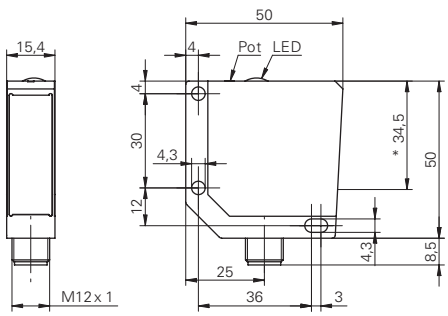

## sensing distance diagram



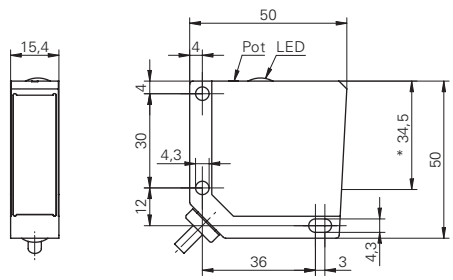

## beam characteristic




## dimension drawings




* emitter axis




* emitter axis

## red light LED version

| product family | FZCK 07 | FZDK 07 | FZDM 08 | FZAM 08 | FZDK 10 | FZDM 12 | FZAM 12 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *MINOS* | *MINOS* | | | | | |
| width / diameter | 8 mm | 8 mm | 8 mm | 8 mm | 10,4 mm | 12,4 mm | 12 mm |
| sensing distance Tw | 20 ... 150 mm | 20 ... 150 mm | < 40 mm<br>< 80 mm | < 40 mm<br>< 80 mm | 5 ... 200 mm | 30 ... 250 mm | 30 ... 200 mm |
| response time / release time | < 0,5 ms | < 0,5 ms | < 1 ms | < 1 ms | < 1 ms | < 1 ms | < 1 ms |
| sensitivity adjustment | Teach-in | Teach-in | no | no | Pot, 270° | Pot, 5 turn | Pot, 270° |
| NPN | ■ | ■ | | | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | metal | metal | plastic | metal | metal |
| | | | | | | | |
| **Page** | **302** | **304** | **306** | **308** | **310** | **316** | **318** |

## laser version

| product family | OZDK 10 | OZDK 10 | OZDK 14 | OZDM 16 | OZDM 16 |
|---|---|---|---|---|---|
| | | | | | |
| version | | line beam | | | |
| width / diameter | 10,4 mm | 10,4 mm | 14,8 mm | 15,4 mm | 15,4 mm |
| sensing distance Tw | 3 ... 150 mm | 3 ... 150 mm | 20 ... 300 mm | 0 ... 250 mm | 0 ... 250 mm |
| response time / release time | < 0,05 ms | < 0,05 ms | < 0,15 ms | < 0,05 ms | < 0,1 ms |
| sensitivity adjustment | Pot, 5 turn | Pot, 5 turn | Teach-in | Pot, 14 turn | Pot, 14 turn |
| NPN | ■ | ■ | ■ | ■ | |
| PNP | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | | ■ | ■ |
| connector | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | metal | metal |
| | | | | | |
| **Page** | **312** | **314** | **322** | **326** | **328** |

| FZDK 14 | FZDM 16 | FZAM 18 | FZAM 18 | FZAM 18 | FZDK 20 | FZAM 30 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| 14,8 mm | 15,4 mm | 18 mm | 18 mm | 18 mm | 20 mm | 30 mm |
| 5 ... 600 mm | 0 ... 400 mm | 60 ... 430 mm | 20 ... 150 mm | 60 ... 430 mm | 5 ... 500 mm | 100 ... 700 mm<br>300 ... 1500 mm |
| < 1 ms | < 1 ms | < 1 ms | < 0,5 ms | < 1 ms | < 0,5 ms | < 0,25 ms<br>< 2,5 ms |
| Pot, 270° | Pot, 270° | Teach-in | Pot, 15 turn | Pot, 270° | Pot, 270° | Pot, 15 turn |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | ■ | ■ | | ■ |
| ■ | ■ | ■ | | ■ | ■ | |
| plastic | metal | metal | metal | metal | plastic | metal |
| | | | | | | |
| **320** | **324** | **330** | **332** | **334** | **336** | **338** |

# Diffuse sensor with intensity difference



## General information

The emitter and receiver are in the same housing. The emitted infrared, red or laser light is reflected directly by the target back to the sensor. If the target reflects sufficiently well, the received light causes the sensor to switch.

## Applications

- Differentiation and sorting of objects, e.g. by size, degree of reflection etc.
- Counting of objects
- Presence check, e.g. of a paper stack.

## Characteristics and advantages

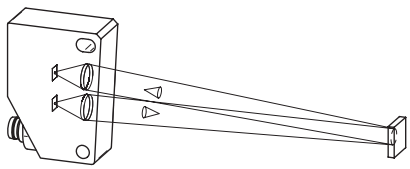
- Exploitation of the refection from the target
- Suitable to discern black from white
- Relatively large active range
- Simple installation (only one sensor)
- Short response time

- The sensing distance depends largely on the reflective properties of the object surface.
- Suitable to discern between black and white objects.
- Relatively large active range.
- Positioning and monitoring with just one sensor.

## Technology and operation

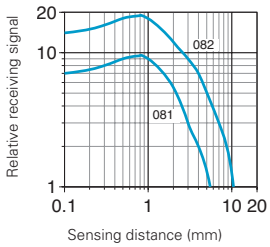
The light shining on the target is largely diffused and reflected back in all directions. A very small part of this remitted light is observed by the receiver. If the target reflects sufficiently well, the received light causes the sensor to switch.

As the sensor operates with the reflection from the materials, the surface properties, color and gloss have a great influence on the switching distance.



## Mounting and adjustment

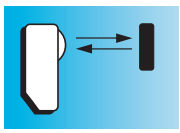
With diffuse sensors operating by the intensity difference principle, the relative receiving signal is specified. This represents the signal level received from a white object as a function of the distance. Using this diagram, the sensing range can be determined for an object which is not white. The correction factor of the respective material is required for this purpose.




### Correction factor

The material and surface properties of the object (representing the reflectivity) influence the switching distance of a diffuse sensor with intensity difference. To determine the corrected switching distance, the following values must therefore be applied to the relative receiving signal (KFs) or in approximation to the distance (KFd).

| Material | KFs | KFd |
|---|---|---|
| Kodak test card | 100% | 100% |
| Pale, planed wood | 80% | 90% |
| Rough wood | 20% | 45% |
| Drawn aluminum | 25% | 50% |
| Cardboard, matte black | 7% | 26% |

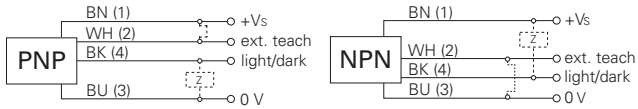


## Tw = 20 ... 150 mm

- ultra compact housing
- sensitivity adjustable via Teach-in
- suppression of mutual opt. interferene

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red LED |
| sensing distance Tw | 20 ... 150 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

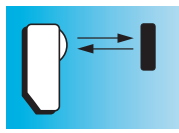
**connection diagrams**



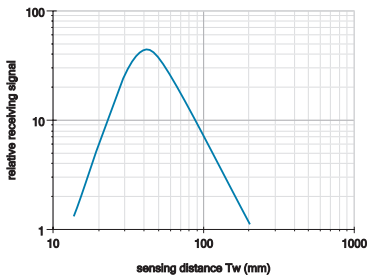

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

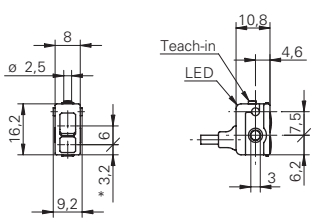
| order reference | connection types | output circuit |
|---|---|---|
| **FZCK 07N6901** | cable rear side | NPN |
| **FZCK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FZCK 07P6901** | cable rear side | PNP |
| **FZCK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



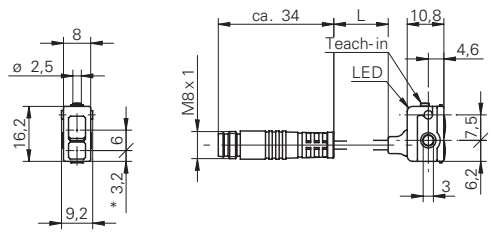
## relative receiving signal



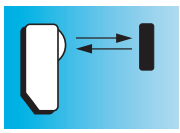

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

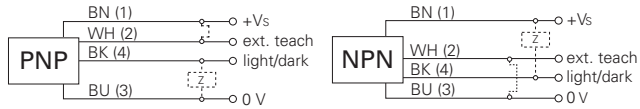


# Tw = 20 ... 150 mm

- ultra compact housing
- sensitivity adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red LED |
| sensing distance Tw | 20 ... 150 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

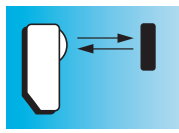
**connection diagrams**



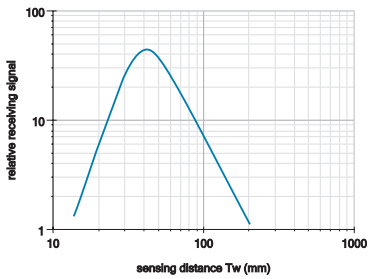

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

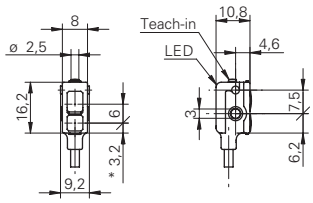
| order reference | connection types | output circuit |
|---|---|---|
| **FZDK 07N6901** | cable bottom side | NPN |
| **FZDK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FZDK 07P6901** | cable bottom side | PNP |
| **FZDK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



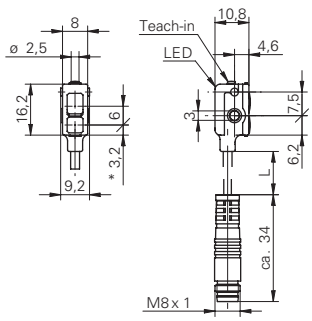
## relative receiving signal



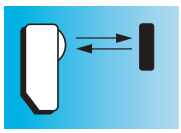

## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

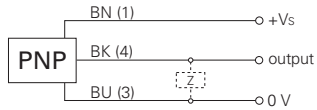


# Tw = 40 mm
# Tw = 80 mm

- subminiature metal housing
- fixed sensing distance

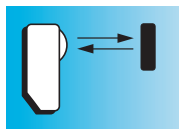
| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED red |
| sensitivity adjustment | no |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 42 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 58 mm |
| depth | 12 mm |
| type | rectangular |
| housing material | aluminum anodized |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

**connection diagram**



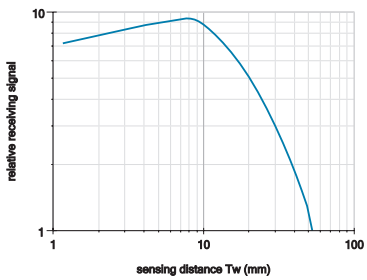

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| order reference | sensing distance Tw | connection types | output function |
|---|---|---|---|
| **FZDM 08P1001** | < 40 mm | cable 3 pin | light operate |
| **FZDM 08P1001/S35L** | < 40 mm | connector M8, 3 pin | light operate |
| **FZDM 08P1002** | < 80 mm | cable 3 pin | light operate |
| **FZDM 08P1002/S35L** | < 80 mm | connector M8, 3 pin | light operate |
| **FZDM 08P3001** | < 40 mm | cable 3 pin | dark operate |
| **FZDM 08P3001/S35L** | < 40 mm | connector M8, 3 pin | dark operate |
| **FZDM 08P3002** | < 80 mm | cable 3 pin | dark operate |
| **FZDM 08P3002/S35L** | < 80 mm | connector M8, 3 pin | dark operate |

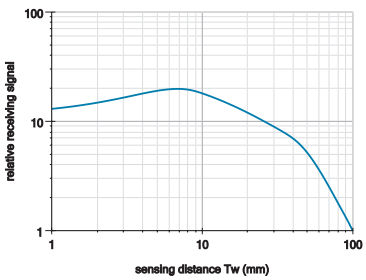


## relative receiving signal

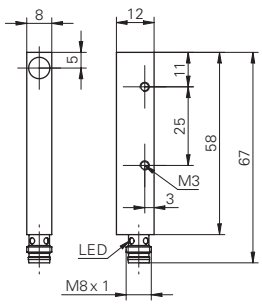
Tw < 40 mm

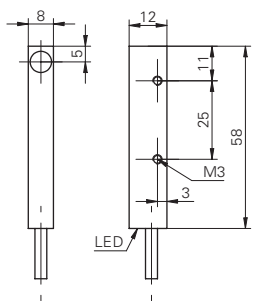


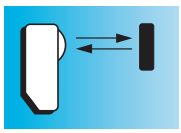

Tw < 80 mm




## dimension drawings



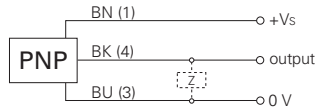


# Tw = 40 mm
# Tw = 80 mm

- subminiature metal housing
- fixed sensing distance

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED red |
| sensitivity adjustment | no |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 42 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

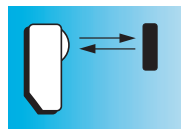
**connection diagram**




| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

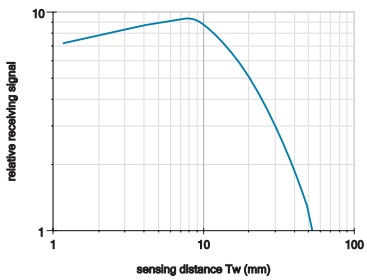
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151719 |
| for details, see accessories section | |

| order reference | sensing distance Tw | height / length | connection types | output function |
|---|---|---|---|---|
| **FZAM 08P1001** | < 40 mm | 56 mm | cable 3 pin | light operate |
| **FZAM 08P1001/S35L** | < 40 mm | 73 mm | connector M8, 3 pin | light operate |
| **FZAM 08P1002** | < 80 mm | 56 mm | cable 3 pin | light operate |
| **FZAM 08P1002/S35L** | < 80 mm | 73 mm | connector M8, 3 pin | light operate |
| **FZAM 08P3001** | < 40 mm | 56 mm | cable 3 pin | dark operate |
| **FZAM 08P3001/S35L** | < 40 mm | 73 mm | connector M8, 3 pin | dark operate |
| **FZAM 08P3002** | < 80 mm | 56 mm | cable 3 pin | dark operate |
| **FZAM 08P3002/S35L** | < 80 mm | 73 mm | connector M8, 3 pin | dark operate |

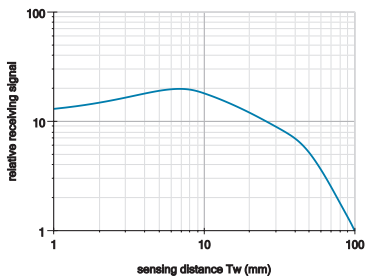


## relative receiving signal

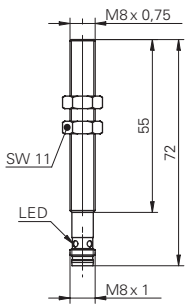
**Tw < 40 mm**

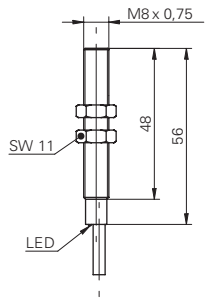


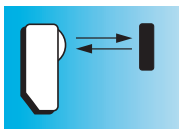

**Tw < 80 mm**




## dimension drawings



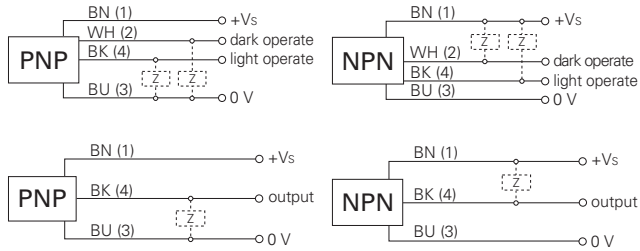


## Tw = 5 ... 200 mm

- subminiature housing
- sensing distance adjustable via potentiometer

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red LED |
| sensing distance Tw | 5 ... 200 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

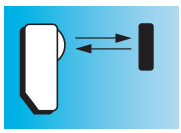
**connection diagrams**



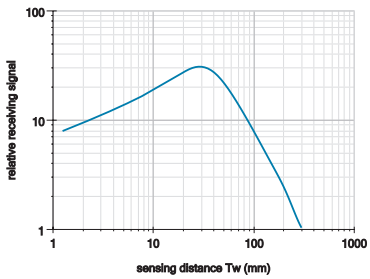

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

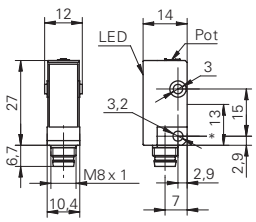
| order reference | connection types | output circuit | output function | protection class |
|---|---|---|---|---|
| **FZDK 10N1101/KS35** | flylead connector M8, 3 pin | NPN | light operate | IP 65 |
| **FZDK 10N5101** | cable 4 pin | NPN | light / dark operate | IP 65 |
| **FZDK 10N5101/S35A** | connector M8, 4 pin | NPN | light / dark operate | IP 67 |
| **FZDK 10P1101/KS35** | flylead connector M8, 3 pin | PNP | light operate | IP 65 |
| **FZDK 10P5101** | cable 4 pin | PNP | light / dark operate | IP 65 |
| **FZDK 10P5101/S35A** | connector M8, 4 pin | PNP | light / dark operate | IP 67 |



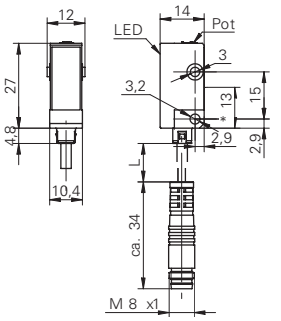
## relative receiving signal



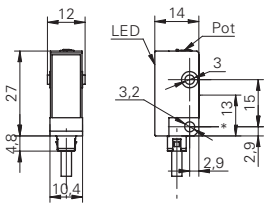

## dimension drawings



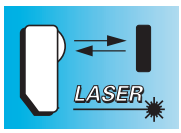

* emitter axis




* emitter axis cable length L = 200 mm




* emitter axis




# Tw = 3 ... 150 mm

- subminiature housing
- line beam
- very short response time

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red laser diode |
| sensing distance Tw | 3 ... 150 mm |
| optimum operating distance | 20 ... 40 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Pot, 5 turn |
| laser class | 2 |
| distance to laser focus | 40 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 16,3 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |

**connection diagrams**

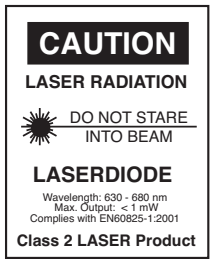
**connectors**

| | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

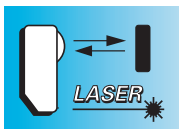
**accessories**

| | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

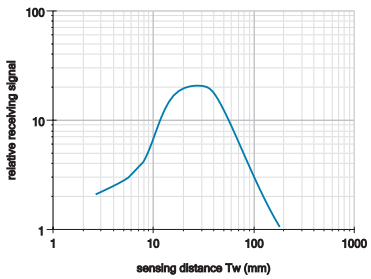
**laser warning**



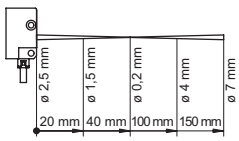

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **OZDK 10N5101** | cable 4 pin | NPN | IP 65 |
| **OZDK 10N5101/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **OZDK 10P5101** | cable 4 pin | PNP | IP 65 |
| **OZDK 10P5101/S35A** | connector M8, 4 pin | PNP | IP 67 |



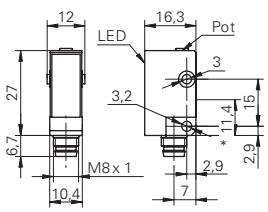

## relative receiving signal



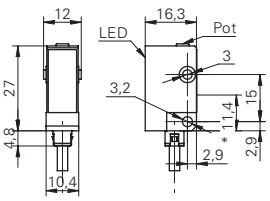

## beam characteristic



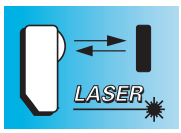

## dimension drawings




* emitter axis




* emitter axis




## Tw = 3 ... 150 mm

- subminiature housing
- high repeatability
- very short response time

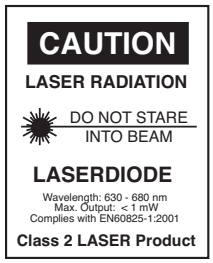
| general data | |
|---|---|
| type | intensity difference |
| version | line beam |
| light source | pulsed red laser diode |
| sensing distance Tw | 3 ... 150 mm |
| optimum operating distance | 35 ... 45 mm |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Pot, 5 turn |
| laser class | 2 |
| distance to laser focus | 40 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 16,3 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |

**connection diagrams**

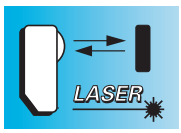
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

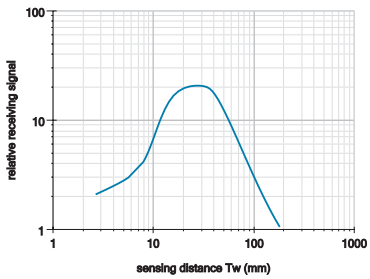
**laser warning**



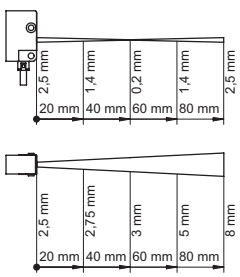

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **OZDK 10N5150** | cable 4 pin | NPN | IP 65 |
| **OZDK 10N5150/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **OZDK 10P5150** | cable 4 pin | PNP | IP 65 |
| **OZDK 10P5150/S35A** | connector M8, 4 pin | PNP | IP 67 |



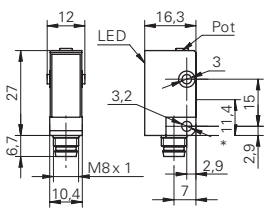

## relative receiving signal



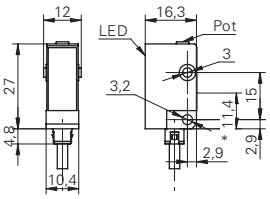

## beam characteristic



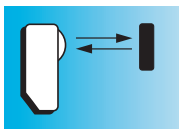

## dimension drawings




* emitter axis




* emitter axis



## Tw = 30 ... 250 mm

- rugged miniature metal housing
- sensing distance adjustable via potentiometer

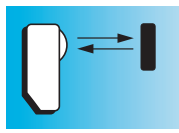
| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 30 ... 250 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 5 turn |
| wave length | 880 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

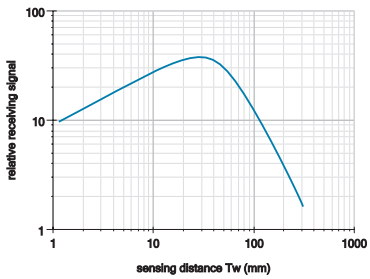
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

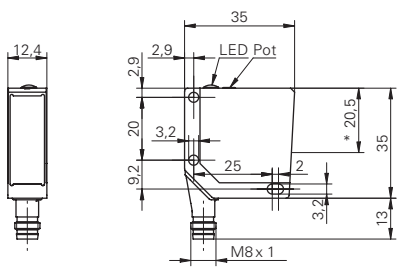
| order reference | connection types | output circuit |
|---|---|---|
| **FZDM 12N5101** | cable 4 pin | NPN |
| **FZDM 12N5101/S35A** | connector M8, 4 pin | NPN |
| **FZDM 12P5101** | cable 4 pin | PNP |
| **FZDM 12P5101/S35A** | connector M8, 4 pin | PNP |



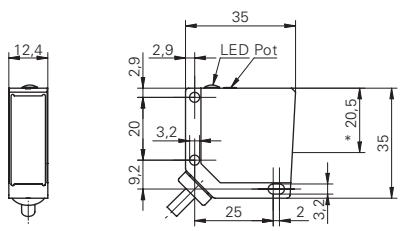
## relative receiving signal



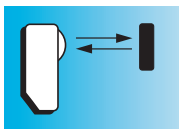

## dimension drawings




* emitter axis




* emitter axis

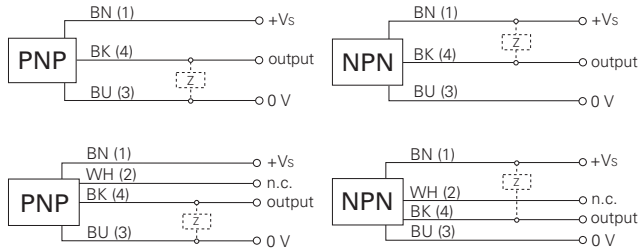


## Tw = 30 ... 200 mm

- rugged metal housing
- sensing distance adjustable via potentiometer
- suppression of mutual optical interference

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 30 ... 200 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 42 mA |
| current consumption typ. | 24 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

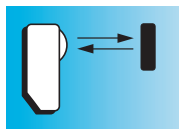
**connection diagrams**



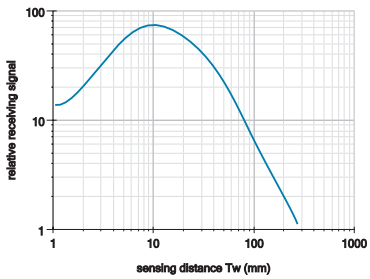

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151720 |
| for details, see accessories section | |

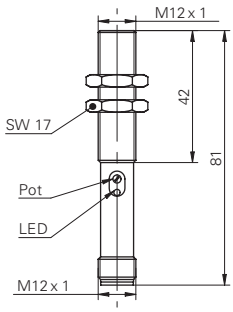
| order reference | height / length | connection types | output circuit | output function |
|---|---|---|---|---|
| **FZAM 12N1104** | 70 mm | cable 3 pin | NPN | light operate |
| **FZAM 12N1104/S14** | 80 mm | connector M12, 4 pin | NPN | light operate |
| **FZAM 12N3104** | 70 mm | cable 3 pin | NPN | dark operate |
| **FZAM 12N3104/S14** | 80 mm | connector M12, 4 pin | NPN | dark operate |
| **FZAM 12P1104** | 70 mm | cable 3 pin | PNP | light operate |
| **FZAM 12P1104/S14** | 80 mm | connector M12, 4 pin | PNP | light operate |
| **FZAM 12P3104** | 70 mm | cable 3 pin | PNP | dark operate |
| **FZAM 12P3104/S14** | 80 mm | connector M12, 4 pin | PNP | dark operate |

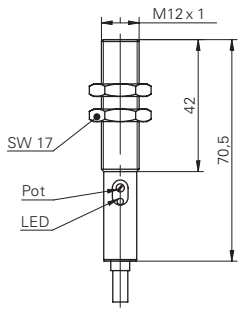


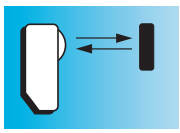
## relative receiving signal




## dimension drawings





## Tw = 5 ... 600 mm

- long sensing range
- sensing distance adjustable via potentiometer
- suppression of mutual optical interference

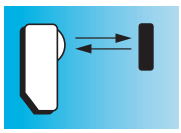
| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red LED |
| sensing distance Tw | 5 ... 600 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **FZDK 14N5101/S35A** | NPN |
| **FZDK 14P5101/S35A** | PNP |

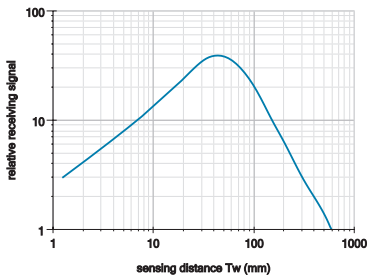
**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

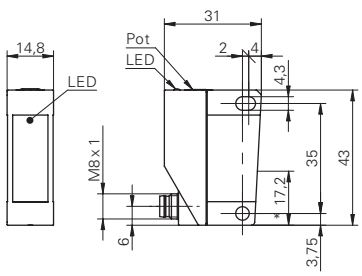
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |



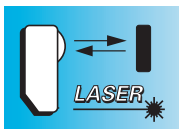
## relative receiving signal




## dimension drawing




* emitter axis




# Tw = 20 ... 300 mm

- very short response time
- high repeatability
- sensing distance adjustable via Teach-in

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red laser diode |
| sensing distance Tw | 20 ... 300 mm |
| repeatability | < 0,2 mm at laser focus |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Teach-in |
| laser class | 2 |
| distance to laser focus | 115 mm |
| wave length | 650 nm |
| **electrical data** | |
| response time / release time | < 0,15 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 2,2 VDC |
| output function | light operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

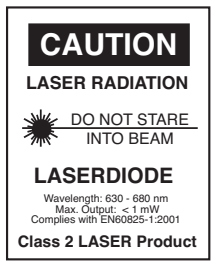
| order reference | output circuit |
|---|---|
| **OZDK 14N1901/S35A** | NPN |
| **OZDK 14P1901/S35A** | PNP |

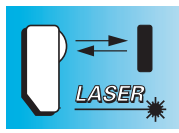
**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

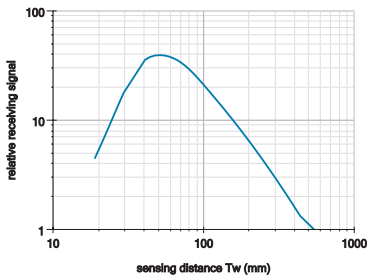
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

**laser warning**

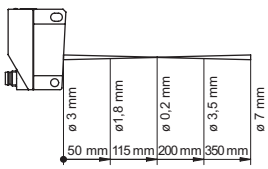




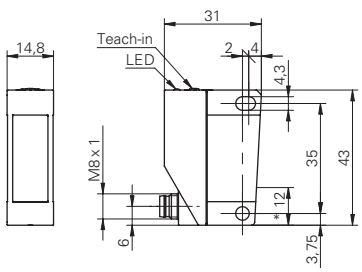

## relative receiving signal



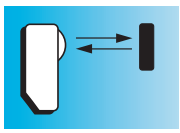

## beam characteristic




## dimension drawing




* emitter axis



## Tw = 0 ... 400 mm

- rugged metal housing
- sensing distance adjustable via potentiometer

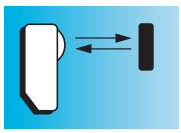
| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 0 ... 400 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 41 mA |
| current consumption typ. | 29 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

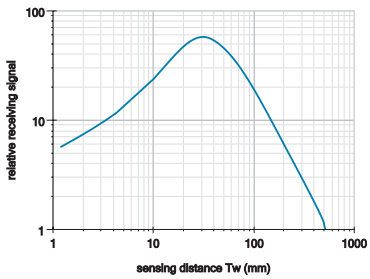
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| for details, see accessories section | |

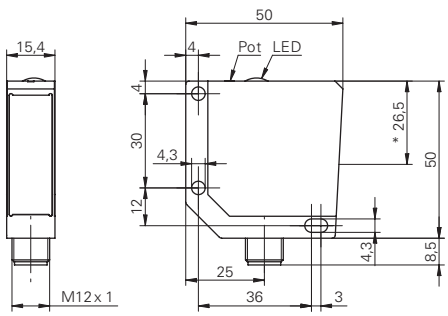
| order reference | connection types | output circuit |
|---|---|---|
| **FZDM 16N5101** | cable 4 pin | NPN |
| **FZDM 16N5101/S14** | connector M12, 4 pin | NPN |
| **FZDM 16P5101** | cable 4 pin | PNP |
| **FZDM 16P5101/S14** | connector M12, 4 pin | PNP |



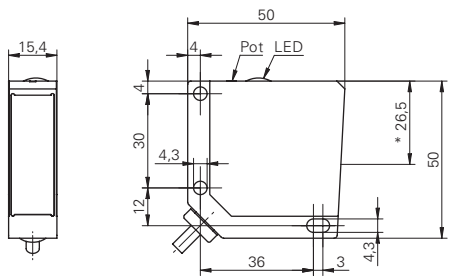
## relative receiving signal



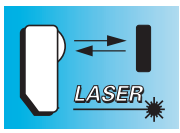

## dimension drawings




* emitter axis




* emitter axis

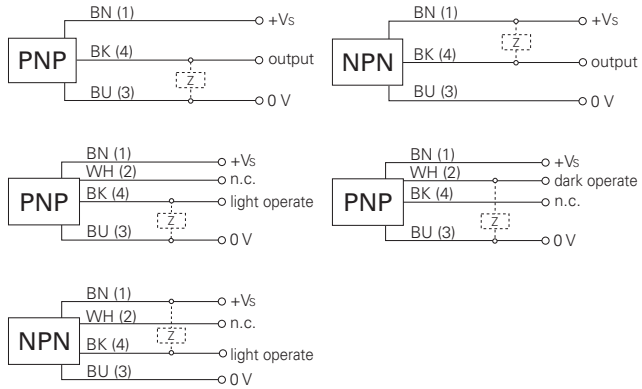



## Tw = 0 ... 250 mm

- rugged metal housing
- high repeatability
- very short response time

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red laser diode |
| sensing distance Tw | 0 ... 250 mm |
| optimum operating distance | 40 ... 80 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| sensitivity adjustment | Pot, 14 turn |
| laser class | 2 |
| distance to laser focus | 80 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 65 mA |
| current consumption typ. | 60 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

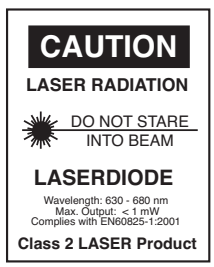
**connection diagrams**



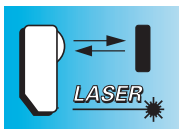

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

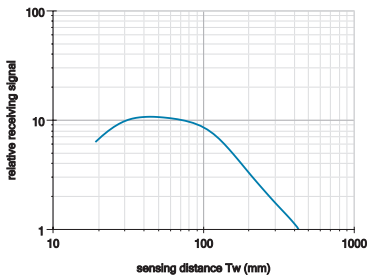
**laser warning**



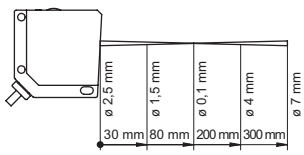

| order reference | connection types | output circuit | output function |
|---|---|---|---|
| **OZDM 16N1001** | cable 3 pin | NPN | light operate |
| **OZDM 16N1001/S14** | connector M12, 4 pin | NPN | light operate |
| **OZDM 16P1001** | cable 3 pin | PNP | light operate |
| **OZDM 16P1001/S14** | connector M12, 4 pin | PNP | light operate |
| **OZDM 16P3001** | cable 3 pin | PNP | dark operate |
| **OZDM 16P3001/S14** | connector M12, 4 pin | PNP | dark operate |



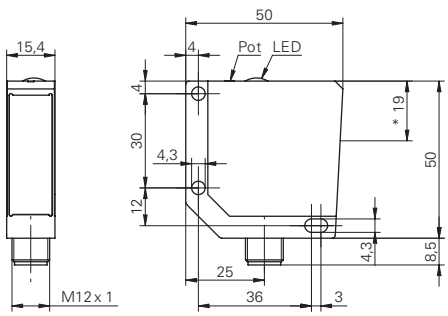

## relative receiving signal



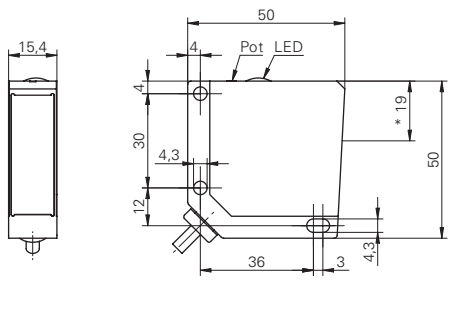

## beam characteristic



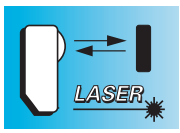

## dimension drawings




* emitter axis




* emitter axis



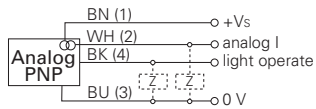

# Tw = 0 ... 250 mm

- with analog output
- high repeatability
- very short response time

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red laser diode |
| sensing distance Tw | 0 ... 250 mm |
| optimum operating distance | 40 ... 80 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| sensitivity adjustment | Pot, 14 turn |
| laser class | 2 |
| distance to laser focus | 80 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,1 ms |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 65 mA |
| current consumption typ. | 60 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output circuit | PNP / analog 4 ... 20 mA |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

| order reference | connection types |
|---|---|
| **OZDM 16P1901** | cable 4 pin |
| **OZDM 16P1901/S14** | connector M12, 4 pin |

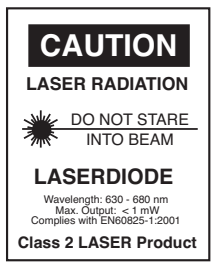
**connection diagram**

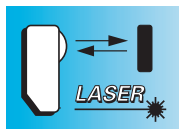



| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

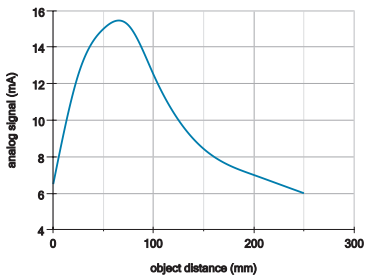
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

**laser warning**

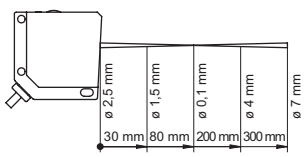




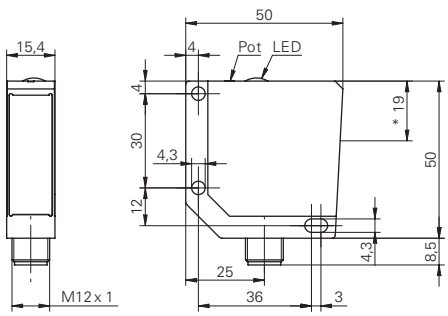

## signal progression



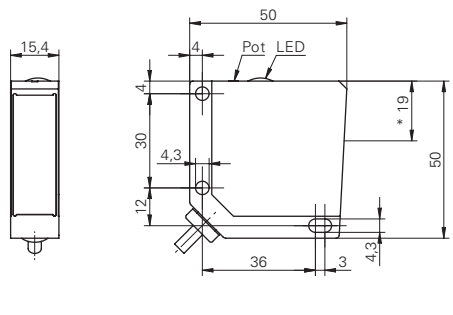

## beam characteristic



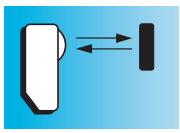

## dimension drawings




* emitter axis




* emitter axis



## Tw = 60 ... 430 mm

- with alarm output
- sensing distance adjustable via Teach-in
- extended sensing distance with lens

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 60 ... 430 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| sensing distance Tw (with doubling lense) | 80 ... 800 mm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 55 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate alarm |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |

**connection diagrams**

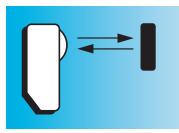
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151658 |
| glass cover | 103068 |
| doubling lens | 107250 |
| cap nut | 115913 |
| for details, see accessories section | |

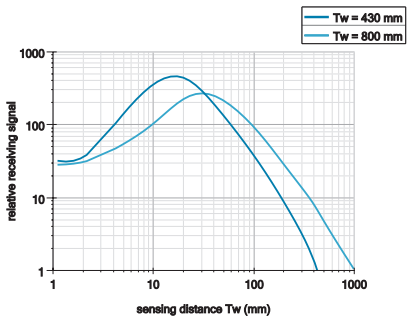
**remarks**

With doubling lens / cap nut, the sensing distance can be doubled.

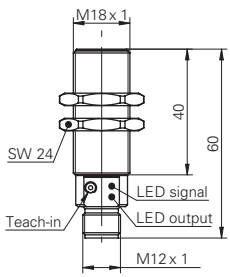
| order reference | height / length | connection types | output circuit |
|---|---|---|---|
| **FZAM 18N6460** | 50 mm | cable 4 pin | NPN |
| **FZAM 18N6460/S14** | 60 mm | connector M12, 4 pin | NPN |
| **FZAM 18P6460** | 50 mm | cable 4 pin | PNP |
| **FZAM 18P6460/S14** | 60 mm | connector M12, 4 pin | PNP |

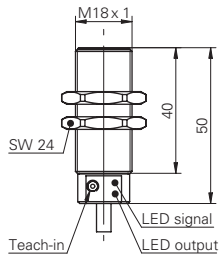


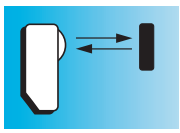
## relative receiving signal




## dimension drawings





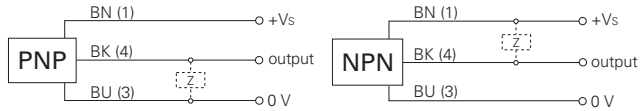
## Tw = 20 ... 150 mm

- rugged metal housing
- sensing distance adjustable with potentiometer (axial)
- extended sensing distance with lens

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 20 ... 150 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 15 turn |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| sensing distance Tw (with doubling lense) | 30 ... 280 mm |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 30 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| height / length | 50 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| front (optics) | PC |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 65 |

| order reference | output circuit |
|---|---|
| **FZAM 18N1155** | NPN |
| **FZAM 18P1155** | PNP |

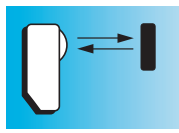
**connection diagrams**



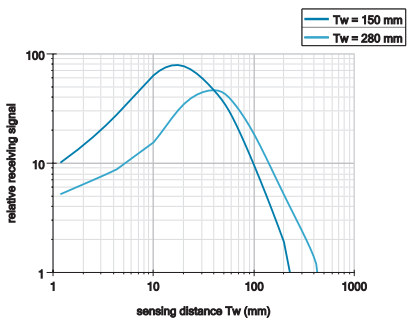

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151658 |
| glass cover | 103068 |
| doubling lens | 107250 |
| cap nut | 115913 |
| for details, see accessories section | |

**remarks**

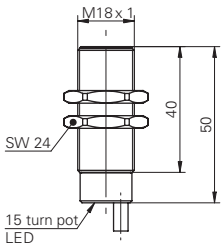
With doubling lens / cap nut, the sensing distance can be doubled.

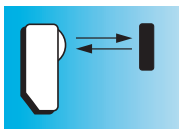


## relative receiving signal




## dimension drawing



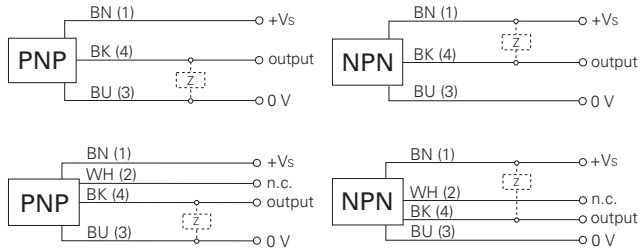


## Tw = 60 ... 430 mm

- rugged metal housing
- sensing distance adjustable with radially mounted potentiometer

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| sensing distance Tw | 60 ... 430 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| sensing distance Tw (with doubling lense) | 80 ... 800 mm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 30 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |

**connection diagrams**



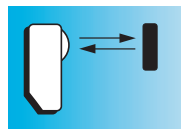

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151658 |
| glass cover | 103068 |
| doubling lens | 107250 |
| cap nut | 115913 |
| for details, see accessories section | |

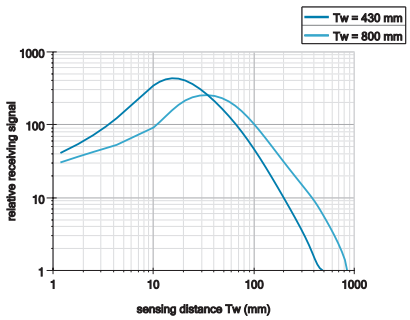
**remarks**

With doubling lens / cap nut, the sensing distance can be doubled.

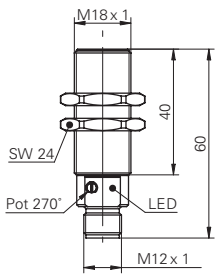
| order reference | height / length | connection types | output circuit |
|---|---|---|---|
| **FZAM 18N1150** | 50 mm | cable 3 pin | NPN |
| **FZAM 18N1150/S14** | 60 mm | connector M12, 4 pin | NPN |
| **FZAM 18P1150** | 50 mm | cable 3 pin | PNP |
| **FZAM 18P1150/S14** | 60 mm | connector M12, 4 pin | PNP |

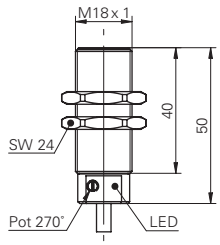


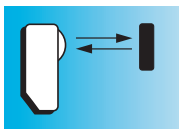
## relative receiving signal




## dimension drawings





## Tw = 5 ... 500 mm

- cross-technology housing concept
- sensing distance adjustable via potentiometer
- small mounting depth

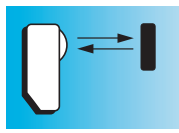
| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed red LED |
| sensing distance Tw | 5 ... 500 mm |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 22 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | plastic (PBT-ASA) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **FZDK 20N5101/S35A** | NPN |
| **FZDK 20P5101/S35A** | PNP |

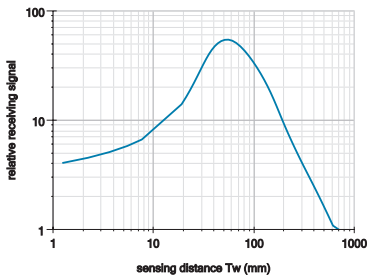
**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

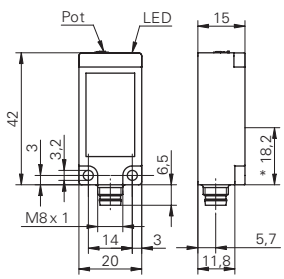
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| for details, see accessories section | |



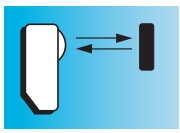
## relative receiving signal




## dimension drawing




* emitter axis



## Tw = 100 ... 1500 mm

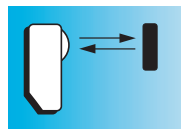
- rugged metal housing
- long sensing range

| general data | |
|---|---|
| type | intensity difference |
| light source | pulsed infrared diode |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 15 turn |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 60 mA |
| current consumption typ. | 50 mA |
| voltage drop Vd | < 2,5 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 66 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| front (optics) | PC |
| connection types | cable 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 65 |

**connection diagrams**

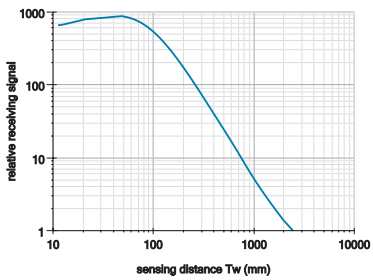
| accessories | |
|---|---|
| glass cover | 103226 |
| doubling lens | 107408 |
| cap nut | 102801 |
| for details, see accessories section | |

| order reference | sensing distance Tw | output circuit | response time / release time |
|---|---|---|---|
| **FZAM 30N5002** | 300 ... 1500 mm | NPN | < 2,5 ms |
| **FZAM 30N5003** | 100 ... 700 mm | NPN | < 0,25 ms |
| **FZAM 30P5002** | 300 ... 1500 mm | PNP | < 2,5 ms |
| **FZAM 30P5003** | 100 ... 700 mm | PNP | < 0,25 ms |

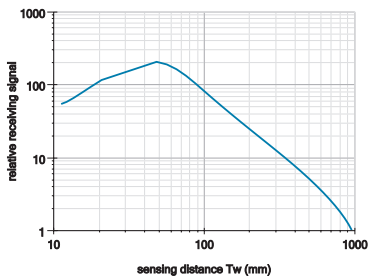


## relative receiving signal

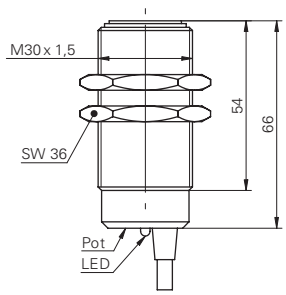
Tw = 300 ... 1500 mm




Tw = 100 ... 700 mm




## dimension drawing

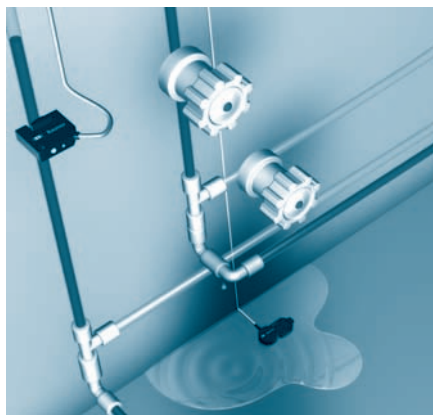


| product family | FFAK 17 | FFAK 17 | FFAK 16 | FFAM 17 | FFAM 16 | FFDK 16 | FODK 23 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 30 mm | 30 mm | 30 mm | 30 mm | 30 mm | 16 mm | 23 mm |
| response time / release time | | | | | | < 2 ms | < 1 ms |
| sensitivity adjustment | no | Pot | no | Pot | Pot | no | no |
| NPN | ■ | ■ | ■ | | | | |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | metal | metal | plastic | plastic |
| **Page** | **344** | **345** | **346** | **347** | **348** | **349** | **350** |

# Level monitoring/leak sensors

## General information

With optical level monitoring and leak sensors, liquids can be easily and reliably detected without the need of an electrical connection or mechanical movement between the liquid and the sensor. There are two possible principles of detection: the sensor is in direct contact with the liquid or it is fastened to a hose or stand pipe to detect the level without contact. The available fiber optic versions permit level and leak control in constricted surroundings and even in hazardous zones.



## Typical applications

The chemical resistance of the sensors permits versatile applications:

- Level monitoring of liquids such as
  - acetone
  - acids, e.g. hydrochloric, sulfuric or battery acid
  - alkalis
  - mineral oil
  - milk
  - all non-conductive liquids
- Contact free level detection in (semi) transparent hoses and stand pipes
- Detection of the minimum and maximum levels in trays and tanks
- Leak monitoring of oil trays or lubricant tanks
- Monitoring of leaked liquids in dispensers and other liquid handling systems

## Characteristics and advantages of level monitoring sensors

**Chemical resistance**
The sensor housings are made of polysulfonide or stainless steel and are resistant to certain liquids.

**Detectable media**
As optical light is used to detect the liquid, various and non-conductive liquids can be detected.

**Simple commissioning**
It is unnecessary to adjust sensors with integrated electronics. With fiber optics, the adjustment is made via a fiber optic sensor.

**Hazardous environments**
The intrinsically safe fiber optic version with Teflon PFA coating can also be used in hazardous environments.

## Characteristics and advantages of leak sensors

**Detectable media**
As optical light is used to detect the liquid, various and non-conductive liquids can be detected. Typically, 1ml of leaked liquid is sufficient to initiate an alarm.

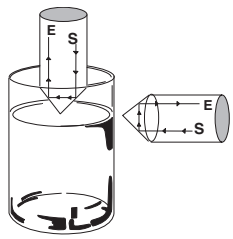
**Failsafe facility**
The integrated failsafe facility triggers an alarm on leaks, cable rupture, detachment from the fastening or if the sensor is defective.

**Hazardous environments**
The intrinsically safe fiber optic version with Teflon PFA coating can also be used in hazardous environments.

## Technology and operation

### Level monitoring and leak sensors in contact with the liquid

The operating principles of both types of sensor are shown in the sketch below. The critical angle for total reflection changes depending on whether the sensor tip is surrounded by water or air. If the sensor tip is surrounded by a liquid, the light beam is refracted by the liquid and the sensor output changes its state. The liquid medium may be electrically conductive, turbid or clear. The same operating principle is employed for the leak sensors. Only the volume of the liquid is different. Typically, as little as 1ml of a liquid can be detected.

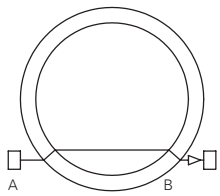



Level not reached

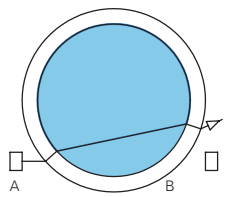
Level reached

### Level monitoring sensors without contact with the liquid

The level monitoring sensors for hose or stand pipe mounting operate by a similar principle. For example, the FFDK 16 also exploits the refractive properties of liquids. In a state without the liquid, the emitted light (A) impinges directly on the receiver (B). If the liquid enters the detection range, a part of the emitted light is refracted, so that less light impinges on the receiver. This change in the light can be assessed by the sensor.

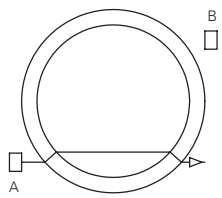



Level not reached

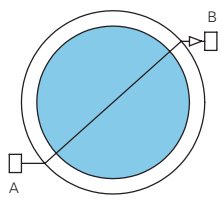



Level reached

With the fiber optic version FSL 500C6Y00, the principle is exactly the opposite. In a state without the liquid, no light impinges on the receiver (B). It is only when liquid enters the detection range of the array that a part of the emitted light (A) is diverted to the receiver (B). This change in the light can be assessed by the receiver. The advantage of the array configuration with a monitoring range of approx. 5 mm is that interference caused by foam and small air bubbles can be suppressed by a powerful fiber optic sensor.




Level not reached

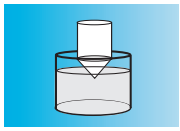



Level reached

## Mounting and adjustment

Level monitoring sensors for hose/stand pipe mounting:
The sensors can very easily be attached to a hose or stand pipe with cable ties. A separate bracket or other holder is unnecessary. No adjustments must be made to the FFDK 16 with integrated electronics. It is only necessary to choose between light and dark switching. With the fiber optic version FSL, the adjustment is made via a fiber optic sensor.

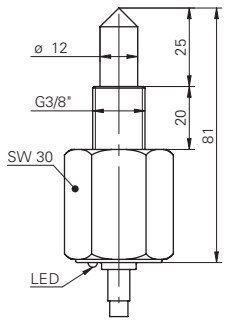
Leak sensors:
The leak sensors can be screwed directly to the floor or on a base. No adjustments must be made to the sensor FODK 23. With the fiber optic version FOC, the adjustment is made via a fiber optic sensor. The sensors can be very easily released from their holders for cleaning purposes move to beginning of sentence.



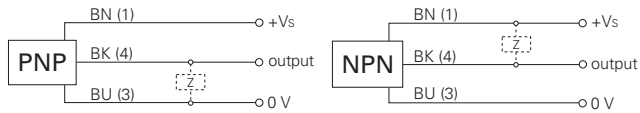
- chemical resistance
- up to 10 bar nominal pressure

| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| nominal pressure (probe tip) | 10 bar |
| output indicator | LED red |
| sensitivity adjustment | no |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| voltage drop Vd | < 2 VDC |
| output function | normally open (NO) |
| output current | < 200 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 81 mm |
| type | cylindrical |
| material (sensing device) | polysulphone |
| housing material | polysulphone |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 67 |

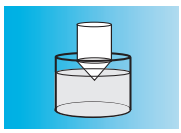
**dimension drawing**




**connection diagrams**



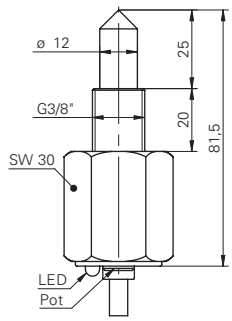

| order reference | output circuit |
|---|---|
| **FFAK 17NTD1001/L** | NPN |
| **FFAK 17PTD1001/L** | PNP |



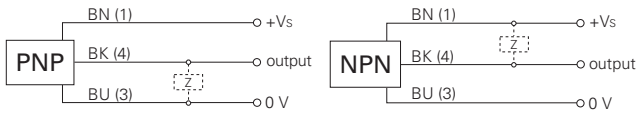
- sensitivity adjustable
- chemical resistance
- up to 10 bar nominal pressure

| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| nominal pressure (probe tip) | 10 bar |
| output indicator | LED red |
| sensitivity adjustment | Pot |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| voltage drop Vd | < 2 VDC |
| output function | normally open (NO) |
| output current | < 200 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 81,5 mm |
| type | cylindrical |
| material (sensing device) | polysulphone |
| housing material | polysulphone |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 67 |

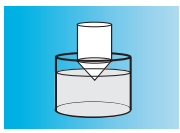
**dimension drawing**




**connection diagrams**



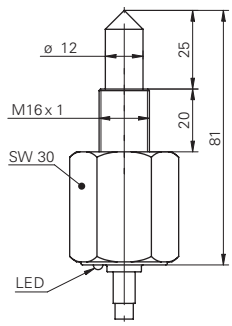

| order reference | output circuit |
|---|---|
| **FFAK 17NTD1002/L** | NPN |
| **FFAK 17PTD1002/L** | PNP |



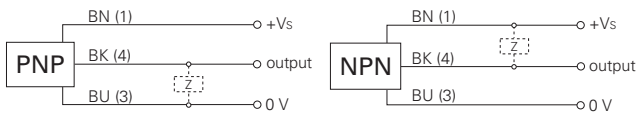
- with thread M16x1
- chemical resistance
- up to 10 bar nominal pressure

| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| nominal pressure (probe tip) | 10 bar |
| output indicator | LED red |
| sensitivity adjustment | no |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| voltage drop Vd | < 2 VDC |
| output function | normally open (NO) |
| output current | < 200 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 81 mm |
| type | cylindrical |
| material (sensing device) | polysulphone |
| housing material | polysulphone |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 67 |

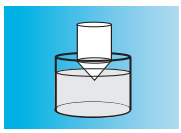
**dimension drawing**




**connection diagrams**




| order reference | output circuit |
|---|---|
| **FFAK 16NTD1001/L** | NPN |
| **FFAK 16PTD1001/L** | PNP |

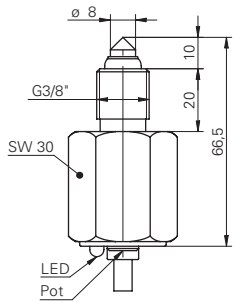


- rugged metal housing
- chemical resistance
- up to 40 bar nominal pressure

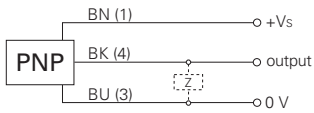
| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| nominal pressure (probe tip) | 40 bar |
| output indicator | LED yellow |
| sensitivity adjustment | Pot |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| voltage drop Vd | < 2 VDC |
| output function | normally open (NO) |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 66,5 mm |
| type | cylindrical |
| material (sensing device) | glass (borosilicate) |
| housing material | stainless steel DIN 1.4305/AISI 303 |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 67 |

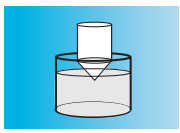
| order reference |
|---|
| **FFAM 17PTD1002/L** |

**dimension drawing**




**connection diagram**



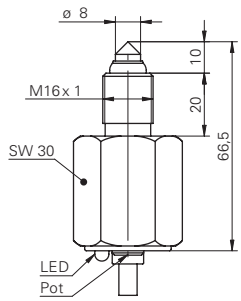


- with thread M16x1
- rugged metal housing
- up to 40 bar nominal pressure

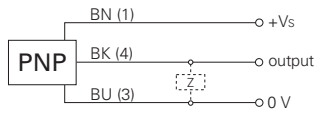
| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| nominal pressure (probe tip) | 40 bar |
| output indicator | LED yellow |
| sensitivity adjustment | Pot |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 15 mA |
| voltage drop Vd | < 2 VDC |
| output function | normally open (NO) |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 66,5 mm |
| type | cylindrical |
| material (sensing device) | glass (borosilicate) |
| housing material | stainless steel DIN 1.4305/AISI 303 |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 67 |

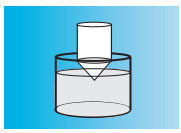
| order reference |
|---|
| **FFAM 16PTD1002/L** |

**dimension drawing**




**connection diagram**



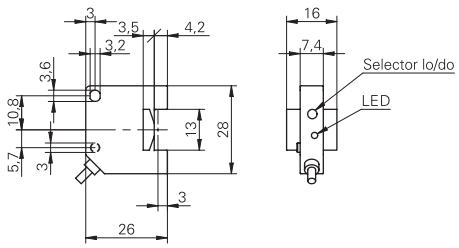


- Liquid level sensor for pipe mounting
- pipe diameter from 8 ... 13mm
- easy setup - no adjustment necessary

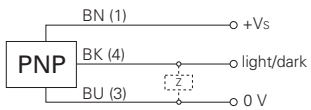
| general data | |
|---|---|
| type | Liquid level sensor |
| light source | pulsed infrared diode |
| output indicator | LED red |
| sensitivity adjustment | no |
| wave length | 950 nm |
| max. outer diameter of the pipe / tube | 8 ... 13 mm |
| max. thickness of the pipe / tube | 1 mm |
| **electrical data** | |
| response time / release time | < 2 ms |
| voltage supply range +Vs | 9 ... 30,8 VDC |
| current consumption max. | 25 mA |
| voltage drop Vd | < 1 VDC |
| output function | light / dark operate switchable |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 16 mm |
| height / length | 28 mm |
| depth | 26 mm |
| type | rectangular |
| housing material | PC |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +55 °C |
| protection class | IP 50 |

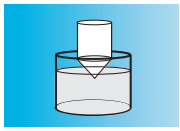
| order reference |
|---|
| **FFDK 16P50Y0** |

**dimension drawing**




**connection diagram**



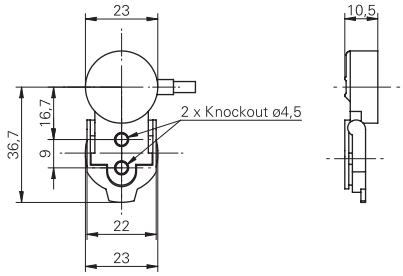


- leakage sensor with integrated electronics
- detects liquid amounts of approx. 1 ml
- chemical resistance thanks to Teflon PFA sheath

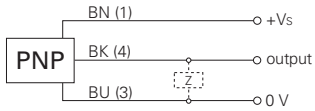
| general data | |
|---|---|
| type | Leakage sensor |
| light source | pulsed red LED |
| output indicator | LED orange |
| light indicator | LED green |
| sensitivity adjustment | no |
| wave length | 645 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 30 mA |
| voltage drop Vd | < 1 VDC |
| output function | normally closed (NC) |
| output circuit | PNP |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 23 mm |
| height / length | 10,5 mm |
| depth | 37,2 mm |
| type | rectangular |
| material (sensing device) | teflon PFA |
| housing material | Teflon PFA |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +50 °C |
| protection class | IP 67 |

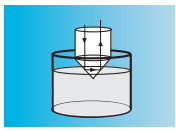
| order reference |
|---|
| **FODK 23P90Y0** |

**dimension drawing**




**connection diagram**



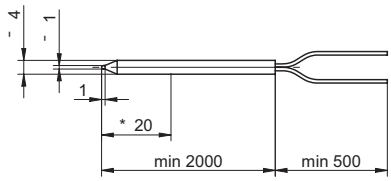


## Fiber optic level sensor FUL

- the special sensor tip prevents drop formation
- high chemical resistance

| general data | |
|---|---|
| type | liquid level sensor |
| optical fiber length | 2 m |
| **mechanical data** | |
| type | cylindrical |
| min. bending radius | 30 mm |
| tensile strength | 5 N |
| optical fiber material | Teflon® PFA |
| **ambient conditions** | |
| operating temperature | -30 … +105 °C |
| **order reference** | |
| **FUL 200D2Y00** | (use with fiber optic sensor FVDK 67 / FVDK 69) |

**dimension drawing**

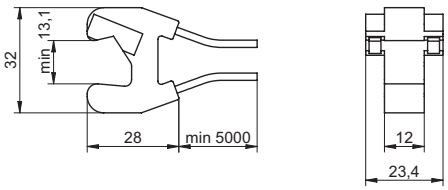



## Fiber optic level sensor for stand pipe mounting FSL

- fine light curtain suppresses foam/air bubbles
- diameter of the pipe/tube 3 ... 13 mm

| general data | |
|---|---|
| type | liquid level sensor |
| optical fiber length | 5 m |
| max. outer diameter of the pipe/tube | 3 ... 13 mm |
| max. thickness of the pipe/tube | 1 mm |
| **mechanical data** | |
| type | rectangular |
| min. bending radius | 4 mm |
| tensile strength | 20 N |
| optical fiber material | PMMA, PFA coated |
| housing material | PEI / PC |
| **ambient conditions** | |
| operating temperature | -30 … +70 °C |
| **order reference** | |
| **FSL 500C6Y00** | (use with fiber optic sensor FVDK 67 / FVDK 69) |

**dimension drawing**

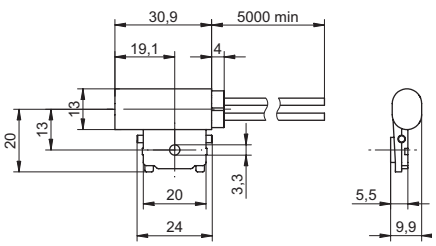


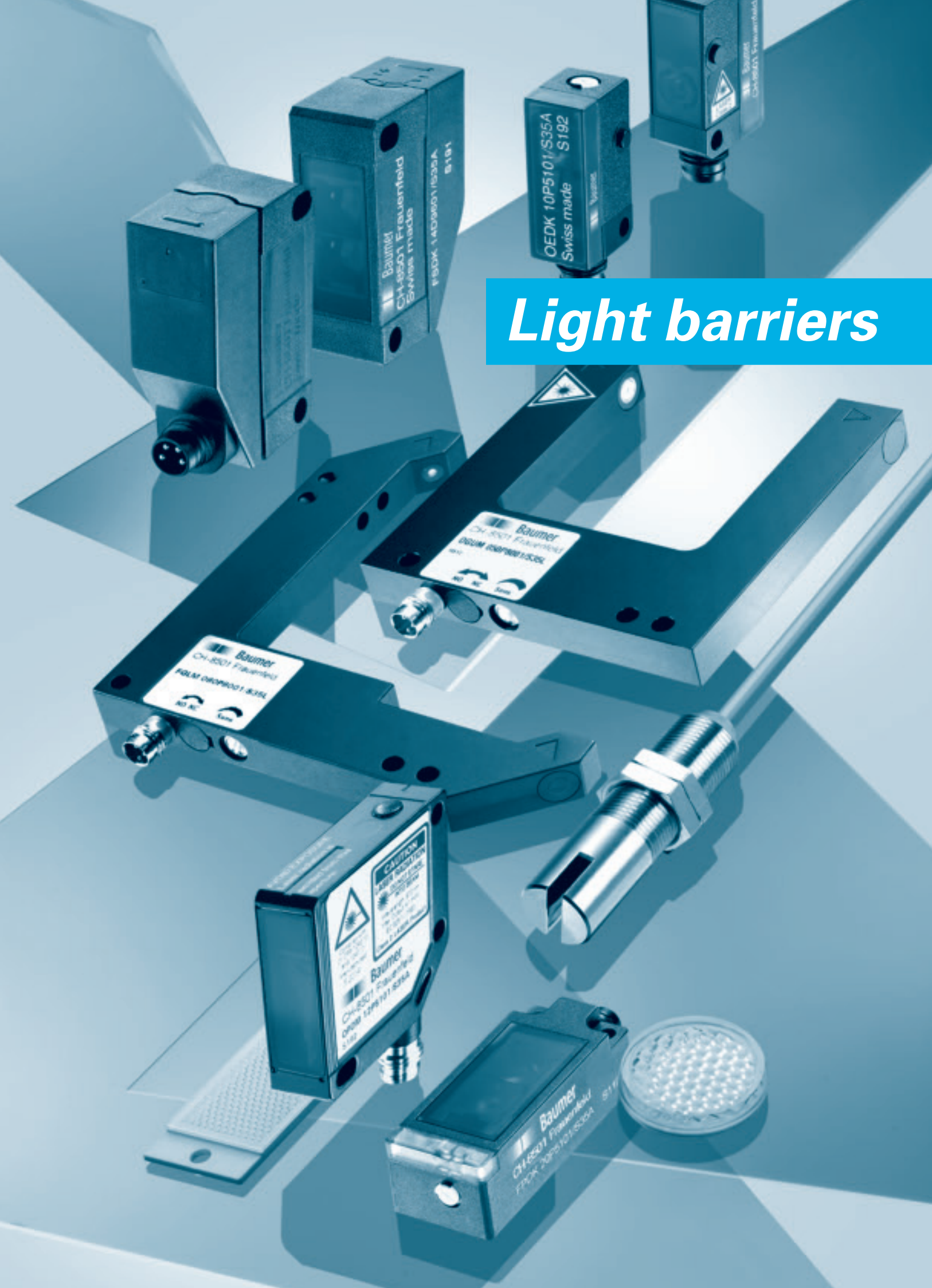

## Fiber optic leak sensor FOC

- detects typical liquid volumes of 1 ml
- high chemical resistance

| general data | |
|---|---|
| type | leakage sensor |
| optical fiber length | 5 m |
| **mechanical data** | |
| type | rectangular |
| min. bending radius | 20 mm |
| tensile strength | 10 N |
| optical fiber material | PE, PFA coated |
| housing material | Teflon® PFA |
| **ambient conditions** | |
| operating temperature | -30 … +70 °C |
| **order reference** | |
| **FOC 500C6Y00** | (use with fiber optic sensor FVDK 67 / FVDK 69) |

**dimension drawing**




Light barriers

## red light LED version

| product family | FPCK 07 | FPDK 07 | FPDK 10 | FPDM 12 | FPDK 14 | FRDK 14 | FPDM 16 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | IO-Link | |
| for transparent objects | | | | | | ■ | |
| version | | | | | single lens optics | | |
| width / diameter | 8 mm | 8 mm | 10,4 mm | 12,4 mm | 14,8 mm | 14,8 mm | 15,4 mm |
| actual range Sb | 0,5 m | 0,5 m | 1,8 m | 5,1 m | 4 m<br>7,2 m | 1 m | 7,3 m |
| response time / release time | < 0,5 ms | < 0,5 ms | < 1 ms | < 1 ms | < 1 ms | < 0,1 ms | < 1 ms |
| sensitivity adjustment | Teach-in | Teach-in | no | no<br>Pot, 5 turn | no | Teach-in | no<br>Pot, 10 turn |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | | | ■ |
| connector | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | metal | plastic | plastic | metal |
| | | | | | | | |
| **Page** | **358** | **360** | **362** | **364** | **368** | **370** | **376** |

## laser version

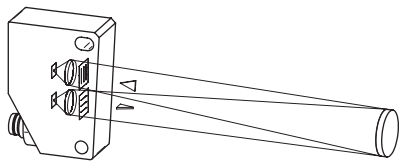
| product family | OPDM 12 | OPDK 14 | OPDK 14 | OPDM 16 |
|---|---|---|---|---|
| | | | | |
| for transparent objects | | | ■ | |
| version | single lens optics | single lens optics | single lens optics | |
| width / diameter | 12,4 mm | 14,8 mm | 14,8 mm | 15,4 mm |
| actual range Sb | 1 m<br>5 m<br>11 m | 10 m | 1 m | 1 m<br>11 m |
| response time / release time | < 0,05 ms<br>< 0,1 ms | < 0,25 ms | < 0,25 ms | < 0,1 ms |
| sensitivity adjustment | no | Teach-in | Teach-in | no<br>Pot, 270° |
| NPN | ■ | ■ | | |
| PNP | ■ | ■ | ■ | ■ |
| cable | ■ | | | ■ |
| connector | ■ | ■ | ■ | ■ |
| housing material | metal | plastic | plastic | metal |
| **Page** | **366** | **372** | **374** | **380** |

| FPDM 16 | FPAM 18 | FPDK 20 | FPDK 26 |
|---|---|---|---|
| | | | |
| | | | |
| ■ | | | |
| | | | |
| 15,4 mm | 18 mm | 20 mm | 25 mm |
| 4 m | 3,2 m | 4,5 m | 10 m |
| < 2,5 ms | < 1 ms | < 0,5 ms | < 1 ms |
| Teach-in | no | Pot, 270° | Pot, 270° |
| | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ |
| | ■ | | |
| ■ | ■ | ■ | ■ |
| metal | metal | plastic | plastic |
| | | | |
| **378** | **382** | **384** | **386** |

# Retro-reflective sensors

## General information

The emitter and receiver are installed in the same housing. The emitted infrared, red or laser light is returned by a triple reflector or a reflective film to the receiver. The output changes its state when the object breaks the light beam (sensor receives no light).



## Applications

- Stack height monitoring
- Detection of objects located at any position on a conveyor belt
- Detection of transparent objects
- Detection of glossy objects on a conveyor belt
- Retro-reflective laser sensors with single-lens optics permit the precise detection of objects through small openings and the smallest distances between the sensor and the reflector.

## Characteristics and advantages

Polarizing filter
Permits objects to be detected regardless of the texture and color of the surface. Glossy and reflective objects are also reliably detected.

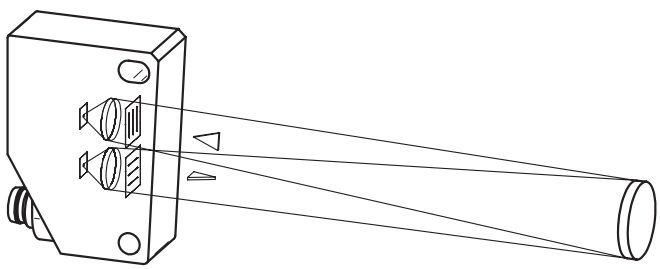
Single-lens optics
The emitted and received beams are on the same axis. The direction of approach of the object is thereby irrelevant and it is possible to view through small openings. Reflectors can also be used in close proximity without a loss of the signal.

Transparent objects
Special versions of retro-reflective sensors can also detect transparent objects such as packaging films, PET bottles and glassware.

Short response times
Retro-reflective laser sensors with response times of 0,05 ms and focused laser beams correctly detect the smallest, quickly-moving objects (0,1 mm diameter).

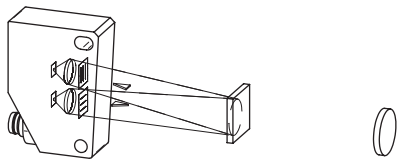
## Technology and operation

The polarizing filter permits the emitted light to pass in only one polarization plane. The triple reflector depolarizes the light on reflection. A part of the light reflected back to the receiver passes the second polarization filter, offset by 90°, and is detected by the receiver.



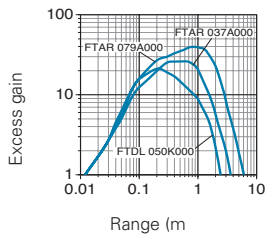
## Technology and operation

A glossy object in the light beam reflects the light without changing its polarization plane. This light cannot pass through the polarization filter in front of the receiver. A glossy object therefore also breaks the light beam.

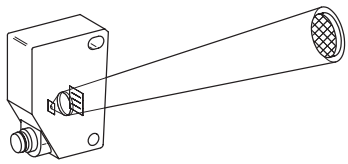


## Mounting and adjustment

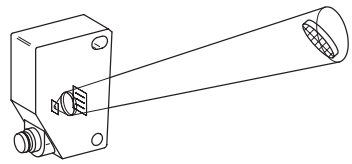
Each sensor has a separate excess gain curve. As the operating reliability depends heavily on the ambient conditions, it must be ensured that the sensor operates with the highest possible excess signal gain.



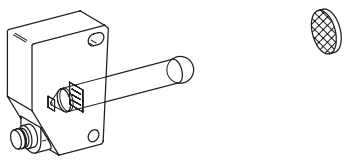

With narrow light beams as used in laser sensors, the size of the light spot on the reflector in relation to the triple structure is important for the choice of the reflector or the reflective film. A spot diameter of up to 1,5 mm, a reflective film should be used, and up to a spot diameter of 3 mm, reflectors with microstructures. It should also be ensured that the reflective film or reflector is not placed close to the focus.

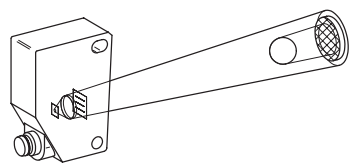


The reflector is aligned and centered.

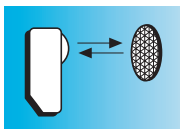


The reflector may not be tilted by more than 15°.





For a correct function, the object must cover the reflector or at least have the size of the beam diameter.

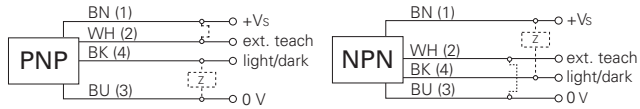


## Sb = 0,5 m

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 0,5 m |
| nominal range Sn | 0,6 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 17,8 mm |
| depth | 12,6 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

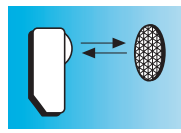
**connection diagrams**



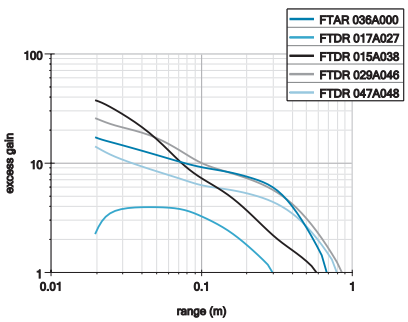

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

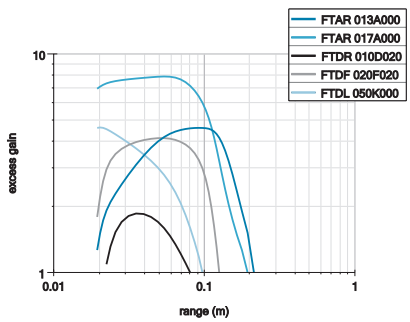
| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

| order reference | connection types | output circuit |
|---|---|---|
| **FPCK 07N6901** | cable rear side | NPN |
| **FPCK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FPCK 07P6901** | cable rear side | PNP |
| **FPCK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



## excess gain curve

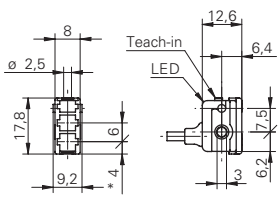


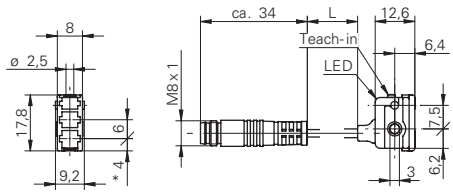

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDL 050K000/... m | tape 50 mm x ... m |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

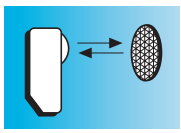
## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

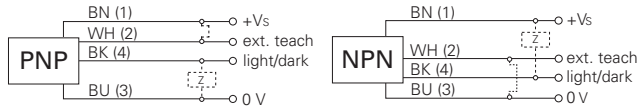


## Sb = 0,5 m

- ultra compact housing
- sensing distance adjustable via Teach-in
- suppression of mutual optical interference

| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 0,5 m |
| nominal range Sn | 0,6 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 17,8 mm |
| depth | 12,6 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

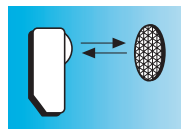
**connection diagrams**



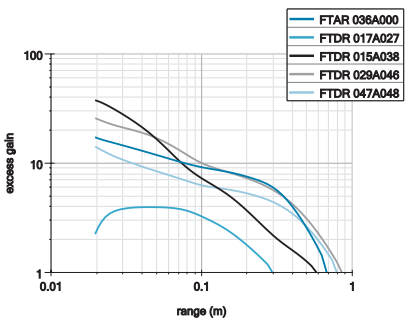

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

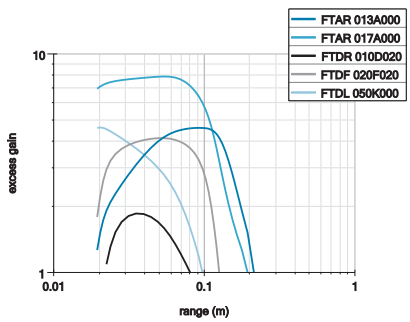
| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

| order reference | connection types | output circuit |
|---|---|---|
| **FPDK 07N6901** | cable bottom side | NPN |
| **FPDK 07N6901/KS35A** | flylead connector M8, 4 pin | NPN |
| **FPDK 07P6901** | cable bottom side | PNP |
| **FPDK 07P6901/KS35A** | flylead connector M8, 4 pin | PNP |



## excess gain curve

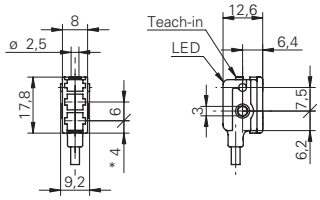


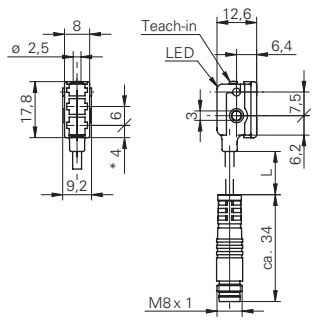

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDL 050K000/... m | tape 50 mm x ... m |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

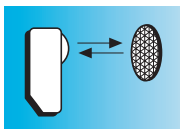
## dimension drawings




* emitter axis




* emitter axis cable length L = 200 mm

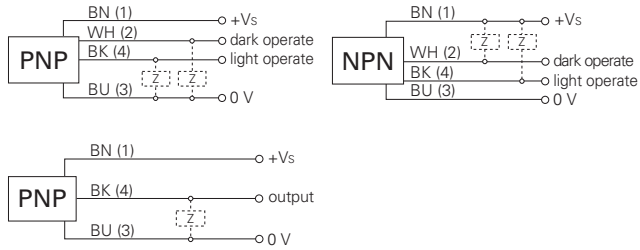


## Sb = 1,8 m

- subminiature housing
- polarization filter to detect shiny objects
- suppression of mutual optical interference

| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 1,8 m |
| nominal range Sn | 2,2 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

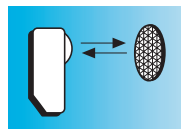
**connection diagrams**



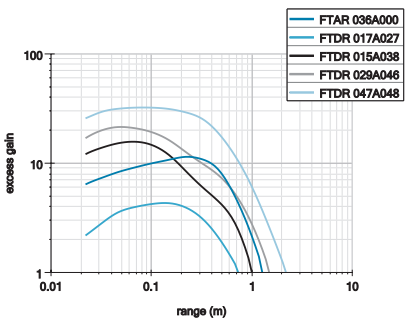

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

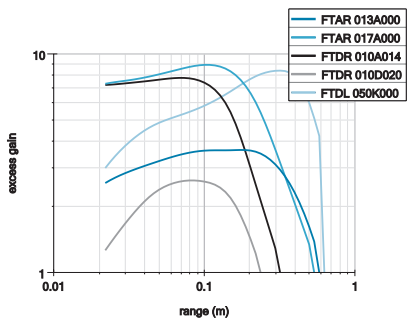
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

| order reference | connection types | output circuit | output function | protection class |
|---|---|---|---|---|
| **FPDK 10N5101** | cable 4 pin | NPN | light / dark operate | IP 65 |
| **FPDK 10N5101/S35A** | connector M8, 4 pin | NPN | light / dark operate | IP 67 |
| **FPDK 10P3101/KS35** | flylead connector M8, 3 pin | PNP | dark operate | IP 65 |
| **FPDK 10P5101** | cable 4 pin | PNP | light / dark operate | IP 65 |
| **FPDK 10P5101/S35A** | connector M8, 4 pin | PNP | light / dark operate | IP 67 |



## excess gain curve

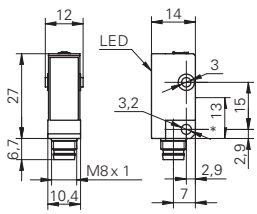


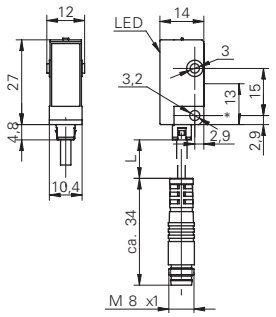

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

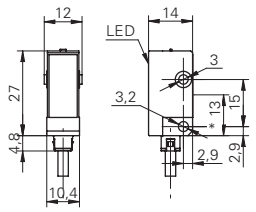
## dimension drawings



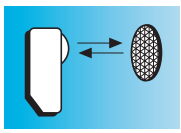

* emitter axis




* emitter axis cable length L = 200 mm




* emitter axis

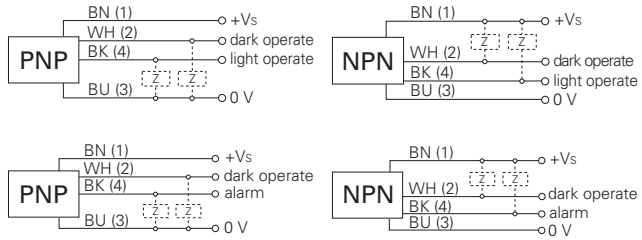


## Sb = 5,1 m

- rugged miniature metal housing
- polarization filter to detect shiny objects
- available with alarm output

| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 5,1 m |
| nominal range Sn | 5,5 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

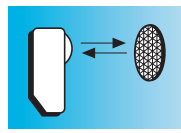
**connection diagrams**



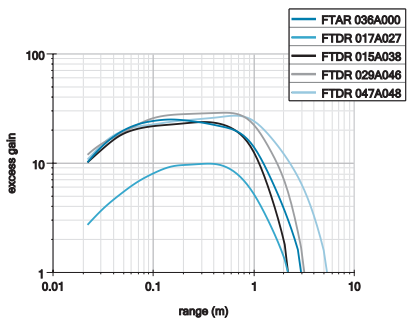

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

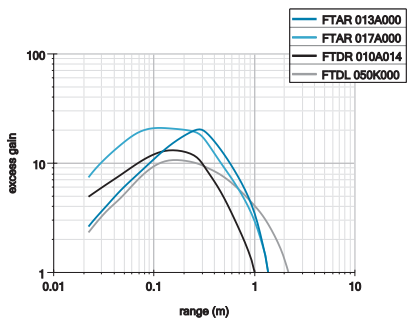
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

| order reference | connection types | output circuit | output function | sensitivity adjustment | suppression of reciprocal influence |
|---|---|---|---|---|---|
| **FPDM 12N3401** | cable 4 pin | NPN | alarm output dark | no | yes |
| **FPDM 12N3401/S35A** | connector M8, 4 pin | NPN | alarm output dark | no | yes |
| **FPDM 12N5101** | cable 4 pin | NPN | light / dark operate | no | yes |
| **FPDM 12N5101/S35A** | connector M8, 4 pin | NPN | light / dark operate | no | yes |
| **FPDM 12P3401** | cable 4 pin | PNP | alarm output dark | no | yes |
| **FPDM 12P3401/S35A** | connector M8, 4 pin | PNP | alarm output dark | no | yes |
| **FPDM 12P5101** | cable 4 pin | PNP | light / dark operate | no | yes |
| **FPDM 12P5101/S35A** | connector M8, 4 pin | PNP | light / dark operate | no | yes |
| **FPDM 12P5105/S35A** | connector M8, 4 pin | PNP | light / dark operate | Pot, 5 turn | - |



## excess gain curve

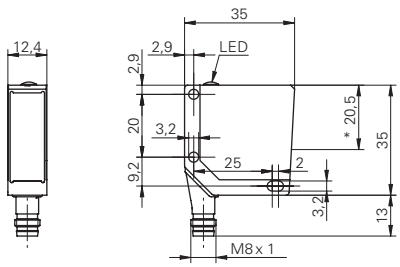


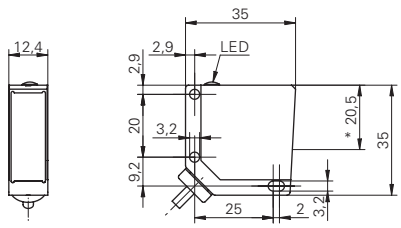

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

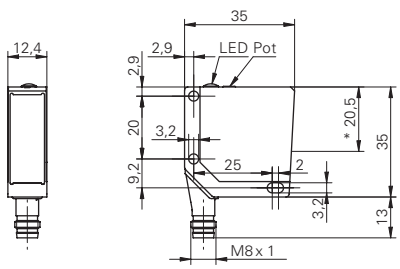
## dimension drawings



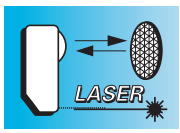

* emitter axis




* emitter axis




* emitter axis




# Sb = 11 m

- rugged miniature metal housing
- single lens optics
- short response time

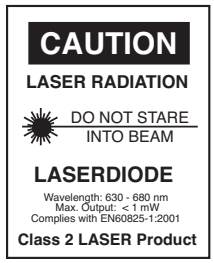
| general data | |
|---|---|
| type | retro-reflective laser sensor |
| version | single lens optics |
| light source | pulsed red laser diode |
| repeatability | < 0,1 mm at laser focus |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | no |
| laser class | 2 |
| wave length | 675 nm |
| **actual range Sb = 1 m** | |
| nominal range Sn | 1,2 m |
| distance to laser focus | 100 mm |
| **actual range Sb = 5 m** | |
| nominal range Sn | 5,5 m |
| distance to laser focus | 400 mm |
| **actual range Sb = 11 m** | |
| nominal range Sn | 13 m |
| distance to laser focus | parallel beam |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

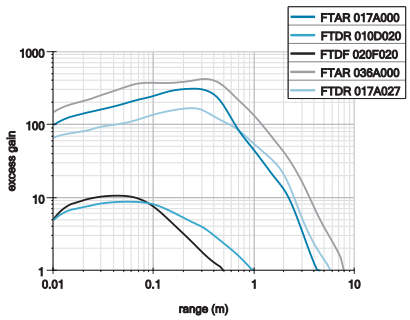
**laser warning**



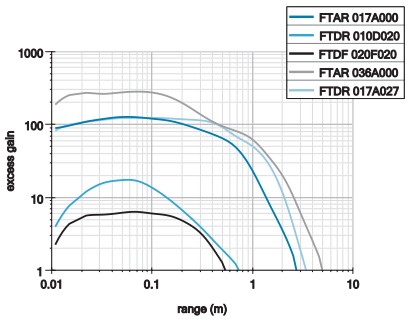

| order reference | actual range Sb | connection types | output circuit | response time / release time |
|---|---|---|---|---|
| **OPDM 12N5101** | 5 m | cable 4 pin | NPN | < 0,1 ms |
| **OPDM 12N5101/S35A** | 5 m | connector M8, 4 pin | NPN | < 0,1 ms |
| **OPDM 12P5101** | 5 m | cable 4 pin | PNP | < 0,1 ms |
| **OPDM 12P5101/S35A** | 5 m | connector M8, 4 pin | PNP | < 0,1 ms |
| **OPDM 12P5102/S35A** | 1 m | connector M8, 4 pin | PNP | < 0,1 ms |
| **OPDM 12P5103/S35A** | 11 m | connector M8, 4 pin | PNP | < 0,1 ms |
| **OPDM 12P5104/S35A** | 1 m | connector M8, 4 pin | PNP | < 0,05 ms |

## excess gain curve

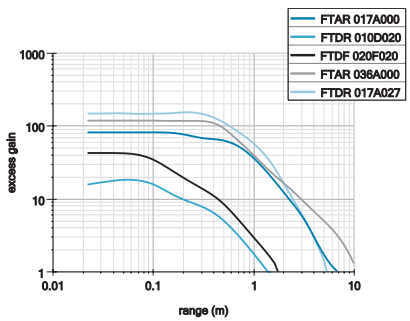
Sb = 5 m




Sb = 1 m




Sb = 11 m

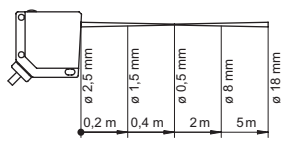



## reflectors

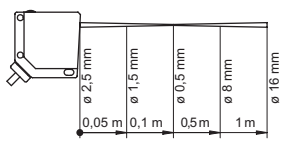
| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## beam characteristic

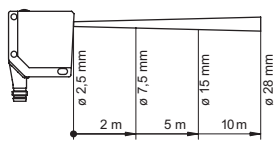
Sb = 5 m



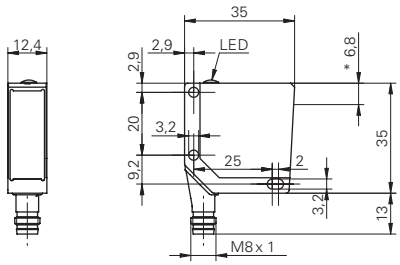

Sb = 1 m



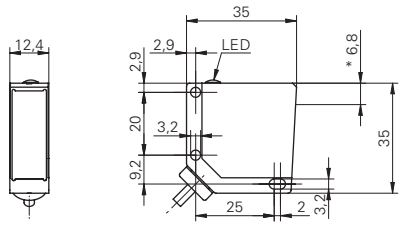

Sb = 11 m



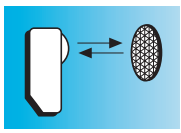

## dimension drawings




* emitter and receiver axis




* emitter and receiver axis



## Sb = 7,2 m

- polarization filter to detect shiny objects
- single lens optics
- suppression of mutual optical interference

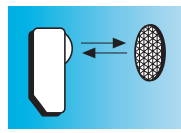
| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **actual range Sb = 4 m** | |
| version | single lens optics |
| nominal range Sn | 4,5 m |
| **actual range Sb = 7,2 m** | |
| nominal range Sn | 8 m |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

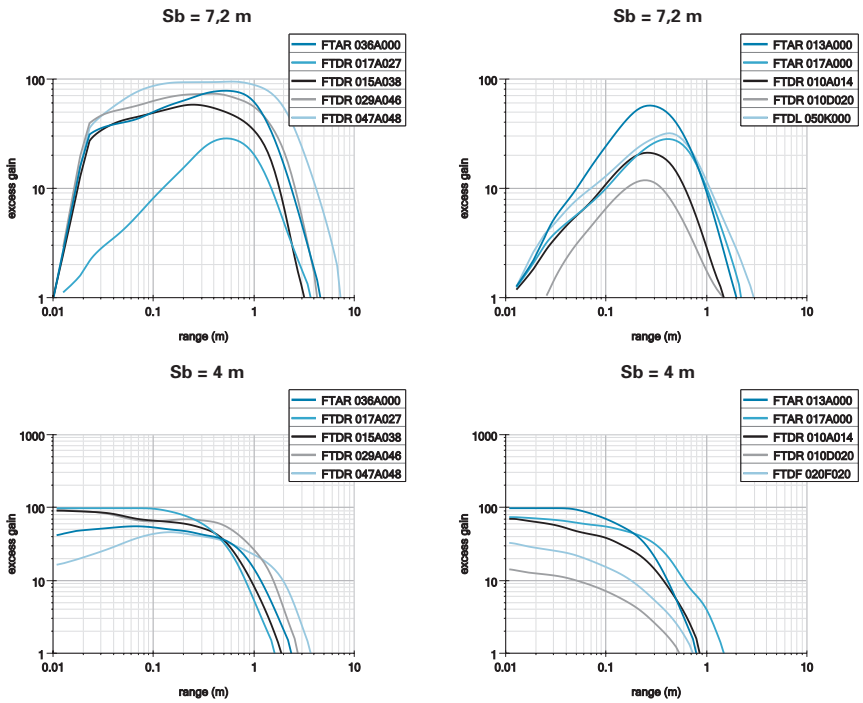
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

| order reference | actual range Sb | output circuit |
|---|---|---|
| **FPDK 14N5101/S35A** | 7,2 m | NPN |
| **FPDK 14N5111/S35A** | 4 m | NPN |
| **FPDK 14P5101/S35A** | 7,2 m | PNP |
| **FPDK 14P5111/S35A** | 4 m | PNP |



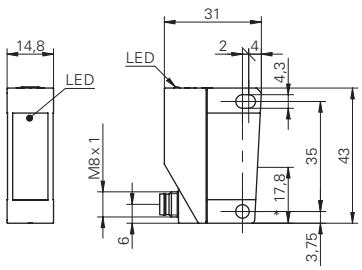
## excess gain curve



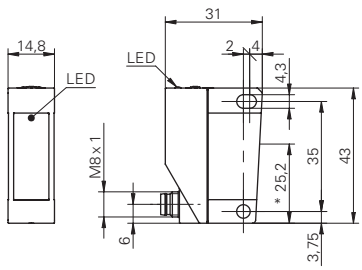

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

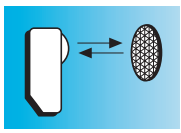
## dimension drawings




* emitter axis




* emitter and receiver axis



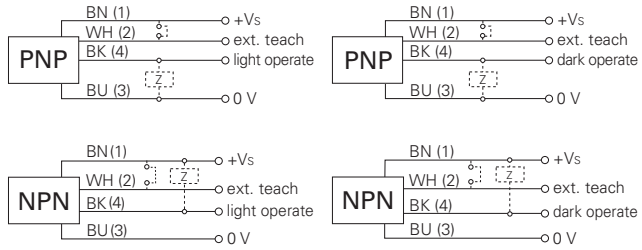
## Sb = 1 m

IO-Link

- designed for detection of transparent objects
- sensitivity adjustable via Teach-in
- short response time

| general data | |
|---|---|
| type | retro-reflective sensor |
| special type | for transparent objects |
| light source | pulsed red LED |
| actual range Sb | 1 m |
| nominal range Sn | 1,5 m |
| polarization filter | no |
| light indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 0,1 ms |
| Teach-in signal time | > 500 µs |
| adaption time | < 20 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 40 mA |
| current consumption typ. | 35 mA |
| voltage drop Vd | < 2,2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

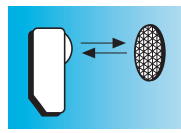
**connection diagrams**



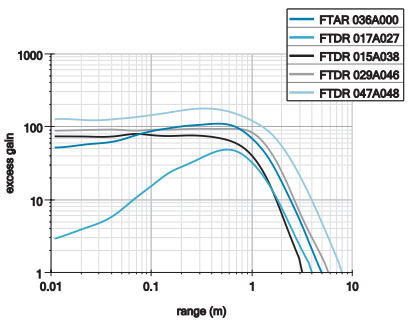

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

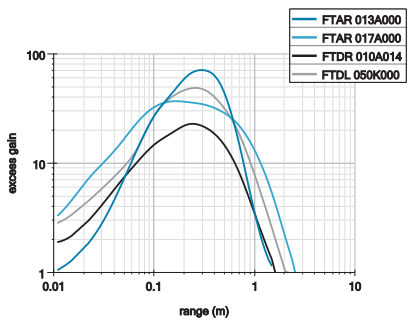
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

| order reference | output circuit | output function | teach value stored after power-off |
|---|---|---|---|
| **FRDK 14N1902/S35A** | NPN | light operate | volatile |
| **FRDK 14N1903/S35A** | NPN | light operate | non volatile |
| **FRDK 14N3902/S35A** | NPN | dark operate | volatile |
| **FRDK 14N3903/S35A** | NPN | dark operate | non volatile |
| **FRDK 14P1902/S35A** | PNP | light operate | volatile |
| **FRDK 14P1903/S35A** | PNP | light operate | non volatile |
| **FRDK 14P3902/S35A** | PNP | dark operate | volatile |
| **FRDK 14P3903/S35A** | PNP | dark operate | non volatile |



## excess gain curve

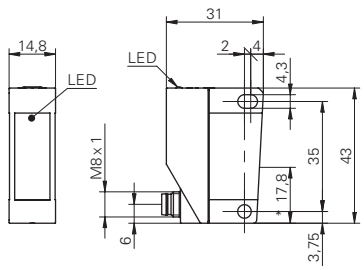


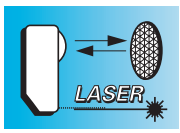

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## dimension drawing




* emitter axis

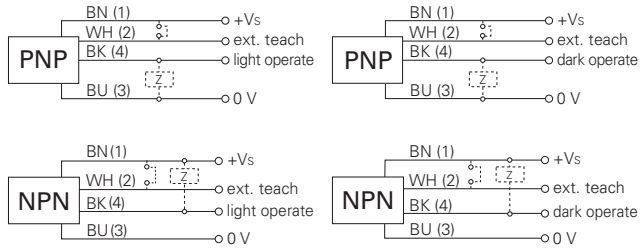



## Sb = 10 m

- single lens optics
- long sensing range
- short response time

| general data | |
|---|---|
| type | retro-reflective laser sensor |
| version | single lens optics |
| light source | pulsed red laser diode |
| actual range Sb | 10 m |
| nominal range Sn | 11 m |
| repeatability | < 0,1 mm at laser focus |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Teach-in |
| laser class | 1 |
| distance to laser focus | 400 mm |
| wave length | 650 nm |
| **electrical data** | |
| response time / release time | < 0,25 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 2,2 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**



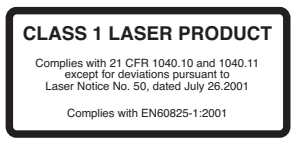

**connectors**

| | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

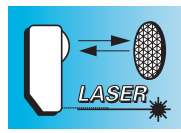
**accessories**

| | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

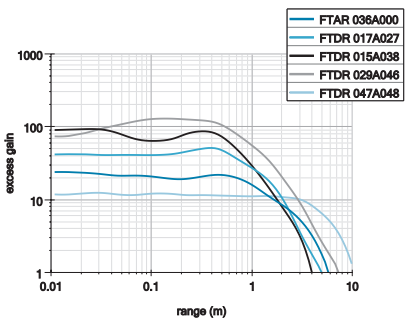
**laser warning**

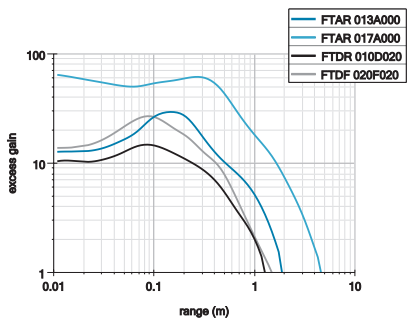



| order reference | output circuit | output function |
|---|---|---|
| **OPDK 14N1901/S35A** | NPN | light operate |
| **OPDK 14N3901/S35A** | NPN | dark operate |
| **OPDK 14P1901/S35A** | PNP | light operate |
| **OPDK 14P3901/S35A** | PNP | dark operate |




## excess gain curve

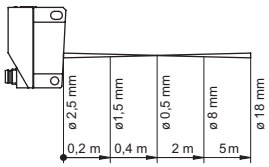


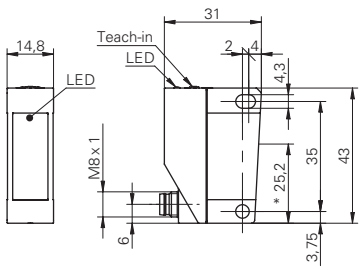

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

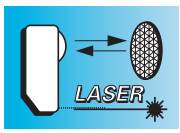
## beam characteristic




## dimension drawing




* emitter and receiver axis




## Sb = 1 m

- designed for detection of transparent objects
- single lens optics
- short response time

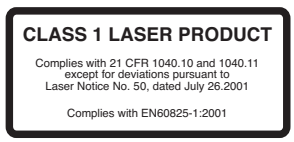
| general data | |
|---|---|
| type | retro-reflective laser sensor |
| special type | for transparent objects |
| version | single lens optics |
| light source | pulsed red laser diode |
| actual range Sb | 1 m |
| nominal range Sn | 1,5 m |
| repeatability | < 0,1 mm at laser focus |
| polarization filter | yes |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Teach-in |
| laser class | 1 |
| distance to laser focus | 100 mm |
| wave length | 650 nm |
| **electrical data** | |
| response time / release time | < 0,25 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 2,2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**

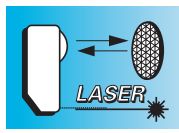
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

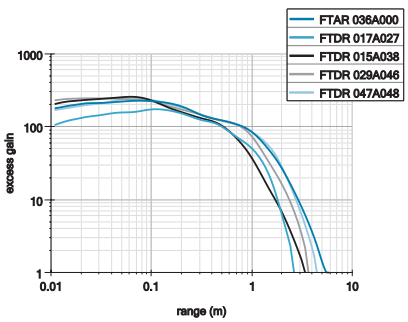
**laser warning**

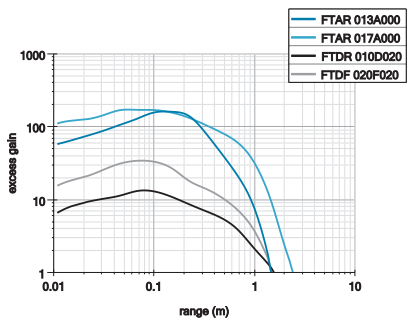



| order reference | output function | teach value stored after power-off |
|---|---|---|
| **OPDK 14P1902/S35A** | light operate | volatile |
| **OPDK 14P1903/S35A** | light operate | non volatile |
| **OPDK 14P3902/S35A** | dark operate | volatile |
| **OPDK 14P3903/S35A** | dark operate | non volatile |




## excess gain curve

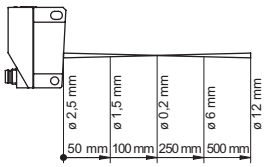


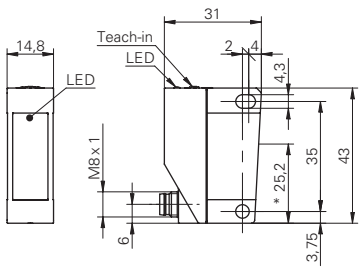

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

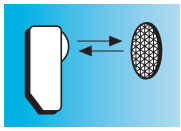
## beam characteristic




## dimension drawing




* emitter and receiver axis



## Sb = 7,3 m

- rugged metal housing
- sensing range adjustable via potentiometer
- polarization filter to detect shiny objects

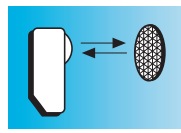
| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 7,3 m |
| nominal range Sn | 9 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 36 mA |
| current consumption typ. | 26 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

**connection diagrams**

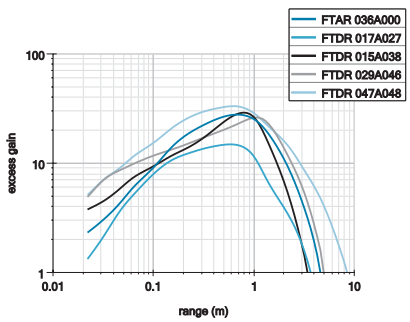
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

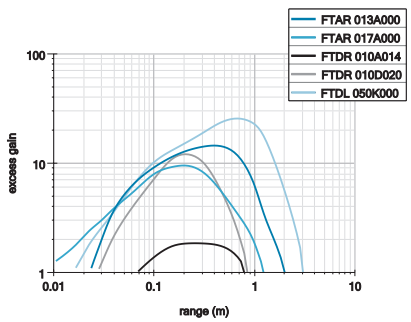
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

| order reference | connection types | output circuit | sensitivity adjustment |
|---|---|---|---|
| **FPDM 16N5101** | cable 4 pin | NPN | no |
| **FPDM 16N5101/S14** | connector M12, 4 pin | NPN | no |
| **FPDM 16N5105** | cable 4 pin | NPN | Pot, 10 turn |
| **FPDM 16N5105/S14** | connector M12, 4 pin | NPN | Pot, 10 turn |
| **FPDM 16P5101** | cable 4 pin | PNP | no |
| **FPDM 16P5101/S14** | connector M12, 4 pin | PNP | no |
| **FPDM 16P5105** | cable 4 pin | PNP | Pot, 10 turn |
| **FPDM 16P5105/S14** | connector M12, 4 pin | PNP | Pot, 10 turn |



## excess gain curve

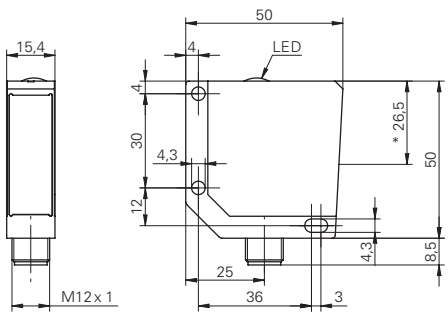


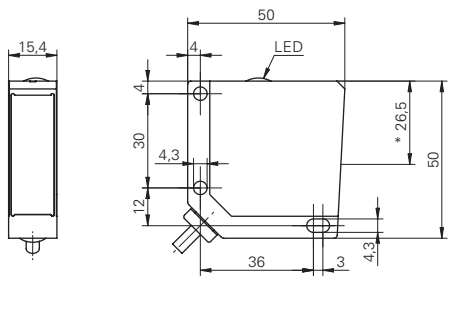

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

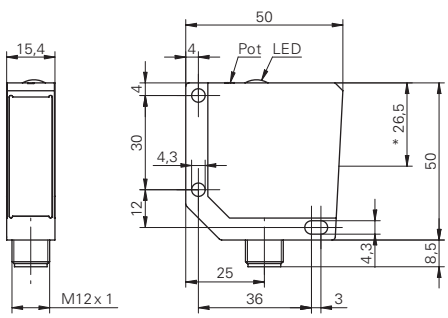
## dimension drawings



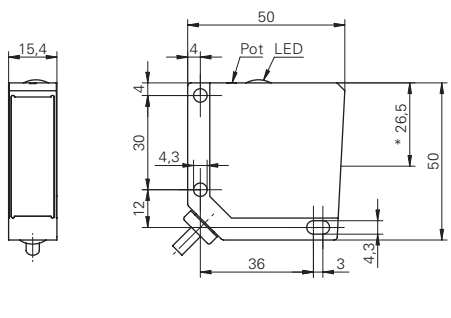

* emitter axis



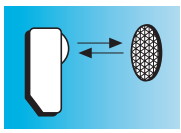

* emitter axis




* emitter axis




* emitter axis



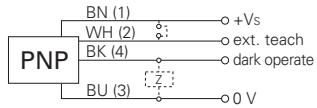
## Sb = 6 m

- rugged metal housing
- designed for detection of transparent objects
- sensitivity adjustable via Teach-in

| general data | |
|---|---|
| type | retro-reflective sensor |
| special type | for transparent objects |
| light source | pulsed red LED |
| actual range Sb | 4 m |
| nominal range Sn | 6 m |
| polarization filter | yes |
| light indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 2,5 ms |
| adaption time | < 25 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | dark operate |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| connection types | connector M12, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

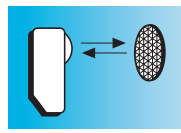
| order reference |
|---|
| **FPDM 16P3921/S14** |

**connection diagram**

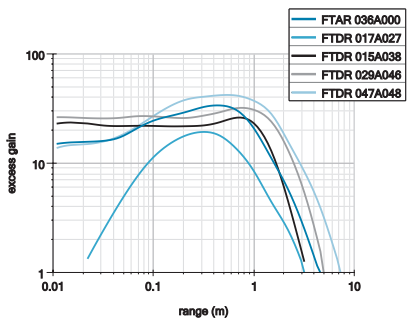


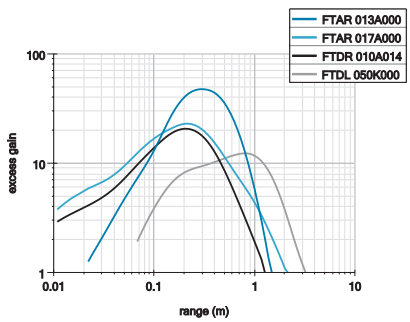

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |



## excess gain curve

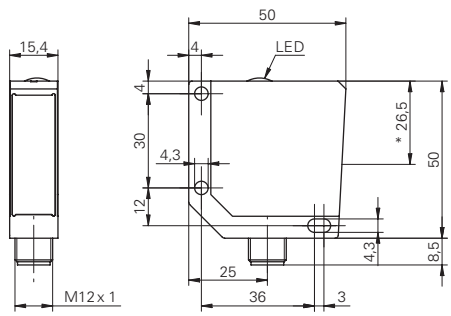


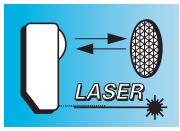

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## dimension drawing




* emitter axis

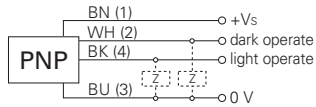



## Sb = 11 m

- rugged metal housing
- high repeatability
- short response time

| general data | |
|---|---|
| type | retro-reflective laser sensor |
| light source | pulsed red laser diode |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| laser class | 1 |
| wave length | 675 nm |
| **actual range Sb = 1 m** | |
| nominal range Sn | 1,3 m |
| repeatability | < 0,1 mm at laser focus |
| sensitivity adjustment | Pot, 270° |
| distance to laser focus | 80 mm |
| **actual range Sb = 11 m** | |
| nominal range Sn | 12 m |
| repeatability | < 1,5 mm at 0 ... 0,5 m |
| sensitivity adjustment | no |
| distance to laser focus | 400 mm |
| **electrical data** | |
| response time / release time | < 0,1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 70 mA |
| current consumption typ. | 60 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

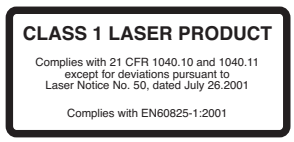
**connection diagram**




| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

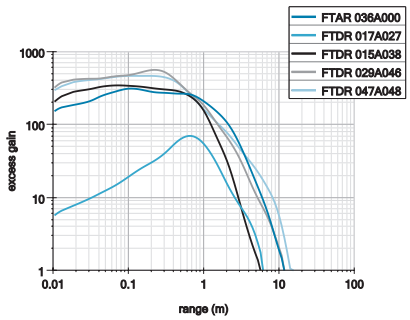
**laser warning**



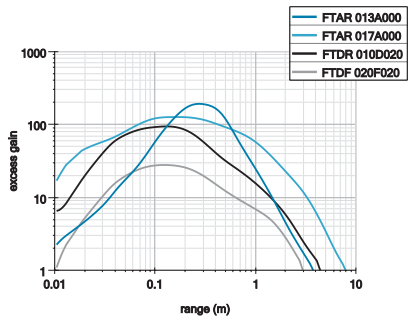

| order reference | actual range Sb | connection types |
|---|---|---|
| **OPDM 16P5102** | 11 m | cable 4 pin |
| **OPDM 16P5102/S14** | 11 m | connector M12, 4 pin |
| **OPDM 16P5103** | 1 m | cable 4 pin |
| **OPDM 16P5103/S14** | 1 m | connector M12, 4 pin |

## excess gain curve

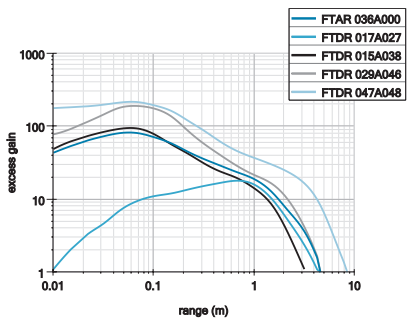
Sb = 11 m



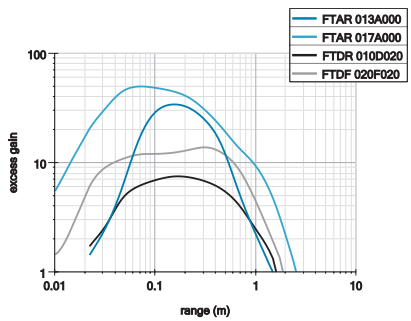

Sb = 11 m




Sb = 1 m




Sb = 1 m

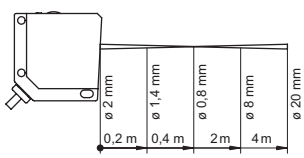



## reflectors

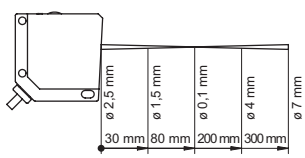
| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDF 020F020 | tape 20 x 20 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## beam characteristic

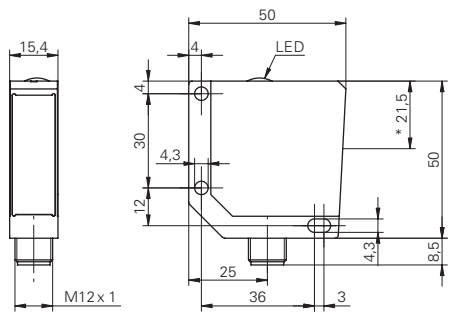
Sb = 11 m



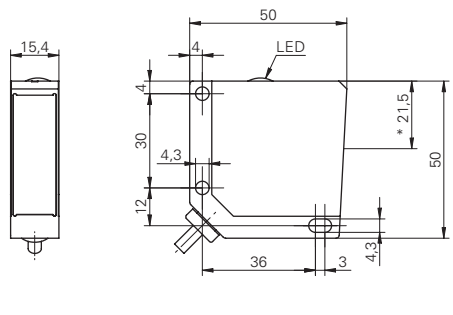

Sb = 1 m



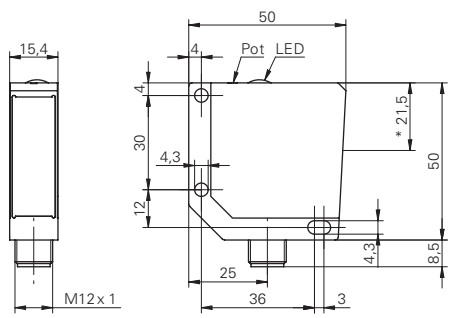

## dimension drawings



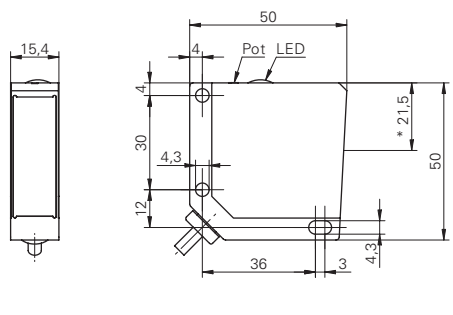

* emitter axis



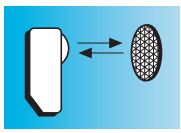

* emitter axis




* emitter axis




* emitter axis

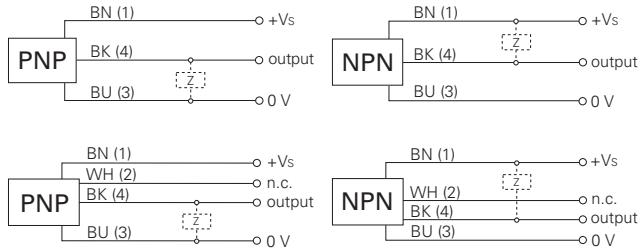


## Sb = 3,2 m

- rugged metal housing
- polarization filter to detect shiny objects

| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 3,2 m |
| nominal range Sn | 4 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 22 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |

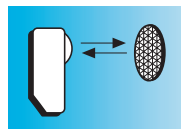
**connection diagrams**



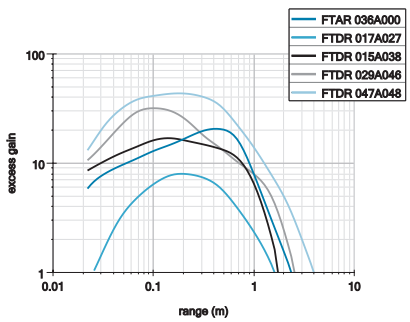

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

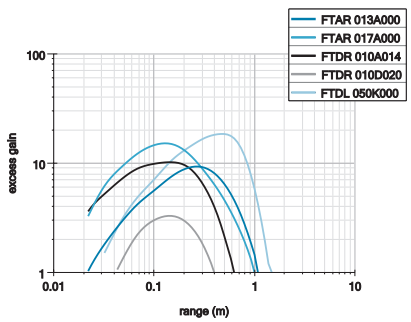
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151658 |
| glass cover | 103068 |
| doubling lens | 107250 |
| cap nut | 115913 |
| for details, see accessories section | |

| order reference | connection types | height / length | output circuit |
|---|---|---|---|
| **FPAM 18N3151** | cable 3 pin | 57 mm | NPN |
| **FPAM 18N3151/S14** | connector M12, 4 pin | 67 mm | NPN |
| **FPAM 18P3151** | cable 3 pin | 57 mm | PNP |
| **FPAM 18P3151/S14** | connector M12, 4 pin | 67 mm | PNP |



## excess gain curve

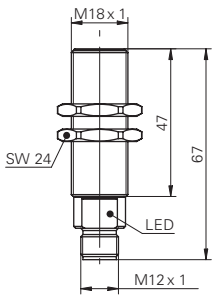


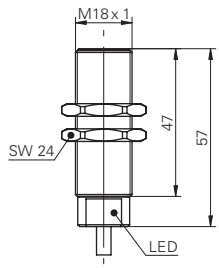



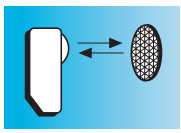

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 010D020 | 15 x 25 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## dimension drawings





## Sb = 4,5 m

- cross-technology housing concept
- polarization filter to detect shiny objects
- small mounting depth

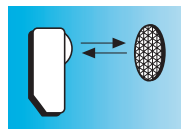
| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 4,5 m |
| nominal range Sn | 5 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 25 mA |
| current consumption typ. | 22 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | plastic (PBT-ASA) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **FPDK 20N5101/S35A** | NPN |
| **FPDK 20P5101/S35A** | PNP |

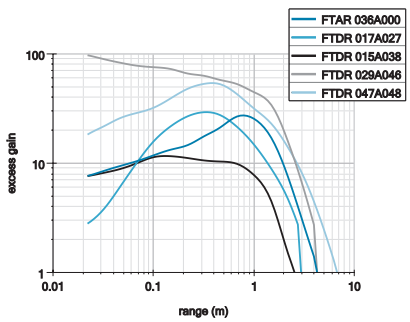
**connection diagrams**

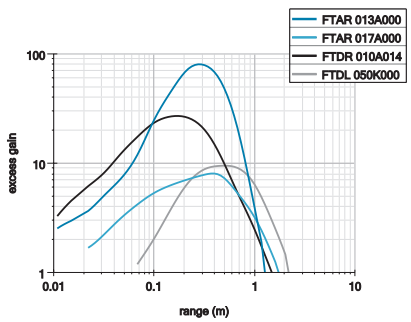
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| for details, see accessories section | |



## excess gain curve

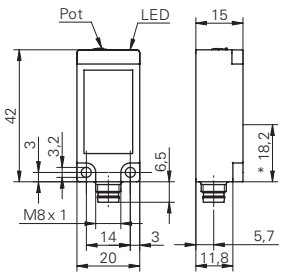


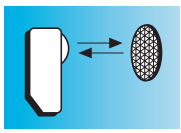

## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## dimension drawing




* emitter axis



## Sb = 10 m

- long sensing range
- polarization filter to detect shiny objects

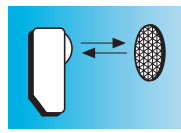
| general data | |
|---|---|
| type | retro-reflective sensor |
| light source | pulsed red LED |
| actual range Sb | 10 m |
| nominal range Sn | 11 m |
| polarization filter | yes |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 55 mA |
| current consumption typ. | 45 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 25 mm |
| height / length | 80 mm |
| depth | 58 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| connection types | connector M12, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **FPDK 26N5103/S14** | NPN |
| **FPDK 26P5103/S14** | PNP |

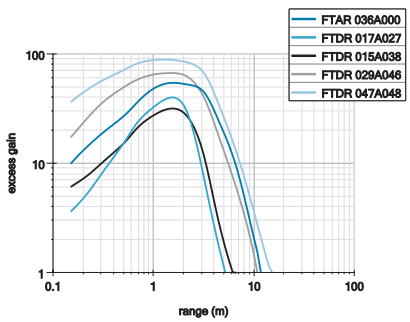
**connection diagrams**

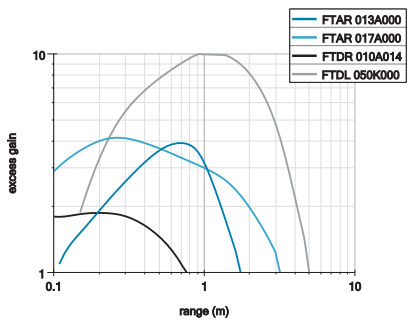
| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| mounting bracket | 112477 |
| for details, see accessories section | |



## excess gain curve

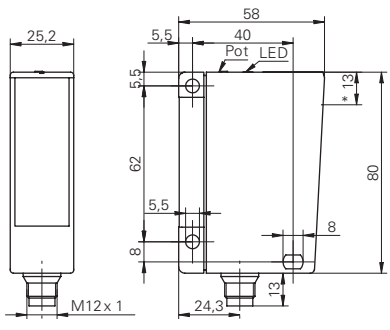


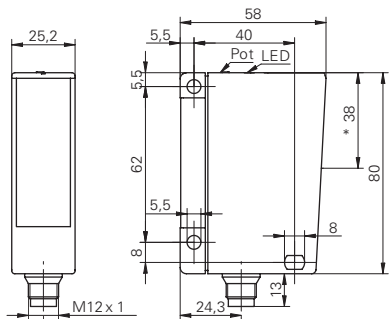




## reflectors

| | |
|---|---|
| FTAR 013A000 | ø 15 mm |
| FTAR 017A000 | ø 20,7 mm |
| FTAR 020A000 | ø 25,2 mm |
| FTAR 036A000 | ø 46 mm |
| FTDL 050K000/... m | tape 50 x ... mm |
| FTDR 010A014 | 12,8 x 16,8 mm |
| FTDR 015A038 | 18 x 40 mm |
| FTDR 017A027 | 20 x 42 mm |
| FTDR 029A046 | 32,5 x 48 mm |
| FTDR 047A048 | 54 x 75 mm |

## dimension drawings



## red light LED version

| product family | FSCK 07 / FECK 07 | FSDK 07 / FEDK 07 | FSDM 08 / FEDM 08 | FSDM 08 / FEDM 08 | FSAM 08 / FEAM 08 | FSDK 10 / FEDK 10 | FSDM 12 / FEDM 12 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 8 mm | 8 mm | 8 mm | 8 mm | 8 mm | 10,4 mm | 12,4 mm |
| actual range Sb | 2 m | 2 m | 0,7 m | 2,5 m | 2,5 m | 5 m | 6 m |
| response time / release time | < 0,5 ms | < 0,5 ms | < 2,5 ms | < 2,5 ms | < 2,5 ms | < 1,4 ms | < 1 ms |
| sensitivity adjustment | Teach-in | Teach-in | no | no | no | Pot, 270° | no |
| NPN | ■ | ■ | | | | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | metal | metal | metal | plastic | metal |
| **Page** | **392** | **394** | **396** | **398** | **400** | **402** | **406** |

## laser version

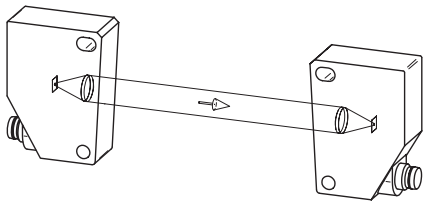
| product family | OSDK 10 / OEDK 10 | OSDK 14 / OEDK 14 | OSDM 16 / OEDM 16 |
|---|---|---|---|
| | | | |
| width / diameter | 10,4 mm | 14,8 mm | 15,4 mm |
| actual range Sb | 8 m | 8 m | 8 m |
| response time / release time | < 0,2 ms | < 0,5 ms | < 0,1 ms |
| sensitivity adjustment | Pot, 270° | no | Pot, 270° |
| NPN | ■ | ■ | |
| PNP | ■ | ■ | ■ |
| cable | ■ | | ■ |
| connector | ■ | ■ | ■ |
| housing material | plastic | plastic | metal |
| **Page** | **404** | **410** | **414** |

| FSDK 14 / FEDK 14 | FSDM 16 / FEDM 16 | FSAM 18 / FEAM 18 | FSDK 20 / FEDK 20 | FSDK 26 / FEDK 26 |
|---|---|---|---|---|
| | | | | |
| 14,8 mm | 15,4 mm | 18 mm | 20 mm | 25 mm |
| 12 m | 3 m<br>8 m | 16 m | 6 m | 20 m |
| < 1,2 ms | 0 ms | < 1 ms | < 0,5 ms | < 1 ms |
| no | no<br>Pot, 10 turn | Pot, 270° | Pot, 270° | no |
| ■ | | ■ | ■ | |
| ■ | ■ | ■ | ■ | ■ |
| | ■ | ■ | | |
| ■ | ■ | ■ | ■ | ■ |
| plastic | metal | metal | plastic | plastic |
| **408** | **412** | **416** | **418** | **420** |

# Through beam sensors

## General information

An emitter in a separate housing transmits the light to a separate receiver. The object is detected when it breaks the emitted beam.



## Applications

- Detection of objects at a great distance – through beam sensors have the longest ranges.
- Monitoring of doors and entrances
- Due to the good repeatability throughout the entire range, positioning of objects
- Reliable detection of high-gloss objects such as mirrors, wafers or chrome-plated surfaces

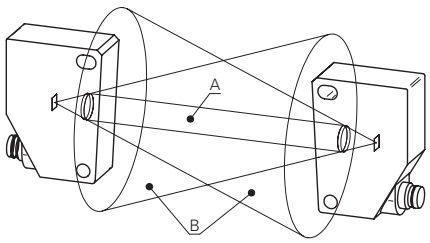
## Characteristics and advantages

- Due to the separated configuration, long ranges with large signal excess gain can be achieved in comparison with equivalent retro-reflective systems. Through beam sensors are therefore most suitable for operation in unfavorable ambient conditions such as dirt, dust and moisture.
- The clearly defined, consistent active zone permits highly constant repeatability throughout the entire sensing distance.
- The switching point is independent of the surface properties of the object.

# Through beam sensors

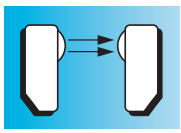
## Technology and operation

The active area (A) of a through beam sensor is equal to the diameter of the lens of the receiver or emitter. The acceptance zone (B) of the emitter and receiver is larger. However, this is only important for adjustment and for operation close to glossy surfaces. With focused through beam laser sensors, the active area is the diameter of the laser beam if this is smaller than the receiver lens or the front opening at the receiver end.




## Mounting and adjustment

The emitter and receiver must be aimed at each other. The narrower the angle of radiation and reception, the more accurately this must be conducted.

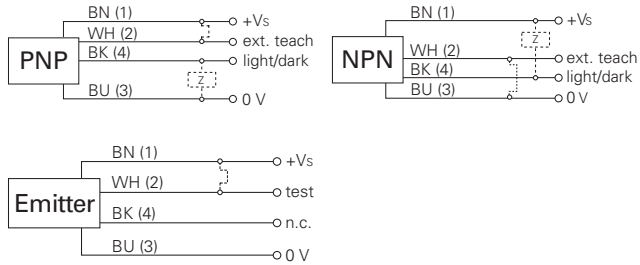


## Sb = 2 m

- ultra compact housing
- sensing range adjustable via Teach-in
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 2 m |
| nominal range Sn | 2,5 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,5 ms |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption typ. | 12 mA |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

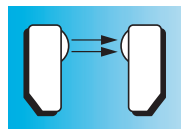
**connection diagrams**



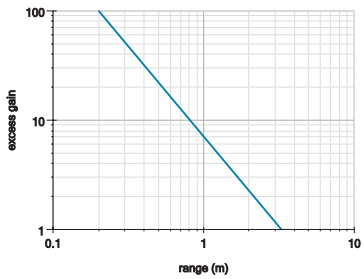

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

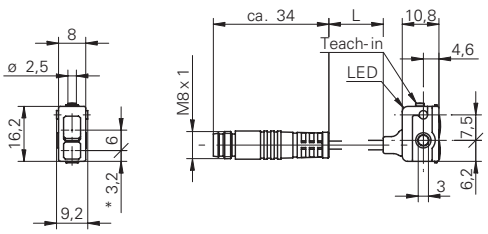
| order reference | emitter / receiver | connection types | output circuit |
|---|---|---|---|
| **FECK 07N6901** | receiver | cable rear side | NPN |
| **FECK 07N6901/KS35A** | receiver | flylead connector M8, 4 pin | NPN |
| **FECK 07P6901** | receiver | cable rear side | PNP |
| **FECK 07P6901/KS35A** | receiver | flylead connector M8, 4 pin | PNP |
| **FSCK 07D9601** | emitter | cable rear side | - |
| **FSCK 07D9601/KS35A** | emitter | flylead connector M8, 4 pin | - |



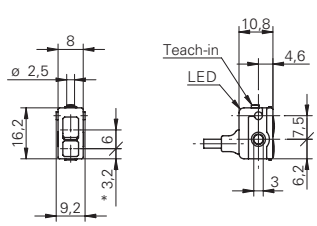
## excess gain curve



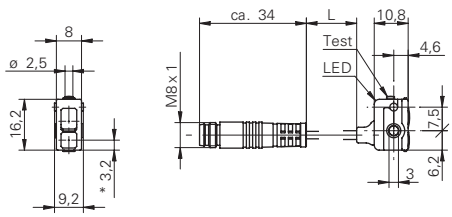

## dimension drawings



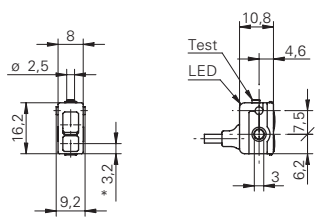

* receiver axis cable length L = 200 mm



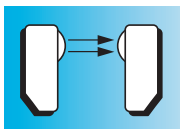

* receiver axis




* emitter axis cable length L = 200 mm




* emitter axis

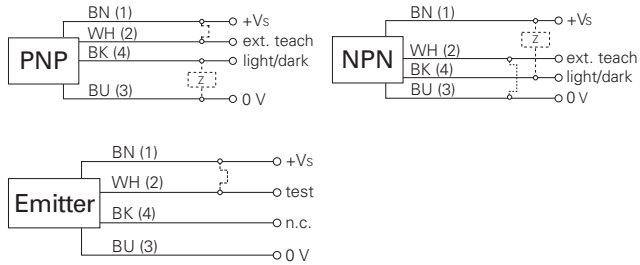


## Sb = 2 m

- ultra compact housing
- sensing range adjustable via Teach-in
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 2 m |
| nominal range Sn | 2,5 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Teach-in |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,5 ms |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption typ. | 12 mA |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 16,2 mm |
| depth | 10,8 mm |
| type | rectangular |
| housing material | plastic (PMMA, MABS, PA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -20 ... +50 °C |
| protection class | IP 65 |

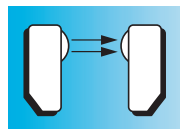
**connection diagrams**



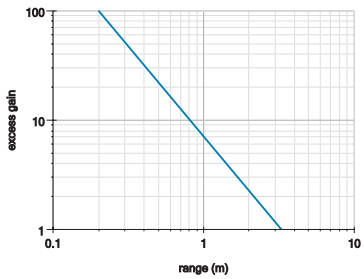

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *MINOFIX* mounting kit | 150844 |
| for details, see accessories section | |

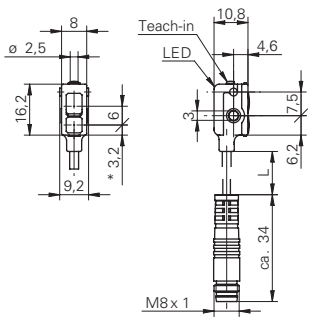
| order reference | emitter / receiver | connection types | output circuit |
|---|---|---|---|
| **FEDK 07N6901** | receiver | cable bottom side | NPN |
| **FEDK 07N6901/KS35A** | receiver | flylead connector M8, 4 pin | NPN |
| **FEDK 07P6901** | receiver | cable bottom side | PNP |
| **FEDK 07P6901/KS35A** | receiver | flylead connector M8, 4 pin | PNP |
| **FSDK 07D9601** | emitter | cable bottom side | - |
| **FSDK 07D9601/KS35A** | emitter | flylead connector M8, 4 pin | - |



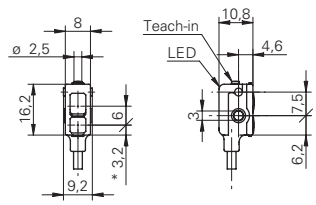
## excess gain curve



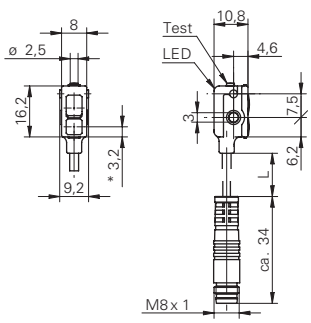

## dimension drawings



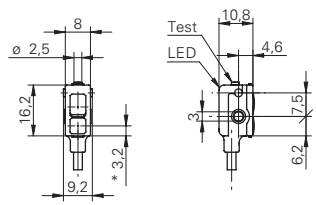

* receiver axis cable length L = 200 mm



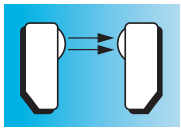

* receiver axis




* emitter axis cable length L = 200 mm




* emitter axis

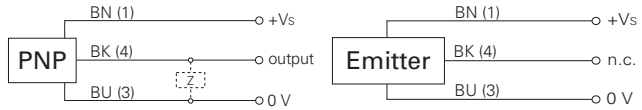


## Sb = 0,7 m

- subminiature metal housing
- small rectangular design

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 0,7 m |
| nominal range Sn | 1 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED red |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 2,5 ms |
| current consumption max. | 24 mA |
| current consumption typ. | 24 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 48 mA |
| current consumption typ. | 17 mA |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 58 mm |
| depth | 12 mm |
| type | rectangular |
| housing material | aluminum anodized |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

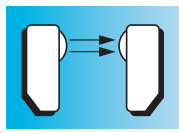
**connection diagrams**



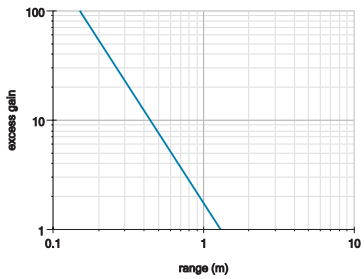

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151719 |
| for details, see accessories section | |

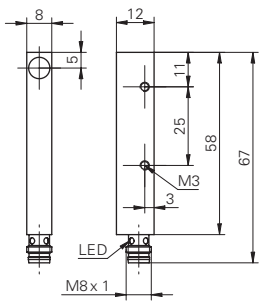
| order reference | emitter / receiver | connection types | output function |
|---|---|---|---|
| **FEDM 08P1001** | receiver | cable 3 pin | light operate |
| **FEDM 08P1001/S35L** | receiver | connector M8, 3 pin | light operate |
| **FEDM 08P3001** | receiver | cable 3 pin | dark operate |
| **FEDM 08P3001/S35L** | receiver | connector M8, 3 pin | dark operate |
| **FSDM 08D9001** | emitter | cable 3 pin | - |
| **FSDM 08D9001/S35** | emitter | connector M8, 3 pin | - |



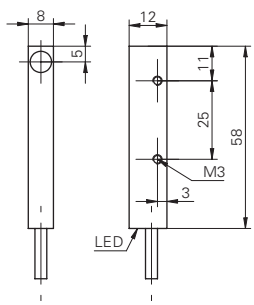
## excess gain curve



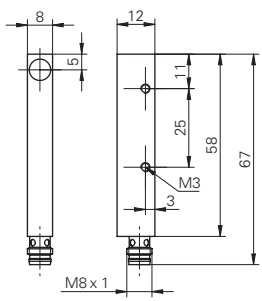

## dimension drawings



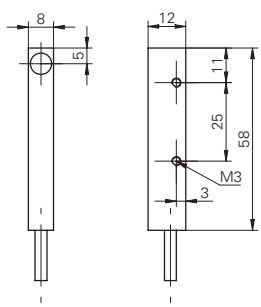

receiver



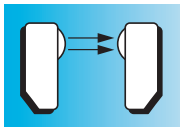

receiver




emitter




emitter

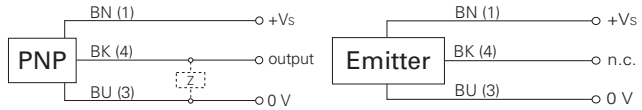


## Sb = 2,5 m

- subminiature metal housing
- small rectangular design

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 2,5 m |
| nominal range Sn | 3 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED red |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 2,5 ms |
| current consumption max. | 24 mA |
| current consumption typ. | 24 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 48 mA |
| current consumption typ. | 17 mA |
| **mechanical data** | |
| width / diameter | 8 mm |
| height / length | 58 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | aluminum anodized |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

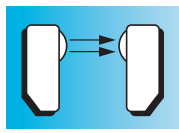
**connection diagrams**



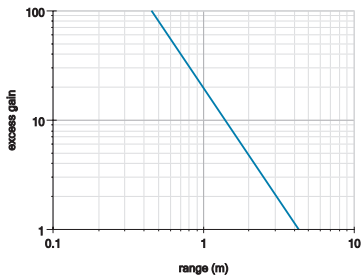

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151719 |
| for details, see accessories section | |

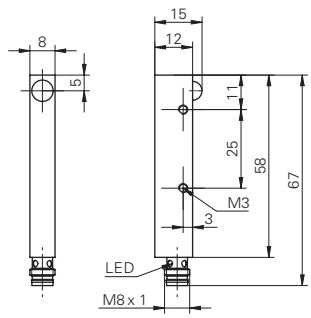
| order reference | emitter / receiver | connection types | output function |
|---|---|---|---|
| **FEDM 08P1002** | receiver | cable 3 pin | light operate |
| **FEDM 08P1002/S35L** | receiver | connector M8, 3 pin | light operate |
| **FEDM 08P3002** | receiver | cable 3 pin | dark operate |
| **FEDM 08P3002/S35L** | receiver | connector M8, 3 pin | dark operate |
| **FSDM 08D9002** | emitter | cable 3 pin | - |
| **FSDM 08D9002/S35** | emitter | connector M8, 3 pin | - |



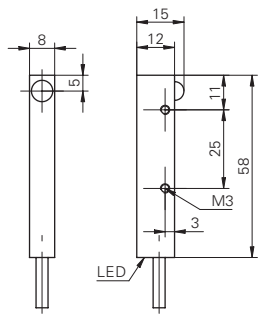
## excess gain curve



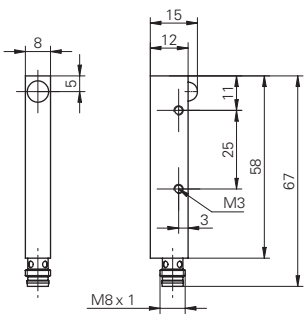

## dimension drawings



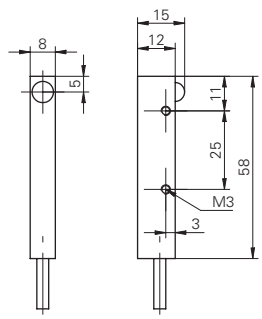

receiver



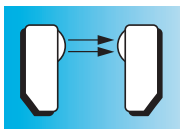

receiver




emitter




emitter

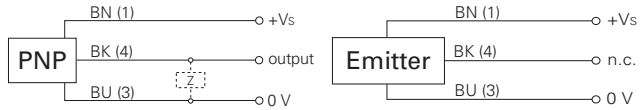


## Sb = 2,5 m

- subminiature metal housing
- cylindrical design

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 2,5 m |
| nominal range Sn | 3 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED red |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 2,5 ms |
| current consumption max. | 24 mA |
| current consumption typ. | 24 mA |
| voltage drop Vd | < 2 VDC |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 48 mA |
| current consumption typ. | 17 mA |
| **mechanical data** | |
| width / diameter | 8 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |

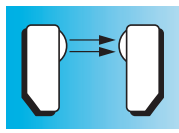
**connection diagrams**



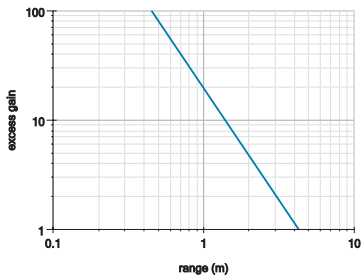

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151719 |
| for details, see accessories section | |

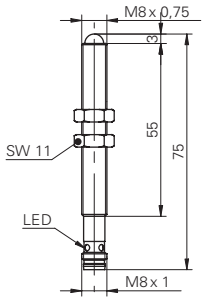
| order reference | emitter / receiver | connection types | height / length | output function |
|---|---|---|---|---|
| **FEAM 08P1002** | receiver | cable 3 pin | 59 mm | light operate |
| **FEAM 08P1002/S35L** | receiver | connector M8, 3 pin | 75,5 mm | light operate |
| **FEAM 08P3002** | receiver | cable 3 pin | 59 mm | dark operate |
| **FEAM 08P3002/S35L** | receiver | connector M8, 3 pin | 75,5 mm | dark operate |
| **FSAM 08D9002** | emitter | cable 3 pin | 59 mm | - |
| **FSAM 08D9002/S35** | emitter | connector M8, 3 pin | 75,5 mm | - |



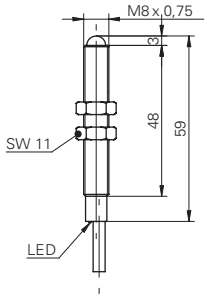
## excess gain curve



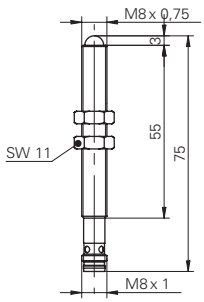

## dimension drawings



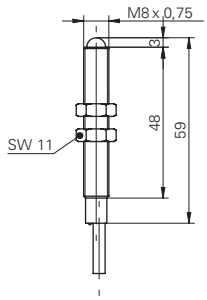

receiver



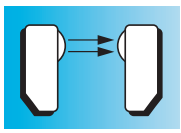

receiver




emitter




emitter

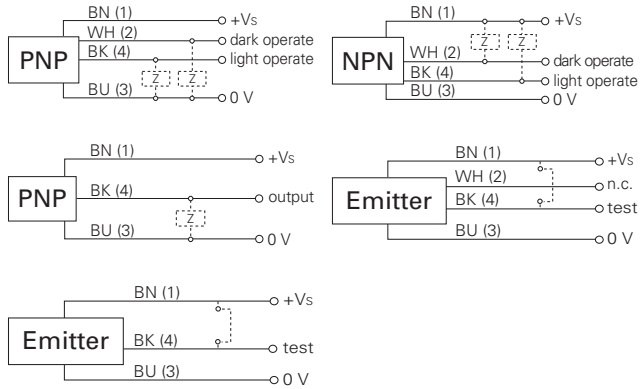


## Sb = 5 m

- subminiature housing
- sensing range adjustable via potentiometer
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 5 m |
| nominal range Sn | 6 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1,4 ms |
| current consumption max. | 16 mA |
| current consumption typ. | 16 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 23 mA |
| current consumption typ. | 15 mA |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |

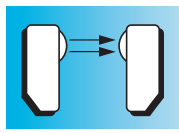
**connection diagrams**



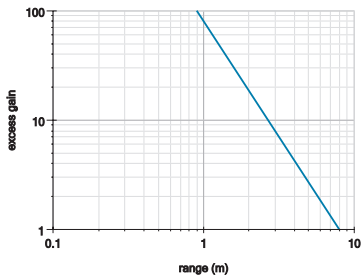

| connectors | | |
|---|---|---|
| ESG 32SH0200 | 3 pin | 2 m straight |
| ESW 31SH0200 | 3 pin | 2 m angular |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

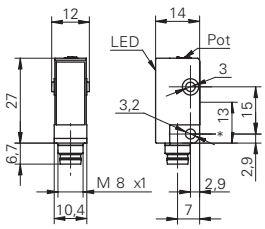
| order reference | emitter / receiver | connection types | output circuit | output function | protection class |
|---|---|---|---|---|---|
| **FEDK 10N5101** | receiver | cable 4 pin | NPN | light / dark operate | IP 65 |
| **FEDK 10N5101/S35A** | receiver | connector M8, 4 pin | NPN | light / dark operate | IP 67 |
| **FEDK 10P1101/KS35** | receiver | flylead connector M8, 3 pin | PNP | light operate | IP 65 |
| **FEDK 10P3101/KS35** | receiver | flylead connector M8, 3 pin | PNP | dark operate | IP 65 |
| **FEDK 10P5101** | receiver | cable 4 pin | PNP | light / dark operate | IP 65 |
| **FEDK 10P5101/S35A** | receiver | connector M8, 4 pin | PNP | light / dark operate | IP 67 |
| **FSDK 10D9001/KS35** | emitter | flylead connector M8, 3 pin | - | - | IP 65 |
| **FSDK 10D9601** | emitter | cable 4 pin | - | - | IP 65 |
| **FSDK 10D9601/S35A** | emitter | connector M8, 4 pin | - | - | IP 67 |



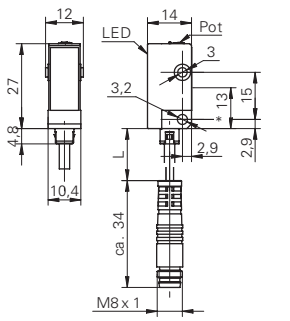
## excess gain curve



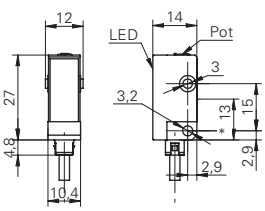

## dimension drawings



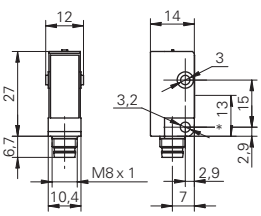

* receiver axis



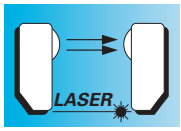

* receiver axis cable length L = 200 mm




* receiver axis




* emitter axis

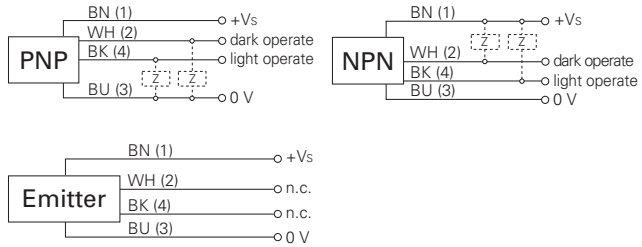



## Sb = 8 m

- long range
- short response time

| general data | |
|---|---|
| type | through beam laser sensor |
| actual range Sb | 8 m |
| nominal range Sn | 10 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| **emitter** | |
| light source | pulsed red laser diode |
| laser class | 2 |
| distance to laser focus | parallel beam |
| wave length | 675 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,2 ms |
| current consumption max. | 16 mA |
| current consumption typ. | 15 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **receiver** | |
| depth | 14 mm |
| **emitter** | |
| depth | 16,3 mm |
| **ambient conditions** | |
| **receiver** | |
| operating temperature | -25 ... +65 °C |
| **emitter** | |
| operating temperature | -10 ... +50 °C |

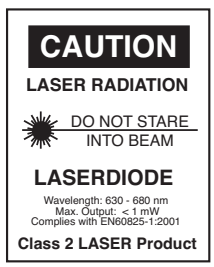
**connection diagrams**



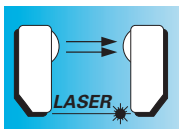

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

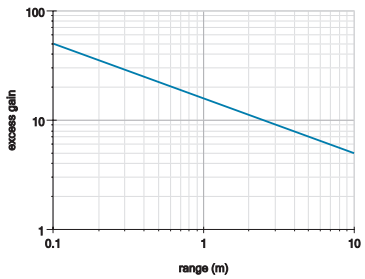
**laser warning**



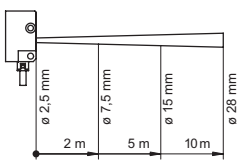

| order reference | emitter / receiver | connection types | output circuit | protection class |
|---|---|---|---|---|
| **OEDK 10N5101** | receiver | cable 4 pin | NPN | IP 65 |
| **OEDK 10N5101/S35A** | receiver | connector M8, 4 pin | NPN | IP 67 |
| **OEDK 10P5101** | receiver | cable 4 pin | PNP | IP 65 |
| **OEDK 10P5101/S35A** | receiver | connector M8, 4 pin | PNP | IP 67 |
| **OSDK 10D9001** | emitter | cable 4 pin | - | IP 65 |
| **OSDK 10D9001/S35A** | emitter | connector M8, 4 pin | - | IP 67 |



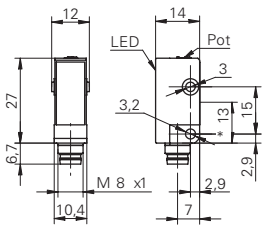

## excess gain curve



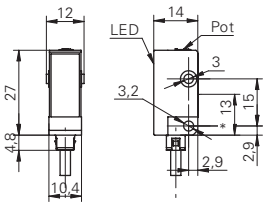

## beam characteristic



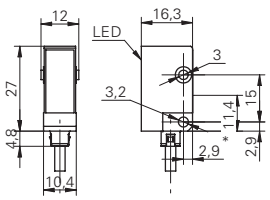

## dimension drawings



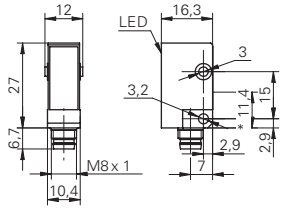

* receiver axis



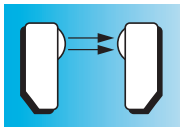

* receiver axis




* emitter axis




* emitter axis

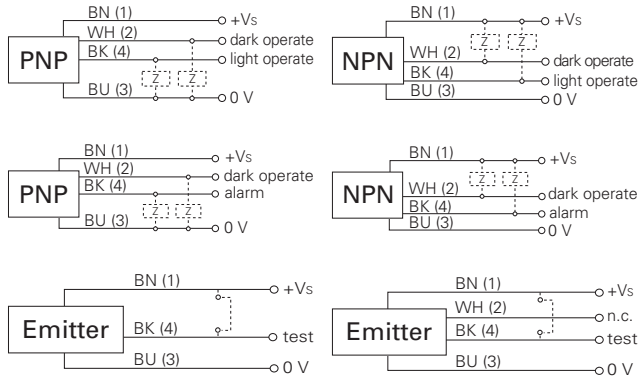


## Sb = 6 m

- rugged miniature metal housing
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 6 m |
| nominal range Sn | 7,5 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1 ms |
| current consumption max. | 17 mA |
| current consumption typ. | 17 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 30 mA |
| current consumption typ. | 18 mA |
| **mechanical data** | |
| width / diameter | 12,4 mm |
| height / length | 35 mm |
| depth | 35 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

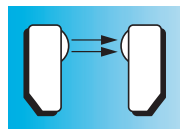
**connection diagrams**



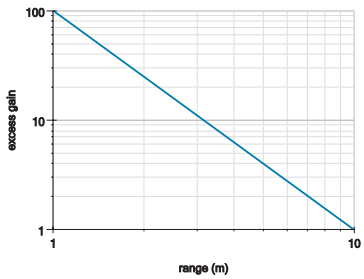

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150328 |
| mounting bracket | 113873 |
| for details, see accessories section | |

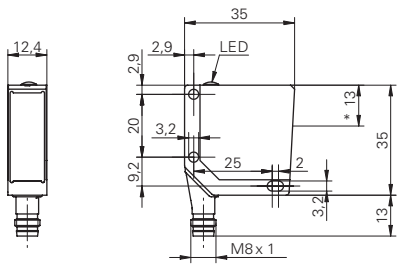
| order reference | emitter / receiver | connection types | output circuit | output function |
|---|---|---|---|---|
| **FEDM 12N3401** | receiver | cable 4 pin | NPN | alarm output dark |
| **FEDM 12N3401/S35A** | receiver | connector M8, 4 pin | NPN | alarm output dark |
| **FEDM 12N5101** | receiver | cable 4 pin | NPN | light / dark operate |
| **FEDM 12N5101/S35A** | receiver | connector M8, 4 pin | NPN | light / dark operate |
| **FEDM 12P3401** | receiver | cable 4 pin | PNP | alarm output dark |
| **FEDM 12P3401/S35A** | receiver | connector M8, 4 pin | PNP | alarm output dark |
| **FEDM 12P5101** | receiver | cable 4 pin | PNP | light / dark operate |
| **FEDM 12P5101/S35A** | receiver | connector M8, 4 pin | PNP | light / dark operate |
| **FSDM 12D9601** | emitter | cable 3 pin | - | - |
| **FSDM 12D9601/S35A** | emitter | connector M8, 4 pin | - | - |



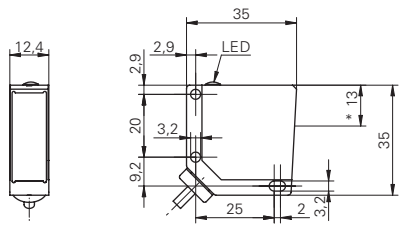
## excess gain curve



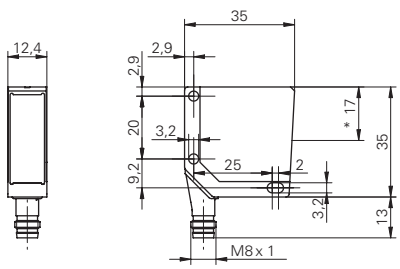

## dimension drawings



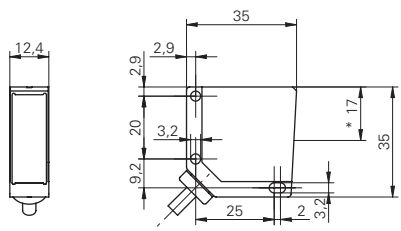

* receiver axis



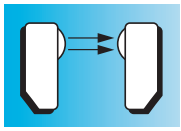

* receiver axis




* emitter axis




* emitter axis

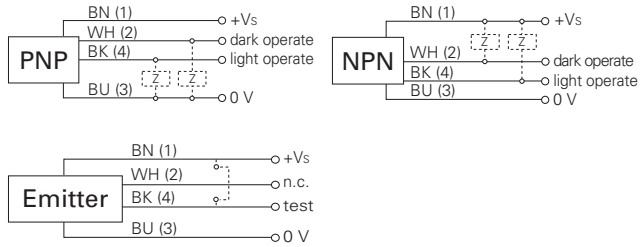


## Sb = 12 m

- long range
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 12 m |
| nominal range Sn | 15 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 20 mA |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1,2 ms |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption typ. | 12 mA |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

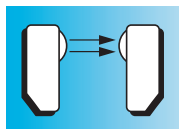
**connection diagrams**



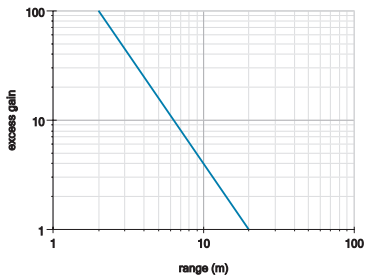

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| slot aperature stickers | 144075 |
| for details, see accessories section | |

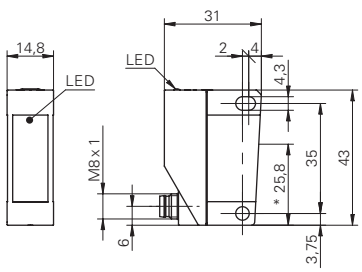
| order reference | emitter / receiver | output circuit |
|---|---|---|
| **FEDK 14N5101/S35A** | receiver | NPN |
| **FEDK 14P5101/S35A** | receiver | PNP |
| **FSDK 14D9601/S35A** | emitter | - |



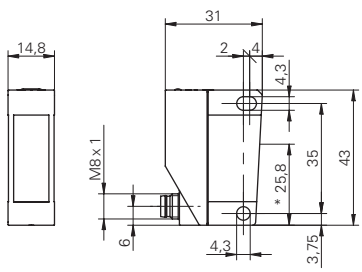
## excess gain curve



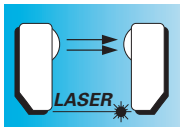

## dimension drawings




* receiver axis




* emitter axis

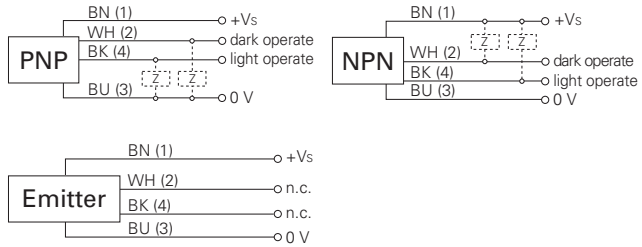



## Sb = 8 m

- long range
- short response time

| general data | |
|---|---|
| type | through beam laser sensor |
| actual range Sb | 8 m |
| nominal range Sn | 10 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed red laser diode |
| power on indication | LED green |
| laser class | 1 |
| distance to laser focus | parallel beam |
| wave length | 650 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,5 ms |
| current consumption max. | 20 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| protection class | IP 67 |
| **receiver** | |
| operating temperature | -25 ... +65 °C |
| **emitter** | |
| operating temperature | 10 ... +50 °C |

**connection diagrams**



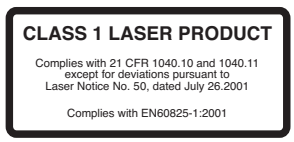

**connectors**

| | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

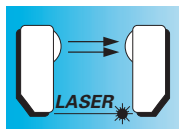
**accessories**

| | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

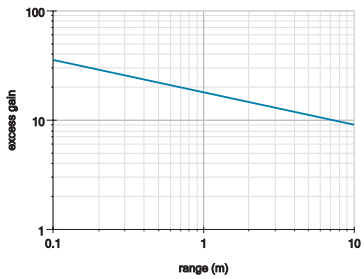
**laser warning**



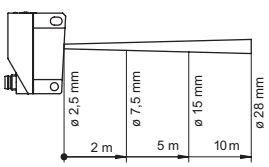

| order reference | emitter / receiver | output circuit |
|---|---|---|
| **OEDK 14N5101/S35A** | receiver | NPN |
| **OEDK 14P5101/S35A** | receiver | PNP |
| **OSDK 14D9001/S35A** | emitter | - |



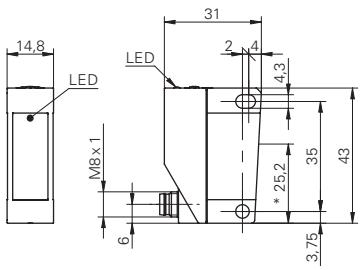

## excess gain curve



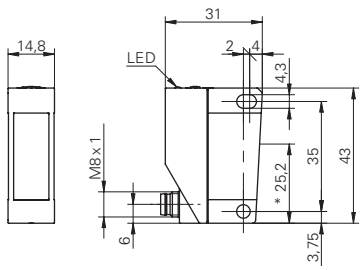

## beam characteristic



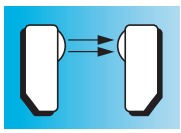

## dimension drawings




* receiver axis




* emitter axis

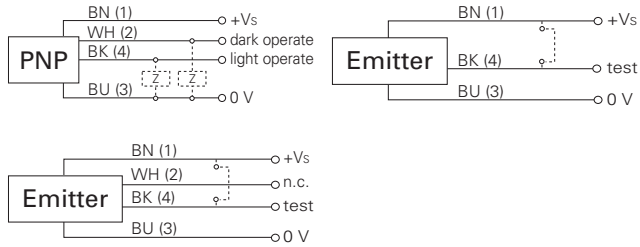


## Sb = 8 m

- rugged metal housing
- sensing range adjustable via potentiometer

| general data | |
|---|---|
| type | through beam sensor |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1 ms |
| current consumption max. | 17 mA |
| current consumption typ. | 17 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 30 mA |
| current consumption typ. | 18 mA |
| test input | Disable emitter: +Vs<br>Enable emitter: 0 V |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

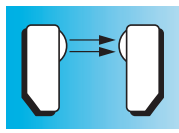
**connection diagrams**




| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

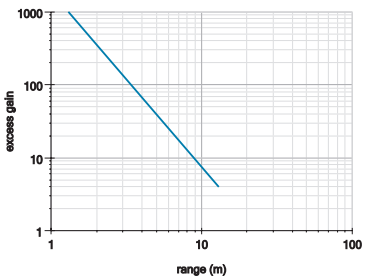
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

| order reference | emitter / receiver | nominal range Sn | actual range Sb | connection types | sensitivity adjustment |
|---|---|---|---|---|---|
| **FEDM 16P5101** | receiver | 10 m | 8 m | cable 4 pin | no |
| **FEDM 16P5101/S14** | receiver | 10 m | 8 m | connector M12, 4 pin | no |
| **FEDM 16P5105** | receiver | 3,5 m | 3 m | cable 4 pin | Pot, 10 turn |
| **FEDM 16P5105/S14** | receiver | 3,5 m | 3 m | connector M12, 4 pin | Pot, 10 turn |
| **FSDM 16D9601** | emitter | 10 m | 8 m | cable 3 pin | - |
| **FSDM 16D9601/S14** | emitter | 10 m | 8 m | connector M12, 4 pin | - |

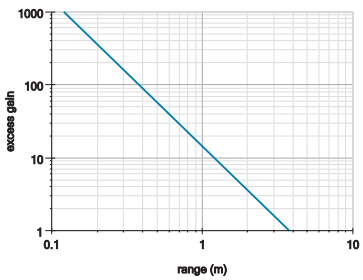


## excess gain curve

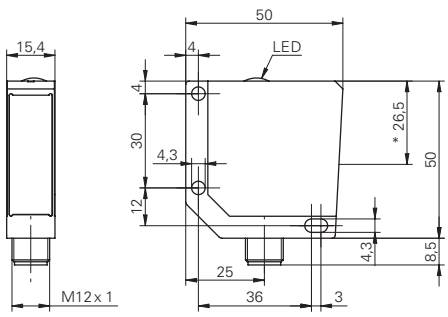
**Sb = 8 m**



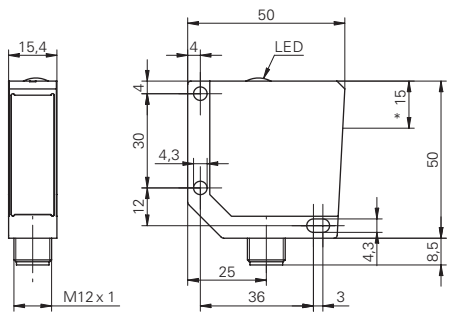

**Sb = 3 m**



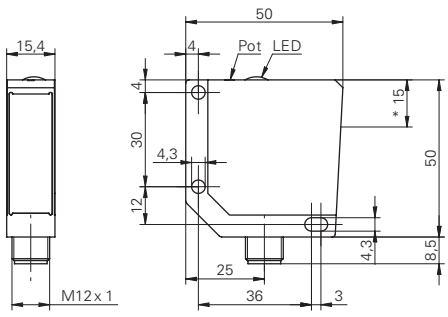

## dimension drawings



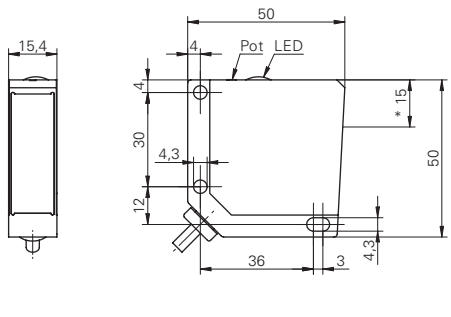

* receiver axis



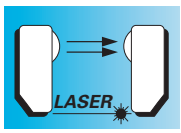

* receiver axis




* receiver axis




* receiver axis

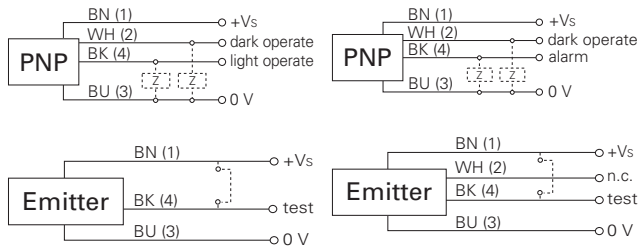



## Sb = 8 m

- long range
- short response time

| general data | |
|---|---|
| type | through beam laser sensor |
| actual range Sb | 8 m |
| **receiver** | |
| nominal range Sn | 10 m |
| alignment / soiled lens indicator | LED green |
| output indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| **emitter** | |
| light source | pulsed red laser diode |
| repeatability | < 0,4 mm at laser focus |
| laser class | 1 |
| distance to laser focus | 400 mm |
| wave length | 675 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,1 ms |
| current consumption max. | 30 mA |
| current consumption typ. | 30 mA |
| voltage drop Vd | < 1,8 VDC |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 75 mA |
| current consumption typ. | 60 mA |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| protection class | IP 67 |
| **receiver** | |
| operating temperature | -25 ... +65 °C |
| **emitter** | |
| operating temperature | 10 ... +50 °C |

**connection diagrams**




| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket emitter | 119373 |
| mounting bracket receiver | 113917 |
| lens cleaning air nozzle bracket | 116407 |
| for details, see accessories section | |

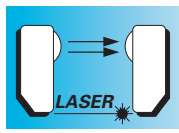
**laser warning**

**CLASS 1 LASER PRODUCT**

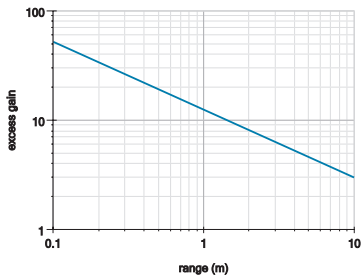
Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26.2001

Complies with EN60825-1:2001

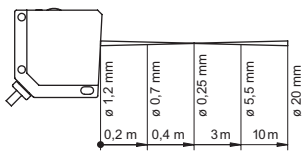
| order reference | emitter / receiver | connection types | output function |
|---|---|---|---|
| **OEDM 16P3401** | receiver | cable 4 pin | alarm output dark |
| **OEDM 16P3401/S14** | receiver | connector M12, 4 pin | alarm output dark |
| **OEDM 16P5101** | receiver | cable 4 pin | light / dark operate |
| **OEDM 16P5101/S14** | receiver | connector M12, 4 pin | light / dark operate |
| **OSDM 16D9601** | emitter | cable 3 pin | - |
| **OSDM 16D9601/S14** | emitter | connector M12, 4 pin | - |



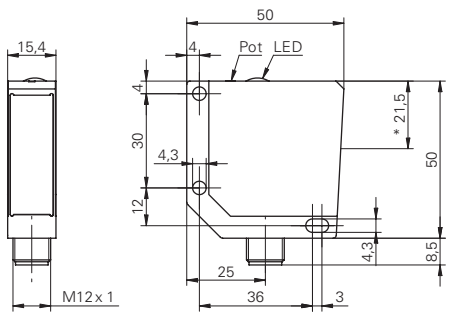

## excess gain curve



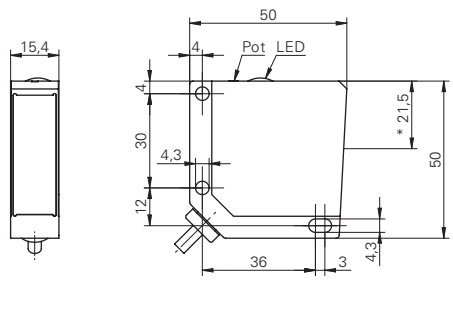

## beam characteristic



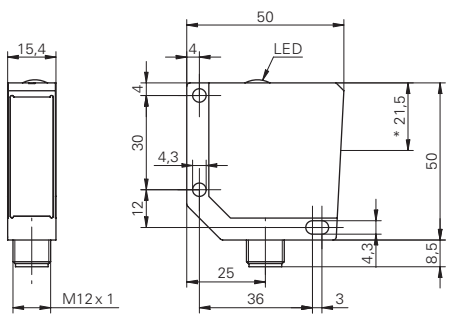

## dimension drawings



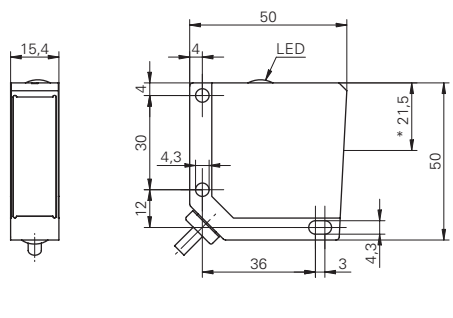

* receiver axis



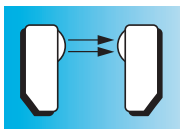

* receiver axis




* emitter axis




* emitter axis

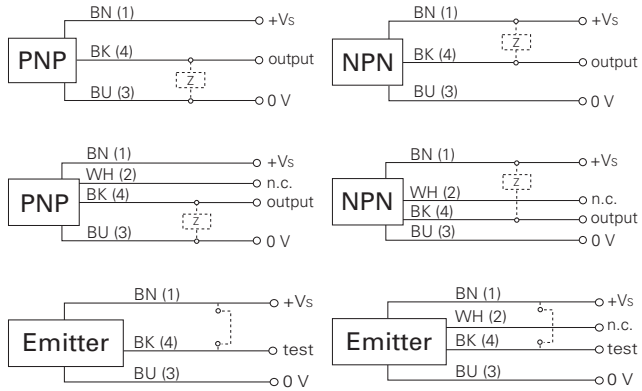


## Sb = 16 m

- subminiature metal housing
- cylindrical design

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 16 m |
| nominal range Sn | 20 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| **emitter** | |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1 ms |
| current consumption max. | 20 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 40 mA |
| current consumption typ. | 30 mA |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| front (optics) | PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |

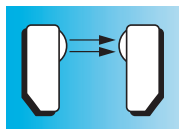
**connection diagrams**



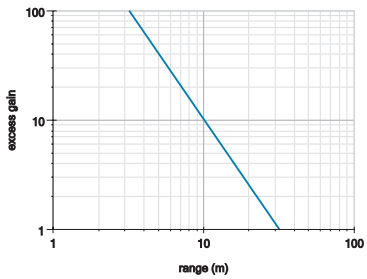

| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151658 |
| glass cover | 103068 |
| cap nut | 101480 |
| for details, see accessories section | |

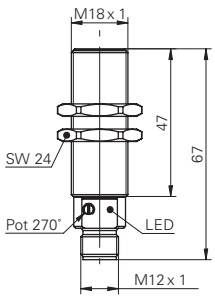
| order reference | emitter / receiver | connection types | height / length | output circuit |
|---|---|---|---|---|
| **FEAM 18N3150** | receiver | cable 3 pin | 57 mm | NPN |
| **FEAM 18N3150/S14** | receiver | connector M12, 4 pin | 67 mm | NPN |
| **FEAM 18P3150** | receiver | cable 3 pin | 57 mm | PNP |
| **FEAM 18P3150/S14** | receiver | connector M12, 4 pin | 67 mm | PNP |
| **FSAM 18D9651** | emitter | cable 3 pin | 57 mm | - |
| **FSAM 18D9651/S14** | emitter | connector M12, 4 pin | 67 mm | - |



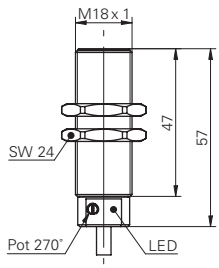
## excess gain curve



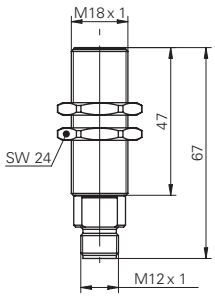

## dimension drawings



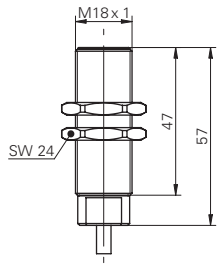

receiver



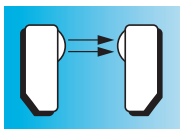

receiver




emitter




emitter

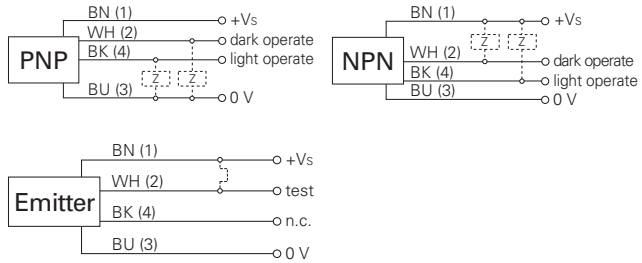


## Sb = 6 m

- cross-technology housing concept
- small mounting depth
- test input

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 6 m |
| nominal range Sn | 8 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | Pot, 270° |
| **emitter** | |
| light source | pulsed red LED |
| wave length | 660 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 0,5 ms |
| current consumption max. | 20 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 25 mA |
| current consumption typ. | 22 mA |
| **mechanical data** | |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | plastic (PBT-ASA) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

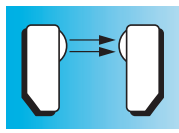
**connection diagrams**



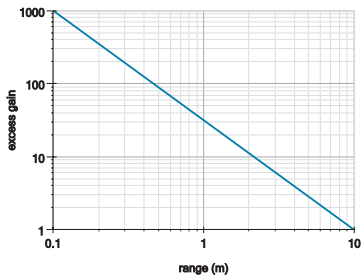

| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| for details, see accessories section | |

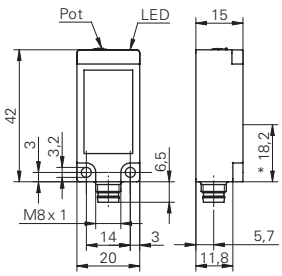
| order reference | emitter / receiver | output circuit |
|---|---|---|
| **FEDK 20N5101/S35A** | receiver | NPN |
| **FEDK 20P5101/S35A** | receiver | PNP |
| **FSDK 20D9601/S35A** | emitter | - |



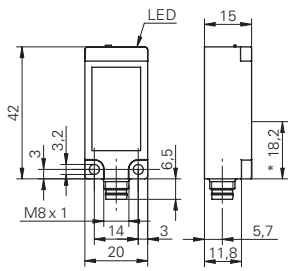
## excess gain curve



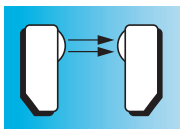

## dimension drawings




* receiver axis




* emitter axis



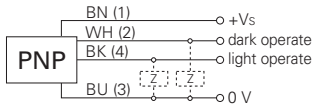
## Sb = 20 m

- long range

| general data | |
|---|---|
| type | through beam sensor |
| actual range Sb | 20 m |
| nominal range Sn | 25 m |
| **receiver** | |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| sensitivity adjustment | no |
| **emitter** | |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| reverse polarity protection | yes |
| **receiver** | |
| response time / release time | < 1 ms |
| current consumption max. | 20 mA |
| current consumption typ. | 20 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output circuit | PNP |
| output current | < 200 mA |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 38 mA |
| current consumption typ. | 28 mA |
| **mechanical data** | |
| width / diameter | 25 mm |
| height / length | 80 mm |
| depth | 58 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| connection types | connector M12, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 67 |

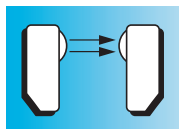
| order reference | emitter / receiver |
|---|---|
| **FEDK 26P5103/S14** | receiver |
| **FSDK 26D9003/S14** | emitter |

**connection diagrams**

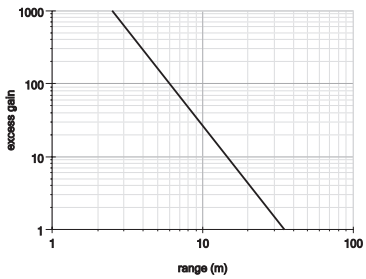



| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

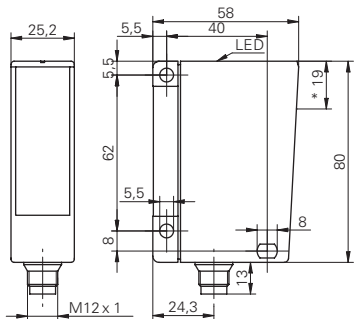
| accessories | |
|---|---|
| mounting bracket | 112477 |
| for details, see accessories section | |



## excess gain curve




## dimension drawing



## red light LED version

| product family | FGUM 030 | FGUM 050 | FGUM 080 | FGUM 020 | FGUM 030 | FGUM 050 | FGUM 080 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 50 mm | 70 mm | 100 mm | 40 mm | 50 mm | 70 mm | 100 mm |
| fork width Sb | 30 mm | 50 mm | 80 mm | 20 mm | 30 mm | 50 mm | 80 mm |
| response time / release time | < 0,166 ms | < 0,166 ms | < 0,166 ms | < 0,125 ms | < 0,125 ms | < 0,125 ms | < 0,125 ms |
| sensitivity adjustment | Teach-in: button / remote | Teach-in: button / remote | Teach-in: button / remote | Pot, 270° | Pot, 270° | Pot, 270° | Pot, 270° |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | | | | | | | |
| connector | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| housing material | metal | metal | metal | metal | metal | metal | metal |
| | | | | | | | |
| **Page** | **427** | **428** | **429** | **430** | **431** | **432** | **433** |

## laser version

| product family | OGUM 030 | OGUM 050 | OGUM 080 | OGUM 120 |
|---|---|---|---|---|
| | | | | |
| width / diameter | 60 mm | 80 mm | 110 mm | 150 mm |
| fork width Sb | 30 mm | 50 mm | 80 mm | 120 mm |
| response time / release time | < 0,166 ms | < 0,166 ms | < 0,166 ms | < 0,166 ms |
| sensitivity adjustment | Pot, 270° | Pot, 270° | Pot, 270° | Pot, 270° |
| PNP | ■ | ■ | ■ | ■ |
| connector | ■ | ■ | ■ | ■ |
| housing material | metal | metal | metal | metal |
| | | | | |
| **Page** | **435** | **436** | **437** | **438** |

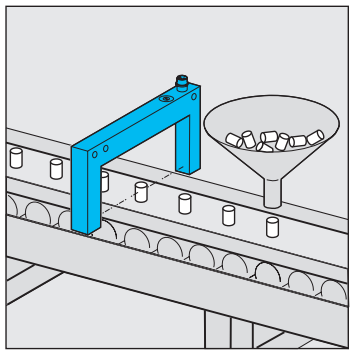
| FGUM 120 | FGLM 050 | FGLM 080 | FGLM 120 | FEG 12 | FGDK 28 | FEG 14 |
|---|---|---|---|---|---|---|
| | | | | | | |
| 144 mm | 75 mm | 105 mm | 150 mm | 12 mm | 28 mm | 14 mm |
| 120 mm | 60 mm | 100 mm | 158 mm | 3 mm | 2,7 mm | 3 mm |
| < 0,25 ms | < 0,125 ms | < 0,125 ms | < 0,25 ms | < 0,01 ms | < 0,01 ms | < 0,01 ms |
| Pot, 270° | Pot, 270° | Pot, 270° | Pot, 270° | no | no | no |
| ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | | | |
| metal | metal | metal | metal | metal | plastic | metal |
| | | | | | | |
| **434** | **439** | **440** | **441** | **442** | **443** | **444** |

Fork and angle sensors consist of an emitter and a receiver which are already optimally aligned to each other and installed in a torsionally rigid metal housing. This permits highly accurate detection and positioning of objects, as is demanded in automatic feeders, vibration conveyors and other applications. The precision collimator optics ensure high repeatability. Equipped with a laser light source, fork sensors can even position the smallest parts in the micron range. Time-consuming alignment and adjustment as is usual with through beam sensors is unnecessary. In contrast with through beam sensors, the wiring is also limited to just one cable connection.

## Typical applications

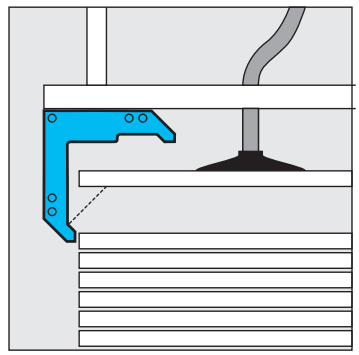
Due to their simple handling and the optimally aligned optics, fork and angle sensors are highly versatile in use. To achieve the best possible installation, different fork spans as well as U and L-shaped versions are available.

### Detection and positioning



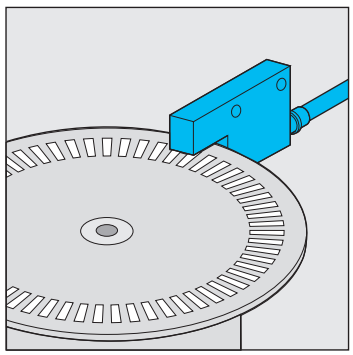
Detection of very small objects down to 50 µm in an automatic feeder

### Stack height monitoring



Monitoring stack heights of cardboard sheets

### Angular speed monitoring



Angular speed monitoring of shafts using pulse disks

# Fork / angle sensors

## Characteristics and advantages

Little installation and adjustment work
The emitter and receiver are already optimally aligned to each other in a torsionally rigid metal housing.

Innovative shapes
The special L-shape of the angle sensor permits an optimum approach to the optical axis.

Fast processes
Switching frequencies of up to 50 kHz permit angular speed measurement.

Rugged
Use also in harsh ambient conditions due to metal housing and protection class IP 67.

## Technology and operation

The fundamental principle of the fork and angle sensors is equivalent to the through beam sensors.

The scratch-resistant, mineral glass collimator optics used in the fork and angle sensors FGUM/FGLM and OGUM produces a homogenous, very narrow light beam. This feature is the reason for the high detection accuracy of the sensor, which is guaranteed over the entire beam range from all sides. The largest laser fork sensor can reliably and repeatably detect an object 50 µm small over the entire range of 120 mm.

The almost parallel light beam and the small beam angle of the receiver optics makes it possible to install the fork and angle sensors closely adjacent to each other without interfering with each other. In this way, it is possible to implement small light barriers.

For sensitivity adjustment, there is an option between two different adjustment methods – simple manual adjustment of the sensitivity using a potentiometer or variable adjustment facilities by automatic teach-in.

Potentiometer
Simple sensitivity adjustment with mechanical 270° potentiometer directly on the fork sensor.

Teach-In
Rapid and simple commissioning in practical use is possible using the teach-in function. Programming can be conducted either with the integrated Teach-in button or via the external Teach-in cable.

## Mounting and adjustment

The almost parallel light beam and the small beam angle of the receiver optics makes it possible to install the fork and angle sensors closely adjacent to each other without interfering with each other. In this way, it is possible to construct small light barriers. Attach the fork / angle sensors so that the object can pass freely through the monitored area. External light impinging directly at the receiver side should be avoided.

### Potentiometer adjustment

The sensitivity is highest when the potentiometer is turned fully counter clockwise. The smallest possible parts are thereby detected. The power of the beam is then smallest. When the potentiometer is turned fully clockwise, the sensitivity is lowest. Only larger parts are detected. The power of the beam is highest and the fork / angle sensor has a high excess gain to combat dirt.

### Teach-in adjustment

With the dynamic Teach-in, the sensor is able to calculate the optimum sensitivity in the running process. This makes completely new applications possible. For example, the smallest objects can be taught in without precise positioning simply by passing the light beam.

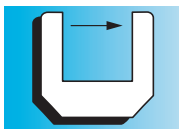
To initiate the dynamic Teach-in procedure, the yellow Teach-in button must be held depressed for 2 seconds. At least two objects should pass the light beam of the fork sensor in the following 2-4 seconds of the active Teach-in phase. The LED indicates the active Teach-in phase by rapid flashing. When the Teach-in procedure has been completed successfully, this is made clearly visible by two flashes of the LED.

The active Teach-in phase can be determined individually by an external Teach-in facility. The longer a pulse is applied to the external Teach-in cable, the longer the sensor learns of its surroundings. When the external Teach-in facility is employed, the Teach-in button can also be automatically disabled.

### Adjustment of light/dark switching

The output functions NO (dark-switching) and NC (light-switching) can be adjusted using a rotary switch. The required switch position can be seen from the type plate. To prevent unintended switching, the rotary switch is covered by a rubber cap.

Important: always set the switch for the output function fully clockwise or counter clockwise. Intermediate positions lead to undefined output states.



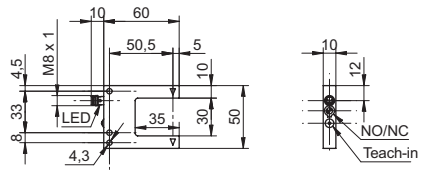
## Sb = 30 mm

- fast version available
- smallest detectable object 0,8 mm
- rugged metal housing

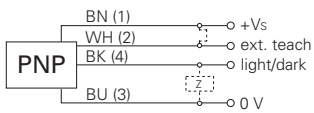
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,3 mm |
| repeatability | < 0,03 mm |
| hysteresis | < 0,1 mm |
| ambient light immunity | 20 kLux |
| sensitivity adjustment | Teach-in: button / remote |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 50 mm |
| fork width Sb | 30 mm |
| height / length | 60 mm |
| penetration depth | 35 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

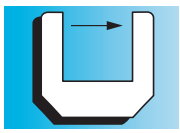
| order reference |
|---|
| **FGUM 030P6901/S35A** |

**dimension drawing**




**connection diagram**





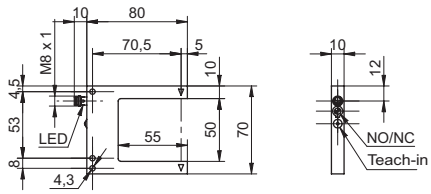
## Sb = 50 mm

- fast version available
- smallest detectable object 0,8 mm
- rugged metal housing

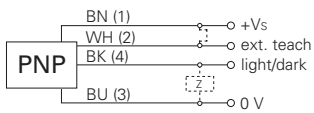
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,3 mm |
| repeatability | < 0,03 mm |
| hysteresis | < 0,1 mm |
| ambient light immunity | 20 kLux |
| sensitivity adjustment | Teach-in: button / remote |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 70 mm |
| fork width Sb | 50 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

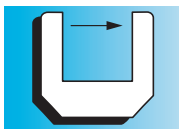
| order reference |
|---|
| **FGUM 050P6901/S35A** |

**dimension drawing**




**connection diagram**



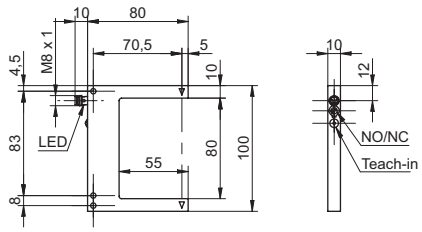


# Sb = 80 mm

- fast version available
- smallest detectable object 0,8 mm
- rugged metal housing

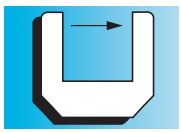
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,3 mm |
| repeatability | < 0,03 mm |
| hysteresis | < 0,1 mm |
| ambient light immunity | 20 kLux |
| sensitivity adjustment | Teach-in: button / remote |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 100 mm |
| fork width Sb | 80 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

**dimension drawing**




**connection diagram**

| order reference |
|---|
| **FGUM 080P6901/S35A** |

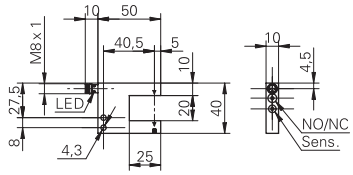


## Sb = 20 mm

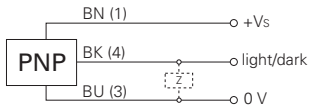
- sensitivity adjustable via potentiometer
- fork width 20 mm
- rugged metal housing

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,4 mm |
| repeatability | < 0,02 mm |
| hysteresis | < 0,1 mm |
| ambient light immunity | 50 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 40 mm |
| fork width Sb | 20 mm |
| height / length | 50 mm |
| penetration depth | 25 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

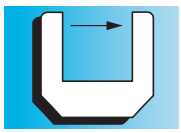
**dimension drawing**




**connection diagram**




| order reference |
|---|
| **FGUM 020P8001/S35L** |



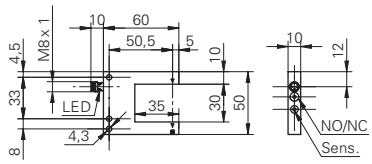
## Sb = 30 mm

- sensitivity adjustable via potentiometer
- fork width 30 mm
- rugged metal housing

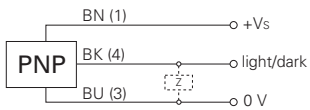
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,5 mm |
| repeatability | < 0,02 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 140 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 50 mm |
| fork width Sb | 30 mm |
| height / length | 60 mm |
| penetration depth | 35 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

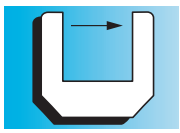
| order reference |
|---|
| **FGUM 030P8001/S35L** |

**dimension drawing**




**connection diagram**





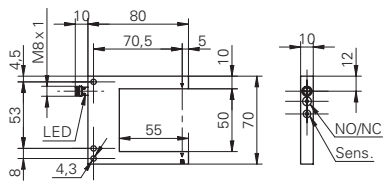
## Sb = 50 mm

- sensitivity adjustable via potentiometer
- fork width 50 mm
- rugged metal housing

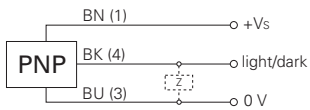
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,5 mm |
| repeatability | < 0,04 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 80 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 70 mm |
| fork width Sb | 50 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

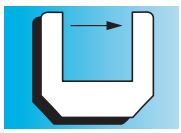
| order reference |
|---|
| **FGUM 050P8001/S35L** |

**dimension drawing**




**connection diagram**





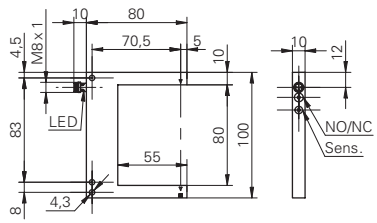
# Sb = 80 mm

- sensitivity adjustable via potentiometer
- fork width 80 mm
- rugged metal housing

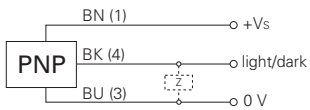
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,5 mm |
| repeatability | < 0,06 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 80 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 100 mm |
| fork width Sb | 80 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

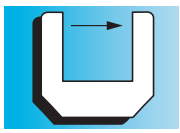
| order reference |
|---|
| **FGUM 080P8001/S35L** |

**dimension drawing**




**connection diagram**



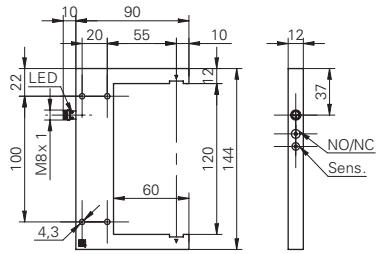


## Sb = 120 mm

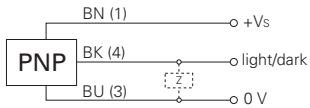
- sensitivity adjustable via potentiometer
- fork width 120 mm
- rugged metal housing

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,8 mm |
| repeatability | < 0,06 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 50 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,25 ms |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 40 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 144 mm |
| fork width Sb | 120 mm |
| height / length | 90 mm |
| penetration depth | 60 mm |
| depth | 12 mm |
| type | U profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

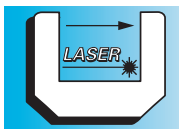
**dimension drawing**




**connection diagram**




| order reference |
|---|
| **FGUM 120P8001/S35L** |

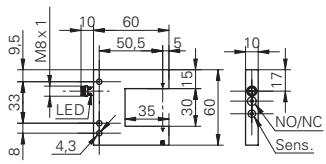



# Sb = 30 mm

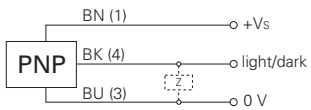
- precise laser fork sensor in rugged metal housing
- smallest detectable object 0.05 mm
- high repeatability

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,05 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,02 mm |
| ambient light immunity | 100 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 60 mm |
| fork width Sb | 30 mm |
| height / length | 60 mm |
| penetration depth | 35 mm |
| depth | 10 mm |
| type | U profile |
| housing material | aluminum anodized |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | 5 ... +45 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

**dimension drawing**

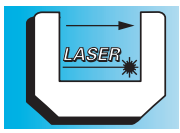



**connection diagram**




**laser warning**

| order reference |
|---|
| **OGUM 030P8001/S35L** |

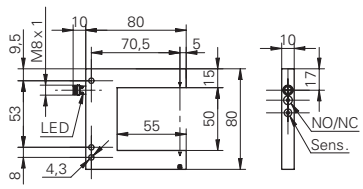



## Sb = 50 mm

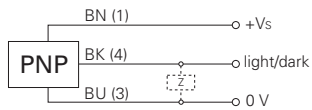
- precise laser fork sensor in rugged metal housing
- smallest detectable object 0,05 mm
- high repeatability

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,05 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,02 mm |
| ambient light immunity | 100 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 80 mm |
| fork width Sb | 50 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | aluminum anodized |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | 5 ... +45 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

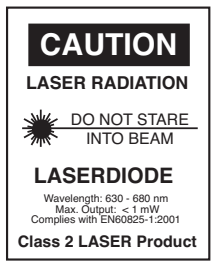
**dimension drawing**




**connection diagram**

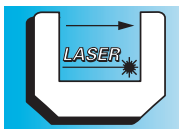



**laser warning**




**order reference**

| OGUM 050P8001/S35L |
|---|




# Sb = 80 mm

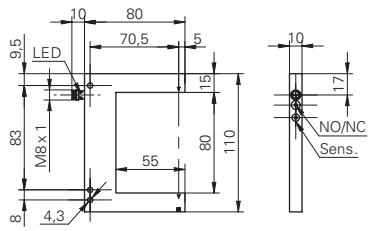
- precise laser fork sensor in rugged metal housing
- smallest detectable object 0,05 mm
- high repeatability

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,05 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,02 mm |
| ambient light immunity | 100 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 110 mm |
| fork width Sb | 80 mm |
| height / length | 80 mm |
| penetration depth | 55 mm |
| depth | 10 mm |
| type | U profile |
| housing material | aluminum anodized |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | 5 ... +45 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

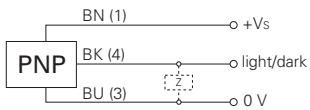
**order reference**

**OGUM 080P8001/S35L**

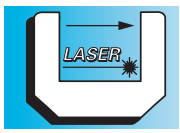
**dimension drawing**




**connection diagram**




**laser warning**




## Sb = 120 mm

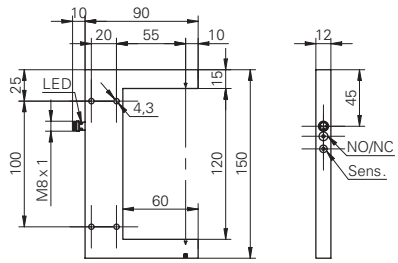
- precise laser fork sensor in rugged metal housing
- smallest detectable object 0,05 mm
- high repeatability

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,05 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,02 mm |
| ambient light immunity | 100 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,166 ms |
| switching frequency | < 3 kHz |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 150 mm |
| fork width Sb | 120 mm |
| height / length | 90 mm |
| penetration depth | 60 mm |
| depth | 12 mm |
| type | U profile |
| housing material | aluminum anodized |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | 5 ... +45 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

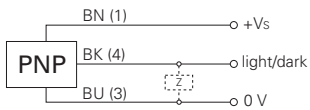
**order reference**

**OGUM 120P8001/S35L**

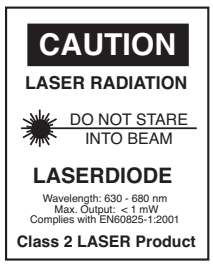
**dimension drawing**

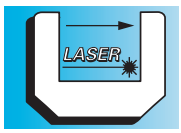



**connection diagram**




**laser warning**





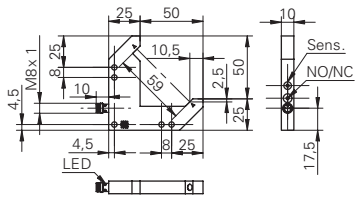

# Sb = 60 mm

- optical axis approachable in x-, y- and z-direction
- smallest detectable object 0,5 mm
- rugged metal housing

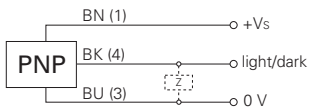
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,5 mm |
| repeatability | < 0,06 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 80 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 75 mm |
| fork width Sb | 60 mm |
| height / length | 75 mm |
| penetration depth | 50 mm |
| depth | 10 mm |
| type | L profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

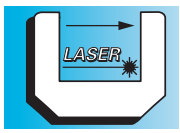
| order reference |
|---|
| **FGLM 050P8001/S35L** |

**dimension drawing**




**connection diagram**



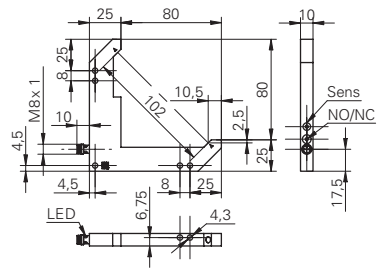



## Sb = 100 mm

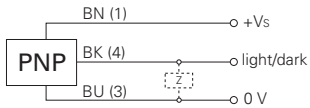
- optical axis approachable in x-, y- and z-direction
- smallest detectable object 0,07 mm
- rugged metal housing

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,7 mm |
| repeatability | < 0,06 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 70 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,125 ms |
| switching frequency | < 4 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 30 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 105 mm |
| fork width Sb | 100 mm |
| height / length | 105 mm |
| penetration depth | 80 mm |
| depth | 10 mm |
| type | L profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

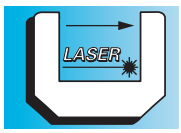
**dimension drawing**




**connection diagram**




| order reference |
|---|
| **FGLM 080P8001/S35L** |



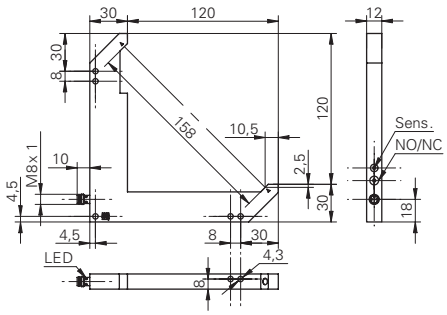

# Sb = 158 mm

- optical axis approachable in x-, y- and z-direction
- smallest detectable object 1 mm
- rugged metal housing

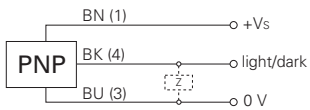
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 1 mm |
| repeatability | < 0,06 mm |
| hysteresis | < 0,25 mm |
| ambient light immunity | 50 kLux |
| sensitivity adjustment | Pot, 270° |
| light source | pulsed red LED |
| wave length | 660 nm |
| light indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,25 ms |
| switching frequency | < 2 kHz |
| voltage supply range +Vs | 10 ... 35 VDC |
| current consumption max. | 40 mA |
| output function | light / dark operate switchable |
| output circuit | PNP |
| voltage drop Vd | < 2,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 150 mm |
| fork width Sb | 158 mm |
| height / length | 150 mm |
| penetration depth | 120 mm |
| depth | 12 mm |
| type | L profile |
| housing material | die-cast zinc |
| connection types | connector M8, 3 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 32SH0200 3 pin | 2 m straight |
| ESW 31SH0200 3 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| PNP to NPN-converter | 149587 |
| for details, see accessories section | |

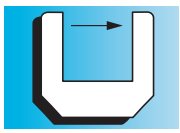
| order reference |
|---|
| **FGLM 120P8001/S35L** |

**dimension drawing**




**connection diagram**

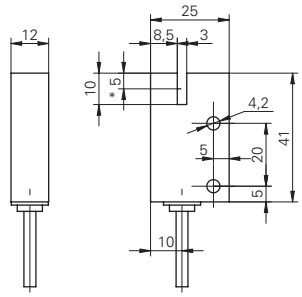




- 3 mm fork opening
- switching frequency up to 50 kHz
- smallest detectable object 0,8 mm

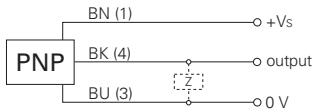
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,8 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,1 mm |
| sensitivity adjustment | no |
| light source | non-pulsed infrared diode |
| wave length | 935 nm |
| **electrical data** | |
| response time / release time | < 0,01 ms |
| switching frequency | < 50 kHz |
| voltage supply range +Vs | 4,5 ... 30 VDC |
| current consumption max. | 24 mA |
| output circuit | PNP |
| voltage drop Vd | < 1 VDC |
| output current | < 100 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 12 mm |
| fork width Sb | 3 mm |
| height / length | 41 mm |
| penetration depth | 10 mm |
| depth | 25 mm |
| type | rectangular |
| housing material | brass nickel plated |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |
| **accessories** | |
| pulse disk | IPS 70 |
| for details, see accessories section | |

**dimension drawing**

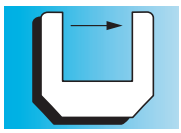



* emitter axis

**connection diagram**



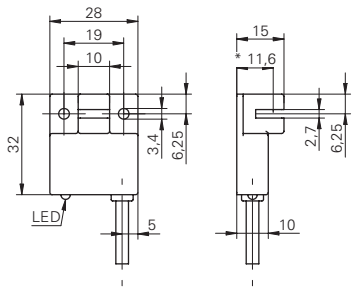

| order reference | output function |
|---|---|
| **FEG 12.24.35** | dark operate |
| **FEG 12.24.45** | light operate |



- 2,7 mm fork opening
- switching frequency up to 50 kHz
- smallest detectable object 0,8 mm

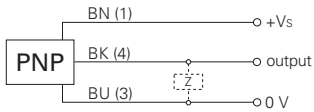
| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,8 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,1 mm |
| sensitivity adjustment | no |
| light source | non-pulsed infrared diode |
| wave length | 935 nm |
| output indicator | LED yellow |
| **electrical data** | |
| response time / release time | < 0,01 ms |
| switching frequency | < 50 kHz |
| voltage supply range +Vs | 4,5 ... 30 VDC |
| current consumption max. | 25 mA |
| output circuit | PNP |
| voltage drop Vd | < 1 VDC |
| output current | < 100 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 28 mm |
| fork width Sb | 2,7 mm |
| height / length | 32 mm |
| penetration depth | 5 mm |
| depth | 15 mm |
| type | rectangular |
| housing material | polyamid |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 65 |
| **accessories** | |
| pulse disk | IPS 70 |
| for details, see accessories section | |

**dimension drawing**

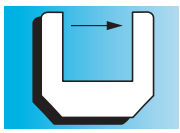



* emitter axis

**connection diagram**




| order reference | output function |
|---|---|
| **FGDK 28P1001** | light operate |
| **FGDK 28P3001** | dark operate |

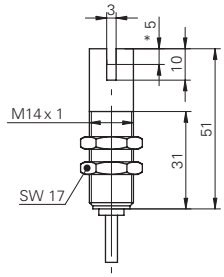


- 3 mm fork opening
- switching frequency up to 50 kHz
- smallest detectable object 0,8 mm

| general data | |
|---|---|
| type | through beam sensor |
| object size | > 0,8 mm |
| repeatability | < 0,01 mm |
| hysteresis | < 0,1 mm |
| sensitivity adjustment | no |
| light source | non-pulsed infrared diode |
| wave length | 935 nm |
| **electrical data** | |
| response time / release time | < 0,01 ms |
| switching frequency | < 50 kHz |
| voltage supply range +Vs | 4,5 ... 30 VDC |
| current consumption max. | 24 mA |
| output function | dark operate |
| output circuit | PNP |
| voltage drop Vd | < 1 VDC |
| output current | < 100 mA |
| short circuit protection | no |
| reverse polarity protection | yes, Vs to GND |
| **mechanical data** | |
| width / diameter | 14 mm |
| fork width Sb | 3 mm |
| height / length | 51 mm |
| penetration depth | 10 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |
| **accessories** | |
| pulse disk | IPS 70 |
| for details, see accessories section | |

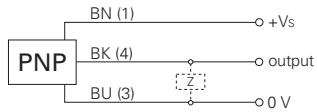
| order reference |
|---|
| **FEG 14.24.35** |

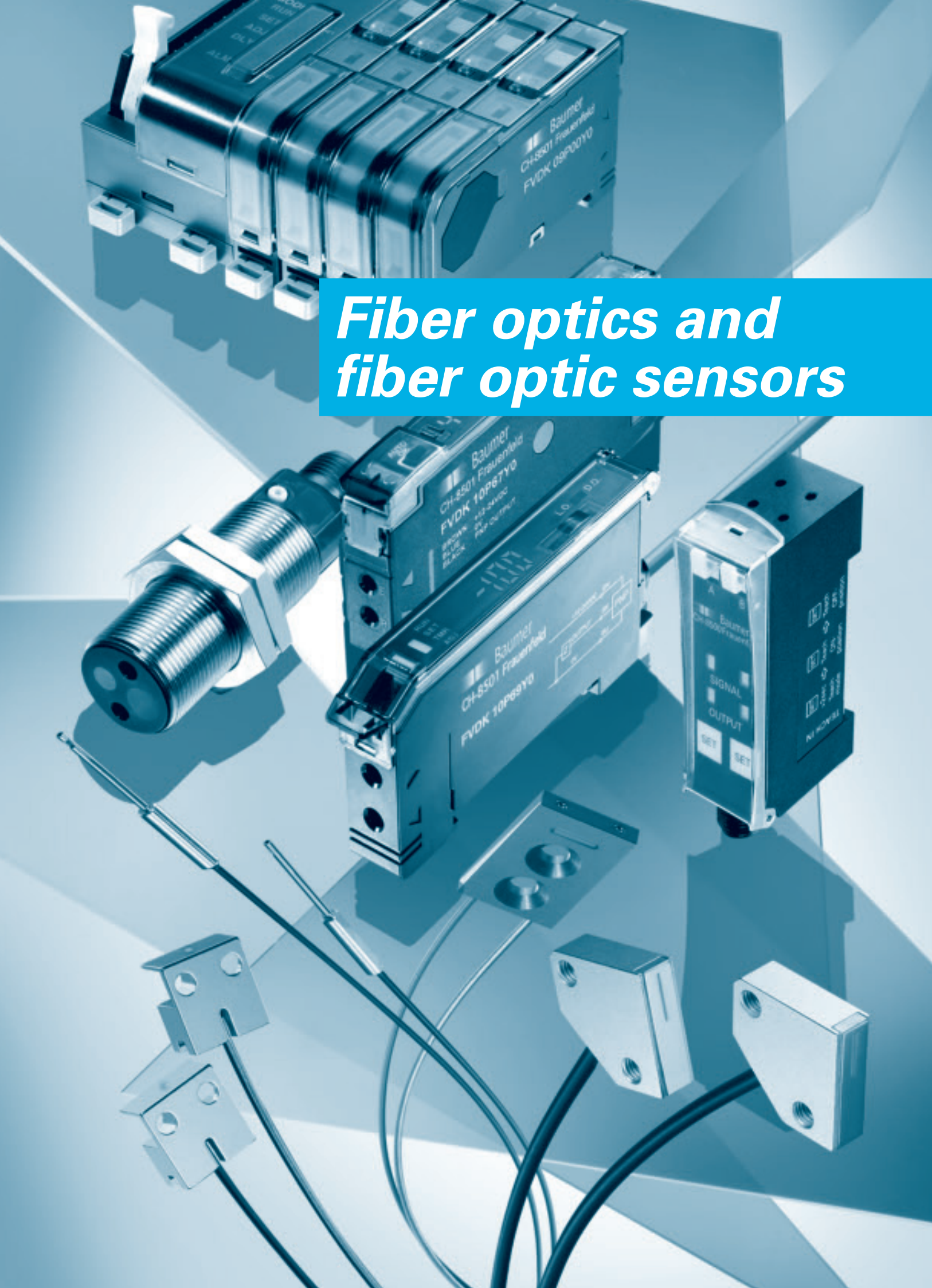
**dimension drawing**




* emitter axis

**connection diagram**






# Fiber optics and fiber optic sensors

| product family | FVDK 10 | FVDK 67 | FVDK 67 | FVDK 67 | FVDK 69 | FVDK 60 | FVDK 12 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 10,4 mm | 10 mm | 10 mm | 10 mm | 10 mm | 10 mm | 12 mm |
| actual range Sb (FSE 200C1002) | 160 mm | 1200 mm | 1200 mm | 1200 mm | 1400 mm | 320 mm | 320 mm |
| sensing distance Tw (FUE 200C1003) | 45 mm | 300 mm | 300 mm | 300 mm | 340 mm | 90 mm | 90 mm |
| response time / release time | < 1 ms | 0,05 ... 5 ms (adjustable) 0,058 ... 5 ms (adjustable) | 0,05 ... 5 ms (adjustable) 0,058 ... 5 ms (adjustable) | 0,14 ... 5 ms (adjustable) | 0,12 ... 5 ms (adjustable) | < 0,5 ms | < 1 ms |
| analog 1 ... 5 VDC | | | | | | | |
| NPN | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| connector | ■ | ■ | | | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | plastic | plastic | plastic | plastic |
| | | | | | | | |
| **Page** | **452** | **454** | **455** | **456** | **457** | **458** | **459** |

| product family | FVDK 12 | FVDK 22 | FVDK 31 | FVDK 09 | FVDK 80 | FWDK 84 |
|---|---|---|---|---|---|---|
| | | | | | | |
| width / diameter | 12 mm | 22 mm | 31 mm | 9 mm | 10 mm | 10 mm |
| actual range Sb (FSE 200C1002) | 140 mm | 320 mm | | 320 mm | 100 mm 240 mm 440 mm | 90 mm |
| sensing distance Tw (FUE 200C1003) | 40 mm | 90 mm | | 90 mm | 30 mm 70 mm 120 mm | 25 mm |
| response time / release time | < 0,05 ms | < 1 ms | < 1 ms | | < 0,05 ms (release time +0,02 ms) < 0,5 ms | 1 ... 50 ms (adjustable) |
| analog 1 ... 5 VDC | | | | | | ■ |
| NPN | | ■ | ■ | | ■ | |
| PNP | ■ | ■ | ■ | | ■ | |
| cable | | ■ | | | ■ | ■ |
| connector | ■ | ■ | ■ | | ■ | |
| housing material | plastic | plastic | plastic | plastic | plastic | plastic |
| | | | | | | |
| **Page** | **460** | **461** | **462** | **463** | **464** | **465** |

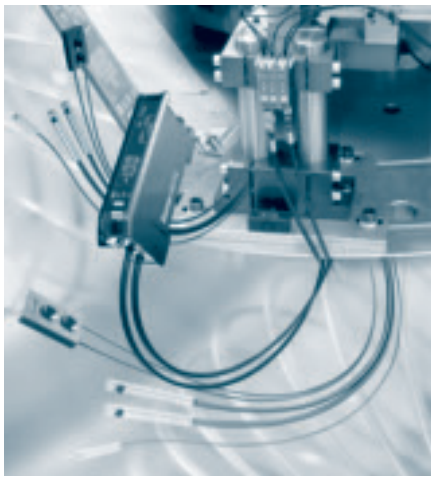
* for fiber optics see page 466 - 473

# Plastic fiber optic sensors

## General information

Fiber optics are the extended vision of conventional sensors and, due to their miniature construction, can be installed directly in the most difficult ambient conditions. As only light is conveyed, fiber optics are intrinsically safe, which adds to their range of applications.

Plastic fiber optics are characterized primarily by the properties of the employed raw material – the plastic. Advances in the manufacture of plastics permit bending radii of just 1 mm for the optical fibers, which is completely impossible for glass fibers. Fiber materials are now available which are extremely tolerant to bending and thereby make their use in drag chains possible.



## Typical applications

Due to their versatility, optical fibers can be used in the most diverse applications. The small, space-saving sensing heads are very suitable for use in very constricted conditions. It is also possible to monitor whole areas or execute precise positioning by the different arrangements of the fibers.

- Due to the light weight and space-saving construction, optical fibers can be integrated directly in pick & place tools
- Detection, differentiation and positioning of the most diverse objects
- Monitoring of whole areas with fiber optic arrays with linear fiber arrangement
- Use at high, low or constantly fluctuating ambient temperatures
- Detection of levels or leaks, including hazardous liquids
- Detection of transparent media such as glass, wafers or films with focused fiber optic reflective types

## Characteristics and advantages

**Independent of the surroundings**
As only light is conveyed, electromagnetic fields, high or low temperatures have no effect on the functional reliability.

**Space-saving**
The smallest sensing heads have a diameter of 1,5 mm and are only 10 mm long. With bending radii of just 1 mm, it is possible to integrate the eye of the sensor even in the most constricted places.

**Precise light spots**
Fiber cross-sections of only 0,25 mm generate a fine core beam in fiber optic through beam types, whereas doubling lenses in fiber optic reflective types permit precise light spots of 0,1 mm.

**Application-specific fiber arrangement**
The coaxial fiber arrangement permits optimum light distribution over the receiver fibers and thereby makes precise positioning of objects possible. Also, fiber optic arrays with a linear fiber arrangement allow a whole area to be monitored or the detection of randomly conveyed objects.

**Application feedback**
Multi-digit displays integrated in the fiber optic sensors permit the stability of the application to be assessed and make fault analyses possible.

**Fast processes**
Fiber optic sensors with response times of only 50 microseconds allow the detection of objects even in very fast processes.

## Technology and operation

The technology is based on intensity differences. The fiber optic through beam types detect an object breaking the light beam between the emitter and receiver. The fiber optic reflective types evaluate the amount of light reflected back from an object. The high-resolution analog/digital conversion in the fiber optic sensors permits very slight changes to be evaluated. This is important where the detection of small objects or differentiation of the finest contrasts is concerned.

Fundamentally, the fiber optics form a unit with the corresponding processing units, and the type of fiber optic head is mainly decisive for the detection of objects. The table below is intended to provide aid in understanding the large range of different sensing heads:

| Version/type | Properties | Field of application | Example types |
|---|---|---|---|
| Standard | Large selection of different shapes.<br>Economical | Standard applications, simple object detection | FUE 200C1002<br>FUE 200C1004 |
| Coaxial | Homogenous light distribution over all receiver fibers.<br>Lens adaptation possible | Optimally suited for positioning tasks.<br>Highly accurate in combination with focusing lenses | FCE 200C1Y00<br>FCE 200D1Y00 |
| Side light exit | 90° light exit<br>Reduced beam angle<br>More installation space | Constricted conditions | FUE 200C4Y00<br>FSE 200C4002 |
| Array | Linear arrangement of the fibers.<br>Line lengths of 5,25 - 21mm.<br>Reflective or through beam types | Detection of objects which cannot be precisely conveyed.<br>Measurement of object sizes or edge positions | FUE 200C6Y00<br>FSE 200C6Y00 |
| Longer range<br>Parallel beam | Integrated lens<br>Small beam angle<br>Long range | Object detection and positioning over a long distance.<br>No influencing by interfering objects close to the optical fiber | FLE 200C1Y00<br>FPE 200C1Y00 |
| Highly flexible | Min. bending radius down to 1mm<br>Suitable for flexible installation | Constricted conditions | FUE 200E1Y00<br>FSE 200F6Y00 |
| Bendable | Extremely bendable, designed for bending more than 1 million times. | For use in drag chains or on moving parts | FUE 100E2Y00<br>FSE 200D1Y50 |
| Small light spot | In combination with focusing lenses, a light spot of only 0,1mm can be produced. | Detection of very small objects<br>Highly accurate edge positioning | FCE 050C1Y10<br>with lens 134544 |
| Level detection | Special sensing tip to avoid liquid residues.<br>Version for pipe/hose fitting | Detection of levels in different liquids, in or out of contact | FUL 200D2Y00<br>FSL 500C6Y00 |

## Fiber optic sensors of the ranges FVDK 67 and FVDK 69 – versatile and multifunctional

The generation of multifunction fiber optic sensors is particularly suitable for handling processes, where very fast movements as well as exact positioning or the detection of very small objects is important. A single sensor undertakes the tasks which were formerly performed by many different sensors. The user can choose from 3 to 8 different operating modes from very short response time to high sensitivity to adapt the sensor optimally to his application. Despite the all-in-one concept, the requirement for simple operation is also fulfilled.

## Characteristics and advantages

### Comprehensive functions

Up to 7 different teach-in functions are integrated. For example, apart from the usual 2-point Teach-in method, there is also electronic background suppression or a dynamic teach-in function with which the fiber optic sensor automatically calculates the optimum switching point from the received signals. Integrated timer functions, closing and opening delays are adjustable in small steps from 250 µs to max. 20 s.

### Application feedback

The application feedback is particularly important during commissioning if consistent detection is to be ensured. The switching point and the relative received signal are indicated simultaneously on the 2x4-digit display of the FVDK 67 range. With this information, it can be determined at a glance whether the switching point has been optimally adjusted.

### High resolution

Usually, the range is subdivided statically by a 12-bit A/D converter into 4096 individual, processable steps. In contrast to this, the FVDK 69 range offers a dynamic resolution with which the fiber optic sensor automatically selects the optimum resolution according to the range. The advantage of this is clearly in the detection of very small objects or of fine contrasts at short range.

## The advantages at a glance

### Type FVDK 67

- 8 operating modes and up to 6 different Teach-in functions available
- Switching point adjustment with Teach-in button or directly manual with +/- button
- 2x4-digit display, the switching point and received signal are indicated simultaneously
- Integrated interlock function to prevent undesired manipulation
- Up to 3 optical fibers can be installed directly adjacent to each other without optical interference
- Application-specific versions with external Teach-in and Teach-in feedback output or with 2 individually adjustable switching outputs

## The advantages at a glance

Type FVDK 69

- 3 operating modes and 7 different Teach-in functions available
- Switching point adjustment with push-and-twist knob
- 1x3-digit display indicates the relative receiving signal
- Dynamic 10-bit resolution, optimized for detection of small objects or fine contrasts at close range
- Version with blue light source, permitting red and white marks to be discerned
- Adjustable protection against optical interference between two optical fibers

## Teach-in or potentiometer? Just simple operation

The fiber optic sensors of the FVDK12, 22, 60, 80 and FWDK 84 ranges are characterized particularly by their simple handling. The sensitivity can be adjusted either with a potentiometer or a Teach-in button. Differently colored LEDs or simple displays provide the adjustment feedback. The sensor ranges differ primarily in their speed, sensitivity, hysteresis functions and supplementary functions such as timers, external Teach-in or logical output gates. However, all have the same thing in common: regardless of where the sensor is installed, the adjustment can be made practically without the need for operating instructions.

## The advantages at a glance

Type FVDK 12

- Integrated, dynamic Teach-in permits the most reliable detection of moving objects or small parts for which it is difficult to find an exact Teach-in position
- High-speed version with a response time of only 50 µs
- Integrated alarm output warns in advance of excessive soiling
- Protection class IP65

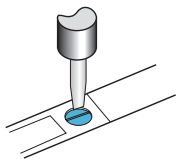
Type FVDK 22

- Two sensors in one housing reduces the necessary wiring
- The two integrated sensors do not interfere with each other
- It is possible to link the two outputs logically
- Version with external Teach-in from the controller

## The advantages at a glance

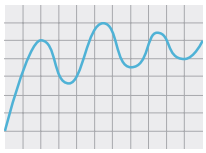
Type FVDK 60

- The switching point and the relative receiving signal are visible on the 1-digit display
- Teach-in errors are indicated directly on the display
- Protection against optical interference between up to 3 optical fibers
- Version with external teach-in from the controller



Type FVDK 80

- 3-turn potentiometer permits accurate adjustment of the sensitivity
- Version with low hysteresis of 10% (full scale) permits accurate positioning
- High-speed version with a response time of only 50 µs
- Integrated alarm output warns in advance of excessive soiling
- Protection against optical interference between up to 3 optical fibers



Type FWDK 84

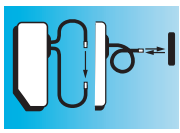
- Analog voltage output 1–5 VDC
- Adjustable resolution of 0,3 to 6% (full scale)
- In combination with a fiber optic array, object sizes or positions can be determined within a range of up to 21 mm

## Master/slave sensors – modular construction reduces the necessary wiring

The wiring of a machine represents a cost and time expenditure which must not be underestimated. The power supply and all output signals of the FVDK 31 range are connected to the controller by only one multi-core cable. Sensor groups can also be formed. The sensors are configured via the master, which is equipped with 2 JOG-dial rotary switches. A total of 7 different teach-in functions are available, which can be used individually for your application. The received signal of the individual slave unit is indicated on the easily legible display.

## The advantages at a glance

- Up to 16 slaves can be programmed simultaneously via one master
- The 3-digit display indicates the reception level of each selected slave
- The wiring of the individual slave outputs is unnecessary due to plug connectors at the sides
- Up to 5 sensor groups can be formed, which can be connected with a cable of max. 2 m length
- 7 different teach-in functions and adjustable opening/closing delay
- Protection against optical interference between up to 4 optical fibers
- The side plug connector technique permits the replacement of individual units without having to detach the entire block

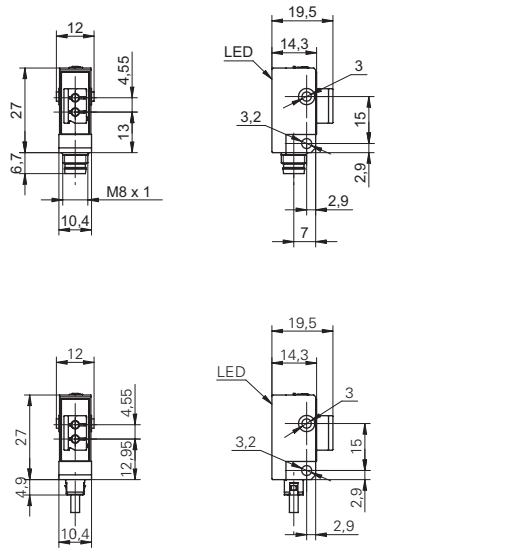


## Sb = 160 mm
## Tw = 45 mm

- sensitivity adjustable via potentiometer
- suppression of mutual optical interference

| general data | | |
|---|---|---|
| actual range Sb (FSE 200C1002) | | 160 mm |
| sensing distance Tw (FUE 200C1003) | | 45 mm |
| light source | | pulsed red LED |
| light indicator | | LED yellow |
| alignment / soiled lens indicator | | flashing light indicator |
| adjustment | | Pot 270° |
| wave length | | 660 nm |
| suppression of reciprocal influence | | yes |
| **electrical data** | | |
| response time / release time | | < 1 ms |
| voltage supply range +Vs | | 10 ... 30 VDC |
| current consumption max. | | 30 mA |
| current consumption typ. | | 20 mA |
| voltage drop Vd | | < 1,8 VDC |
| output function | | light / dark operate |
| output current | | < 100 mA |
| short circuit protection | | yes |
| reverse polarity protection | | yes |
| **mechanical data** | | |
| width / diameter | | 10,4 mm |
| height / length | | 27 mm |
| depth | | 14 mm |
| type | | rectangular |
| housing material | | plastic (ASA) |
| **ambient conditions** | | |
| operating temperature | | -25 ... +55 °C |
| protection class | | IP 40 |
| **connectors** | | |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |
| **accessories** | | |
| *SENSOFIX* mounting kit | | 150326 |
| mounting bracket (cable type) | | 114501 |
| mounting bracket (connector type) | | 133792 |
| for details, see accessories section | | |

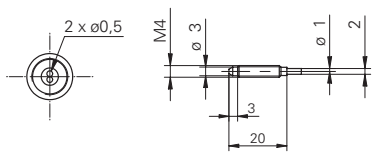
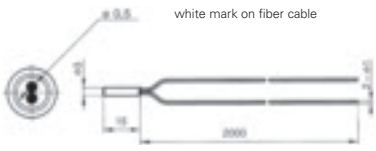
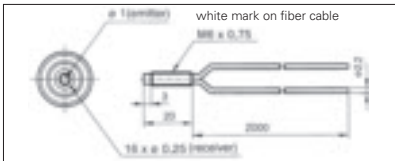
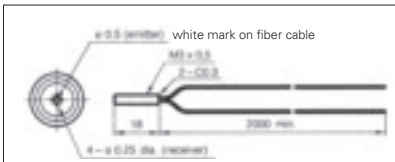
### dimension drawings



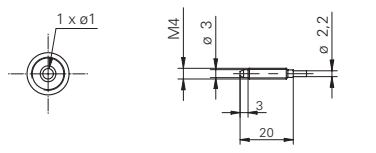
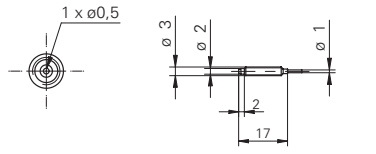
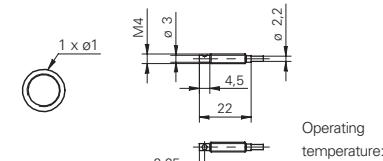
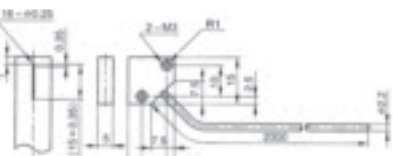

### connection diagrams

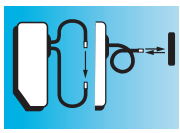
| order reference | output circuit | connection types |
|---|---|---|
| **FVDK 10N5101** | NPN | cable |
| **FVDK 10N5101/S35A** | NPN | connector M8 |
| **FVDK 10P5101** | PNP | cable |
| **FVDK 10P5101/S35A** | PNP | connector M8 |

## Reflective types (other types on demand)

| | Shape | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| **Standard M4**<br>Sensing head: brass |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FUE 200C1004** | 18 |
| **Standard ø 3 mm**<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FUE 200D2Y00** | 18 |
| **Coaxial M6**<br>Suitable for positioning<br>Sensing head: stainless steel |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FCE 200C1Y00** | 45 |
| **Coaxial M3**<br>Suitable for positioning. Spot sizes of 0,4 mm possible with doubling lens (see fiber optic accessories).<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FCE 200D1Y00** | 10 |

## True beam types (other types on demand)

| Model<br>Features | Shape | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| **Standard M4**<br>Sensing head: brass |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200C1002** | 160 |
| **Standard M3**<br>Sensing head: brass |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FSE 200C1004** | 50 |
| **Side view M4**<br>Sensing head: brass |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200C4002** | 100 |
| **Array (fine light barrier)**<br>Reliably detects small, thin or vibrating workpieces in a light curtain of 5,25 mm.<br>Sensing head: brass, Ni plated |  <br>R = 4 mm Operating temperature: -30...+70 °C | **FSE 200C6Y00** | 100 |

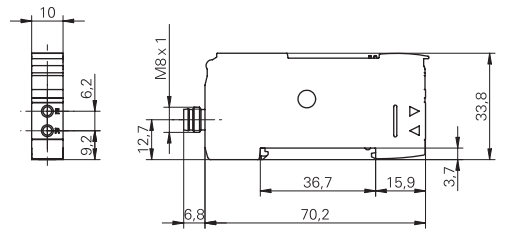


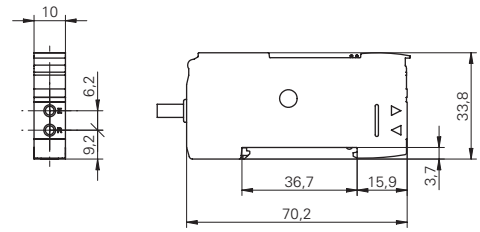
## Sb = 1200 mm
## Tw = 300 mm

- 2x4 digit display indicates the switching point and receiving light level
- versatile applicable due to 8 operating modes

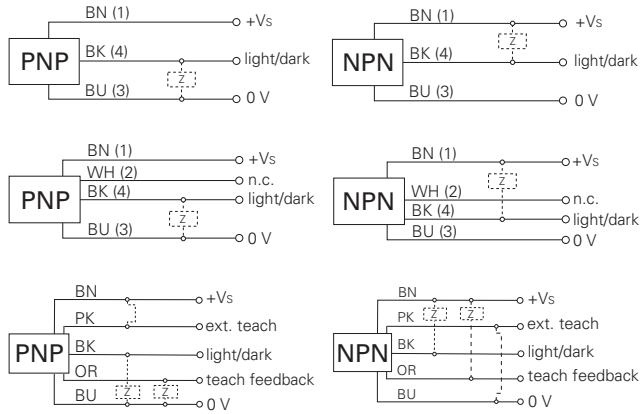
| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 1200 mm |
| sensing distance Tw (FUE 200C1003) | 300 mm |
| light source | pulsed red LED |
| light indicator | 2 x 4-digit display |
| output indicator | LED orange |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 30 mA |
| voltage drop Vd | < 2,1 VDC |
| output function | light / dark operate switchable |
| on / off delay | 0,25 ... 20000 ms |
| min. output pulse length | 0,25 ... 20000 ms |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 33,8 mm |
| depth | 70,2 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +55 °C |
| protection class | IP 40 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| mounting bracket for mounting on DIN Rail | 159806 |
| for details, see accessories section | |

**dimension drawings**

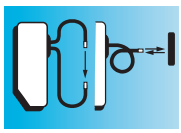



**connection diagrams**




| order reference | adjustment | response time / release time | output circuit | output current | connection types |
|---|---|---|---|---|---|
| **FVDK 10N67Y0** | Teach-in | 0,05 ... 5 ms (adjustable) | NPN | < 100 mA | cable |
| **FVDK 10N67Y0/S35A** | Teach-in | 0,05 ... 5 ms (adjustable) | NPN | < 100 mA | connector M8, 4 pin |
| **FVDK 10N67YR** | Teach-in: button / external | 0,05 ... 5 ms (adjustable) | NPN | < 50 mA | cable |
| **FVDK 10P67Y0** | Teach-in | 0,058 ... 5 ms (adjustable) | PNP | < 100 mA | cable |
| **FVDK 10P67Y0/S35A** | Teach-in | 0,058 ... 5 ms (adjustable) | PNP | < 100 mA | connector M8, 4 pin |
| **FVDK 10P67YR** | Teach-in: button / external | 0,058 ... 5 ms (adjustable) | PNP | < 50 mA | cable |

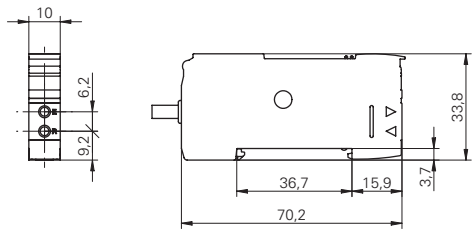


## Sb = 1200 mm
## Tw = 300 mm

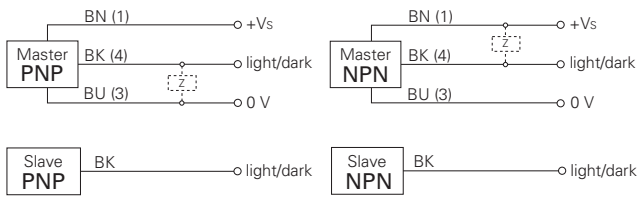
- master/slave system with up to 16 extension units
- integrated dynamic auto-teach-in function
- 2x4 digit display

| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 1200 mm |
| sensing distance Tw (FUE 200C1003) | 300 mm |
| light source | pulsed red LED |
| light indicator | 2 x 4-digit display |
| output indicator | LED orange |
| adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 30 mA |
| voltage drop Vd | < 2,1 VDC |
| output function | light / dark operate switchable |
| on / off delay | 0,25 ... 20000 ms |
| min. output pulse length | 0,25 ... 20000 ms |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 33,8 mm |
| depth | 70,2 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +55 °C |
| protection class | IP 40 |
| **accessories** | |
| mounting bracket for mounting on DIN Rail | 159806 |
| for details, see accessories section | |

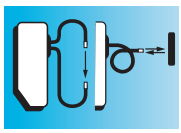
**dimension drawing**




**connection diagrams**




| order reference | type | response time / release time | output circuit | connection types |
|---|---|---|---|---|
| **FVDK 10N67YM** | master | 0,05 ... 5 ms (adjustable) | NPN | cable |
| **FVDK 10N67YS** | slave | 0,05 ... 5 ms (adjustable) | NPN | cable (output only) |
| **FVDK 10P67YM** | master | 0,058 ... 5 ms (adjustable) | PNP | cable |
| **FVDK 10P67YS** | slave | 0,058 ... 5 ms (adjustable) | PNP | cable (output only) |

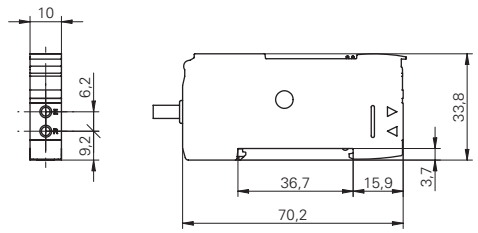


## Sb = 1200 mm
## Tw = 300 mm

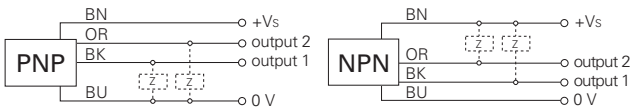
- 2 adjustable outputs
- optional logical output operation
- 2x4 digit display

| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 1200 mm |
| sensing distance Tw (FUE 200C1003) | 300 mm |
| light source | pulsed red LED |
| light indicator | 2 x 4-digit display |
| output indicator | LED orange |
| adjustment | Teach-in |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | 0,14 ... 5 ms (adjustable) |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 30 mA |
| voltage drop Vd | < 2,1 VDC |
| output function | light / dark operate switchable |
| on / off delay | 0,25 ... 20000 ms |
| min. output pulse length | 0,25 ... 20000 ms |
| output current | < 30 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 33,8 mm |
| depth | 70,2 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -20 ... +55 °C |
| protection class | IP 40 |
| **accessories** | |
| mounting bracket for mounting on DIN Rail | 159806 |
| for details, see accessories section | |

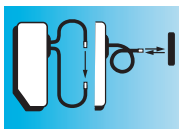
**dimension drawing**




**connection diagrams**




| order reference | output circuit |
|---|---|
| **FVDK 10N67Y2** | NPN |
| **FVDK 10P67Y2** | PNP |

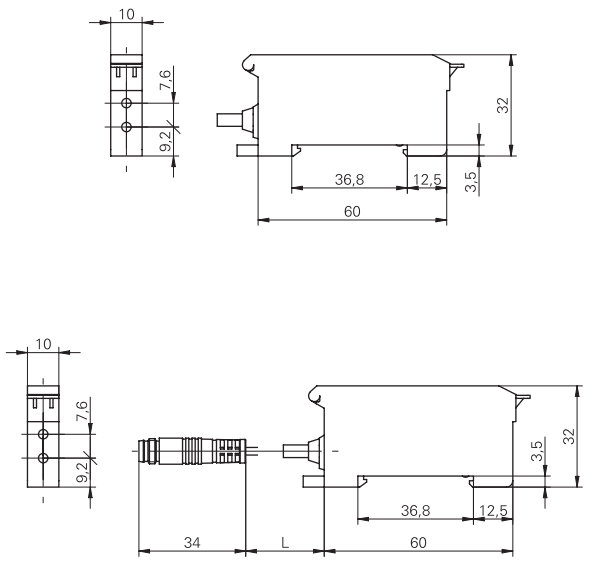


## Sb = 1400 mm
## Tw = 340 mm

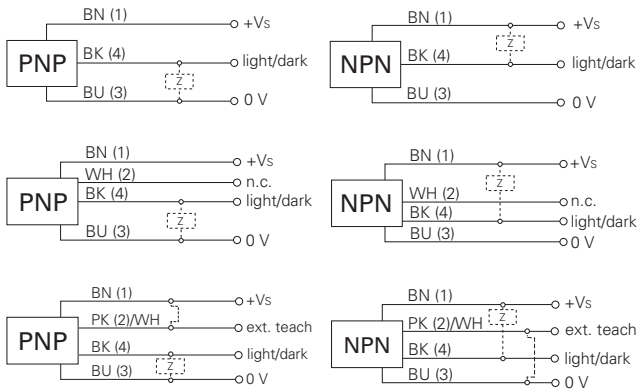
- dynamic resolution principle, optimized for difficult applications
- versatile applicable due to 3 operating modes

| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 1400 mm |
| sensing distance Tw (FUE 200C1003) | 340 mm |
| light source | pulsed red LED |
| light indicator | 1 x 3-digit display |
| output indicator | LED orange |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | 0,12 ... 5 ms (adjustable) |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 30 mA |
| voltage drop Vd | < 2 VDC |
| output function | light / dark operate switchable |
| on / off delay | 1 ... 1000 ms |
| min. output pulse length | 1 ... 1000 ms |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 32 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +55 °C |
| protection class | IP 40 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **remarks** | |
| Blue light version on request. | |

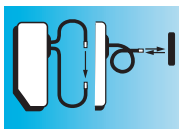
### dimension drawings




### connection diagrams




| order reference | adjustment | output circuit | connection types |
|---|---|---|---|
| **FVDK 10N69Y0** | Teach-in | NPN | cable |
| **FVDK 10N69Y0/KS35A** | Teach-in | NPN | flylead connector M8, 4 pin |
| **FVDK 10N69YR** | Teach-in: button / external | NPN | cable |
| **FVDK 10P69Y0** | Teach-in | PNP | cable |
| **FVDK 10P69Y0/KS35A** | Teach-in | PNP | flylead connector M8, 4 pin |
| **FVDK 10P69YR** | Teach-in: button / external | PNP | cable |

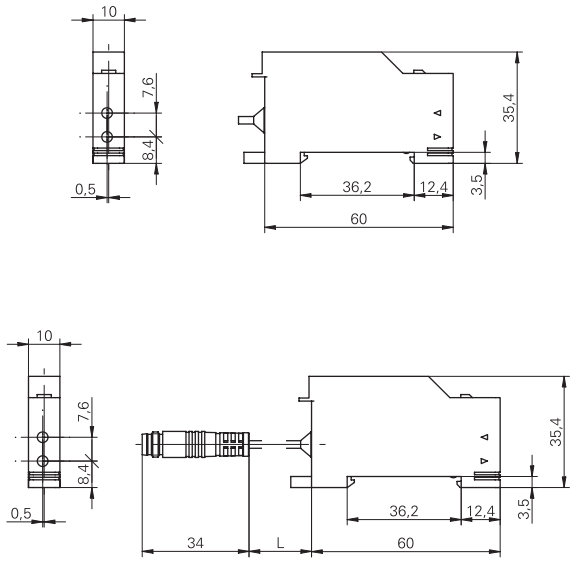


## Sb = 320 mm
## Tw = 90 mm

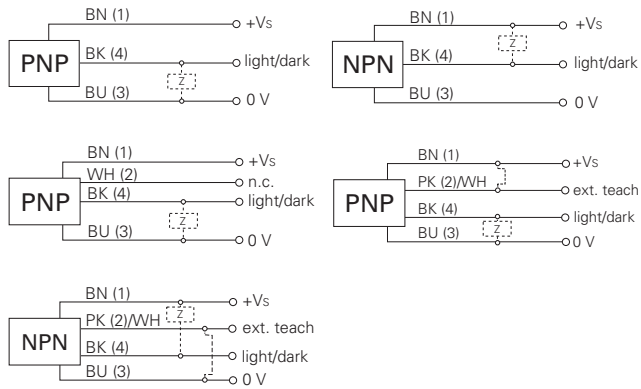
- visible excess gain signal on display
- sensitivity adjustable via Teach-in
- external teach-in via PLC

| general data | | |
|---|---|---|
| actual range Sb (FSE 200C1002) | | 320 mm |
| sensing distance Tw (FUE 200C1003) | | 90 mm |
| light source | | pulsed red LED |
| light indicator | | 1 x 1-digit display |
| alignment / soiled lens indicator | | LED green |
| output indicator | | LED red |
| wave length | | 680 nm |
| suppression of reciprocal influence | | yes |
| **electrical data** | | |
| response time / release time | | < 0,5 ms |
| voltage supply range +Vs | | 10 ... 30 VDC |
| current consumption max. | | 50 mA |
| voltage drop Vd | | < 1 VDC |
| output function | | light / dark operate switchable |
| off delay | | 40 ms |
| output current | | < 100 mA |
| short circuit protection | | yes |
| reverse polarity protection | | yes |
| **mechanical data** | | |
| width / diameter | | 10 mm |
| height / length | | 35,4 mm |
| depth | | 60 mm |
| type | | rectangular |
| housing material | | polycarbonate/ABS |
| **ambient conditions** | | |
| operating temperature | | -20 ... +55 °C |
| protection class | | IP 40 |
| **connectors** | | |
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

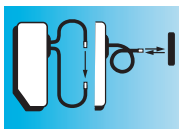
**dimension drawings**




**connection diagrams**




| order reference | adjustment | output circuit | connection types |
|---|---|---|---|
| **FVDK 10N60Y0** | Teach-in | NPN | cable |
| **FVDK 10N65Y0** | Teach-in: button / external | NPN | cable |
| **FVDK 10P60Y0** | Teach-in | PNP | cable |
| **FVDK 10P60Y0/KS35A** | Teach-in | PNP | flylead connector M8, 4 pin |
| **FVDK 10P65Y0** | Teach-in: button / external | PNP | cable |
| **FVDK 10P65Y0/KS35A** | Teach-in: button / external | PNP | flylead connector M8, 4 pin |

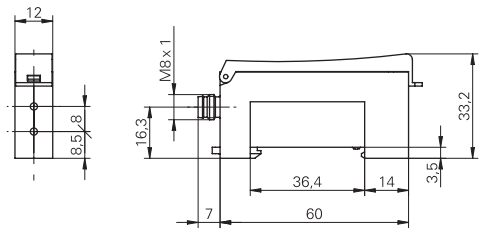


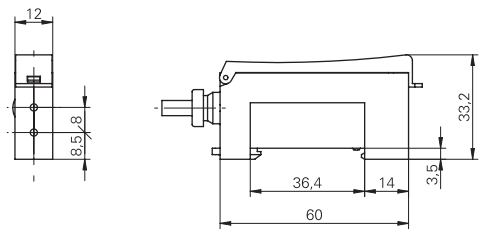
## Sb = 320 mm
## Tw = 90 mm

- sensitivity adjustable via Teach-in
- integrated alarm output
- protection class IP 65

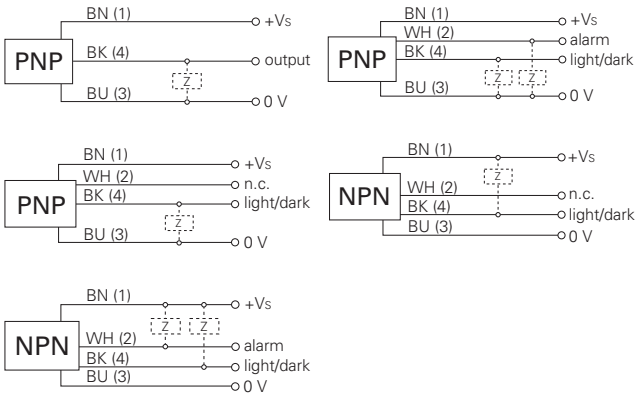
| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 320 mm |
| sensing distance Tw (FUE 200C1003) | 90 mm |
| light source | pulsed red LED |
| light indicator | LED green |
| alignment / soiled lens indicator | LED green, flashing |
| output indicator | LED yellow |
| adjustment | Teach-in |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 46 mA |
| current consumption typ. | 36 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate switchable |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12 mm |
| height / length | 33,2 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | PBT / PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 65 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

### dimension drawings

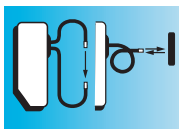



### connection diagrams




| order reference | min. output pulse length | output circuit | connection types | version |
|---|---|---|---|---|
| **FVDK 12N6101/S35A** | - | NPN | connector M8, 4 pin | - |
| **FVDK 12N6401/S35A** | - | NPN | connector M8, 4 pin | integrated alarm output |
| **FVDK 12P6101** | - | PNP | cable | - |
| **FVDK 12P6101/S35A** | - | PNP | connector M8, 4 pin | - |
| **FVDK 12P6401** | - | PNP | cable | integrated alarm output |
| **FVDK 12P6401/S35A** | - | PNP | connector M8, 4 pin | integrated alarm output |
| **FVDK 12P6501/S35A** | 40 ms | PNP | connector M8, 4 pin | integrated alarm output |

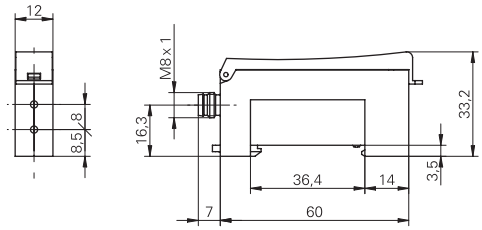


## Sb = 140 mm

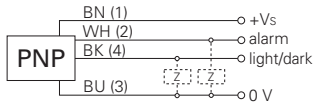
- Teach-in
- fast version available
- alarm output

| general data | |
|---|---|
| version | fast version |
| actual range Sb (FSE 200C1002) | 140 mm |
| sensing distance Tw (FUE 200C1003) | 40 mm |
| light source | pulsed red LED |
| light indicator | LED green |
| alignment / soiled lens indicator | LED green, flashing |
| output indicator | LED yellow |
| adjustment | Teach-in |
| wave length | 660 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate switchable |
| output circuit | PNP |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12 mm |
| height / length | 33,2 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | PBT / PC |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 65 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

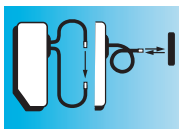
**dimension drawing**




**connection diagram**




| order reference |
|---|
| **FVDK 12P6410/S35A** |

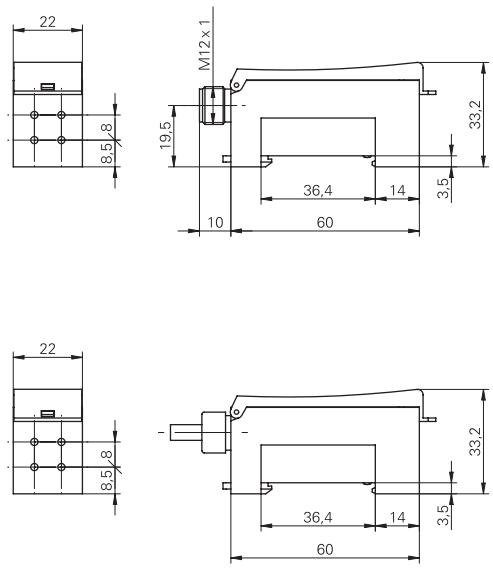


## Sb = 320 mm
## Tw = 90 mm

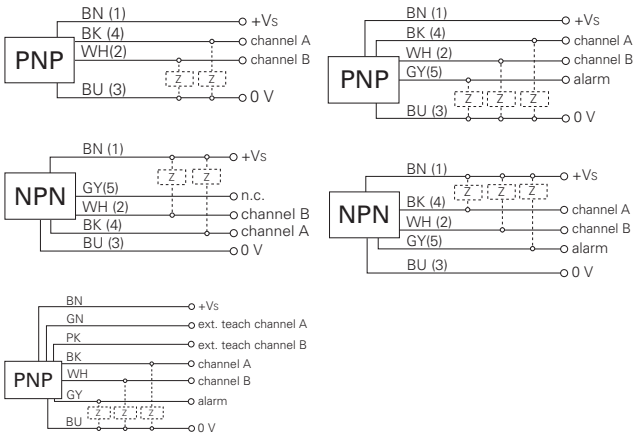
- 2 sensors in one housing
- sensitivity adjustable via Teach-in
- optional logical output operation

| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 320 mm |
| sensing distance Tw (FUE 200C1003) | 90 mm |
| light source | pulsed red LED |
| light indicator | LED green |
| alignment / soiled lens indicator | LED green, flashing |
| output indicator | LED yellow |
| wave length | 660 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 68 mA |
| current consumption typ. | 50 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate switchable |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 22 mm |
| height / length | 33,2 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | PBT / PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 65 |
| **connectors** | |
| ES 34CP2 | 5 pin 2 m straight |
| ES 33CP2 | 5 pin 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

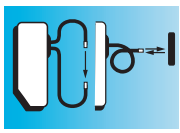
### dimension drawings




### connection diagrams



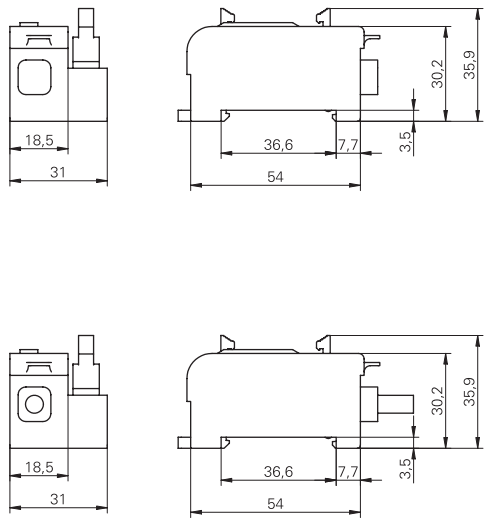

| order reference | adjustment | min. output pulse length | output circuit | connection types | version |
|---|---|---|---|---|---|
| **FVDK 22N6101/S14C** | Teach-in | - | NPN | connector M12, 5 pin | - |
| **FVDK 22N6401/S14C** | Teach-in | - | NPN | connector M12, 5 pin | integrated alarm output |
| **FVDK 22P6101** | Teach-in | - | PNP | cable | - |
| **FVDK 22P6101/S14C** | Teach-in | - | PNP | connector M12, 5 pin | - |
| **FVDK 22P6401** | Teach-in | - | PNP | cable | integrated alarm output |
| **FVDK 22P6401/S14C** | Teach-in | - | PNP | connector M12, 5 pin | integrated alarm output |
| **FVDK 22P6420** | Teach-in: button / external | - | PNP | cable | integrated alarm output |
| **FVDK 22P6501/S14C** | Teach-in | 40 ms | PNP | connector M12, 5 pin | integrated alarm output |



- master/slave system with up to 16 extension units
- all sensors can be set at the same time
- 3 digit display

| general data | |
|---|---|
| type | master |
| light indicator | 1 x 3-digit display |
| adjustment | Teach-in |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 12 ... 24 VDC |
| current consumption max. | 60 mA |
| voltage drop Vd | < 1 VDC |
| on / off delay | 1 ... 1000 ms |
| min. output pulse length | 1 ... 1000 ms |
| output current | < 50 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 31 mm |
| height / length | 35,9 mm |
| depth | 54 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +40 °C |
| protection class | IP 40 |
| **accessories** | |
| ribbon shielded cable 20 pin 2 m | 141139 |
| ribbon shielded cable 20 pin 5 m | 141140 |
| ribbon shielded cable 20 pin 10 m | 144161 |
| for details, see accessories section | |

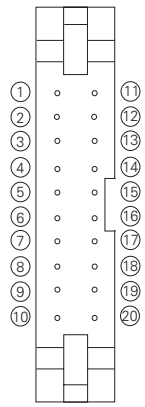
## dimension drawings



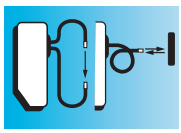

## connection diagram

| Pin no. | Version | |
|---|---|---|
| | NPN | PNP |
| 1 | output 1 | |
| 2 | output 2 | |
| 3 | output 3 | |
| 4 | output 4 | |
| 5 | output 5 | |
| 6 | output 6 | |
| 7 | output 7 | |
| 8 | output 8 | |
| 9 | +Vs | 0 V |
| 10 | 0 V | +Vs |

| Pin no. | Version | |
|---|---|---|
| | NPN | PNP |
| 11 | output 9 | |
| 12 | output 10 | |
| 13 | output 11 | |
| 14 | output 12 | |
| 15 | output 13 | |
| 16 | output 14 | |
| 17 | output 15 | |
| 18 | output 16 | |
| 19 | +Vs | 0 V |
| 20 | 0 V | +Vs |




| order reference | output circuit | connection types |
|---|---|---|
| **FVDK 31N06Y0** | NPN | cable / MIL connector |
| **FVDK 31P06Y0** | PNP | cable / MIL connector |
| **FVDK 31P06Y1** | PNP | MIL connector |

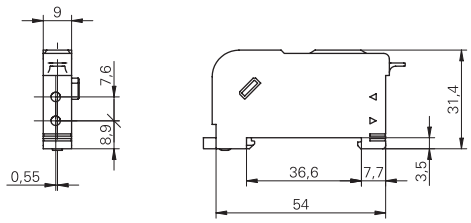


## Sb = 320 mm
## Tw = 90 mm

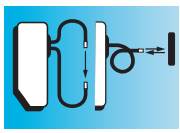
- FVDK 31 slave unit for master
- up to 16 slaves can be mounted
- reduced wiring

| general data | |
|---|---|
| type | slave |
| actual range Sb (FSE 200C1002) | 320 mm |
| sensing distance Tw (FUE 200C1003) | 90 mm |
| light source | pulsed red LED |
| output indicator | LED orange |
| adjustment | no |
| wave length | 680 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| current consumption max. | 35 mA |
| output function | light / dark operate switchable |
| **mechanical data** | |
| width / diameter | 9 mm |
| height / length | 31,4 mm |
| depth | 54 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +40 °C |
| protection class | IP 40 |

**dimension drawing**




| order reference |
|---|
| **FVDK 09P00Y0** |

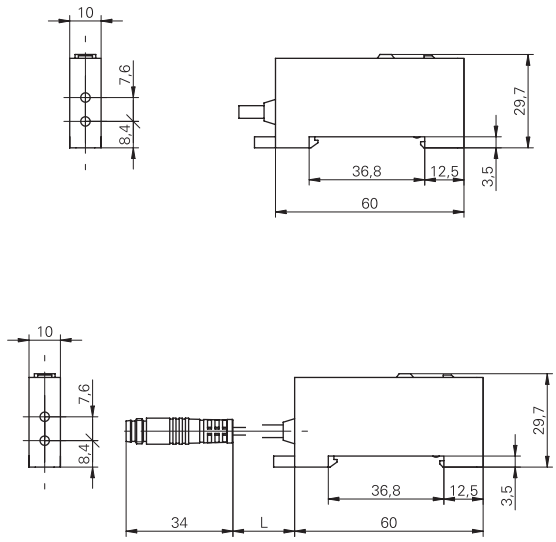


## Sb = 440 mm
## Tw = 120 mm

- sensitivity adjustable via potentiometer
- fast and high sensitivity version available
- integrated alarm output

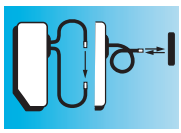
| general data | |
|---|---|
| light source | pulsed red LED |
| light indicator | LED green |
| alignment / soiled lens indicator | LED green, flashing |
| output indicator | LED red |
| adjustment | potentiometer |
| wave length | 680 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| voltage drop Vd | < 1 VDC |
| output function | light / dark operate switchable |
| off delay | 40 ms |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 29,7 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| **ambient conditions** | |
| operating temperature | -20 ... +60 °C |
| protection class | IP 40 |
| **connectors** | |
| ESG 32AH0200 4 pin | 2 m straight |
| ESW 31AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |

**dimension drawings**




**connection diagrams**

| order reference | actual range Sb (FSE 200C1002) | sensing distance Tw (FUE 200C1003) | response time / release time | output circuit | connection types | version |
|---|---|---|---|---|---|---|
| **FVDK 10N81Y0** | 240 mm | 70 mm | < 0,5 ms | NPN | cable | small hysteresis |
| **FVDK 10N82Y0** | 100 mm | 30 mm | < 0,05 ms (release time +0.02 ms) | NPN | cable | fast version |
| **FVDK 10N83Y0** | 440 mm | 120 mm | < 0,5 ms | NPN | cable | high sensitivity |
| **FVDK 10P81Y0** | 240 mm | 70 mm | < 0,5 ms | PNP | cable | small hysteresis |
| **FVDK 10P81Y0/KS35A** | 240 mm | 70 mm | < 0,5 ms | PNP | flylead connector M8, 4 pin | small hysteresis |
| **FVDK 10P82Y0** | 100 mm | 30 mm | < 0,05 ms (release time +0.02 ms) | PNP | cable | fast version |
| **FVDK 10P82Y0/KS35A** | 100 mm | 30 mm | < 0,05 ms (release time +0.02 ms) | PNP | flylead connector M8, 4 pin | fast version |
| **FVDK 10P83Y0** | 440 mm | 120 mm | < 0,5 ms | PNP | cable | high sensitivity |
| **FVDK 10P83Y0/KS35A** | 440 mm | 120 mm | < 0,5 ms | PNP | flylead connector M8, 4 pin | high sensitivity |



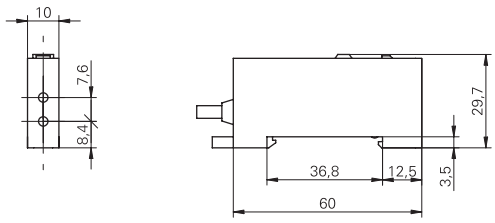
## Sb = 90 mm
## Tw = 25 mm

- analog output 1-5 VDC
- adjustable resolution

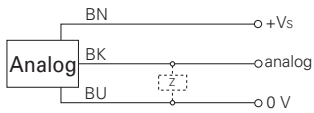
| general data | |
|---|---|
| actual range Sb (FSE 200C1002) | 90 mm |
| sensing distance Tw (FUE 200C1003) | 25 mm |
| light source | pulsed red LED |
| alignment / soiled lens indicator | LED red |
| output indicator | LED green |
| adjustment | potentiometer |
| resolution | 0,3 ... 6 % (Full Scale) |
| wave length | 680 nm |
| **electrical data** | |
| response time / release time | 1 ... 50 ms (adjustable) |
| voltage supply range +Vs | 10,8 ... 26,4 VDC |
| current consumption max. | 40 mA |
| output circuit | analog 1 ... 5 VDC |
| load resistance | > 10 kOhm |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10 mm |
| height / length | 29,7 mm |
| depth | 60 mm |
| type | rectangular |
| housing material | polycarbonate/ABS |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -20 ... +60 °C |
| protection class | IP 40 |

| order reference |
|---|
| **FWDK 10U84Y0** |

**dimension drawing**




**connection diagram**



# Plastic fiber optics
# Reflective types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

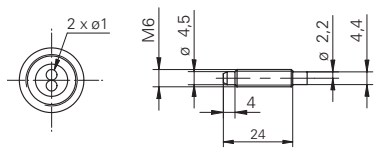
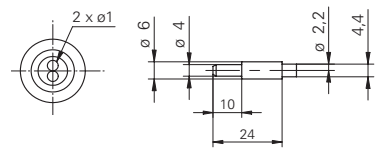
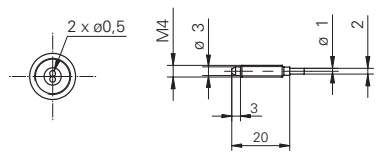
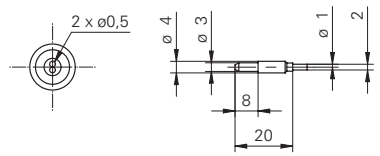
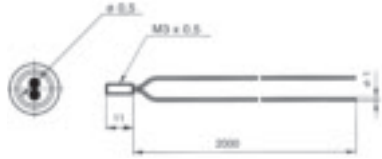
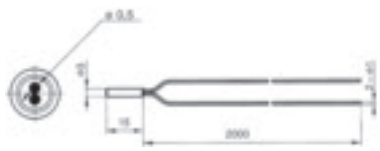
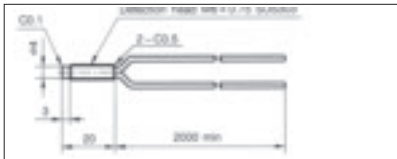
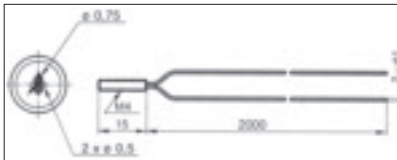
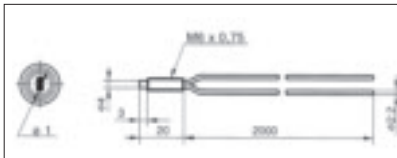
**FVDK 84**
Analog output

**FVDK 12/22/31/60**
Teach-in/Master-Slave

HS nL HP
**FVDK 67**
Dual Display

HS nL HP
**FVDK 69**
High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| Model<br>Features | Shape | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| **Standard M6**<br>Sensing head: brass |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FUE 200C1003** | 70<br>30<br>120<br>25<br>90<br>33/260/300<br>55/260/340 |
| **Standard ø 6 mm**<br>Smooth sensing head without thread<br>Sensing head: aluminum |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FUE 200C2003** | 70<br>30<br>120<br>25<br>90<br>33/260/300<br>55/260/340 |
| **Standard M4**<br>Sensing head: brass |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FUE 200C1004** | 25<br>12<br>45<br>10<br>35<br>12/100/120<br>20/100/140 |
| **Standard ø 4 mm**<br>Smooth sensing head without thread<br>Sensing head: aluminum |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FUE 200C2004** | 25<br>12<br>45<br>10<br>35<br>12/100/120<br>20/100/140 |
| **Standard M3**<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FUE 200D1Y00** | 25<br>12<br>45<br>10<br>35<br>12/100/120<br>20/100/140 |
| **Standard ø 3 mm**<br>Smooth sensing head without thread<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FUE 200D2Y00** | 25<br>12<br>45<br>10<br>35<br>12/100/120<br>20/100/140 |
| **Long-distance M6**<br>Longer sensing distance than with the standard version.<br>With integrated lens.<br>Sensing head: stainless steel |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FLE 200C1Y00** | 120<br>55<br>240<br>45<br>160<br>57/400/550<br>95/400/650 |
| **Long-distance M4**<br>Longer sensing distance than with the standard version.<br>With integrated lens.<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FLE 200D1Y00** | 50<br>25<br>100<br>18<br>70<br>27/190/230<br>45/190/270 |
| **Ultra flexible M6**<br>Ultra flexible type with bending radius of 2 mm<br>Sensing head: stainless steel |  <br>R = 2 mm Operating temperature: -30...+70 °C | **FUE 200E1Y00** | 44<br>20<br>85<br>16<br>60<br>24/180/220<br>40/180/260 |

# Plastic fiber optics
# Reflective types

**FVDK 81** Low hysteresis

**FVDK 82** Fast version

**FVDK 83** High sensitivity

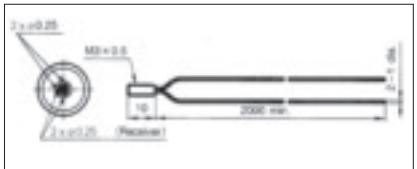
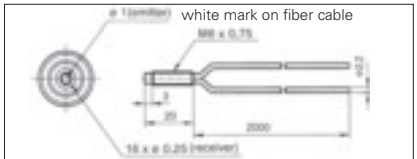
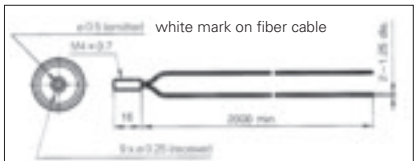
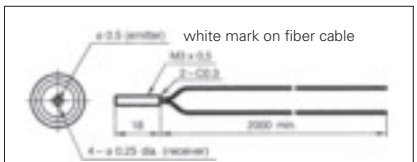
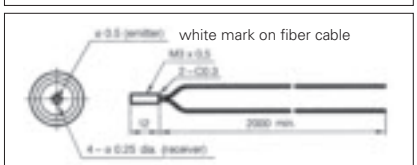
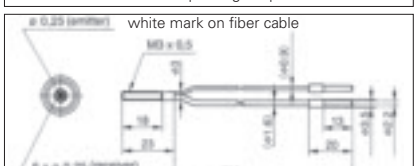
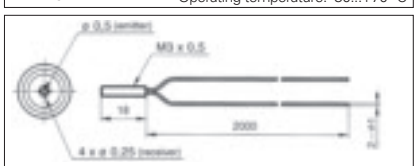
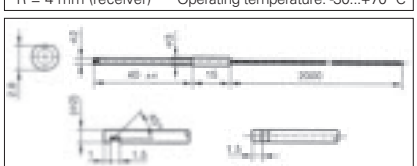
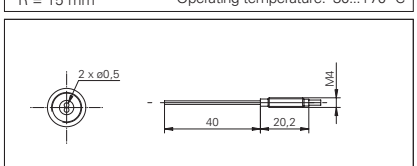
**FVDK 84** Analog output

**FVDK 12/22/31/60** Teach-in/Master-Slave

**FVDK 67** Dual Display

**FVDK 69** High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| Model<br>Features | Shape | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| **Ultra flexible, pliable M3**<br>Highly flexible, extremely pliable fiber with a min. bending radius of 4 mm. Suitable for drag chains.<br>Sensing head: stainless steel |  <br>R = 4 mm<br>Operating temperature: -30...+70 °C | **FUE 200F1Y00** | 12<br>6<br>20<br>-<br>15<br>5/40/50<br>9/40/60 |
| **Coaxial M6**<br>Suitable for positioning<br>Sensing head: stainless steel |  <br>white mark on fiber cable<br>R = 20 mm<br>Operating temperature: -30...+70 °C | **FCE 200C1Y00** | 70<br>30<br>120<br>25<br>90<br>33/260/300<br>55/260/340 |
| **Coaxial M4**<br>Suitable for positioning<br>Sensing head: stainless steel |  <br>white mark on fiber cable<br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FCE 200C1Y01** | 20<br>12<br>40<br>8<br>25<br>12/80/110<br>20/80/120 |
| **Coaxial M3**<br>Suitable for positioning. Spot sizes of 0.1 mm possible with doubling lens (see fiber optic accessories).<br>Sensing head: stainless steel |  <br>white mark on fiber cable<br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FCE 200D1Y00** | 15<br>8<br>30<br>5<br>20<br>8/65/95<br>12/65/110 |
| **Coaxial M3**<br>Suitable for positioning. Spot sizes of 0.1 mm possible with doubling lens (see fiber optic accessories).<br>Sensing head: stainless steel |  <br>white mark on fiber cable<br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FCE 200D1Y01** | 15<br>8<br>30<br>5<br>20<br>8/65/95<br>12/65/110 |
| **Coaxial M3**<br>Suitable for positioning. Spot sizes of 0.1 mm possible with doubling lens (see fiber optic accessories).<br>Sensing head: stainless steel |  <br>white mark on fiber cable<br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FCE 050C1Y10** | 15<br>8<br>30<br>5<br>20<br>6/50/70<br>10/50/80 |
| **Coaxial, ultra flexible M3**<br>Ultra flexible. Suitable for positioning. Spot sizes of 0.1 mm possible with doubling lens (see fiber optic accessories).<br>Sensing head: stainless steel |  <br>R = 1 mm (emitter)<br>R = 4 mm (receiver)<br>Operating temperature: -30...+70 °C | **FCE 200E1Y00** | 13<br>6<br>26<br>4<br>18<br>6/50/70<br>10/50/80 |
| **Side view ø 2 mm**<br>Smaller outside diameter, suitable for constrained conditions.<br>Sensing head: stainless steel |  <br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FUE 200C4Y00** | 9<br>3<br>14<br>-<br>10<br>4/30/45<br>6/30/50 |
| **Smaller sensing head, flexible**<br>Chrome nickel sensing head which can be bent once. R > 7.5 mm. Other sensing head lengths on request.<br>Sensing head: chrome nickel/brass |  <br>2 x ø0,5<br>M4<br>40<br>20,2<br>R = 8 mm<br>Operating temperature: -30...+70 °C | **FUE 200C1012** | 25<br>12<br>45<br>10<br>35<br>12/100/120<br>20/100/140 |

# Plastic fiber optics
# Reflective types

**FVDK 81**
Low hysteresis

**FVDK 12/22/31/60**
Teach-in/Master-Slave

**FVDK 82**
Fast version

**FVDK 67**
Dual Display

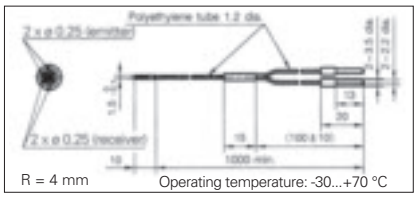
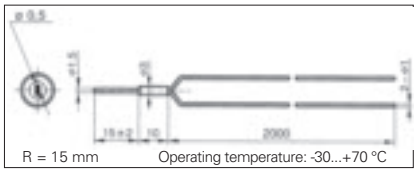
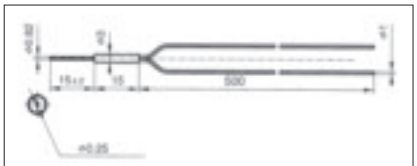
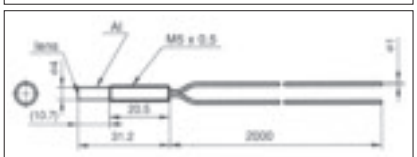
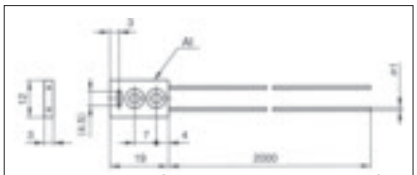
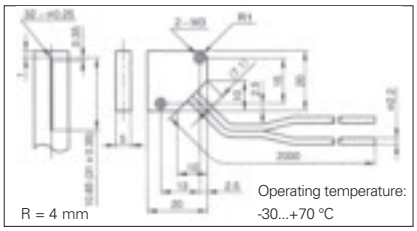
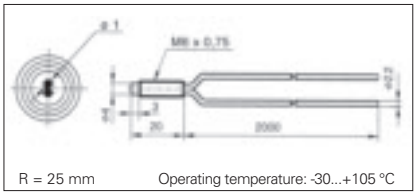
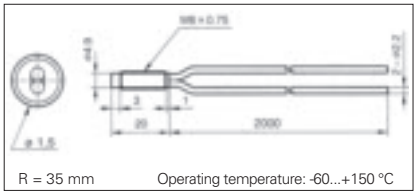
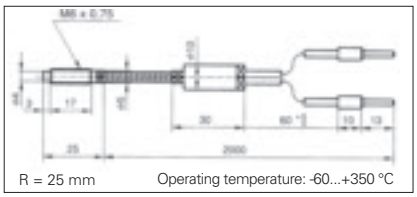
**FVDK 83**
High sensitivity

**FVDK 69**
High Performance

**FVDK 84**
Analog output

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity



| Model<br>Features | Shape | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| **Small sensing head ø 1,5 mm**<br>Highly flexible, extremely pliable fiber with a min. bending radius of 4 mm. Suitable for drag chains.<br>Sensing head: stainless steel |  <br>R = 4 mm<br>Operating temperature: -30...+70 °C | **FUE 100E2Y00** | 12<br>6<br>20<br>-<br>15<br>5/40/50<br>9/40/60 |
| **Small sensing head ø 1,5 mm**<br>Suitable for small spaces<br>Sensing head: stainless steel |  <br>R = 15 mm<br>Operating temperature: -30...+70 °C | **FUE 200C2Y00** | 25<br>12<br>45<br>9<br>35<br>12/90/120<br>20/90/140 |
| **Small sensing head ø 0,82 mm**<br>Suitable for small spaces<br>Sensing head: stainless steel |  <br>R = 15 mm<br>Operating temperature: -30...+70°C | **FUE 050C2Y10** | 5<br>2<br>12<br>-<br>8<br>3/20/30<br>5/20/35 |
| **Parallel beam M5**<br>Sharp beam eliminates the influence of reflections from periphery. Spot size 3 mm at a distance of 20 mm.<br>Sensing head: stainl. steel / Al |  <br>R = 15 mm<br>Operating temperature: -30...+70°C | **FKE 200D1Y00** | 15<br>8<br>30<br>5<br>20<br>8/60/70<br>12/60/80 |
| **Focus**<br>Suitable for detection of highly transparent objects (glass, foils)<br>Sensing distance:<br>2,5 mm ±0,5<br>Sensing head: aluminum |  <br>R = 15 mm<br>Operating temperature: -30...+70°C | **FFE 200D6Y00** | 2.5<br>-<br>2.5<br>-<br>2.5<br>2.5<br>2.5 |
| **Array**<br>Reliably detects small, thin or vibrating workpieces in an area of 10,85 mm.<br>Sensing head: brass, Ni plated |  <br>R = 4 mm<br>Operating temperature: -30...+70 °C | **FUE 200C6Y00** | 70<br>30<br>120<br>20<br>80<br>30/200/270<br>50/200/320 |
| **Heat resistant M6**<br>Heat resistant up to +105 °C<br>Sensing head: stainless steel |  <br>R = 25 mm<br>Operating temperature: -30...+105 °C | **FUA 200C1Y00** | 50<br>25<br>100<br>18<br>70<br>27/200/220<br>45/200/260 |
| **Heat and cold resistant M6**<br>Continuous use from -60 °C up to +150 °C<br>Sensing head: stainless steel |  <br>R = 35 mm<br>Operating temperature: -60...+150 °C | **FUB 200C1Y00** | 80<br>40<br>160<br>28<br>110<br>42/300/400<br>70/300/460 |
| **Heat and cold resistant M6**<br>Continuous use from -60 °C up to +350 °C<br>(Glass fiber optics)<br>Sensing head: stainless steel |  <br>R = 25 mm<br>Operating temperature: -60...+350 °C | **FUG 200C1Y00** | 50<br>25<br>100<br>18<br>70<br>27/180/220<br>45/180/260 |

# Plastic fiber optics
# Reflective types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

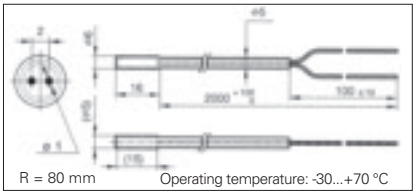
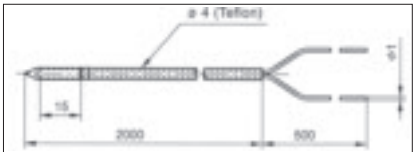
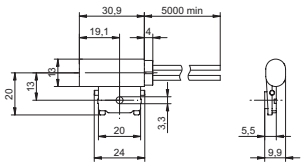
**FVDK 84**
Analog output

**FVDK 12/22/31/60**
Teach-in/Master-Slave

**FVDK 67**
Dual Display

**FVDK 69**
High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| **Model**<br>Features | **Shape** | **Part number** | **Tw = sensing distance [mm]** |
|---|---|---|---|
| **Chemical proof**<br>For use in chemically aggressive environments. Fiber optic sensor is fully sheathed in Teflon PFA.<br><br>Sensing head: stainless steel / Teflon PFA |  <br>R = 80 mm Operating temperature: -30...+70 °C | **FUC 200C2Y00** | 40<br>20<br>70<br>12<br>50<br>18/150/185<br>30/150/220 |
| **Level recognition**<br>Detection of diverse liquids. Resistant to chemicals due to Teflon PFA sheath.<br>Heat resistant up to +105 °C<br><br>Sensing head: Teflon |  <br>R = 15 mm / 30 mm tip auf 40 mm length Operating temperature: -30...+105 °C | **FUL 200D2Y00** | Switches when immersed in liquid.<br>Recommend fiber optic sensor Series 67.<br>Do not use with Series 82!<br><br>More information about liquid level recogniton or leak detection, see chapter «level monitoring and leak detecting sensors». |
| **Leak monitoring**<br>Detects liquids escaping from tanks and trays. Resistant to chemicals due to Teflon PFA sheath.<br><br>Heat resistant up to +105 °C<br><br>Sensing head: Teflon |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FOC 500C6Y00** | Fiber optic sensor is mounted directly on the floor or a base and switches on contact with escaping liquids. Recommend fiber optic sensor Series 67.<br>Do not use with Series 82!<br><br>More information can be found in chapter «Level and leak sensors». |

# Plastic fiber optics
# Through beam types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

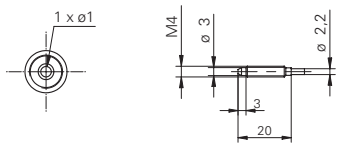
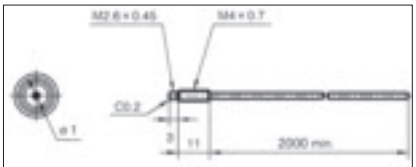
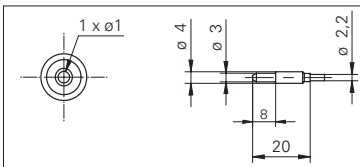
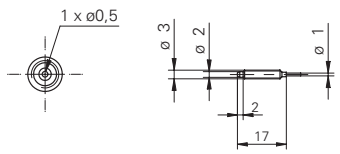
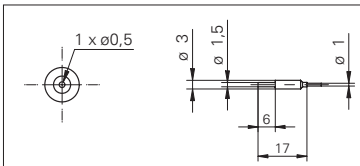
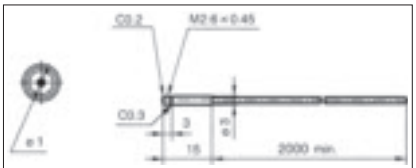
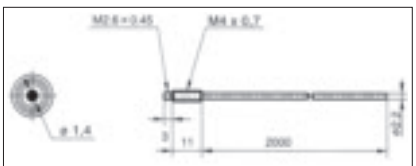
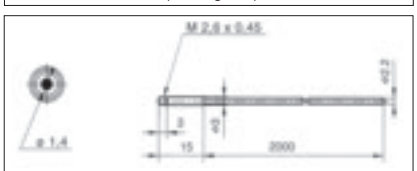
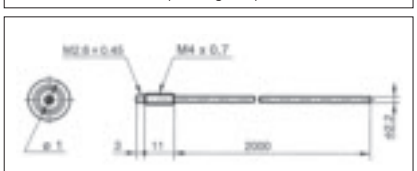
**FVDK 84**
Analog output

**FVDK 12/22/31/60**
Teach-in/Master-Slave

HS nL HP
**FVDK 67**
Dual Display

HS nL HP
**FVDK 69**
High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| Model<br>Features | Shape | Part number | Sb = actual range [mm] |
|---|---|---|---|
| **Standard M4**<br><br>Sensing head: brass |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200C1002** | 240<br>100<br>440<br>90<br>320<br>130/900/1200<br>190/900/1400 |
| **Standard M4**<br><br>Shorter version<br><br>Sensing head: stainless steel |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FSE 200C1Y00** | 240<br>100<br>440<br>90<br>320<br>130/900/1200<br>190/900/1400 |
| **Standard ø 4 mm**<br><br>Smooth sensing head without thread<br><br>Sensing head: aluminum |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200C2002** | 240<br>100<br>440<br>90<br>320<br>130/900/1200<br>190/900/1400 |
| **Standard M3**<br><br>Sensing head: brass |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FSE 200C1004** | 70<br>30<br>140<br>28<br>100<br>40/290/340<br>60/290/400 |
| **Standard ø 3 mm**<br><br>Smooth sensing head without thread<br><br>Sensing head: aluminum |  <br>R = 8 mm Operating temperature: -30...+70 °C | **FSE 200C2004** | 70<br>30<br>140<br>28<br>100<br>40/290/340<br>60/290/400 |
| **Standard ø 3 mm**<br><br>Shorter version<br>Smooth sensing head without thread |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FSE 200C2Y00** | 240<br>100<br>440<br>90<br>100<br>130/900/1200<br>190/900/1400 |
| **Long distance M4**<br>Twice the range of an M4 standard fiber optic sensor with integrated lens<br><br>Sensing head: stainless steel |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FWE 200C1Y00** | 510<br>220<br>950<br>190<br>680<br>260/1600/2350<br>380/1600/2800 |
| **Long distance ø 3 mm**<br><br>Smooth sensing head without thread, with integrated lens<br><br>Sensing head: stainless steel |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FWE 200C2Y00** | 510<br>220<br>950<br>190<br>680<br>260/1600/2350<br>380/1600/2800 |
| **Ultra flexible M4**<br>Ultra flexible type with bending radius of 2 mm<br><br>Sensing head: stainless steel |  <br>R = 2 mm Operating temperature: -30...+70 °C | **FSE 200E1Y00** | 200<br>90<br>380<br>75<br>270<br>100/700/920<br>160/700/1100 |

# Plastic fiber optics
# Through beam types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

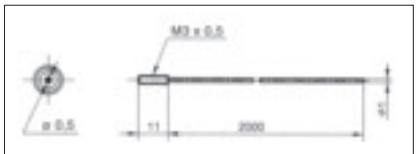
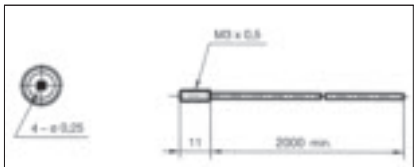
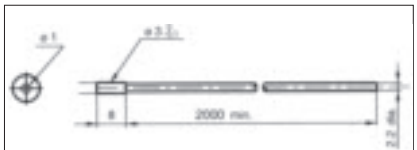
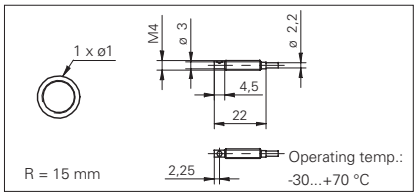
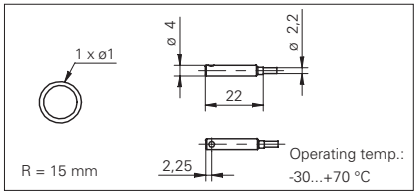
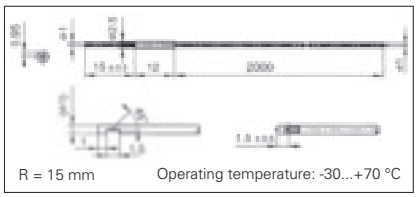
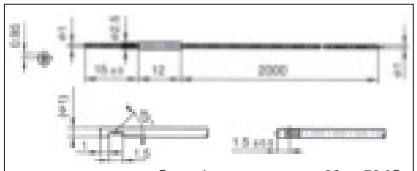
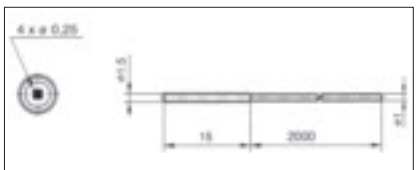
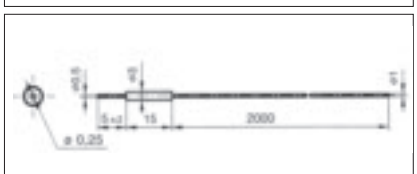
**FVDK 84**
Analog output

**FVDK 12/22/31/60**
Teach-in/Master-Slave

**FVDK 67**
Dual Display

**FVDK 69**
High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| Model<br>Features | Shape | Part number | Sb = actual range [mm] |
|---|---|---|---|
| **Ultra flexible M3**<br>Highly flexible fiber with a min. bending radius of 1 mm<br>Sensing head: stainless steel |  <br>R = 1 mm Operating temperature: -30...+70 °C | **FSE 200F1Y00** | 23<br>10<br>43<br>8<br>30<br>14/95/140<br>20/95/165 |
| **Highly flexible, pliable M3**<br>Highly flexible, extremely pliable fiber with a min. bending radius of 4 mm. Suitable for drag chains.<br>Sensing head: stainless steel |  <br>R = 4 mm Operating temperature: -30...+70 °C | **FSE 200D1Y50** | 40<br>20<br>100<br>20<br>45<br>18/120/180<br>22/120/210 |
| **Ultra flexible, 3 mm**<br>Highly flexible, extremely pliable fiber with a min. bending radius of 2 mm.<br>Sensing head: stainless steel |  <br>R = 2 mm Operating temperature: -30...+70 °C | **FSE 200E2Y00** | 200<br>90<br>380<br>75<br>270<br>100/700/920<br>160/700/1100 |
| **Side view M4**<br>Sensing head: brass |  <br>R = 15 mm Operating temp.: -30...+70 °C | **FSE 200C4002** | 150<br>60<br>280<br>55<br>200<br>80/600/750<br>120/600/880 |
| **Side view ø 4 mm**<br>Smooth sensing head without thread<br>Sensing head: aluminum |  <br>R = 15 mm Operating temp.: -30...+70 °C | **FSE 200C4001** | 150<br>60<br>280<br>55<br>200<br>80/600/750<br>120/600/880 |
| **Side view ø 1 mm**<br>**Small sensing head**<br>Small target object detection<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200D4Y00** | 38<br>16<br>70<br>14<br>50<br>20/130/160<br>30/130/200 |
| **Side light exit, small sensing head 4 mm diameter, highly flexible**<br>Small target object detection<br>Sensing head: stainless steel |  <br>R = 1 mm Operating temperature: -30...+70 °C | **FSE 200F4Y00** | 11<br>5<br>22<br>4<br>15<br>5/40/55<br>9/40/65 |
| **Small sensing head ø 1,5 mm**<br>Highly flexible, extremely pliable fiber with a min. bending radius of 4 mm.<br>Suitable for drag chains.<br>Sensing head: stainless steel |  <br>R = 4 mm Operating temperature: -30...+70 °C | **FSE 200D2Y00** | 40<br>18<br>80<br>15<br>55<br>20/140/190<br>30/140/230 |
| **Small sensing head ø 0,5 mm**<br>Detection of very small objects. Light spot diameter 0,25 mm<br>Sensing head: stainless steel |  <br>R = 15 mm Operating temperature: -30...+70 °C | **FSE 200D2Y50** | 11<br>5<br>21<br>4<br>15<br>5/35/52<br>9/35/60 |

# Plastic fiber optics
# Through beam types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

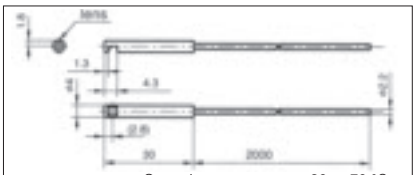
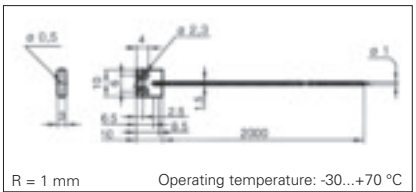
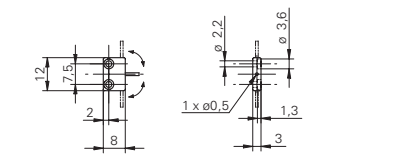
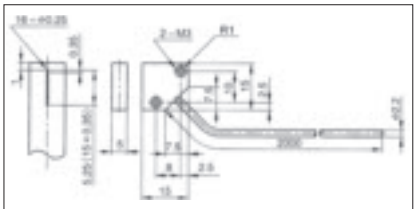
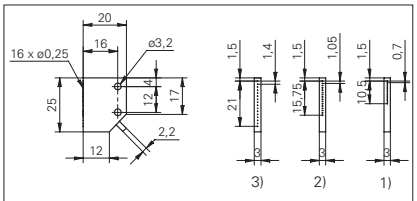
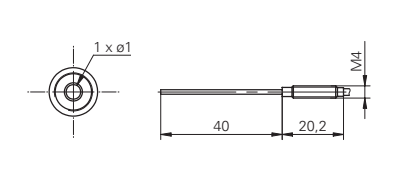
**FVDK 84**
Analog output

**FVDK 12/22/31/60**
Teach-in/Master-Slave

**FVDK 67**
Dual Display

**FVDK 69**
High Performance

**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| Model<br>Features | Shape | Part number | Sb = actual range [mm] |
|---|---|---|---|
| **Parallel beam M4, exit angle ± 2°**<br>The small beam angle makes a precise, virtually parallel light beam.<br>Sensing head: stainless steel | <br>R = 20 mm Operating temperature: -30...+70 °C | **FPE 200C1Y00** | 1050<br>460<br>2000<br>390<br>1400<br>490/3000/4000<br>700/3000/4000 |
| **Parallel beam M4, exit angle ± 1°**<br>The small beam angle makes a precise, virtually parallel light beam.<br>Sensing head: stainless steel | <br>R = 15 mm Operating temperature: -30...+70 °C | **FPE 200D1Y00** | 600<br>260<br>1100<br>220<br>800<br>340/2400/3600<br>480/2400/4000 |
| **Parallel beam, side view ± 2°**<br>The small beam angle makes a precise, virtually parallel light beam.<br>Sensing head: stainless steel |  <br>R = 30 mm Operating temperature: -30...+70 °C | **FPE 200C4Y00** | 750<br>340<br>1600<br>280<br>1000<br>450/3000/4000<br>600/3000/4000 |
| **Flat sensing head, highly flexible fiber**<br>Can be mounted directly on a plate.Highly flexible fiber with a min. bending radius of 1 mm.<br>Sensing head: brass, Ni plated |  <br>R = 1 mm Operating temperature: -30...+70 °C | **FSE 200F6Y00**<br>With similar dimensions also available with an inexpensive POM sensing head: FSE 100F6Y01 | 30<br>13<br>55<br>11<br>40<br>17/110/140<br>24/110/165 |
| **Flat sensing head, highly flexible fiber**<br>Highly flexible fiber with a min. bending radius of 1 mm.<br>Sensing head: POM |  <br>R = 1 mm Operating temperature: -30...+70 °C | **FSE 100F6Y01** | 30<br>13<br>55<br>11<br>40<br>17/110/140<br>24/110/165 |
| **Array (fine light barrier)**<br>Reliably detects small, thin or vibrating workpieces in a light curtain of 5,25 mm.<br>Sensing head: brass, Ni plated |  <br>R = 4 mm Operating temperature: -30...+70 °C | **FSE 200C6Y00** | 150<br>65<br>280<br>55<br>200<br>85/600/790<br>120/600/920 |
| **Array (fine light barrier)**<br>Reliably detects small, thin or vibrating workpieces in a light curtain:<br>of 10,5, 15,75 and 21 mm.<br>Sensing head: aluminum |  <br>R = 4 mm Operating temperature: -30...+70 °C | **1) FSE 200C6Y01**<br>**2) FSE 200C6Y15**<br>**3) FSE 200C6Y02** | 150<br>65<br>280<br>55<br>200<br>85/600/790<br>120/600/920 |
| **Small, bendable sensing head**<br>Chrome nickel sensing head which can be bent once.<br>R > 7.5 mm.<br>Other sensing head lengths on request.<br>Sensing head: chrome nickel / brass |  <br>R = 8 mm | **FSE 200C1013** | 70<br>30<br>140<br>28<br>100<br>40/290/340<br>60/290/400 |

Through beam types

Plastic fiber optics

# Plastic fiber optics
# Through beam types

**FVDK 81**
Low hysteresis

**FVDK 82**
Fast version

**FVDK 83**
High sensitivity

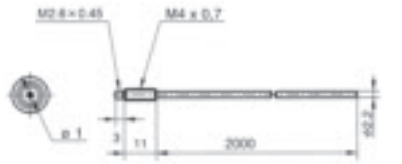
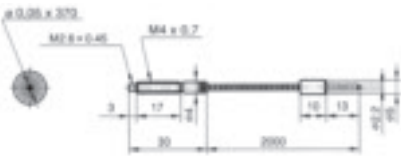
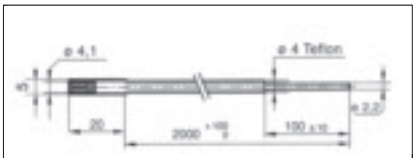
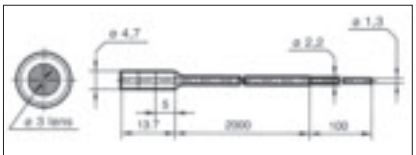
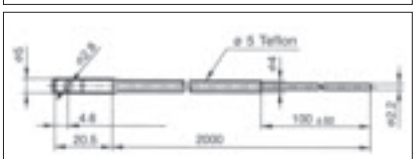
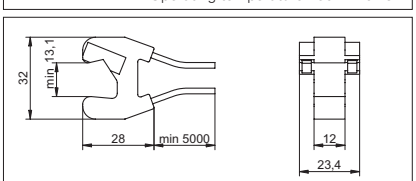
**FVDK 84**
Analog output

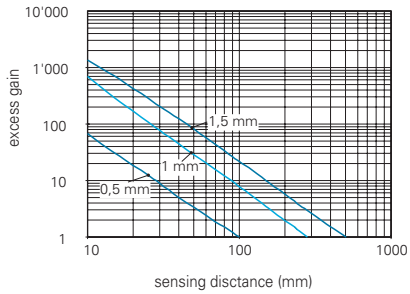
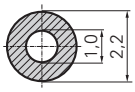
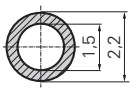
**FVDK 12/22/31/60**
Teach-in/Master-Slave

HS nL HP
**FVDK 67**
Dual Display

HS nL HP
**FVDK 69**
High Performance

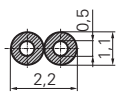
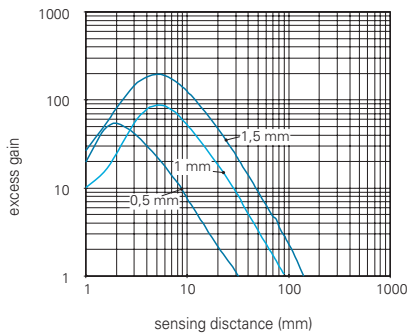
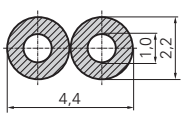
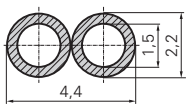
**Legend of operating modes**
**HS** High Speed
**nL** Standard
**HP** High Sensitivity

| **Model**<br>Features | **Shape** | **Part number** | **Sb = actual range [mm]** |
|---|---|---|---|
| **Heat resistant M4**<br>Heat resistant up to +105 °C<br><br>Sensing head: stainless steel |  <br>R = 25 mm Operating temperature: -30...+105 °C | **FSA 200C1Y00** | 160<br>70<br>290<br>60<br>210<br>85/550/750<br>120/550/900 |
| **Heat and cold resistant M4**<br>Continuous use from -60 °C up to +150 °C<br><br>Sensing head: stainless steel | <br>R = 35 mm Operating temperature: -60...+150 °C | **FSB 200C1Y00** | 230<br>100<br>430<br>85<br>310<br>120/900/1300<br>190/900/1500 |
| **Heat and cold resistant M4**<br>Continuous use from -60 °C up to +350 °C<br>(Glass fiber optics)<br><br>Sensing head: stainless steel |  <br>R = 25 mm Operating temperature: -60...+350 °C | **FSG 200C1Y00** | 160<br>70<br>290<br>60<br>210<br>85/550/750<br>120/550/900 |
| **Chemical and oil proof**<br>For use in chemically aggressive environments. Fiber optic sensor is fully sheathed in Teflon.<br><br>Sensing head: stainless steel / PFA |  <br>R = 80 mm Operating temperature: -30...+70 °C | **FSC 200C2Y00** | 900<br>400<br>1700<br>320<br>1200<br>500/3500/4000<br>720/3500/4000 |
| **Chemical and oil proof**<br>For use in chemically aggressive environments. Fiber optic sensor is fully sheathed in Teflon.<br><br>Sensing head: stainless steel / PFA |  <br>R = 20 mm Operating temperature: -30...+70 °C | **FLC 200D2Y00** | 800<br>360<br>1600<br>300<br>1100<br>420/3300/4000<br>640/3300/4000 |
| **Chemical and oil proof, side view**<br>For use in chemically aggressive environments. Fiber optic sensor is fully sheathed in Teflon.<br><br>Sensing head: stainless steel / PFA |  <br>R = 80 mm Operating temperature: -30...+70 °C | **FSC 200C4Y00** | 200<br>90<br>380<br>75<br>270<br>105/750/1020<br>150/750/1200 |
| **Contact-free level detection**<br>Detects liquids in (semi-)transparent stand pipes/hoses with 3-13 mm diameter.<br><br>Sensing head: PFI / PC |  <br>R = 4 mm Operating temperature: -30...+70 °C | **FSL 500C6Y00** | Fiber optic sensor is mounted directly on the hose/stand pipe and switches on contact with escaping liquids. Recommend fiber optic sensor Series 69 and 67.<br>Do not use with Series 82!<br>More information can be found in chapter «Level and leak sensors». |

| through-beam types | fiber ø | fiber mm² | min. bending radius | part nr. [1] | excess gain curve (2 m cut fiber) |
|---|---|---|---|---|---|
| | 0,5 mm | ≈ 0,2 mm² | 8 mm | 114158 |  |
|  | 1 mm | ≈ 0,8 mm² | 15 mm | 114157 | |
|  | 1,5 mm | ≈ 1,8 mm² | 25 mm | 123729 | |

reduction of sensing distance: 4% per meter
(valid up to 10 m)

Highly flexible version on demand.

| reflective types | fiber ø | fiber mm² | min. bending radius | part nr. [1] | excess gain curve (2 m cut fiber) |
|---|---|---|---|---|---|
|  | 2 x 0,5 mm | ≈ 2 x 0,2 mm² | 8 mm | 114594 |  |
|  | 2 x 1 mm | ≈ 2 x 0,8 mm² | 15 mm | 114595 | |
|  | 2 x 1,5 mm | ≈ 2 x 1,8 mm² | 25 mm | 124878 | |

reduction of sensing distance: 4% per meter
(valid up to 10 m)

Highly flexible version on demand.

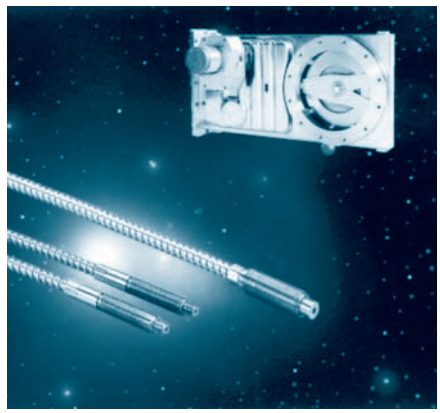
[1] order designation in meters

| product family | FZAM 18 | FZAM 18 | FZAM 18 | FZAM 30 | FVDM 15 |
|---|---|---|---|---|---|
| | | | | | |
| width / diameter | 18 mm | 18 mm | 18 mm | 30 mm | 15 mm |
| actual range Sb | 310 mm | 800 mm | 800 mm | 600 mm<br>1400 mm | 1200 mm |
| sensing distance Tw | 60 mm | 150 mm | 150 mm | 110 mm<br>230 mm | 240 mm |
| response time / release time | < 0,5 ms | < 1 ms | < 1 ms | < 0,25 ms<br>< 2,5 ms | < 0,1 ms<br>< 1 ms |
| adjustment | Pot, 15 turn | Pot 270° | Teach-in | Pot, 20 turn | Pot, 20 turn |
| NPN | ■ | ■ | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | ■ | ■ | ■ |
| connector | | ■ | ■ | | ■ |
| housing material | metal | metal | metal | metal | metal |
| | | | | | |
| **Page** | **478** | **479** | **480** | **481** | **486** |

# Glass fiber optics

## General information

In contrast to plastic fiber optics, glass fiber optics contain hundreds of individual fibers. Each one conveys a part of the emitted light. Depending on the arrangement of the individual fibers, a homogenous light spot or a line can be produced. Also, glass is a high-quality, durable material, which guarantees a long and constant service life. This is only one of the reasons that glass optical fibers are used in the telecommunications industry. The high heat resistance also permits fields of application which are difficult or completely impossible with other sensors.



## Typical applications

The wide range of sheath materials and sensing heads make it possible for you to adapt the sensors optimally to your machine concept. A way can always be found to fasten the small fiber optic heads. Due to the different available lengths, the fiber optic sensor can be placed individually at an optimum point.

- Metal-sheathed optical fibers can also be used in harsh conditions
- Detection, differentiation and positioning of different objects
- Monitoring of areas using fiber optic arrays with linear fiber arrangement
- Use at high, low or constantly fluctuating ambient temperatures
- Ranges of up to 1,4 m with fiber optic through beam types

## Characteristics and advantages

**Independent of the surroundings**
As only light is conveyed, electromagnetic fields or high/low temperatures have no effect on the functional reliability.

**Rugged**
Metal-sheathed optical fibers are protected against mechanical effects (chips etc). All fiber optic sensors are fitted with a rugged metal housing.

**Stable operation**
High-quality glass fibers ensure stable operation for a long period. All fiber optic sensors are equipped with high-power infrared light sources, which provide sufficient excess gain even with a certain degree of soiling.

**Area monitoring**
Fiber optic arrays with a linear fiber arrangement permit an area to be monitored or the detection of objects which are not precisely conveyed.

**Optimum installation**
Apart from the common threaded types, fiber optic sensors with smooth sleeves or side light exit are available.

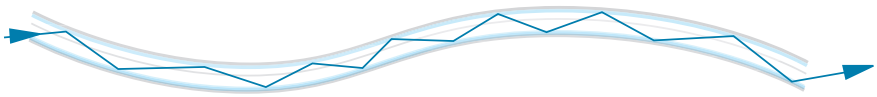
**Fast processes**
Fiber optic sensors with response times of only 50 microseconds permit the detection of objects even in very fast processes.

# Glass fiber optics

## Technology and operation

By exploiting the so-called total reflection, it is possible to convey light in a medium such as glass without great loss.

Explanation of total reflection
When light waves reflect on a barrier layer between two media with different optical densities, they do not simply carry on in a straight line. When they penetrate from an optically denser medium (e.g. glass fiber core) into an optically thinner medium (e.g. glass sheath), there is a smaller angle, the critical angle, under which total reflection occurs. The light wave is reflected back and remains in the optically denser medium.



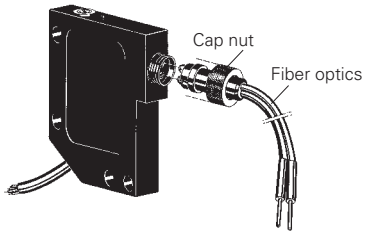
The glass sheath surrounding the core fiber is decisive for the transmission of light waves almost completely without loss. This ensures an optically consistent density of the sheath and the core and thereby permits a practically constant number of total reflections. This also occurs when the optical fiber is slightly bent. If there was no core sheath, it would be highly decisive for the total reflection whether the optical fiber is used in an air medium or, for example, water. The critical angle would then change decisively, which could permit an undesired escape of light under certain circumstances.

In the sensing principle, fiber optic solutions are based on intensity differences. With fiber optic through beam types, an object breaking the light beam between the emitter and receiver is detected. With the fiber optic reflective types, the amount of light reflected by an object is evaluated.

For more information, see the section on plastic fiber optics in this chapter.

## Mounting and adjustment

Fiber optics series 15

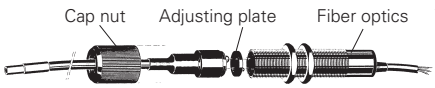



The cap nut to fasten the fiber optics is supplied with every order.

If damaged or lost, the cap nut can be ordered under the following number:

Cap nut 103230

Fiber optics series 18

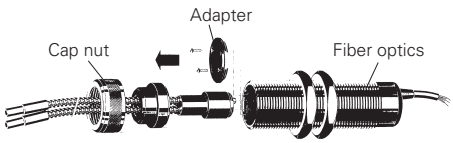



The adjusting plate and cap nut are supplied with every order.

If damaged or lost, they can be ordered under the following part numbers:

| | |
|---|---|
| Adjusting plate | 101958 |
| Cap nut | 101480 |

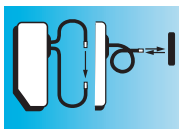
Fiber optics series 30




The adapter and the cap nut must be ordered as accessories with every order.

| | |
|---|---|
| Adapter | 102757 |
| Cap nut | 102801 |

For installation of the fiber optics, the cover must be removed.

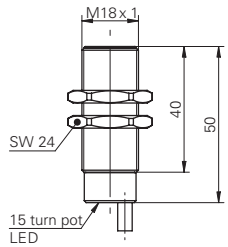


## Sb = 310 mm
## Tw = 60 mm

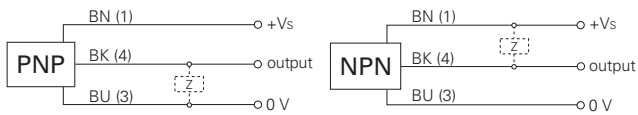
- sensitivity adjustable via potentiometer (axial)
- rugged metal housing
- infrared light source

| general data | |
|---|---|
| actual range Sb | 310 mm |
| sensing distance Tw | 60 mm |
| light source | pulsed infrared diode |
| light indicator | LED yellow |
| alignment / soiled lens indicator | LED, flashing |
| adjustment | Pot, 15 turn |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 0,5 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 30 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| height / length | 50 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| connection types | cable 3 pin |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 65 |
| **accessories** | |
| *SENSOFIX* mounting kit | 151658 |
| adjusting plate | 101958 |
| cap nut | 101480 |
| for details, see accessories section | |

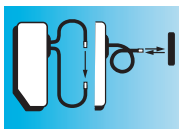
**dimension drawing**




**connection diagrams**




| order reference | output circuit |
|---|---|
| **FZAM 18N1155** | NPN |
| **FZAM 18P1155** | PNP |

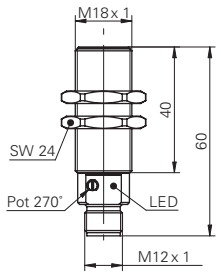


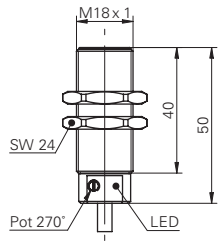
## Sb = 800 mm
## Tw = 150 mm

- sensitivity adjustable via potentiometer (radial)
- rugged metal housing
- infrared light source

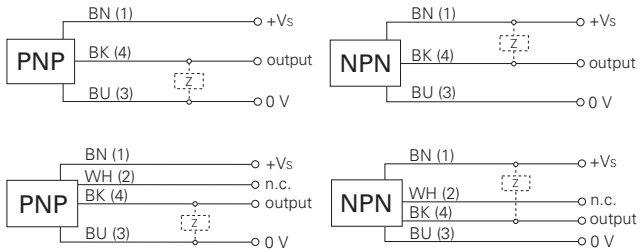
| general data | |
|---|---|
| actual range Sb | 800 mm |
| sensing distance Tw | 150 mm |
| light source | pulsed infrared diode |
| light indicator | LED yellow |
| alignment / soiled lens indicator | LED, flashing |
| adjustment | Pot 270° |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 45 mA |
| current consumption typ. | 30 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 34AH0200 4 pin | 2 m straight |
| ESW 33AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 151658 |
| adjusting plate | 101958 |
| cap nut | 101480 |
| for details, see accessories section | |

### dimension drawings

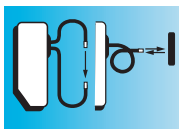



### connection diagrams




| order reference | height / length | output circuit | connection types |
|---|---|---|---|
| **FZAM 18N1150** | 50 mm | NPN | cable 3 pin |
| **FZAM 18N1150/S14** | 60 mm | NPN | connector M12, 4 pin |
| **FZAM 18P1150** | 50 mm | PNP | cable 3 pin |
| **FZAM 18P1150/S14** | 60 mm | PNP | connector M12, 4 pin |

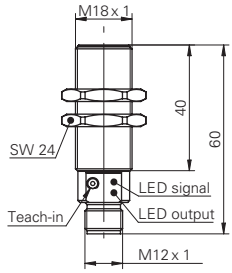


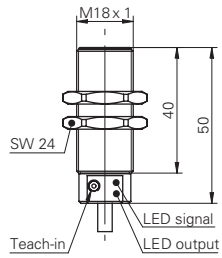
## Sb = 800 mm
## Tw = 150 mm

- sensitivity adjustable via Teach-in
- light / dark operation programmable
- rugged metal housing

| general data | |
|---|---|
| actual range Sb | 800 mm |
| sensing distance Tw | 150 mm |
| light source | pulsed infrared diode |
| light indicator | LED green |
| alignment / soiled lens indicator | LED green, flashing |
| output indicator | LED yellow |
| adjustment | Teach-in |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| response time / release time | < 1 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 55 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate switchable |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 18 mm |
| type | cylindrical |
| housing material | brass nickel plated / PC |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 34AH0200 4 pin | 2 m straight |
| ESW 33AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| *SENSOFIX* mounting kit | 151658 |
| adjusting plate | 101958 |
| cap nut | 101480 |
| for details, see accessories section | |

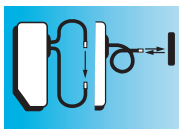
**dimension drawings**




**connection diagrams**

| order reference | height / length | output circuit | connection types |
|---|---|---|---|
| **FZAM 18N6460** | 50 mm | NPN | cable 4 pin |
| **FZAM 18N6460/S14** | 60 mm | NPN | connector M12, 4 pin |
| **FZAM 18P6460** | 50 mm | PNP | cable 4 pin |
| **FZAM 18P6460/S14** | 60 mm | PNP | connector M12, 4 pin |

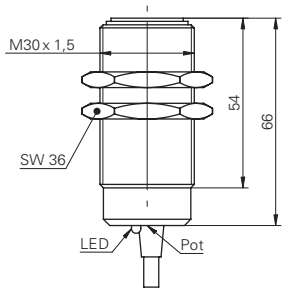


## Sb = 1400 mm
## Tw = 230 mm

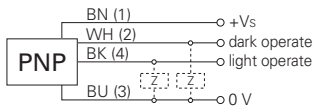
- extended sensing distance
- fast version available
- rugged metal housing

| general data | |
|---|---|
| light source | pulsed infrared diode |
| light indicator | LED yellow |
| alignment / soiled lens indicator | LED, flashing |
| adjustment | Pot, 20 turn |
| wave length | 880 nm |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| voltage drop Vd | < 2,5 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 30 mm |
| height / length | 66 mm |
| type | cylindrical |
| housing material | brass nickel plated |
| connection types | cable 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +65 °C |
| protection class | IP 65 |
| **accessories** | |
| adapter | 102757 |
| cap nut | 102801 |
| for details, see accessories section | |

**dimension drawing**




**connection diagrams**

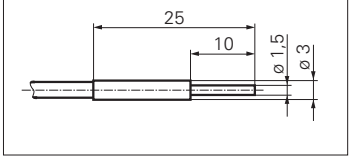
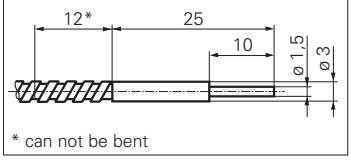
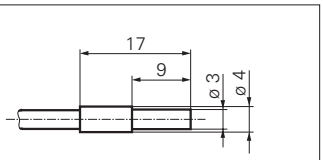
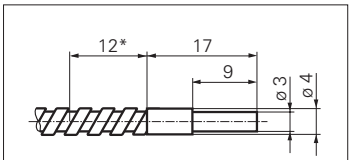
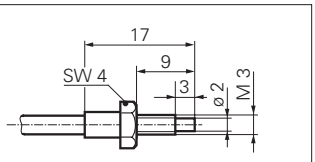
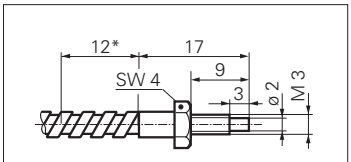
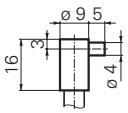
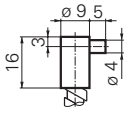


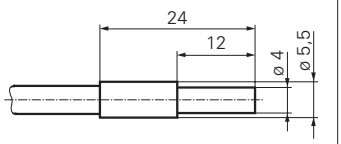
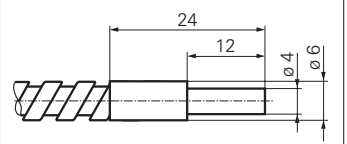
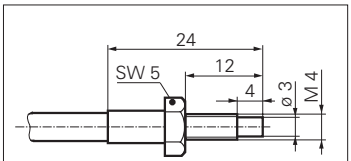
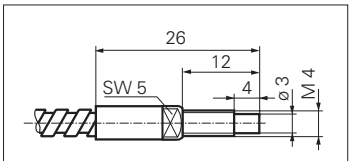
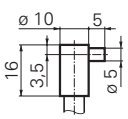
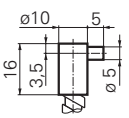

| order reference | actual range Sb | sensing distance Tw | response time / release time | current consumption max. | current consumption typ. | output circuit |
|---|---|---|---|---|---|---|
| **FZAM 30N5001** | 600 mm | 110 mm | < 0,25 ms | 40 mA | 30 mA | NPN |
| **FZAM 30N5004** | 1400 mm | 230 mm | < 2,5 ms | 50 mA | 33 mA | NPN |
| **FZAM 30P5001** | 600 mm | 110 mm | < 0,25 ms | 40 mA | 30 mA | PNP |
| **FZAM 30P5004** | 1400 mm | 230 mm | < 2,5 ms | 50 mA | 33 mA | PNP |

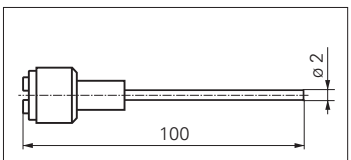
# Glass fiber optics for Series 18, 30
# Reflective types

Series 18 20-turn pot. | Series 18 Side mounted pot. Teach-in | Series 30 Fast version | Series 30 Extended Tw



| Fiber diameter 2 x 0,5 mm² | | | Tw = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PVC ø 2,5 mm (FUE ...) | Sheath material: brass chromium plated ø 4 mm (FUF ...) | Part number | |
|  |  * can not be bent | **FUE 050A2004**<br>**FUF 050A2004**<br>(length 50 cm) | 10<br>20<br>15<br>35 |
| | | **FUE 100A2004**<br>**FUF 100A2004**<br>(length 100 cm) | 5<br>20<br>15<br>30 |
|  |  * can not be bent | **FUE 050A2003**<br>**FUF 050A2005**<br>(length 50 cm) | 10<br>20<br>15<br>35 |
| | | **FUE 100A2003**<br>**FUF 100A2005**<br>(length 100 cm) | 5<br>20<br>15<br>30 |
|  |  * can not be bent | **FUE 050A1003**<br>**FUF 050A1005**<br>(length 50 cm) | 10<br>20<br>15<br>35 |
| | | **FUE 100A1003**<br>**FUF 100A1005**<br>(length 100 cm) | 5<br>20<br>15<br>30 |
|  |  | **FUE 050A4004**<br>**FUF 050A4004**<br>(length 50 cm) | 10<br>20<br>15<br>35 |
| | | **FUE 100A4004**<br>**FUF 100A4004**<br>(length 100 cm) | 5<br>20<br>15<br>30 |

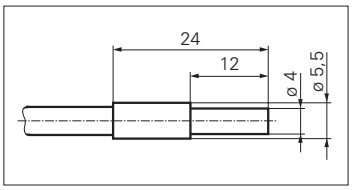
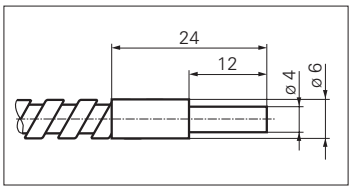
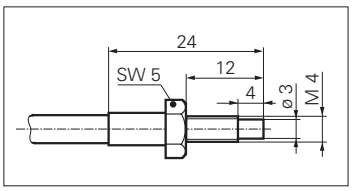
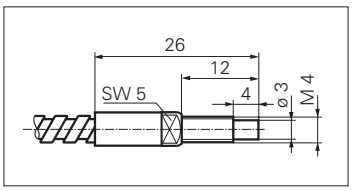
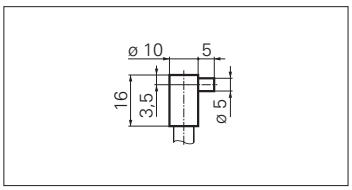
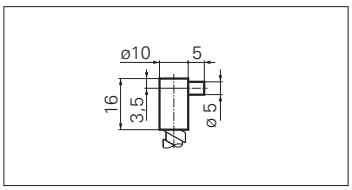
| Fiber diameter 2 x 1 mm² | | | Tw = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PUR ø 4,5 mm (FUE ...) | Sheath material: brass chromium plated ø 5 mm (FUF ...) | Part number | |
|  |  | **FUE 050A2002**<br>**FUF 050A2007**<br>(length 50 cm) | 15<br>40<br>30<br>70 |
| | | **FUE 100A2002**<br>**FUF 100A2007**<br>(length 100 cm) | 15<br>40<br>30<br>60 |
|  |  | **FUE 050A1002**<br>**FUF 050A1007**<br>(length 50 cm) | 15<br>40<br>30<br>70 |
| | | **FUE 100A1002**<br>**FUF 100A1007**<br>(length 100 cm) | 15<br>40<br>30<br>60 |
|  |  | **FUE 050A4005**<br>**FUF 050A4005**<br>(length 50 cm) | 15<br>40<br>30<br>70 |
| | | **FUE 100A4005**<br>**FUF 100A4005**<br>(length 100 cm) | 15<br>40<br>30<br>60 |

| Fiber diameter 2 x 0,5 mm² | | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
| Sheath material: Chrome-nickel-steel ø 2 mm FUH 010A2002 | | | |
|  | | **FUH 010A2002**<br>(length 10 cm) | 10<br>20<br>15<br>35 |

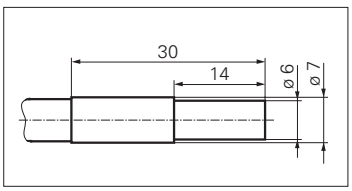
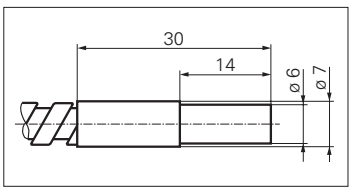
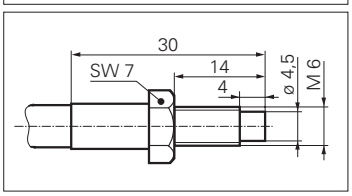
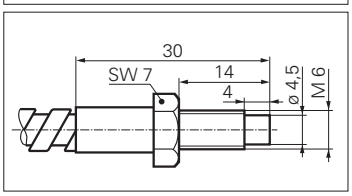
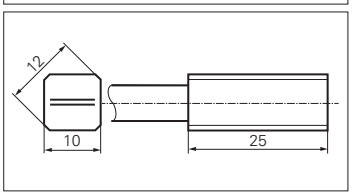
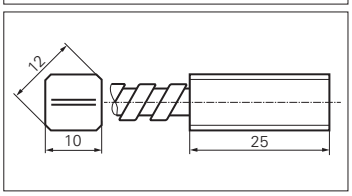
# Glass fiber optics for Series 18, 30
# Reflective types

Series 18 20-turn pot. | Series 18 Side mounted pot. Teach-in | Series 30 Fast version | Series 30 Extended Tw

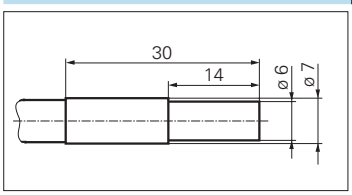
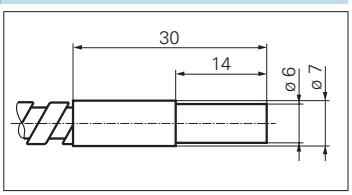
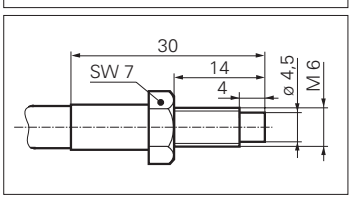
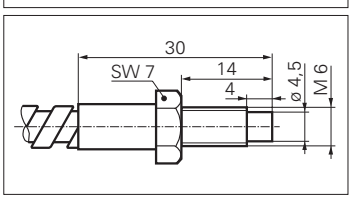
## Fiber diameter 2 x 2 mm²

| Sheath material: PUR ø 4,5 mm (FUE ...) | Sheath material: brass chromium plated ø 5 mm (FUF ...) | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
|  |  | **FUE 050A2011**<br>**FUF 050A2011**<br>(length 50 cm) | 35<br>80<br>60<br>115 |
| | | **FUE 100A2011**<br>**FUF 100A2011**<br>(length 100 cm) | 35<br>80<br>60<br>115 |
|  |  | **FUE 050A1011**<br>**FUF 050A1011**<br>(length 50 cm) | 35<br>80<br>60<br>115 |
| | | **FUE 100A1011**<br>**FUF 100A1011**<br>(length 100 cm) | 35<br>80<br>60<br>115 |
|  |  | **FUE 050A4003**<br>**FUF 050A4002**<br>(length 50 cm) | 35<br>80<br>60<br>115 |
| | | **FUE 100A4003**<br>**FUF 100A4002**<br>(length 100 cm) | 35<br>80<br>60<br>115 |

## Fiber diameter 2 x 3 mm²

| Sheath material: PUR ø 6 mm (FUE ...) | Sheath material: brass chromium plated ø 6 mm (FUF ...) | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
|  |  | **FUE 050A2008**<br>**FUF 050A2003**<br>(length 50 cm) | 60<br>150<br>100<br>210 |
| | | **FUE 100A2008**<br>**FUF 100A2003**<br>(length 100 cm) | 55<br>150<br>100<br>200 |
|  |  | **FUE 050A1008**<br>**FUF 050A1003**<br>(length 50 cm) | 60<br>150<br>100<br>210 |
| | | **FUE 100A1008**<br>**FUF 100A1003**<br>(length 100 cm) | 55<br>150<br>100<br>200 |
|  |  | **FUE 050A3001**<br>**FUF 050A3001**<br>(length 50 cm) | 60<br>150<br>100<br>210 |
| | | **FUE 100A3001**<br>**FUF 100A3001**<br>(length 100 cm) | 55<br>150<br>100<br>200 |

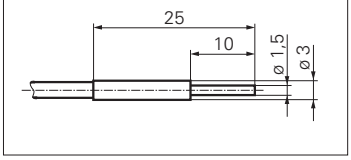
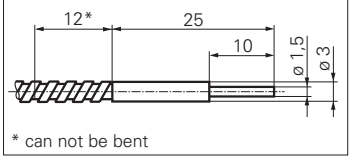
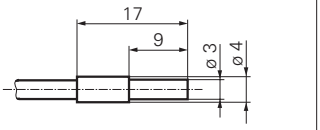
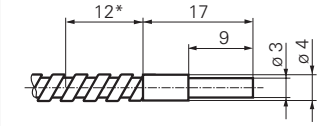
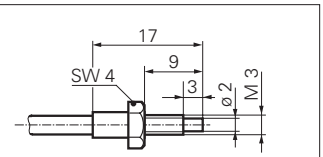
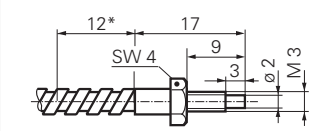
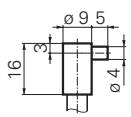
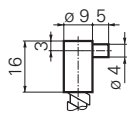
## Fiber diameter 2 x 4 mm²

| Sheath material: PUR ø 6 mm (FUE ...) | Sheath material: brass chromium plated ø 6 mm (FUF ...) | Part number | Tw = sensing distance [mm] |
|---|---|---|---|
|  |  | **FUE 050A2001**<br>**FUF 050A2001**<br>(length 50 cm) | 60<br>150<br>110<br>230 |
| | | **FUE 100A2001**<br>**FUF 100A2001**<br>(length 100 cm) | 60<br>150<br>100<br>220 |
|  |  | **FUE 050A1001**<br>**FUF 050A1001**<br>(length 50 cm) | 60<br>150<br>110<br>230 |
| | | **FUE 100A1001**<br>**FUF 100A1001**<br>(length 100 cm) | 60<br>150<br>100<br>220 |

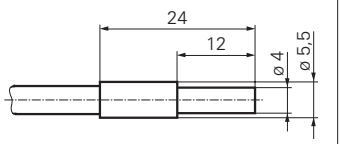
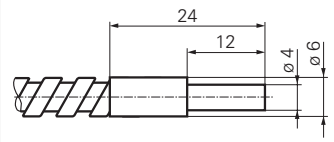
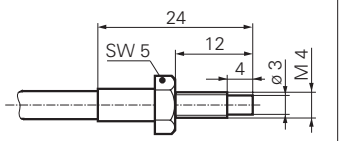
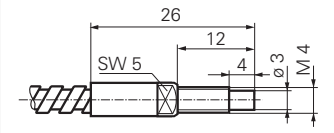
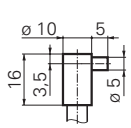
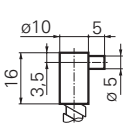
# Glass fiber optics for Series 18, 30
# Through beam types

Series 18 20-turn pot. | Series 18 Side mounted pot. Teach-in | Series 30 Fast version | Series 30 Extended Sb

## Fiber diameter 2 x 1 mm²

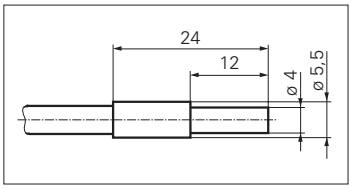
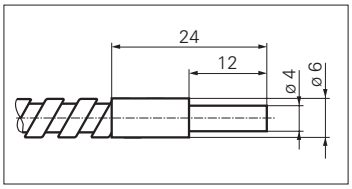
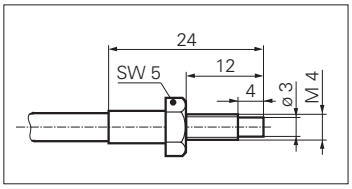
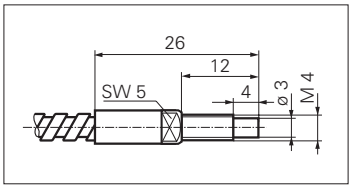
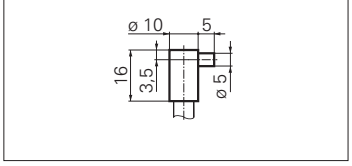
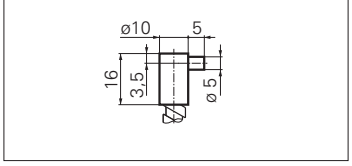
| Sheath material: PVC ø 2,5 mm (FSE ...) | Sheath material: brass chromium plated ø 4 mm (FSF ...) | Part number | Sb = actual range [mm] |
|---|---|---|---|
|  |  * can not be bent | **FSE 050A2002**<br>**FSF 050A2004**<br>(length 50 cm) | 90<br>270<br>200<br>450 |
| | | **FSE 100A2002**<br>**FSF 100A2004**<br>(length 100 cm) | 90<br>250<br>190<br>500 |
|  |  * can not be bent | **FSE 050A2001**<br>**FSF 050A2005**<br>(length 50 cm) | 90<br>270<br>200<br>450 |
| | | **FSE 100A2001**<br>**FSF 100A2005**<br>(length 100 cm) | 90<br>250<br>190<br>500 |
|  |  * can not be bent | **FSE 050A1001**<br>**FSF 050A1005**<br>(length 50 cm) | 90<br>270<br>200<br>450 |
| | | **FSE 100A1001**<br>**FSF 100A1005**<br>(length 100 cm) | 90<br>250<br>190<br>500 |
|  |  | **FSE 050A4003**<br>**FSF 050A4003**<br>(length 50 cm) | 90<br>270<br>200<br>450 |
| | | **FSE 100A4003**<br>**FSF 100A4003**<br>(length 100 cm) | 90<br>250<br>190<br>500 |

## Fiber diameter 2 x 2 mm²

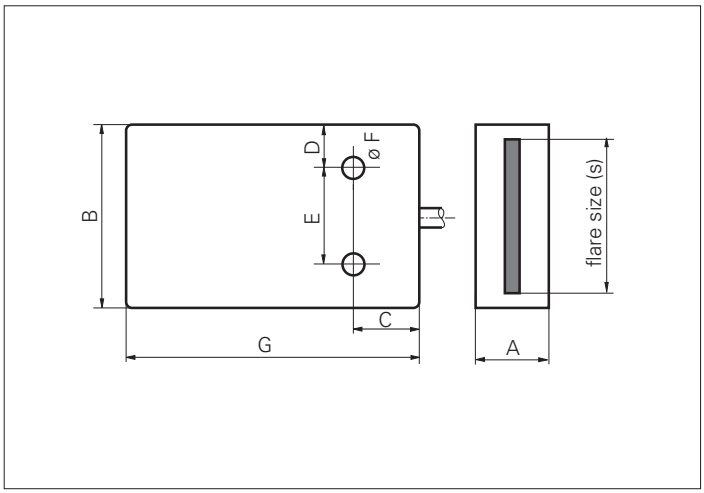
| Sheath material: PUR ø 4,5 mm (FSE ...) | Sheath material: brass chromium plated ø 5 mm (FSF ...) | Part number | Sb = actual range [mm] |
|---|---|---|---|
|  |  | **FSE 050A2006**<br>**FSF 050A2002**<br>(length 50 cm) | 180<br>450<br>380<br>450 |
| | | **FSE 100A2006**<br>**FSF 100A2002**<br>(length 100 cm) | 170<br>500<br>370<br>860 |
|  |  | **FSE 050A1006**<br>**FSF 050A1002**<br>(length 50 cm) | 180<br>450<br>380<br>450 |
| | | **FSE 100A1006**<br>**FSF 100A1002**<br>(length 100 cm) | 170<br>500<br>370<br>860 |
|  |  | **FSE 050A4006**<br>**FSF 050A4002**<br>(length 50 cm) | 180<br>450<br>380<br>450 |
| | | **FSE 100A4006**<br>**FSF 100A4002**<br>(length 100 cm) | 170<br>500<br>370<br>860 |

# Glass fiber optics for Series 18, 30
# Through beam types

Series 18 20-turn pot. | Series 18 Side mounted pot. Teach-in | Series 30 Fast version | Series 30 Extended Sb

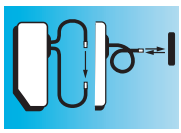
| Fiber diameter 2 x 4 mm² | | Part number | Sb = actual range [mm] |
|---|---|---|---|
| Sheath material: PVC ø 4 mm (FSE ...) | Sheath material: brass chromium plated ø 5 mm (FSF ...) | | |
|  |  | **FSE 050A2003**<br>**FSF 050A2001**<br>(length 50 cm) | 310<br>500<br>500<br>500 |
| | | **FSE 100A2003**<br>**FSF 100A2001**<br>(length 100 cm) | 300<br>800<br>600<br>1400 |
|  |  | **FSE 050A1003**<br>**FSF 050A1001**<br>(length 50 cm) | 310<br>500<br>500<br>500 |
| | | **FSE 100A1003**<br>**FSF 100A1001**<br>(length 100 cm) | 300<br>800<br>600<br>1400 |
|  |  | **FSE 050A4004**<br>**FSF 050A4004**<br>(length 50 cm) | 310<br>500<br>500<br>500 |
| | | **FSE 100A4004**<br>**FSF 100A4004**<br>(length 100 cm) | 300<br>800<br>600<br>1400 |

## Arrays (for Series 18 only)




| Part number | Sb = actual range [mm] |
|---|---|
| **FSF 050A3020**<br>**FSE 050A3020**<br>(length 50 cm) | 310<br>500 |
| **FSF 100A3020**<br>**FSE 100A3020**<br>(length 100 cm) | 310<br>800 |
| **FSF 050A3021**<br>**FSF 050A3022**<br>(length 50 cm) | 350<br>500 |
| **FSF 100A3021**<br>**FSF 100A3022**<br>(length 100 cm) | 350<br>900 |

| flare size | dimensions mm | | | | | | | part number |
|---|---|---|---|---|---|---|---|---|
| s | A | B | C | D | E | F | G | |
| 8 mm | 10 | 10 | - | - | - | - | 25 | FSF 050A3020<br>FSF 100A3020 |
| 8 mm | 10 | 10 | - | - | - | - | 25 | FSE 050A3020<br>FSE 100A3020 |
| 20 mm | 10 | 25 | 9 | 6.5 | 12 | 3,2 | 40 | FSF 050A3021<br>FSF 100A3021 |
| 35 mm | 12 | 40 | 12 | 7.5 | 25 | 4,2 | 50 | FSF 050A3022<br>FSF 100A3022 |
| metal sheath (FSF...) | | | | | | | | length 50 cm<br>length 100 cm |
| plastic sheath (FSE...)<br>(PUR) | | | | | | | | length 50 cm<br>length 100 cm |

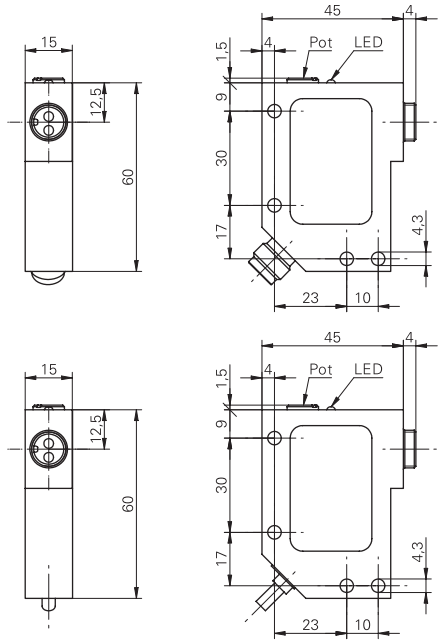


## Sb = 1200 mm
## Tw = 240 mm

- sensitivity adjustable via potentiometer
- fast version available
- rugged metal housing

| general data | |
|---|---|
| actual range Sb | 1200 mm |
| sensing distance Tw | 240 mm |
| light source | pulsed infrared diode |
| light indicator | LED yellow |
| alignment / soiled lens indicator | LED, flashing |
| adjustment | Pot, 20 turn |
| wave length | 880 nm |
| suppression of reciprocal influence | yes |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15 mm |
| height / length | 60 mm |
| depth | 45 mm |
| type | rectangular |
| housing material | die-cast aluminum |
| **ambient conditions** | |
| operating temperature | -25 ... +65 °C |
| protection class | IP 65 |
| **connectors** | |
| ESG 34AH0200 4 pin | 2 m straight |
| ESW 33AH0200 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| mounting bracket | 103415 |
| for details, see accessories section | |

**dimension drawings**

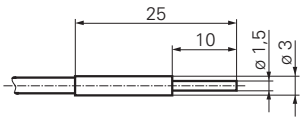
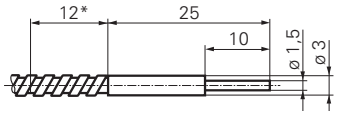
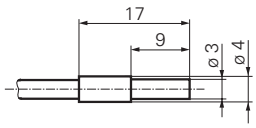
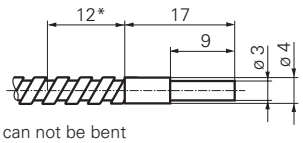
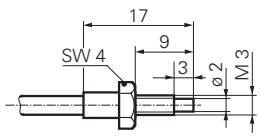
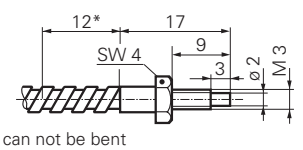
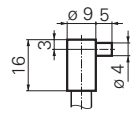
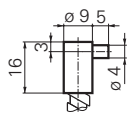
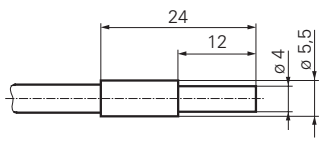
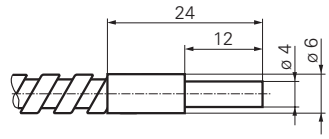
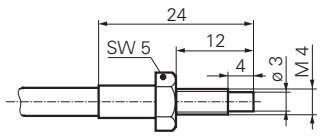
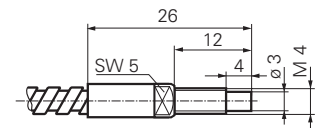
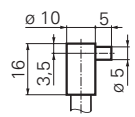
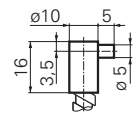
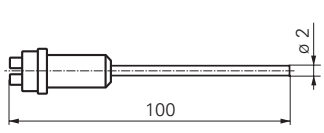
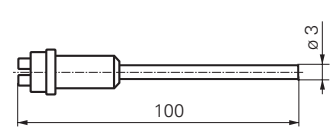



**connection diagrams**

| order reference | response time / release time | current consumption max. | current consumption typ. | output circuit | connection types |
|---|---|---|---|---|---|
| **FVDM 15N5103** | < 1 ms | 46 mA | 30 mA | NPN | cable 4 pin |
| **FVDM 15N5103/S14** | < 1 ms | 46 mA | 30 mA | NPN | connector M12, 4 pin |
| **FVDM 15P5103** | < 1 ms | 46 mA | 30 mA | PNP | cable 4 pin |
| **FVDM 15P5103/S14** | < 1 ms | 46 mA | 30 mA | PNP | connector M12, 4 pin |
| **FVDM 15P5130** | < 0,1 ms | 60 mA | 50 mA | PNP | cable 4 pin |
| **FVDM 15P5130/S14** | < 0,1 ms | 60 mA | 50 mA | PNP | connector M12, 4 pin |

# Glass fiber optics for Series 15
# Reflective types

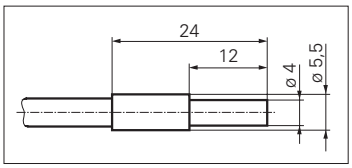
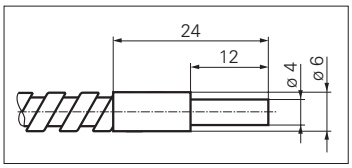
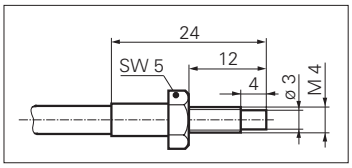
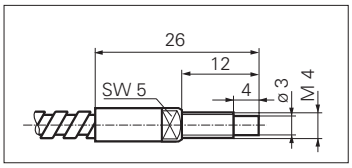
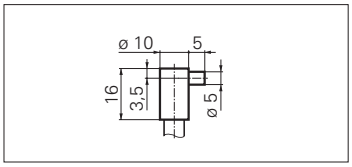
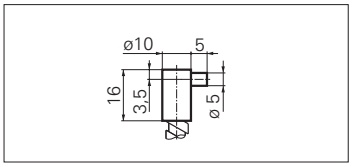
Series 15

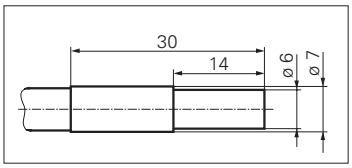
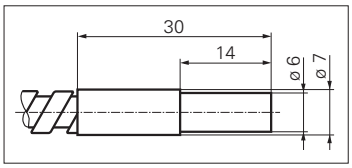
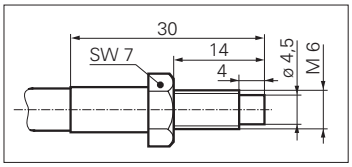
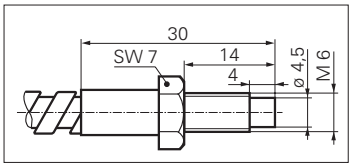
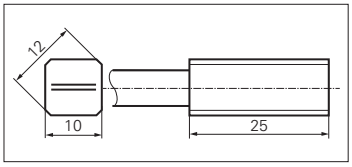
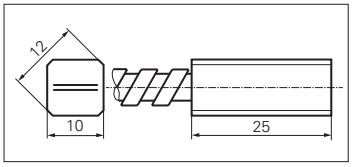
| Fiber diameter 2 x 0,5 mm² | | Part number | $T_W$ = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PVC ø 2,5 mm (FUE ...) | Sheath material: brass chromium plated ø 4 mm (FUF ...) | | |
|  |  * can not be bent | **FUE 025B2004**<br>**FUF 025B2004**<br>(length 25 cm) | 25 |
| | | **FUE 050B2004**<br>**FUF 050B2004**<br>(length 50 cm) | 25 |
|  |  * can not be bent | **FUE 025B2003**<br>**FUF 025B2003**<br>(length 25 cm) | 25 |
| | | **FUE 050B2003**<br>**FUF 050B2003**<br>(length 50 cm) | 25 |
|  |  * can not be bent | **FUE 025B1003**<br>**FUF 025B1003**<br>(length 25 cm) | 25 |
| | | **FUE 050B1003**<br>**FUF 050B1003**<br>(length 50 cm) | 25 |
|  |  | **FUE 025B4003**<br>**FUF 025B4006**<br>(length 25 cm) | 25 |
| | | **FUE 050B4003**<br>**FUF 050B4006**<br>(length 50 cm) | 25 |
| **Fiber diameter 2 x 1 mm²** | | **Part number** | **$T_W$ = sensing distance [mm]** |
| **Sheath material: PUR ø 4,5 mm (FUE ...)** | **Sheath material: brass chromium plated ø 5 mm (FUF ...)** | | |
|  |  | **FUE 025B2002**<br>**FUF 025B2005**<br>(length 25 cm) | 60 |
| | | **FUE 050B2002**<br>**FUF 050B2005**<br>(length 50 cm) | 60 |
|  |  | **FUE 025B1002**<br>**FUF 025B1005**<br>(length 25 cm) | 60 |
| | | **FUE 050B1002**<br>**FUF 050B1005**<br>(length 50 cm) | 60 |
|  |  | **FUE 025B4005**<br>**FUF 025B4008**<br>(length 25 cm) | 60 |
| | | **FUE 050B4005**<br>**FUF 050B4008**<br>(length 50 cm) | 60 |
| **Fiber diameter 2 x 0,5 mm²** | **Fiber diameter 2 x 1 mm²** | **Part number** | **$T_W$ = sensing distance [mm]** |
| **Sheath material: Chrome-nickel-steel ø 2 mm FUH 010B2002** | **Sheath material: Chrome-nickel-steel ø 3 mm FUH 010B2001** | | |
|  |  | **FUH 010B2002**<br>(length 10 cm) | 25 |
| | | **FUH 010B2001**<br>(length 10cm) | 60 |

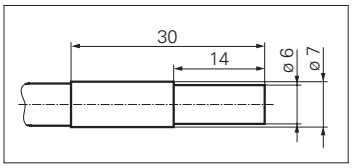
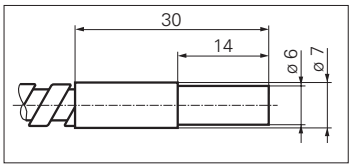
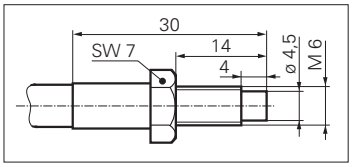
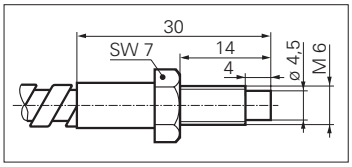
# Glass fiber optics for Series 15
# Reflective types

Series 15



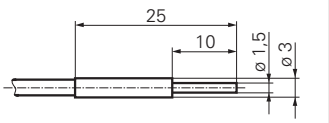
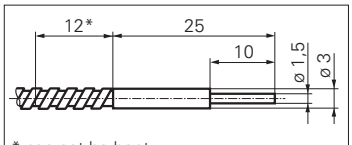
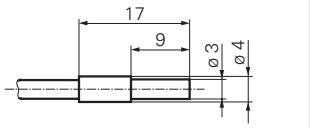
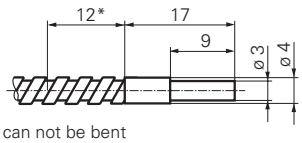
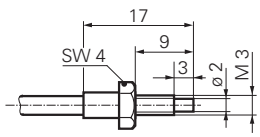
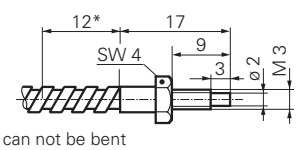
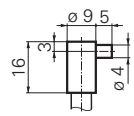
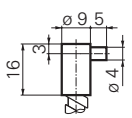
| Fiber diameter 2 x 2 mm² | | Part number | $T_W$ = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PUR ø 4,5 mm (FUE ...) | Sheath material: brass chromium plated ø 5 mm (FUF ...) | | |
|  |  | **FUE 025B2011**<br>**FUF 025B2011**<br>(length 25 cm) | 110 |
| | | **FUE 050B2011**<br>**FUF 050B2011**<br>(length 50 cm) | 100 |
|  |  | **FUE 025B1011**<br>**FUF 025B1011**<br>(length 25 cm) | 110 |
| | | **FUE 050B1011**<br>**FUF 050B1011**<br>(length 50 cm) | 100 |
|  |  | **FUE 025B4004**<br>**FUF 025B4002**<br>(length 25 cm) | 110 |
| | | **FUE 050B4004**<br>**FUF 050B4002**<br>(length 50 cm) | 100 |

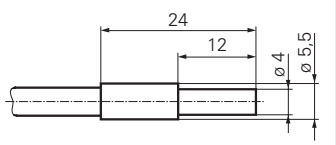
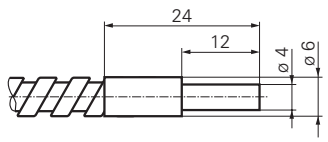
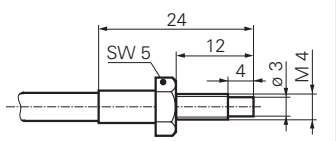
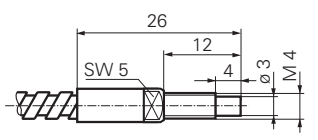
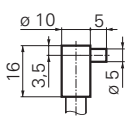
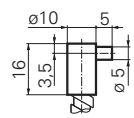
| Fiber diameter 2 x 3 mm² | | Part number | $T_W$ = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PUR ø 6 mm (FUE ...) | Sheath material: brass chromium plated ø 6 mm (FUF ...) | | |
|  |  | **FUE 025B2008**<br>**FUF 025B2002**<br>(length 25 cm) | 210 |
| | | **FUE 050B2008**<br>**FUF 050B2002**<br>(length 50 cm) | 200 |
|  |  | **FUE 025B1008**<br>**FUF 025B1002**<br>(length 25 cm) | 210 |
| | | **FUE 050B1008**<br>**FUF 050B1002**<br>(length 50 cm) | 200 |
|  |  | **FUE 025B3001**<br>**FUF 025B3001**<br>(length 25 cm) | 210 |
| | | **FUE 050B3001**<br>**FUF 050B3001**<br>(length 50 cm) | 200 |

| Fiber diameter 2 x 4 mm² | | Part number | $T_W$ = sensing distance [mm] |
|---|---|---|---|
| Sheath material: PUR ø 6 mm (FUE ...) | Sheath material: brass chromium plated ø 6 mm (FUF ...) | | |
|  |  | **FUE 025B2001**<br>**FUF 025B2001**<br>(length 25 cm) | 240 |
| | | **FUE 050B2001**<br>**FUF 050B2001**<br>(length 50 cm) | 230 |
|  |  | **FUE 025B1001**<br>**FUF 025B1001**<br>(length 25 cm) | 240 |
| | | **FUE 050B1001**<br>**FUF 050B1001**<br>(length 50 cm) | 230 |

# Glass fiber optics for Series 15
# Through beam types

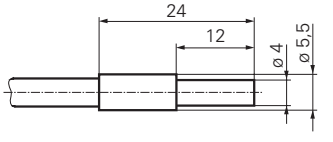
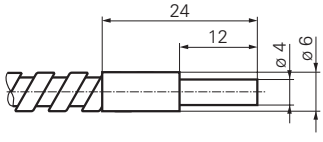
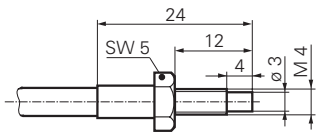
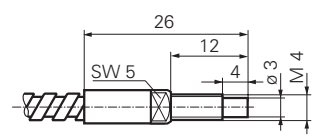
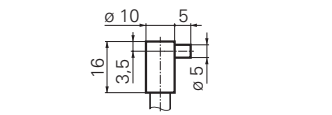
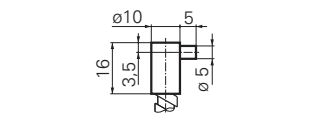


| Fiber diameter 2 x 1 mm² | | Part number | Sb = actual range [mm] |
|---|---|---|---|
| Sheath material: PVC ø 2,5 mm (FSE ...) | Sheath material: brass chromium plated ø 4 mm (FSF ...) | | |
|  |  * can not be bent | **FSE 025B2002**<br>**FSF 025B2002**<br>(length 25 cm) | 140 |
| | | **FSE 050B2002**<br>**FSF 050B2002**<br>(length 50 cm) | 320 |
|  |  * can not be bent | **FSE 025B2001**<br>**FSF 025B2005**<br>(length 25 cm) | 140 |
| | | **FSE 050B2001**<br>**FSF 050B2005**<br>(length 50 cm) | 320 |
|  |  * can not be bent | **FSE 025B1001**<br>**FSF 025B1005**<br>(length 25 cm) | 140 |
| | | **FSE 050B1001**<br>**FSF 050B1005**<br>(length 50 cm) | 320 |
|  |  | **FSE 025B4003**<br>**FSF 025B4003**<br>(length 25 cm) | 140 |
| | | **FSE 050B4003**<br>**FSF 050B4003**<br>(length 50 cm) | 320 |

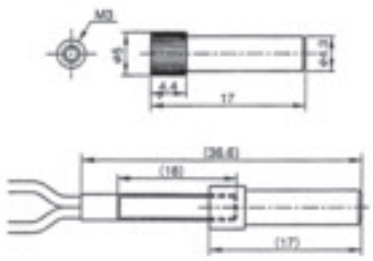
| Fiber diameter 2 x 2 mm² | | Part number | Sb = actual range [mm] |
|---|---|---|---|
| Sheath material: PUR ø 4,5 mm (FSE ...) | Sheath material: brass chromium plated ø 5 mm (FSF ...) | | |
|  |  | **FSE 025B2006**<br>**FSF 025B2006**<br>(length 25 cm) | 160 |
| | | **FSE 050B2006**<br>**FSF 050B2006**<br>(length 50 cm) | 450 |
|  |  | **FSE 025B1007**<br>**FSF 025B1007**<br>(length 25 cm) | 160 |
| | | **FSE 050B1007**<br>**FSF 050B1007**<br>(length 50 cm) | 450 |
|  |  | **FSE 025B4006**<br>**FSF 025B4002**<br>(length 25 cm) | 160 |
| | | **FSE 050B4006**<br>**FSF 050B4002**<br>(length 50 cm) | 450 |

# Glass fiber optics for Series 15
# Through beam types

Series 15

| Fiber diameter 2 x 4 mm² | | Part number | Sb = actual range [mm] |
|---|---|---|---|
| Sheath material: PVC ø 4 mm (FSE ...) | Sheath material: brass chromium plated ø 5 mm (FSF ...) | | |
|  |  | **FSE 025B2003**<br>**FSF 025B2001**<br>(length 25 cm) | 160 |
| | | **FSE 050B2003**<br>**FSF 050B2001**<br>(length 50 cm) | 500 |
|  |  | **FSE 025B1003**<br>**FSF 025B1001**<br>(length 25 cm) | 160 |
| | | **FSE 050B1003**<br>**FSF 050B1001**<br>(length 50 cm) | 500 |
|  |  | **FSE 025B4004**<br>**FSF 025B4004**<br>(length 25 cm) | 160 |
| | | **FSE 050B4004**<br>**FSF 050B4004**<br>(length 50 cm) | 500 |

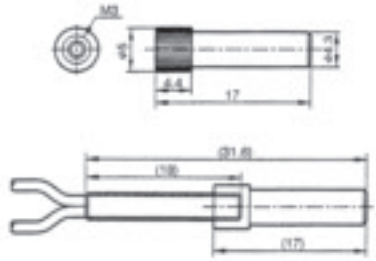
## Focusing lens M3



**Part number** **134544**

Light spot Ø 0,1 mm at a distance of 4,6 mm
For fiber optic:
FCE 050C1Y10 (recommended)
FCE 200D1Y00 FCE 200E1Y00
FCE 200D1Y01

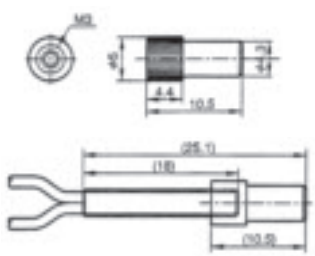
## Focusing lens M3



**Part number** **134543**

Light spot Ø 0,4 mm at a distance of 7 mm
For fiber optic:
FCE 050C1Y10 FCE 200E1Y00
FCE 200D1Y00
FCE 200D1Y01

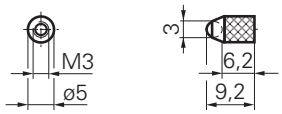
## Focusing lens M3



**Part number** **134542**

Light spot Ø 2 mm at a distance of 19 mm
For fiber optic:
FCE 050C1Y10 FCE 200E1Y00
FCE 200D1Y00
FCE 200D1Y01

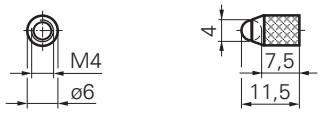
## Focusing lens M3 (pair)




**Part number** **119910**

Increases the actual range Sb by a factor of 6
For fiber optic:
FSE 200C1004

## Focusing lens M4 (pair)




**Part number** **119909**

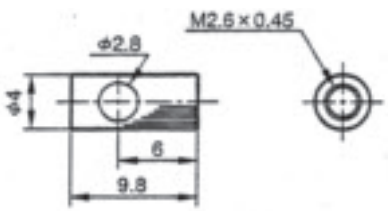
Increases the actual range Sb by a factor of 6
For fiber optic:
FSE 200C1002

## Focusing lens M2.6 (pair)

**Part number** **134541**

Increases the actual range Sb by a factor of 6
For fiber optic:
FSE 200C1Y00 / FSE 200C2Y00
FSA 200C1Y00 FSE 200E1Y00
FSG 200C1Y00

## Focusing lens M2.6 (pair)

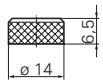



**Part number** **134540**

Side light exit
Increases the actual range Sb by a factor of 6
For fiber optic: FSE 200C1Y00 /
FSE 200C2Y00 FSG 200C1Y00
FSA 200C1Y00 FSE 200E1Y00

# Accessories fiber optics

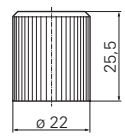
## Cap nut Serie 15




**Part number** **103230**

- for re-orders when lost
- enclosed with every fiber optic of Series 15

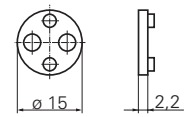
## Cap nut Serie 18




**Part number** **101480**

- for re-orders when lost
- enclosed with every fiber optic of Series 18

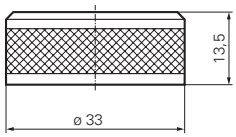
## Adjusting plate Serie 18




**Part number** **101958**

- for re-orders when lost
- enclosed with every fiber optic of Series 18

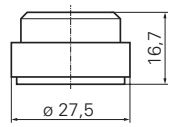
## Cap nut Serie 30




**Part number** **102801**

- must be ordered with every fiber optic of Series 30

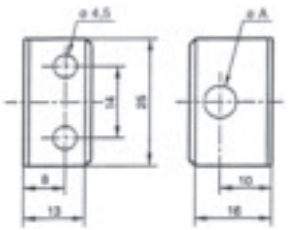
## Adapter Serie 30




**Part number** **102757**

- must be ordered with every fiber optic of Series 30

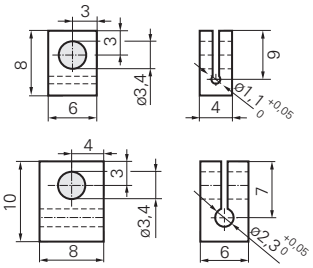
## Mounting bracket



**Part number**

**134532** for sensing head M3 øA 3,5 mm
**134536** for sensing head M4 øA 4,5 mm
**134538** for sensing head M6 øA 6,5 mm

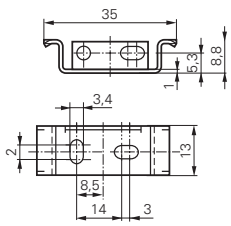
## Mounting bracket



**Part number**

**119912** For fiber optic through beam type with 1,1 mm sheath diameters
**119911** For fiber optic through beam type with 2,2 mm sheath diameters

## Mounting bracket

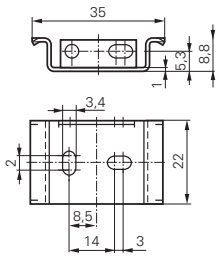


**Part number** **145702**

For Series 12 fiber optic sensors

Delivered with every plastic fiber optic sensor

## Mounting bracket



**Part number** **125534**

For Series 22 fiber optic sensors

Delivered with every plastic fiber optic sensor.

## Mounting bracket

**Part number** **159806**

Delivered with every Series 69, Series 60, Series 80 fiber optic sensor.

The mounting bracket must be ordered separately for Series 67 sensors.

## Reduction tube

**Part number** **140260**

Set of 2

Delivered with every 1 mm diameter plastic fiber optic.

## Fiber optic cable extension

**Part number**

**145523** Länge: 5 m

Highly flexible fiber

Reduction in range due to fiber optic extension: approx. 25 %

## Fiber optic extension

**Part number**

**156738** Länge: 2 m
**158142** Länge: 5 m

Reduction in range due to fiber optic extension: 2 m = approx. 25 %; 5 m = approx. 60 %

## Cutting tool

**Part number** **114652**

Delivered with every plastic fiber optic

# Vision sensors
# Edge/Profile recognition

| product family | VXS 1203M10 | VXS 1203M16 | VXS 1003M10 |
|---|---|---|---|
| | | | |
| | *VeriSens* | *VeriSens* | *VeriSens* |
| picture sensor | High Sensitive Progressive Scan CCD | High Sensitive Progressive Scan CCD | High Sensitive Progressive Scan CCD |
| pixel quantity | 656 x 494 | 656 x 494 | 656 x 494 |
| objectiv (focal distance) | 10 mm | 16 mm | 10 mm |
| min. object distance | 50 mm | 60 mm | 50 mm |
| lighting LED red | ■ | ■ | ■ |
| lighting LED white | ■ | ■ | ■ |
| signal processing | processor Baumer FEX® 3.0<br>64 MByte | processor Baumer FEX® 3.0<br>64 MByte | processor Baumer FEX® 3.0<br>64 MByte |
| communication seriell | setting up USB 2.0<br>process interface RS485 | setting up USB 2.0<br>process interface RS485 | USB 2.0 |
| housing material | aluminum and polycarbonat | aluminum and polycarbonat | aluminum and polycarbonat |
| | | | |
| **Page** | **500** | **501** | **502** |

| VXS 1003M16 | VXS 0501M10 |
|---|---|
| | |
| *VeriSens* | *VeriSens* |
| High Sensitive Progressive Scan CCD | CMOS |
| 656 x 494 | 320 x 240 |
| 16 mm | 10 mm |
| 60 mm | 50 mm |
| ■ | - |
| ■ | ■ |
| processor Baumer FEX® 3.0<br>64 MByte | processor Baumer FEX® 2.5<br>32 MByte |
| USB 2.0 | USB 2.0 |
| aluminum and polycarbonat | aluminum and polycarbonat |
| | |
| **503** | **504** |

## General information

The new image-processing vision sensors ***VeriSens®*** from Baumer close the gap between classical optical sensors and complex vision systems.
Their high-resolution image sensor permits 2-dimensional, i.e. arial inspection of objects. For this purpose, ***VeriSens®*** vision sensors offer extensive functions, thus supporting numerous inspection tasks in automation technology.

Due to the innovative Baumer FEX® processor technology, Baumer ***VeriSens®*** vision sensors are characterized by an extremely compact design. They provide process reliability and user-friendliness unachieved in this class until today.

## Applications

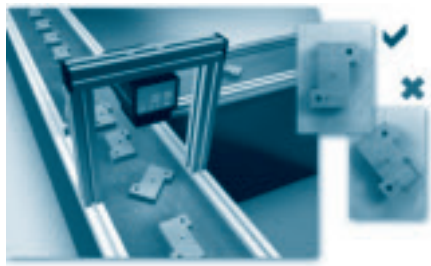
**Completeness checking**

Placement checking in the handling industry

**Presence checking**

Seal checking and inspection of labels in the packaging industry

**Location and position detection**



Detection of the correct position of objects in material handling

The Baumer ***VeriSens®*** is a flexible solution for many sensor applications in automated production.

The ***VeriSens®*** offers an extensive library of pre-configured functions for this purpose. You can define the job of your ***VeriSens®*** according to your requirements. The parameters are simply set with the configuration software on a PC.

Within the shortest time you can reliably implement simple presence checks up to extensive 100% inspections of several object properties simultaneously. Several jobs can be loaded into a ***VeriSens®***. The current job is selected automatically via digital inputs by a PLC or manually by the operator. This also permits the switching between different jobs when changing products subjected to inspection.

Once the parameters have been set, the ***VeriSens®*** operates completely autonomously and reliably – just like a sensor should!

## Characteristics and advantages

- Pre-configured sensor functions support many inspection tasks
- Position correction functions in the x, y and rotation directions allow for reliable operation even with varying position of the inspected specimen
- Inspection tasks can be selected by digital inputs
- Compact design with integrated LED illumination, precision optics and processing electronics

## Technology and operation

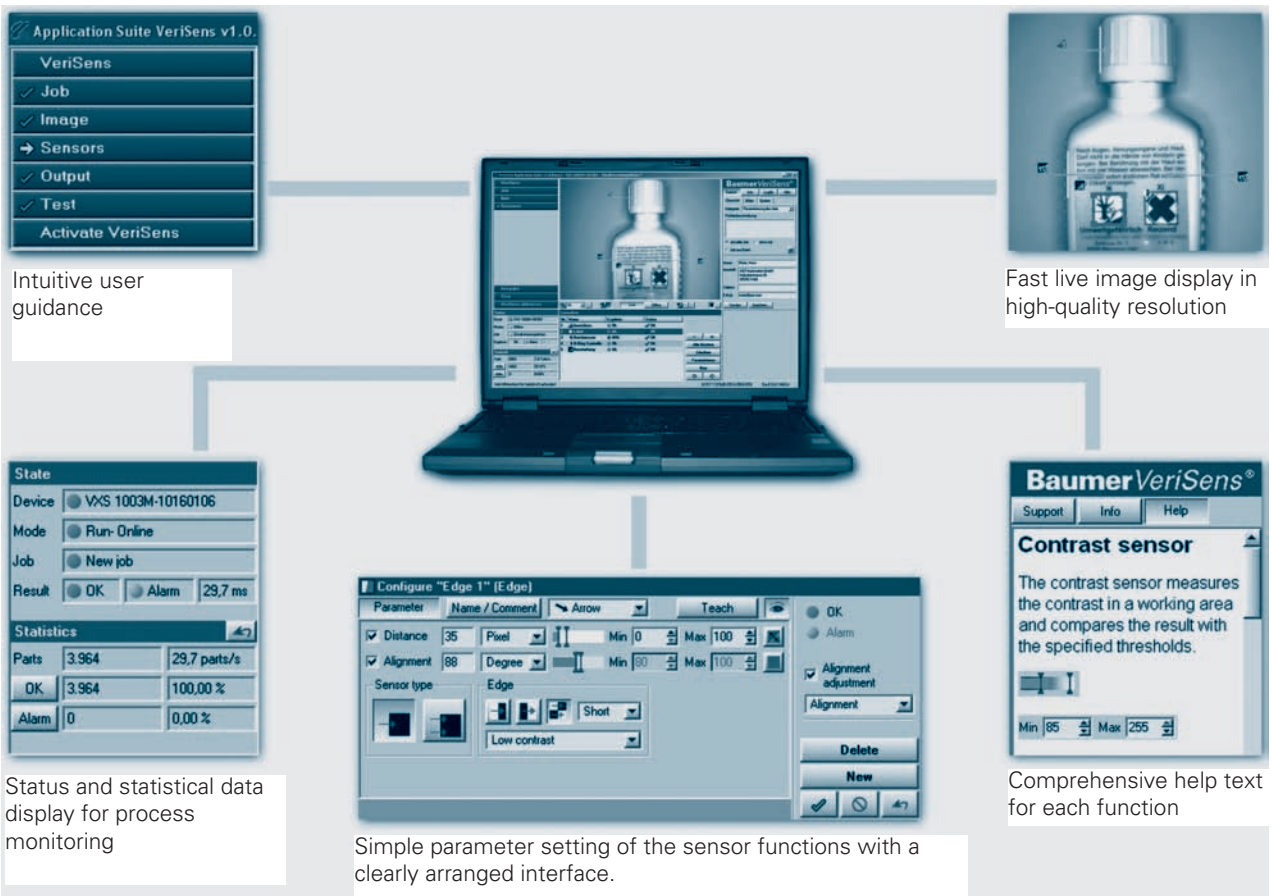
The ***VeriSens***® is equipped with integrated LED illumination, precision optics, a CCD camera, processing electronics and interfaces, all contained in a very compact, rugged aluminum housing. This permits stand-alone operation without additional external modules.

The Baumer FEX® image processor calculates all object contours in a grey-value image in real-time and with subpixel accuracy, even at minimum brightness contrast.

## The *VeriSens* Application Suite

Configuring a ***VeriSens***® vision sensor easily takes place with the "Application Suite" control program on a PC or laptop.
The graphical user interface of the Application Suite is characterized by a straightforward user guidance. It also provides intuitive support for people not specialized in setting up an image processing application. Apart from the actual inspection function, ***VeriSens***® can also be connected conveniently to a PLC.

Numerous additional functions are available to the professional, such as functions otherwise offered by expensive vision systems only. These functions include the detection of image sequences in real-time for offline parameter setting of the sensors, the convenient management of configuration data, the visualization of statistical data and the



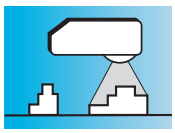

Intuitive user guidance

Fast live image display in high-quality resolution

Status and statistical data display for process monitoring

Simple parameter setting of the sensor functions with a clearly arranged interface.

Comprehensive help text for each function



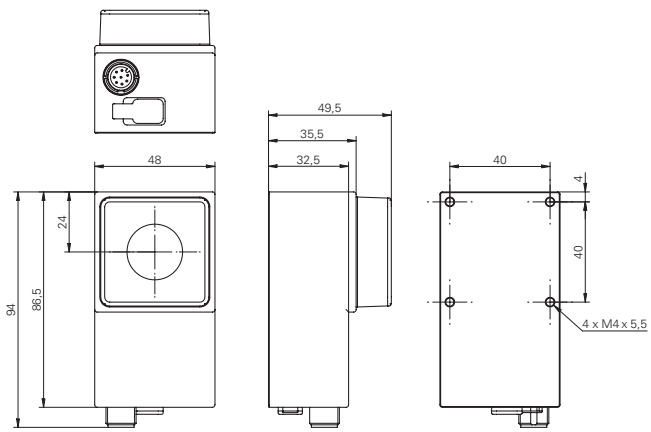
## focal distance = 10 mm

- Outline function and Outline comparison
- Brightness, Contrast and Blob

| general data | |
|---|---|
| picture sensor | High Sensitive Progressive Scan CCD |
| pixel quantity | 656 x 494 |
| version | monochromatic |
| speed<br>high resolution mode:<br>high speed mode: | <br>max. 30 inspections/sec<br>max. 50 inspections/sec |
| objectiv (focal distance) | 10 mm |
| min. object distance | 50 mm |
| **inspection field** | |
| at 60 mm object distance | 24 x 18 mm |
| at 100 mm object distance | 43 x 32 mm |
| at 200 mm object distance | 92 x 69 mm |
| at 300 mm object distance | 140 x 106 mm |
| signal processing | processor Baumer FEX® 3.0<br>64 MByte |
| inputs | 8 ... 30 VDC |
| outputs | PNP 100 mA |
| 4x input digital | Trigger, job options 1 + 2,<br>job option 3 / external Teach |
| 4x output digital | Pass / Fail, Ready, Alarm,<br>Flash sync |
| communication serial | setting up USB 2.0<br>process interface RS485 |
| **electrical data** | |
| voltage supply range +Vs | 8 ... 30 VDC |
| power consumption max. | typ. 6 W |
| **mechanical data** | |
| width / diameter | 48 mm |
| height / length | 94 mm |
| depth | 49,5 mm |
| type | rectangular |
| housing material | aluminum and polycarbonate |
| weight | 250 g |
| **ambient conditions** | |
| operating temperature | +5 ... +50 °C |
| humidity | 0 ... 90 % (non-condensing) |
| protection class | IP 64 |
| **accessories** | |
| mounting bracket straight | 159905 |
| mounting bracket angular | 159906 |
| USB cable | 159907 |
| *VeriSens* application suite CD | 159908 |
| for details, see accessories section | |

| order reference | lighting |
|---|---|
| **VXS 1203M10RR** | LED red (typ. 660 nm) |
| **VXS 1203M10WR** | LED white |

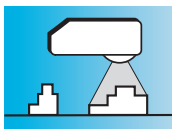
**dimension drawing**




| SPS-Interface | Typ M12 |
|---|---|
| 1: IN1 (Trigger) | |
| 2: Power +24 VDC | |
| 3: OUT1 (Ready) | |
| 4: OUT2 (Pass / Fail) | |
| 5: OUT3 (Alarm) | |
| 6: IN2 (Job) | |
| 7: Ground | |
| 8: IN3 (Job) | |

| SPS-Interface | Typ M12 |
|---|---|
| 1: OUT4 (Flash) | |
| 2: IN4 (Job / Teach) | |
| 3: Ground | |
| 4: RS485+ | |
| 5: RS485- | |

| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| ESG 34FP0500B | 8 pin | 5 m straight (shielded) |
| ES 34CP2B | 5 pin | 2 m straight (shielded) |
| ES 34CP5B | 5 pin | 5 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |



## focal distance = 16 mm

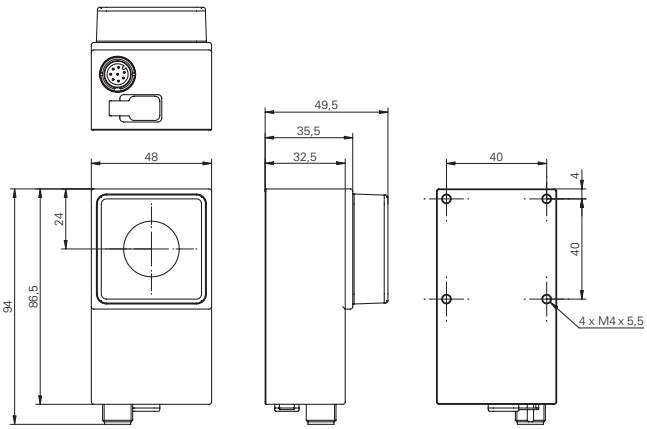
- Outline function and Outline comparison
- Brightness, Contrast and Blob

| general data | |
|---|---|
| picture sensor | High Sensitive Progressive Scan CCD |
| pixel quantity | 656 x 494 |
| version | monochromatic |
| speed<br>high resolution mode:<br>high speed mode: | <br>max. 30 inspections/sec<br>max. 50 inspections/sec |
| objectiv (focal distance) | 16 mm |
| min. object distance | 60 mm |
| **inspection field** | |
| at 60 mm object distance | 13 x 10 mm |
| at 100 mm object distance | 25 x 19 mm |
| at 200 mm object distance | 55 x 42 mm |
| at 300 mm object distance | 86 x 64 mm |
| signal processing | processor Baumer FEX® 3.0<br>64 MByte |
| inputs | 8 ... 30 VDC |
| outputs | PNP 100 mA |
| 3x input digital | Trigger, job options 1 + 2,<br>job option 3 / external Teach |
| 3x output digital | Pass / Fail, Ready, Alarm,<br>Flash sync |
| communication serial | setting up USB 2.0<br>process interface RS485 |
| **electrical data** | |
| voltage supply range +Vs | 8 ... 30 VDC |
| power consumption max. | typ. 6 W |
| **mechanical data** | |
| width / diameter | 48 mm |
| height / length | 94 mm |
| depth | 49,5 mm |
| type | rectangular |
| housing material | aluminum and polycarbonate |
| weight | 250 g |
| **ambient conditions** | |
| operating temperature | +5 ... +50 °C |
| humidity | 0 ... 90 % (non-condensing) |
| protection class | IP 64 |

| accessories | |
|---|---|
| mounting bracket straight | 159905 |
| mounting bracket angular | 159906 |
| USB cable | 159907 |
| *VeriSens* application suite CD | 159908 |
| for details, see accessories section | |

| order reference | lighting |
|---|---|
| **VXS 1203M16RR** | LED red (typ. 660 nm) |
| **VXS 1203M16WR** | LED white |

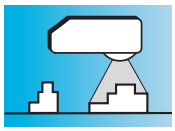
**dimension drawing**




| SPS-Interface | Typ M12 |
|---|---|
| 1: IN1 (Trigger) | |
| 2: Power +24 VDC | |
| 3: OUT1 (Ready) | |
| 4: OUT2 (Pass / Fail) | |
| 5: OUT3 (Alarm) | |
| 6: IN2 (Job) | |
| 7: Ground | |
| 8: IN3 (Job) | |

| SPS-Interface | Typ M12 |
|---|---|
| 1: OUT4 (Flash) | |
| 2: IN4 (Job / Teach) | |
| 3: Ground | |
| 4: RS485+ | |
| 5: RS485- | |

| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| ESG 34FP0500B | 8 pin | 5 m straight (shielded) |
| ES 34CP2B | 5 pin | 2 m straight (shielded) |
| ES 34CP5B | 5 pin | 5 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |



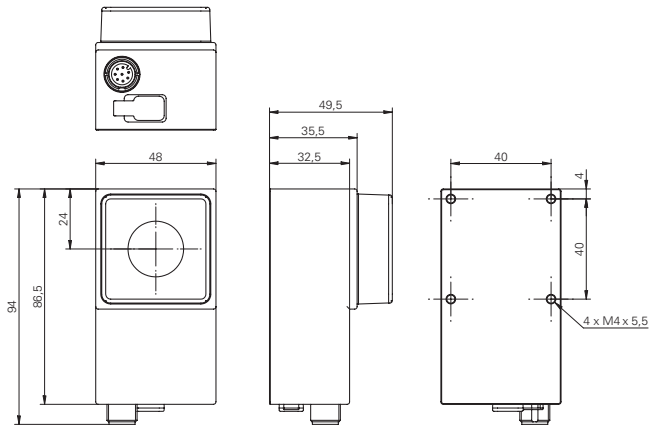
## focal distance = 10 mm

- Outline function and Outline comparison
- Brightness, Contrast and Blob

| general data | |
|---|---|
| picture sensor | High Sensitive Progressive Scan CCD |
| pixel quantity | 656 x 494 |
| version | monochromatic |
| speed<br>high resolution mode:<br>high speed mode: | <br>max. 30 inspections/sec<br>max. 50 inspections/sec |
| objectiv (focal distance) | 10 mm |
| min. object distance | 50 mm |
| **inspection field** | |
| at 60 mm object distance | 24 x 18 mm |
| at 100 mm object distance | 43 x 32 mm |
| at 200 mm object distance | 92 x 69 mm |
| at 300 mm object distance | 140 x 106 mm |
| signal processing | processor Baumer FEX® 3.0<br>64 MByte |
| inputs | 8 ... 30 VDC |
| outputs | PNP 100 mA |
| 3x input digital | Trigger, job options 1 + 2 |
| 3x output digital | Pass / Fail, Ready<br>Alarm / Flash sync |
| communication serial | USB 2.0 |
| **electrical data** | |
| voltage supply range +Vs | 8 ... 30 VDC |
| power consumption max. | typ. 6 W |
| **mechanical data** | |
| width / diameter | 48 mm |
| height / length | 94 mm |
| depth | 49,5 mm |
| type | rectangular |
| housing material | aluminum and polycarbonate |
| weight | 250 g |
| **ambient conditions** | |
| operating temperature | +5 ... +50 °C |
| humidity | 0 ... 90 % (non-condensing) |
| protection class | IP 64 |
| **accessories** | |
| mounting bracket straight | 159905 |
| mounting bracket angular | 159906 |
| USB cable | 159907 |
| *VeriSens* application suite CD | 159908 |
| for details, see accessories section | |

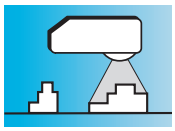
| order reference | lighting |
|---|---|
| **VXS 1003M10RS** | LED red (typ. 660 nm) |
| **VXS 1003M10WS** | LED white |

**dimension drawing**




| SPS-Interface | Typ M12 |
|---|---|
| 1: IN1 (Trigger) | |
| 2: Power +24 VDC | |
| 3: OUT1 (Ready) | |
| 4: OUT2 (Pass / Fail) | |
| 5: OUT3 (Flash / Alarm) | |
| 6: IN2 (Job) | |
| 7: Ground | |
| 8: IN3 (Job) | |

| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| ESG 34FP0500B | 8 pin | 5 m straight (shielded) |
| ESG 34FP1000B | 8 pin | 10 m straight (shielded) |
| ESW 33FP1000B | 8 pin | 10 m angular (shielded) |



## focal distance = 16 mm

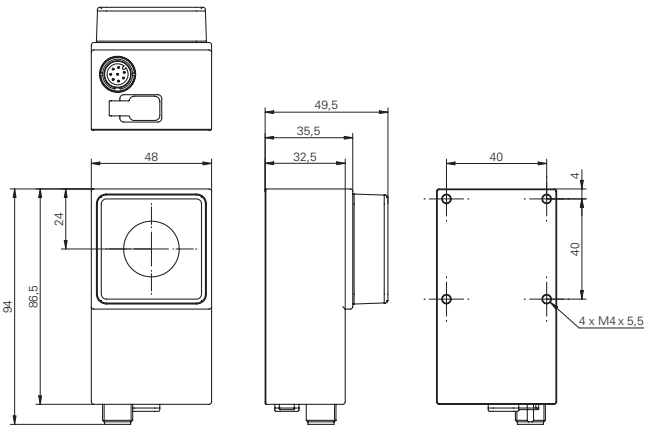
- Outline function and Outline comparison
- Brightness, Contrast and Blob

| general data | |
|---|---|
| picture sensor | High Sensitive Progressive Scan CCD |
| pixel quantity | 656 x 494 |
| version | monochromatic |
| speed<br>high resolution mode:<br>high speed mode: | <br>max. 30 inspections/sec<br>max. 50 inspections/sec |
| objectiv (focal distance) | 16 mm |
| min. object distance | 60 mm |
| **inspection field** | |
| at 60 mm object distance | 13 x 10 mm |
| at 100 mm object distance | 25 x 19 mm |
| at 200 mm object distance | 55 x 42 mm |
| at 300 mm object distance | 86 x 64 mm |
| signal processing | processor Baumer FEX® 3.0<br>64 MByte |
| inputs | 8 ... 30 VDC |
| outputs | PNP 100 mA |
| 3x input digital | Trigger, job options 1 + 2 |
| 3x output digital | Pass / Fail, Ready<br>Alarm / Flash sync |
| communication seriell | USB 2.0 |
| **electrical data** | |
| voltage supply range +Vs | 8 ... 30 VDC |
| power consumption max. | typ. 6 W |

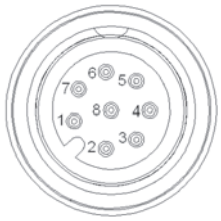
| mechanical data | |
|---|---|
| width / diameter | 48 mm |
| height / length | 94 mm |
| depth | 49,5 mm |
| type | rectangular |
| housing material | aluminum and polycarbonate |
| **ambient conditions** | |
| operating temperature | +5 ... +50 °C |
| humidity | 0 ... 90 % (non-condensing) |
| protection class | IP 64 |
| **accessories** | |
| mounting bracket straight | 159905 |
| mounting bracket angular | 159906 |
| USB cable | 159907 |
| *VeriSens* application suite CD | 159908 |
| for details, see accessories section | |

| order reference | lighting |
|---|---|
| **VXS 1003M16RS** | LED red (typ. 660 nm) |
| **VXS 1003M16WS** | LED white |

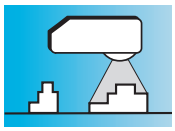
**dimension drawing**




| SPS-Interface | Typ M12 |
|---|---|
| 1: IN1 (Trigger) | |
| 2: Power +24 VDC | |
| 3: OUT1 (Ready) | |
| 4: OUT2 (Pass / Fail) | |
| 5: OUT3 (Flash / Alarm) | |
| 6: IN2 (Job) | |
| 7: Ground | |
| 8: IN3 (Job) | |




| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| ESG 34FP0500B | 8 pin | 5 m straight (shielded) |
| ESG 34FP1000B | 8 pin | 10 m straight (shielded) |
| ESW 33FP1000B | 8 pin | 10 m angular (shielded) |



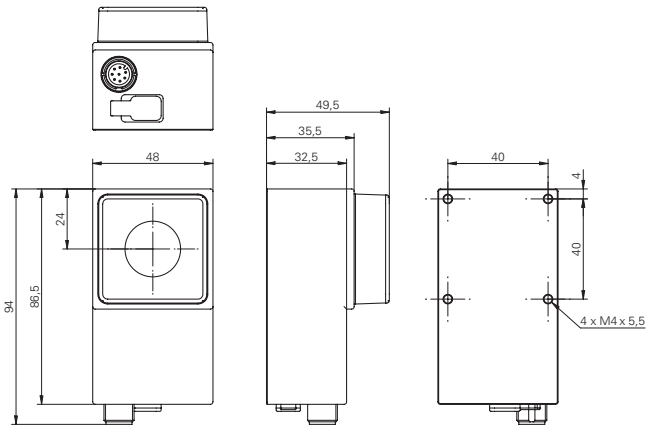
## focal distance = 10 mm

- Outline function and Outline comparison
- Brightness, Contrast and Blob

| general data | |
|---|---|
| picture sensor | CMOS |
| pixel quantity | 320 x 240 |
| version | monochromatic |
| speed | max. 50 inspections/sec |
| objectiv (focal distance) | 10 mm |
| min. object distance | 50 mm |
| **inspection field** | |
| at 60 mm object distance | 22 x 14 mm |
| at 100 mm object distance | 40 x 25 mm |
| at 200 mm object distance | 85 x 55 mm |
| at 300 mm object distance | 130 x 83 mm |
| signal processing | processor Baumer FEX® 2.5<br>32 MByte |
| inputs | 8 ... 30 VDC |
| outputs | PNP 100 mA |
| 3x input digital | Trigger, job options 1 + 2 |
| 3x output digital | Pass / Fail, Ready<br>Alarm / Flash sync |
| communication seriell | USB 2.0 |
| **electrical data** | |
| voltage supply range +Vs | 8 ... 30 VDC |
| power consumption max. | typ. 6 W |
| **mechanical data** | |
| width / diameter | 48 mm |
| height / length | 94 mm |
| depth | 49,5 mm |
| type | rectangular |
| housing material | aluminum and polycarbonate |
| weight | 250 g |
| **ambient conditions** | |
| operating temperature | +5 ... +50 °C |
| humidity | 0 ... 90 % (non-condensing) |
| protection class | IP 64 |
| **accessories** | |
| mounting bracket straight | 159905 |
| mounting bracket angular | 159906 |
| USB cable | 159907 |
| *VeriSens* application suite CD | 159908 |
| for details, see accessories section | |

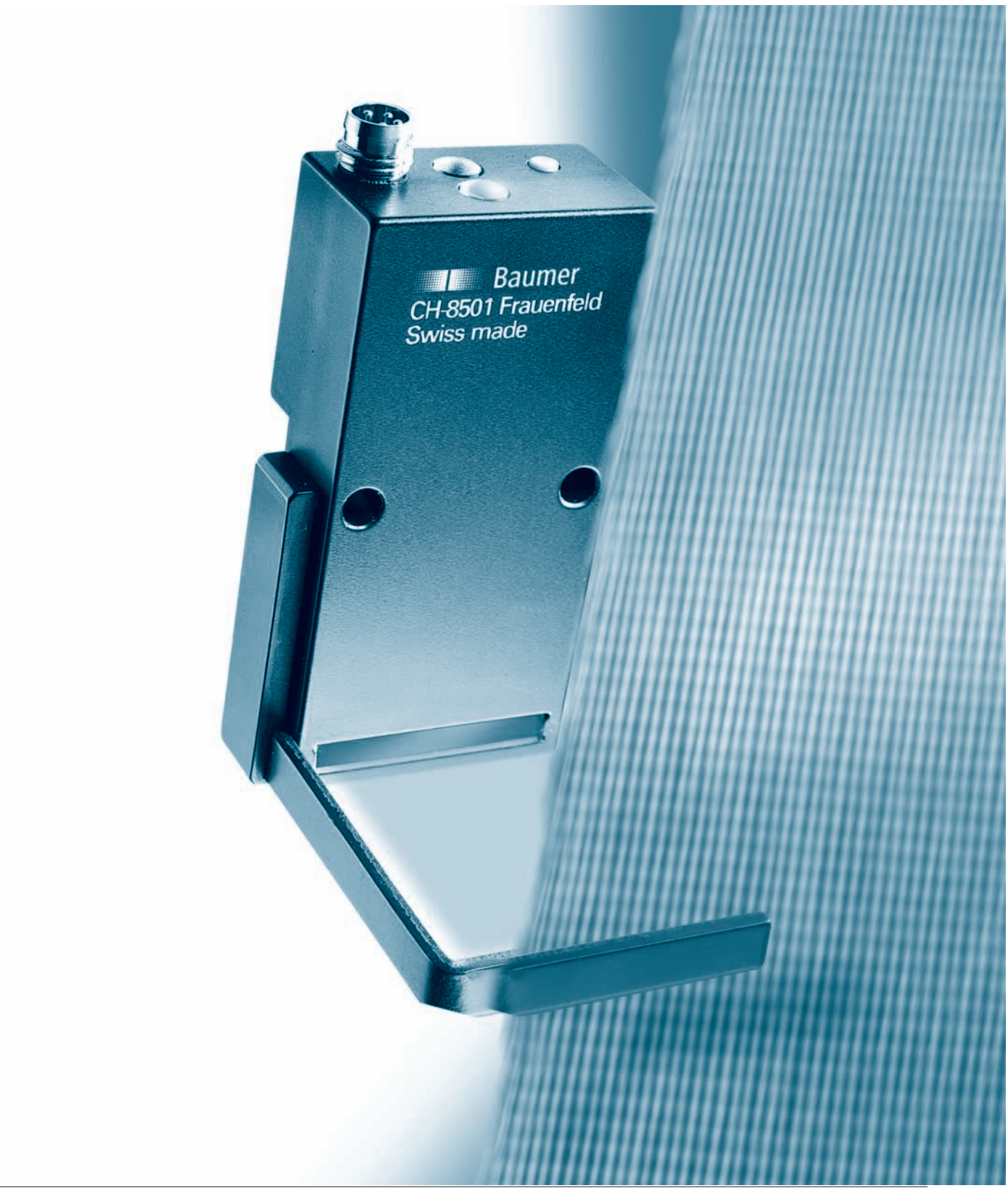
| order reference | lighting |
|---|---|
| **VXS 0501M10WS** | LED white |

**dimension drawing**




| SPS-Interface | Typ M12 |
|---|---|
| 1: IN1 (Trigger) | |
| 2: Power +24 VDC | |
| 3: OUT1 (Ready) | |
| 4: OUT2 (Pass / Fail) | |
| 5: OUT3 (Flash / Alarm) | |
| 6: IN2 (Job) | |
| 7: Ground | |
| 8: IN3 (Job) | |

| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| ESG 34FP0500B | 8 pin | 5 m straight (shielded) |
| ESG 34FP1000B | 8 pin | 10 m straight (shielded) |
| ESW 33FP1000B | 8 pin | 10 m angular (shielded) |


Baumer
CH-8501 Frauenfeld
Swiss made

| product family | ZADM 034 | ZADM 034 |
|---|---|---|
| | | |
| | *ParCon* | *ParCon* |
| measuring field size | 24 mm | 24 mm |
| measuring range towards object | 0 ... 40 mm | 0 ... 40 mm |
| measuring frequency | > 1000 Hz | > 4000 Hz |
| output signal | 4 ... 20 mA | |
| PNP | | ■ |
| analog | ■ | |
| connector | ■ | ■ |
| housing material | metal | metal |
| **Page** | **510** | **512** |

| product family | ZADM 023 | ZADM 023 |
|---|---|---|
| | | |
| | *PosCon* | *PosCon* |
| measuring field size | 30 mm<br>150 mm<br>350 mm | |
| measuring field size (dep. on measuring dist.) | | 400 ... 875 mm |
| measuring distance (to object) | 50 mm<br>200 mm<br>500 mm | |
| measuring range towards object | | 640 ... 1400 mm |
| measuring frequency | > 500 Hz | > 500 Hz |
| analog and RS 485 | ■ | ■ |
| output signal | 4 ... 20 mA | 4 ... 20 mA |
| connector | ■ | ■ |
| housing material | metal | metal |
| | | |
| **Page** | **514** | **516** |

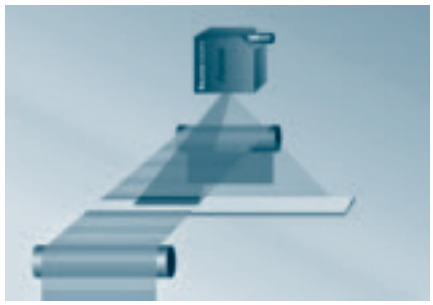
## General information

Line sensors are used to detect object widths and object positions. The position / width is issued as an analog value with high accuracy proportional to the overall measuring area. Although smaller than a deck of playing cards, the sensors contain not only the complete signal conditioning, but also a long-life illumination unit.
The simple switching version of the ***ParCon*** also permits the detection of small objects within the measuring area.

## Applications

Edge recognition (*PosCon*, *ParCon*)

- Control of textile, plastic or paper edges
- Positioning of objects by the edge
- Level measurement

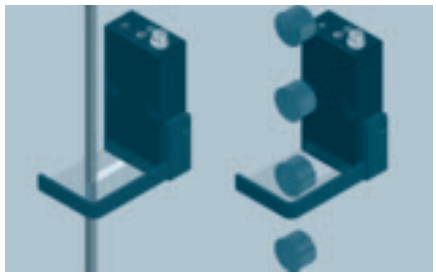


Width measurement (*PosCon*, *ParCon*)

- Width inspection during the production of fabric and rubber bands

Center position (*PosCon*)

- Position measurement by the object center, by which bands or objects of different width can be aligned centrally to each other



Counting and detecting objects (*ParCon*), switching output

- Detection and counting of small objects falling through the measurement area
- Wire and belt break monitoring

## Characteristics and advantages

*ParCon* line sensor

- The two measuring modes (edge, center) can be set at the push of a button.
- Due to the parallel light beams, the vertical movement of fabric webs does not affect the measurement signal.
- The high measuring frequency of 1000 Hz in the analog sensor also permits rapid movements to be detected.
- Due to the high switching frequency of 4 kHz, even small, rapidly moving parts are reliably detected.

*PosCon* line sensor

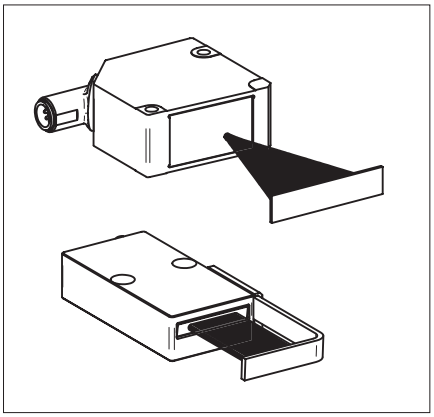
- The measuring area can be restricted by a simple Teach-in process to suppress interfering objects and areas.
- The three different measuring modes (width, edge, center) can be set simply at the push of a button.
- Two threshold values can be programmed with the Teach-in button and serve as tolerance limits for the switching output.
- All functions available with the buttons can also be operated via an RS 485 interface.
- The position and other information can be read via the interface.
- Measurement is possible on transparent objects and films.

## Technology and operation

With the line sensors, the light of the integrated illumination is reflected by a reflective film (special film) installed opposite the sensor and is received by the diode line. The length of the diode line and the optics determine the measuring area. Due to the narrow diode line, the measuring area is also only a narrow band. If an object obstructs a part of the light, no light falls on the corresponding part of the diode line. The integrated microcontroller processes the shaded areas and the transitions from dark to light and calculates the corresponding analog value according to the measuring mode.

The optics of the ***PosCon*** and the ***ParCon*** are constructed differently. The ***PosCon*** has a diverging measuring field. This makes large measuring areas of up to 800 mm possible. The specified measuring area is achieved at the nominal distance. It becomes larger or smaller proportionally with the distance. This causes an object to appear larger or smaller according to the distance.

The ***ParCon*** has a parallel measuring field, making an object appear equal in size in the entire measuring area.

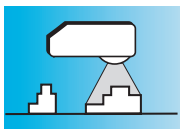


## Mounting and adjustment

The reflective tape specified in the documentation must be used for the ***PosCon*** and ***ParCon***.

If the reflective tape is protected against abrasion by a Plexiglas or glass sheet, this must be tilted 7° to the sensor to ensure that the direct reflection does not reflect to the receiver. The reflective tape for the ParCon is covered by a protective film.

If highly reflective objects are measured, it is conceivable that a direct reflection will occur just as strong as the light from the reflective film. In this case, measuring errors can occur. This can be prevented by tilting the object away from the sensor.



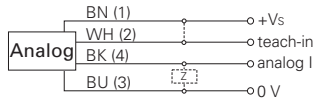
## measuring range = 0 ... 40

- measuring of edge position and object width
- parallel, uniform light beam
- high measuring frequency

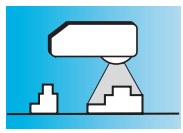
| general data | |
|---|---|
| measuring field size | 24 mm |
| measuring range towards object | 0 ... 40 mm |
| measuring frequency | > 1000 Hz |
| resolution | < 0,05 mm |
| smallest object recognizable | 1 mm |
| linearity error | ± 0,4 mm (S = 0...40 mm)<br>± 0,2 mm (S = 20...40 mm) |
| repeatability | < 0,05 mm |
| power on indication | LED green |
| output indicator | LED yellow |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| **electrical data** | |
| response time | < 1 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | analog |
| output signal | 4 ... 20 mA |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| housing material | aluminum |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +55 °C |
| protection class | IP 67 |

| order reference | type |
|---|---|
| **ZADM 034I240.0001** | rectangular, side view |
| **ZADM 034I240.0021** | rectangular, front view |

**connection diagram**

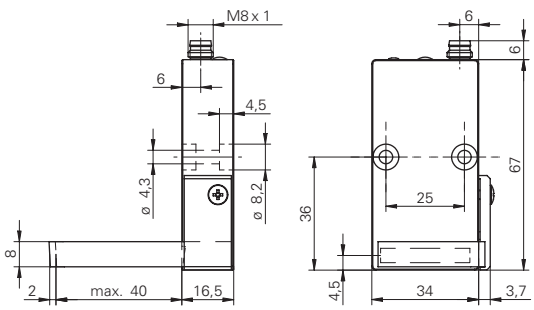


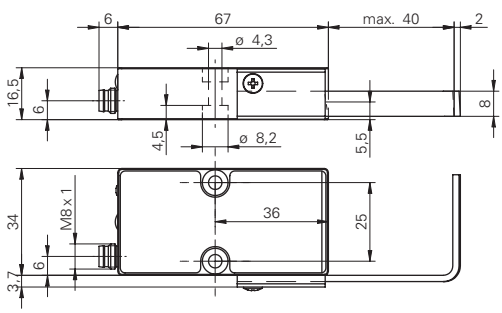

| connectors | | |
|---|---|---|
| ESG 32AP0500G | 4 pin | 5 m straight (shielded) |
| ESW 31AP0500G | 4 pin | 5 m angular (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

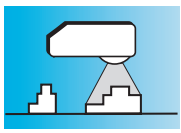


| **reflectors** | |
|---|---|
| FTDF 012M050 | tape 12 x 50 mm (included) |
| FTDR 008M030/01 | bracket for ZADM 034x240.xx01 (included) |
| FTDR 008M030/21 | bracket for ZADM 034x240.xx21 (included) |
| | |
| optional | |
| FTDF 050M234 | tape 50 x 234 mm |

**dimension drawings**





## measuring range = 0 ... 40

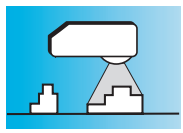
- detection of small objects
- measuring area 24 x 40 mm
- high measuring frequency

| general data | |
|---|---|
| measuring field size | 24 mm |
| measuring range towards object | 0 ... 40 mm |
| measuring frequency | > 4000 Hz |
| resolution | < 0,1 mm |
| smallest object recognizable | 0,5 mm |
| hysteresis | 0,4 mm |
| power on indication | LED green |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| adjustment | Teach-in |
| **electrical data** | |
| response time | < 0,25 ms |
| output pulse length | 10 ms |
| voltage supply range +Vs | 12 ... 28 VDC |
| current consumption max. | 120 mA |
| output circuit | PNP |
| output current | < 100 mA |
| voltage drop Vd | < 2,2 VDC |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| output function | light / dark operate |
| **mechanical data** | |
| housing material | aluminum |
| front (optics) | glass |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | 0 ... +55 °C |
| protection class | IP 67 |

| order reference | type |
|---|---|
| **ZADM 034P240.6901** | rectangular, side view |
| **ZADM 034P240.6921** | rectangular, front view |

**connection diagram**

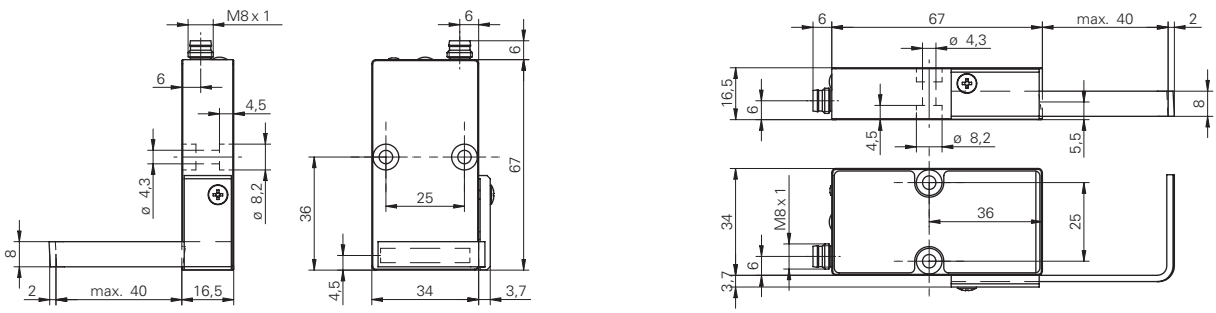
| connectors | | |
|---|---|---|
| ESG 32AP0500G | 4 pin | 5 m straight (shielded) |
| ESW 31AP0500G | 4 pin | 5 m angular (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

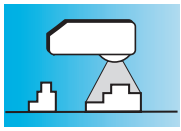


| reflectors | |
|---|---|
| FTDF 012M050 | tape 12 x 50 mm (included) |
| FTDR 008M030/01 | bracket for ZADM 034x240.xx01 (included) |
| FTDR 008M030/21 | bracket for ZADM 034x240.xx21 (included) |

| optional | |
|---|---|
| FTDF 050M234 | tape 50 x 234 mm |

## dimension drawings



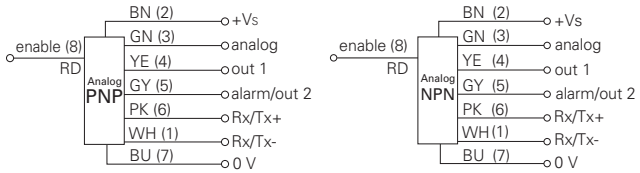


## measuring field size = 350

- Teach-in measuring range
- measuring mode: edges, center, width
- RS 485 interface

| general data | |
|---|---|
| version | with filter for transparent objects |
| measuring frequency | > 500 Hz |
| linearity error relative | < 0,3 % |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| adjustment | Teach-in |
| **measuring field size = 30 mm** | |
| measuring distance (to object) | 50 mm |
| resolution | < 0,03 mm |
| smallest object recognizable | 0,3 mm |
| **measuring field size = 150 mm** | |
| measuring distance (to object) | 200 mm |
| resolution | < 0,15 mm |
| smallest object recognizable | 1,2 mm |
| **measuring field size = 350 mm** | |
| measuring distance (to object) | 500 mm |
| resolution | < 0,35 mm |
| smallest object recognizable | 4 mm |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 28 VDC |
| current consumption max. | 150 mA |
| output signal | 4 ... 20 mA |
| output current | < 100 mA |
| interface | analog and RS 485 |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +55 °C |
| protection class | IP 67 |

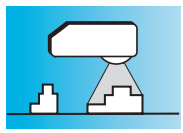
**connection diagrams**




| connectors | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| mounting bracket | 126220 |
| for details, see accessories section | |

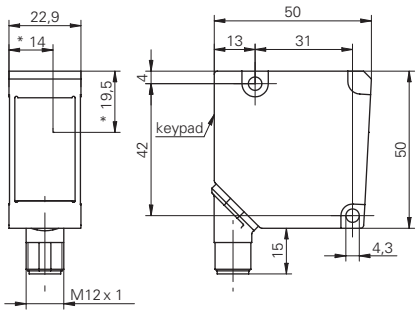
| order reference | measuring field size | output function | switching output | reflector width |
|---|---|---|---|---|
| **ZADM 023H151.0001** | 150 mm | Out 1 / Alarm | PNP | 15 mm |
| **ZADM 023H151.0002** | 150 mm | Out 1 / Alarm | NPN | 15 mm |
| **ZADM 023H151.0011** | 150 mm | Out 1 / Out 2 | PNP | 15 mm |
| **ZADM 023H151.0012** | 150 mm | Out 1 / Out 2 | NPN | 15 mm |
| **ZADM 023H300.0001** | 30 mm | Out 1 / Alarm | PNP | 3 mm |
| **ZADM 023H300.0002** | 30 mm | Out 1 / Alarm | NPN | 3 mm |
| **ZADM 023H300.0011** | 30 mm | Out 1 / Out 2 | PNP | 3 mm |
| **ZADM 023H300.0012** | 30 mm | Out 1 / Out 2 | NPN | 3 mm |
| **ZADM 023H351.0001** | 350 mm | Out 1 / Alarm | PNP | 30 mm |
| **ZADM 023H351.0002** | 350 mm | Out 1 / Alarm | NPN | 30 mm |
| **ZADM 023H351.0011** | 350 mm | Out 1 / Out 2 | PNP | 30 mm |
| **ZADM 023H351.0012** | 350 mm | Out 1 / Out 2 | NPN | 30 mm |



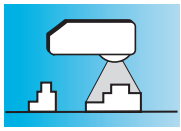
## reflectors

| | | reflector | reflector tape on reel | | reflective tape | |
|---|---|---|---|---|---|---|
| measuring range | 30 mm | FTDR 005I040 | FTDL 005I000/... m | width 5 mm | FTDF 005I040 | 5 x 40 mm |
| measuring range | 150 mm | FTDR 020I175 | FTDL 020I000/... m | width 20 mm | FTDF 020I175L | 20 x 17,5 mm |
| measuring range | 350 mm | FTDR 035I395 | FTDL 035I000/... m | width 35 mm | FTDF 035I395 | 35 x 395 mm |
| | | | FTDL 610I000/... m | width 610 mm | | |

## dimension drawing




* receiver axis

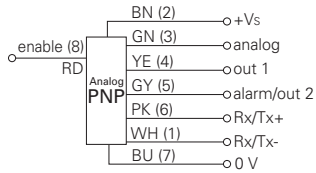


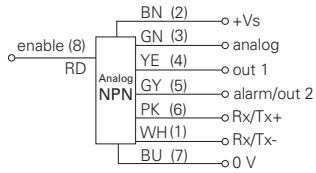
## measuring field size = 875

- Teach-in measuring range
- measuring mode: edges, center, width
- RS 485 interface

| general data | |
|---|---|
| version | without filter for transparent objects |
| measuring field size (dep. on measuring dist.) | 400 ... 875 mm |
| measuring range towards object | 640 ... 1400 mm |
| measuring frequency | > 500 Hz |
| resolution | 0,5 ... 1 mm |
| smallest object recognizable | 8,5 ... 18 mm |
| linearity error relative | < 0,3 % |
| light source | pulsed infrared diode |
| wave length | 880 nm |
| adjustment | Teach-in |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 28 VDC |
| current consumption max. | 150 mA |
| output signal | 4 ... 20 mA |
| output current | < 100 mA |
| interface | analog and RS 485 |
| reverse polarity protection | yes, Vs to GND |
| short circuit protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| reflector width | 50 mm |
| front (optics) | glass |
| connection types | connector M12, 8 pin, rotatable |
| **ambient conditions** | |
| operating temperature | 0 ... +55 °C |
| protection class | IP 67 |

**connection diagrams**



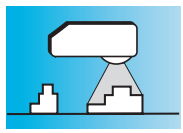

**connectors**

| | | |
|---|---|---|
| ESG 34FP0200B | 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | | |

**accessories**

| | |
|---|---|
| mounting bracket | 126220 |
| for details, see accessories section | |

| order reference | output function | switching output |
|---|---|---|
| **ZADM 023H871.0001** | Out 1 / Alarm | PNP |
| **ZADM 023H871.0002** | Out 1 / Alarm | NPN |
| **ZADM 023H871.0011** | Out 1 / Out 2 | PNP |
| **ZADM 023H871.0012** | Out 1 / Out 2 | NPN |



## reflectors

| | |
|---|---|
| FTDL 050I000/... m | on reel, width 35 mm |
| FTDL 610I000/... m | on reel, width 610 mm |
| included | |

## conversion factors

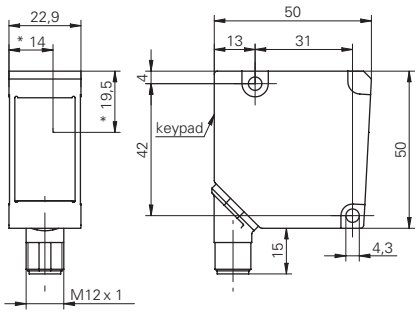
| measuring distance (mm) | measuring range (mm) |
|---|---|
| 640 | 400 |
| 1400 | 875 |
| **meas. distance : meas. range** | **= 1,6** |

| measuring distance (mm) | resolution (mm) |
|---|---|
| 640 | 0,5 |
| 1400 | 1 |
| **meas. distance : resolution** | **= 1300** |

| measuring distance (mm) | smallest object (mm) |
|---|---|
| 640 | 8,5 |
| 1400 | 18 |
| **meas. distance : smallest object** | **= 75** |

| example | desired measuring range | |
|---|---|---|
| meas. distance | 650 mm x 1,6 | = 1040 mm |
| resolution | 1040 mm : 1300 | = 0,8 mm |
| smallest object | 1040 mm : 75 | = 13,9 mm |
| | | **= 650 mm** |

## dimension drawing




* receiver axis

| product family | FLDM 170 | FLDM 170 | FLDK 110 | FLDK 110 |
|---|---|---|---|---|
| | | | | |
| | *SCATEC-15* | *SCATEC-10* | *SCATEC-2* | *SCATEC-J* |
| measuring distance Sd | 0 ... 120 mm | 0 ... 90 mm | 0 ... 60 mm | 0 ... 55 mm |
| optimum operating distance | 100 mm | 70 mm | 40 mm | 40 mm |
| counting rate | < 3'000'000 copies/h | < 3'000'000 copies/h | < 600'000 copies/h | < 280'000 copies/h |
| output pulse length | 0,3 ... 500 ms selectable | 0,3 ... 500 ms selectable | 5 / 10 / 15 / 20 ms selectable | 10 ms |
| sensitivity | single sheet/edge thickness 0,15 mm | single sheet/edge thickness 0,1 mm | single sheet/edge thickness 0,2 mm | single sheet/edge thickness 1,5 mm |
| false pulse suppression | 4 program options | 4 program options | on/off switchable | |
| sensitivity adjustment | 4 preset levels or level set by customer | 4 preset levels or level set by customer | high/low switchable | no |
| direct gap detection | yes | yes | | |
| interface | CAN and serial | serial | | |
| push-pull | ■ | ■ | ■ | ■ |
| opto isolated | ■ | ■ | ■ | |
| housing material | metal | metal | plastic | plastic |
| **Page** | **522** | **524** | **526** | **528** |

## General information

The sensors in the ***SCATEC*** range were developed specifically for non-contact counting of overlapped paper sheets and newspapers. Other flat objects conveyed in a lap stream or individually can also be counted. If such an object moves through the laser beam, the sensor replies with an electrical impulse with a fixed time period. The patented optical principle permits objects to be detected regardless of their color and surface; matte black objects are counted just as accurately as white glossy ones.

## Characteristics and advantages

- Counts regardless of the direction of product motion
  The copies are counted when an edge facing the laser beam moves through the beam, whether the direction of product motion is forwards or backwards.
- Visible laser beam
  The red laser line is easily visible on the object and permits simple alignment.
- Color insensitivity
  The integrated laser controller makes the ***SCATEC*** extremely insensitive to different surfaces of the object.
- No blind region
  Large counted objects can even touch the sensor without causing counting errors.
- Sensitivity adjustment
  Depending on the model, the sensitivity can be adjusted with a DIP switch, on the control panel or via the interface.
- Edge indicator
  Yellow LED: this lights as long as an edge is in the laser beam.

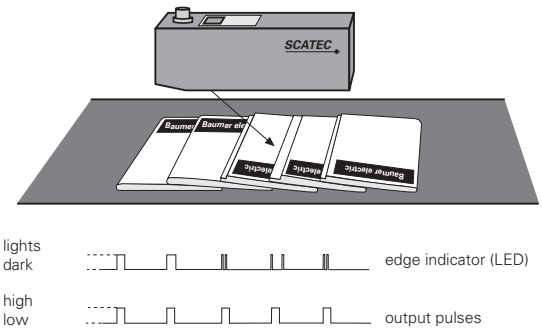
## Characteristics and advantages

Multiple pulse suppression
Particularly with thick copies (newspapers, folded cardboard boxes etc.) or with a small prefold, multiple pulses which can occur at the edge can be suppressed by this function. Error pulse suppression operates by preventing further pulses from being emitted when an output pulse is active or during an idle time. The following programs guarantee optimum adjustment to all counting problems:

Fixed idle time: adjustable in milliseconds

Dynamic dead time: the microcontroller constantly monitors the pulse sequence and eliminates multiple pulses even if the conveying speed varies by dynamically adjusting the dead time to the pulse sequence.

Synchronization to the machine cycle: the ***SCATEC*** can be synchronized to the machine cycle (e.g. by an encoder) via a synchronization input. The dead time then corresponds to a defined distance which is absolutely independent of the conveying speed.




- No counting errors when the lap stream is interrupted
  The ***SCATEC*** detects only the leading edge of an object. It does not detect trailing edges which become visible when the lap stream is interrupted. Projecting trailing edges can be suppressed by direct gap detection or by delaying the output pulse (***SCATEC-10*** or ***SCATEC-15***). An integrated retro-reflective sensor permits accurate detection of gaps in the lap stream. This can additionally increase the counting accuracy.
- Programming and diagnostic software
  With the programming software ***ScaDiag***, all functions and parameters can be simply adjusted on a PC. Furthermore, measurement sequences can be recorded and stored for diagnosis and troubleshooting.
- CAN interface
  The ***SCATEC-15*** can be automatically programmed via the CAN interface (e.g. if the format is changed).

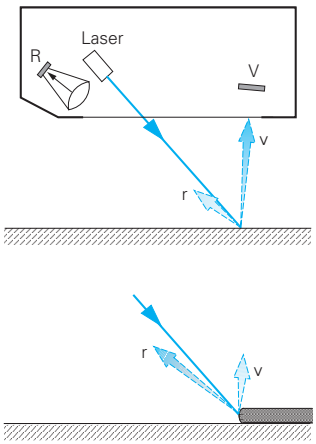
## Technology and operation

Stated simply, the *SCATEC* consists of a laser light source and two photodetectors. The beam is aimed diagonally at the objects to be detected.

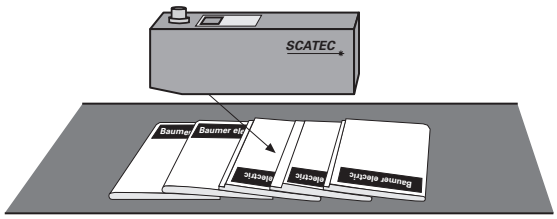
The photodetector **R** is located close to the laser light source and photodetector **V** is a little further away. The sensor determines the ratio between signal **v** (light diffused forwards) and signal **r** (light diffused backwards).

The ration **v/r** differs widely depending on whether the beam strikes a flat surface or an edge. If an edge moves into the laser beam, the direct view from detector **V** to the laser strike point is obstructed, reducing signal **v**, and also the edge increases the backwards diffusion, which causes signal **r** to rise. Both effects make the ratio **v/r** much smaller at an edge than on a flat surface. If the ratio **v/r** falls below a specific threshold, this is interpreted by the sensor as an edge.

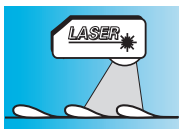
Due to the well-focused laser beam, the *SCATEC* detects even the smallest edges. There is no blind region directly beneath the sensor. Large counted objects may even touch the sensor without causing counting errors.




## Mounting and adjustment




- The objects to be counted must have an edge facing the beam.
- The sensor must be installed parallel above the working plane.
- The laser beam should be blocked by a beam stop mounted parallel and just below the working plane. We recommend a light, matte object for this purpose (white paper, light and matte metal surface).



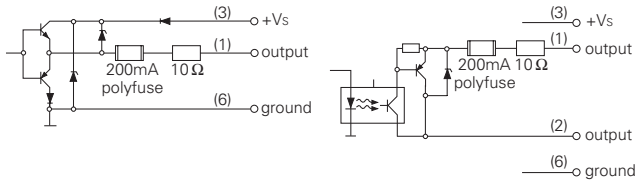

## Sd = 0 ... 120 mm

- counting of up to 3 million copies/hour
- integrated copy counter
- CAN interface

| general data | |
|---|---|
| measuring distance Sd | 0 ... 120 mm |
| optimum operating distance | 100 mm |
| counting rate | < 3'000'000 copies/h |
| object speed | < 5 m/sec |
| object cycle distance | > 1 mm |
| sensitivity | single sheet/edge thickness 0,15 mm |
| sync. input | yes |
| measuring point | visible red laser line 8 mm |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| edge indicator | LED yellow |
| power on indication | LED green |
| direct gap detection | yes |
| false pulse suppression | 4 program options |
| sensitivity adjustment | 4 preset levels or level set by customer |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 230 mA |
| output pulse length | 0,3 ... 500 ms selectable |
| short circuit protection | yes |
| reverse polarity protection | yes |
| interface | CAN and serial |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| connector base (main connector) | DIN 45322, 6 pin |
| connector base (interface) | DIN 45326, 8 pin |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 54 |

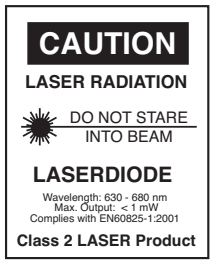
| order reference | output circuit |
|---|---|
| **FLDM 170C1030/S42** | opto isolated |
| **FLDM 170G1030/S42** | push-pull |

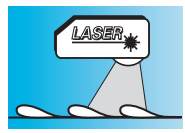
### connection diagrams



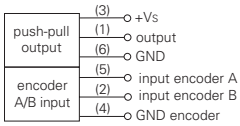

| accessories | |
|---|---|
| ScaDiag kit diagnostic program includes interface converter and manual | 156491 |
| mounting plate for mounting on rails | 157472 |
| for details, see accessories section | |

### laser warning

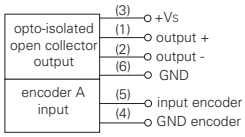




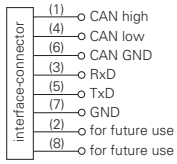

## pin assignments




main connector push-pull

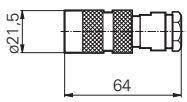


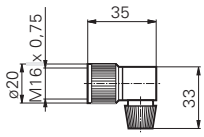

main connector open collector




interface-connector

## connectors




| | | |
|---|---|---|
| 104236 | 6 pin | (included) |
| 153202 | 8 pin | (optional) |

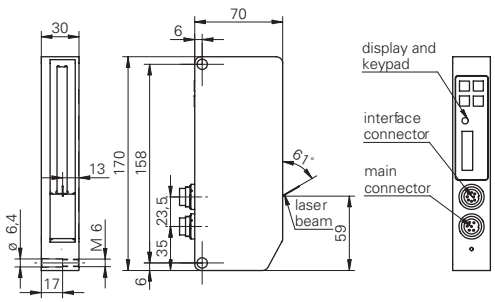
| | | |
|---|---|---|
| 153094 | 6 pin | (optional) |
| 153095 | 8 pin | (optional) |

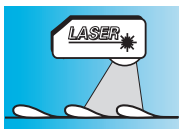
| connector | |
|---|---|
| ESG 16FP1000G | CAN cable, length = 10 m |

## reflectors

| | |
|---|---|
| FTDF 025F025 | tape 25 x 25 mm |
| (included) | |

## dimension drawing






## Sd = 0 ... 90 mm

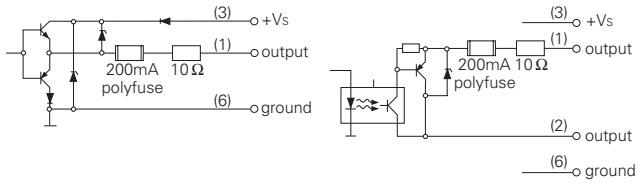
- counting of up to 3 million copies/hour
- integrated copy counter

| general data | |
|---|---|
| measuring distance Sd | 0 ... 90 mm |
| optimum operating distance | 70 mm |
| counting rate | < 3'000'000 copies/h |
| object speed | < 5 m/sec |
| object cycle distance | > 1 mm |
| sensitivity | single sheet/edge thickness 0,1 mm |
| sync. input | yes |
| measuring point | visible red laser line 6 mm |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| edge indicator | LED yellow |
| power on indication | LED green |
| direct gap detection | yes |
| false pulse suppression | 4 program options |

| electrical data | |
|---|---|
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 230 mA |
| output pulse length | 0,3 ... 500 ms selectable |
| short circuit protection | yes |
| reverse polarity protection | yes |
| interface | serial |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| connector base (main connector) | DIN 45322, 6 pin |
| connector base (interface) | DIN 45326, 8 pin |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 54 |

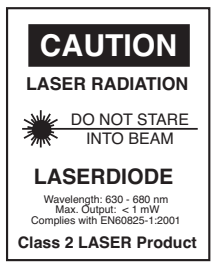
| order reference | output circuit |
|---|---|
| **FLDM 170C1011/S42** | opto isolated |
| **FLDM 170G1011/S42** | push-pull |

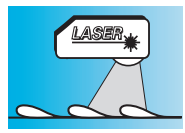
### connection diagrams



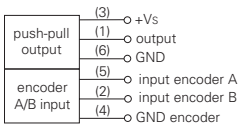

| accessories | |
|---|---|
| ScaDiag kit diagnostic program includes interface converter and manual | 156490 |
| mounting plate for mounting on rails | 157472 |
| for details, see accessories section | |

### laser warning

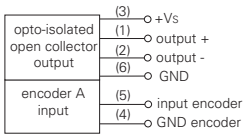





## pin assignments

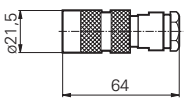



main connector push-pull

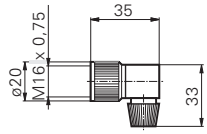



main connector open collector

## connectors




| | | |
|---|---|---|
| 104236 | 6 pin | (included) |

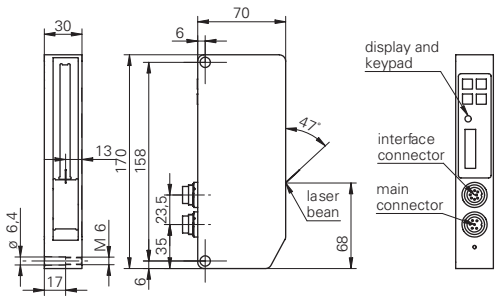


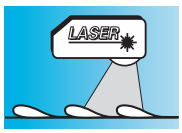

| | | |
|---|---|---|
| 153094 | 6 pin | (optional) |

## reflectors

| | |
|---|---|
| FTDF 025F025 | tape 25 x 25 mm |
| (included) | |

## dimension drawing





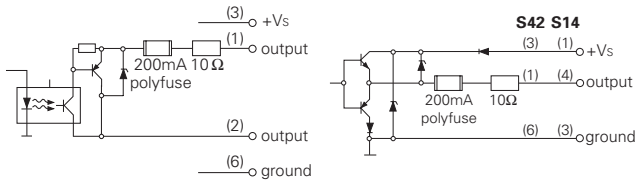

## Sd = 0 ... 60 mm

- counting of up to 600'000 copies/hour
- standard connector M12x1
- compact design

| general data | |
|---|---|
| measuring distance Sd | 0 ... 60 mm |
| optimum operating distance | 40 mm |
| counting rate | < 600'000 copies/h |
| object speed | < 5 m/sec |
| object cycle distance | > 1 mm |
| sensitivity | single sheet/edge thickness 0,2 mm |
| sync. input | no |
| measuring point | visible red laser line 2 mm |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| edge indicator | LED yellow |
| power on indication | LED green |
| false pulse suppression | on/off switchable |

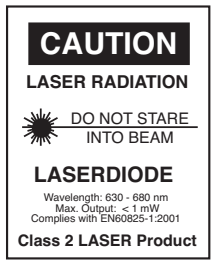
| electrical data | |
|---|---|
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 180 mA |
| output pulse length | 5 / 10 / 15 / 20 ms selectable |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | PA 6 |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 54 |

### connection diagrams

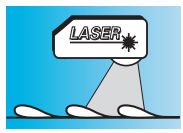



| accessories | |
|---|---|
| ScaDiag kit (M12 x 1) diagnostic program includes interface converter and manual | 156479 |
| ScaDiag kit (DIN 45322) diagnostic program includes interface converter and manual | 156489 |
| for details, see accessories section | |

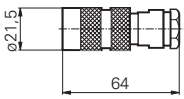
### laser warning



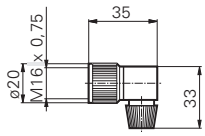

| order reference | output circuit | connector base (main connector) |
|---|---|---|
| **FLDK 110C1003/S42** | opto isolated | DIN 45322, 6 pin |
| **FLDK 110G1003/S14** | push-pull | M12 x 1, 4 pin |
| **FLDK 110G1003/S42** | push-pull | DIN 45322, 6 pin |




## connectors




| | | |
|---|---|---|
| 104236 | 6 pin | DIN 45322 |
| (included) | | |

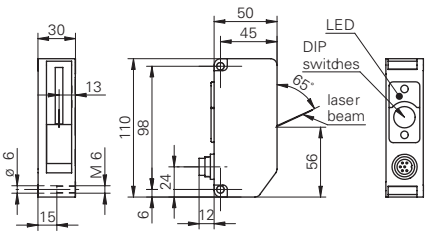


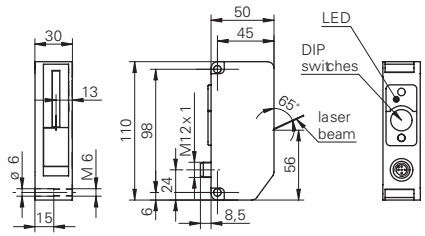

| | | |
|---|---|---|
| 153094 | 6 pin | DIN 45322 |
| (optional) | | |

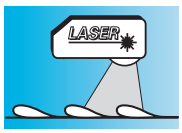
| connectors M12 x 1 | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m, straight |
| ESG 34AH0500 | 4 pin | 5 m, straight |
| ESG 34AH1000 | 4 pin | 10 m, straight |

| connectors M12 x 1 | | |
|---|---|---|
| ESW 34AH0200 | 4 pin | 2 m, angular |
| ESW 34AH0500 | 4 pin | 5 m, angular |
| ESW 34AH1000 | 4 pin | 10 m, angular |

## dimension drawings



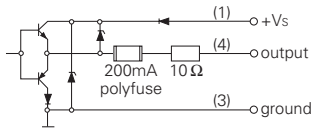



## Sd = 0 ... 55 mm

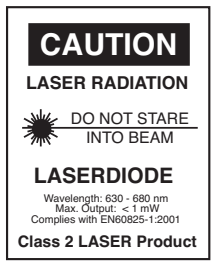
- Plug & Play
- counting of up to 280'000 copies/hour
- compact design

| general data | |
|---|---|
| measuring distance Sd | 0 ... 55 mm |
| optimum operating distance | 40 mm |
| counting rate | < 280'000 copies/h |
| object speed | < 2 m/sec |
| object cycle distance | > 13 mm |
| sensitivity | single sheet/edge thickness 1,5 mm |
| sync. input | no |
| measuring point | visible red point |
| light source | pulsed red laser diode |
| wave length | 670 nm |
| laser class | 2 |
| edge indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | no |
| **electrical data** | |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 180 mA |
| output circuit | push-pull |
| output pulse length | 10 ms |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | PA 6 |
| connector base (main connector) | M12 x 1, 4 pin |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | 0 ... +50 °C |
| protection class | IP 54 |

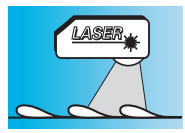
**connection diagram**




**laser warning**



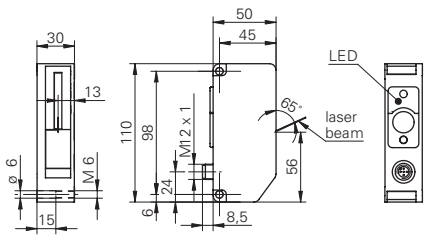

| order reference |
|---|
| **FLDK 110G1010/S14** |




## connectors

| connectors M12 x 1 | | | connectors M12 x 1 | | |
|---|---|---|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m, straight | ESW 34AH0200 | 4 pin | 2 m, angular |
| ESG 34AH0500 | 4 pin | 5 m, straight | ESW 34AH0500 | 4 pin | 5 m, angular |
| ESG 34AH1000 | 4 pin | 10 m, straight | ESW 34AH1000 | 4 pin | 10 m, angular |

## dimension drawing



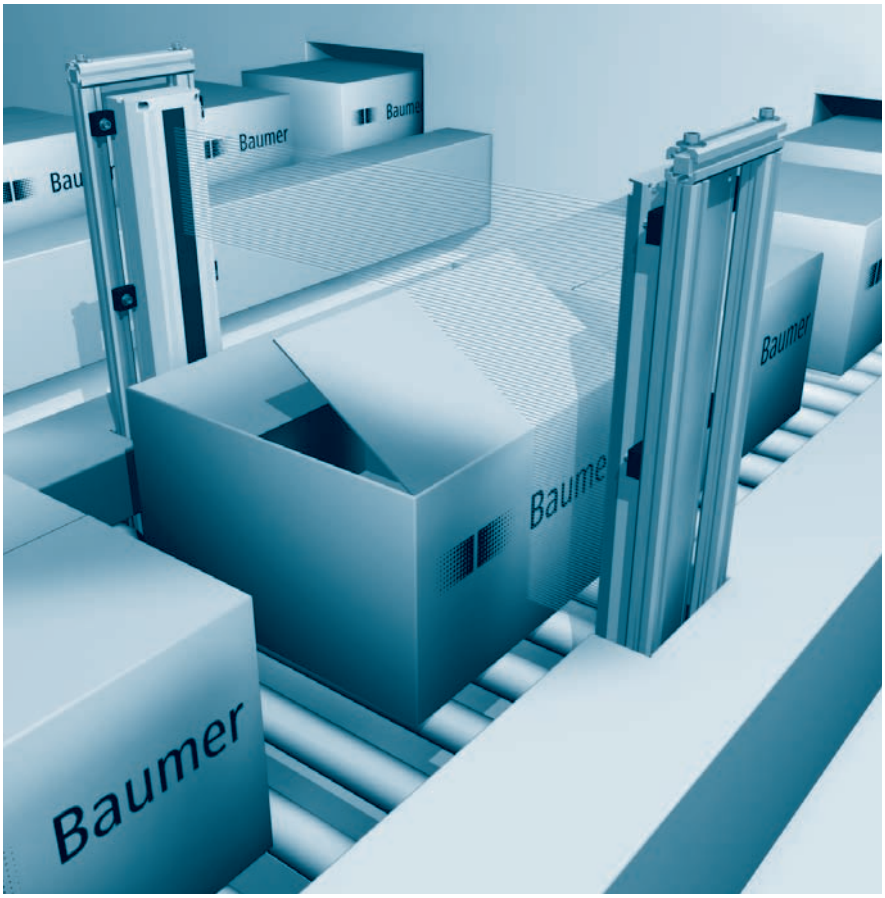
| **product family** | **FCDM 012** | **FCDM 082** |
|---|---|---|
| | | |
| | *SpiderScan* | *SpiderScan* |
| width | 12 mm | 82 mm |
| actual range Sb | < 4 m | < 6,5 m |
| measuring field size | 150 mm | < 1677,5 mm |
| beam distance | 50 mm | 2,5 mm |
| resolution | 50 mm | 2,5 mm |
| switching output | ■ | - |
| switching output + RS 422 | ■ | - |
| RS 422 | - | ■ |
| SSI + RS 422 | - | ■ |
| parallel 10 Bit + RS 422 | - | ■ |
| **Page** | **534** | **536** |

## General information

The light barriers are electronic infrared light curtains to detect objects or for continuous measuring purposes. Light barriers are available with a measuring field of up to 1,6 m, a measuring distance of up to 6,5 m and a resolution of 1,25 mm to 50 mm.

## Applications

- Automatic measurement of large objects such as parcels or crates on a conveyor belt.
- Use as area/object size/object position monitor, e.g. in front of the compartment door of automatic spray painting machines
- Ejection monitoring of punching machines



## Characteristics and advantages

- High cycle rate
  Due to the high clock frequency of the system (100 kHz), very fast measurements are achieved, which ensures the highest measuring accuracy even with quickly moving objects.
  Example: a light barrier with 96 beams requires less than 1.2 ms for a measuring cycle, or the measuring cycle is < 0.1 ms with a light barrier with 4 beams.

- Reliable measuring principle
  As the individual light beams are aligned parallel to each other, it is irrelevant to the measurement results whether the measured object is closer to the receiver or closer to the emitter.

- Simple installation
  As only the receiver associated with each emitter diode is activated, a wide-angled beam from the emitter is possible. This light beam ensures that the light barrier operates faultlessly even under heavy vibrations. An LED integrated in the receiver unit which immediately indicates all interruptions of the beam channel is a valuable aid for adjusting the light barrier.

- Integrated processing
  Due to the compact construction, it is possible to integrate the processing and interface electronics in the light barrier, making an external processing unit unnecessary. This substantially simplifies installation and wiring.

- Rugged housing
  Both the emitter and the receiver are installed in an aluminum housing. The design of this housing takes account not only of ruggedness, but also a means of simple installation.

- Multi-system operation
  The light barrier FCDM 082 is equipped to make it possible to synchronize several measuring systems with each other. This prevents several systems operating on one measurement from interfering with each other.

- Parameter setting software
  With the ***SpiderView*** software, the parameters of the light barriers can be set via an RS 422 interface. The software is written for Windows 95/98/2000/XP.

## Technology and operation

Each measuring system consists of an emitter and a receiver unit, each containing a microcontroller to control the light pulses. During a measuring cycle, the individual emitting diodes are activated in sequence and the corresponding receiver unit is simultaneously scanned. This means that the first sensor is interrupted at the precise time when the imaginary line from the first emitter to the first receiver is interrupted. This applies equivalently to the next beams, forming a "light barrier" of parallel light beams.
During each measuring cycle, the number of interrupted beams is determined. The value is issued as "DATA" and the position of the first interrupted beam is available as the "POSITION" value.

### Output formats:

DATA/POSITION "normal"
The system issues the number of interrupted beams as "DATA" and the position of the first interrupted beam as "POSITION".

DATA/POSITION „largest blocked area"
The system issues the largest blocked area as "DATA" and the number of the beam at which this area begins as "POSITION".

## Technology and operation

DATA/POSITION „over all“
The system issues the number of beams between the first and last interrupted beam as “DATA” and the position of the first interrupted beam as “POSITION”.

### Double scanning:
For various applications, higher measuring accuracy and improved object detection are required. The double scanning function is available for this purpose. An additional diagonal beam is inserted between the parallel beams. This produces twice the resolution at the middle of the measuring distance.

### Smoothing:
With the “smoothing” function, the number of interrupted beams from which a measurement is made is determined. Measuring beams are thereby only regarded as interrupted if the number of immediately adjacent interrupted measuring beams is at least equal to the “smoothing” value. In units with RS 422 interfaces, this value can be adjusted. Otherwise, this function is inactive and unavailable.

### Interfaces:
Parallel
Parallel output of the number of interrupted beams as a 10-bit binary value. Whether DATA or POSITION is issued as the value can be chosen via a control line.

Example: in a light barrier with 32 measuring beams, an object interrupts the first 15 measuring beams. The first four of the six PNP switch elements are therefore closed (0000001111).

RS 422
The RS 422 interface permits the connection of the light barrier to a supersidiary controller. Apart from reading the measured data, numerous adjustments can be made to the system via the interface.

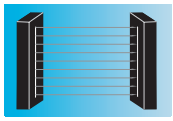
Transistor switching output
If a beam (or a number of beams determined by the smoothing value) is interrupted, the output switches.

SSI (synchronous serial interface)
With the SSI interface, the data is transmitted in Gray code with a clock frequency of 100 kHz.

## Mounting and adjustment

The emitter and receiver should be as parallel as possible to each other and be installed at the same height to ensure the optimum function and receiver excess gain.

Due to the diverging angle of radiation of the IR diodes (which has advantages for installation), reflective surfaces in close proximity with the light barrier can deflect the light sufficiently to result in incorrect information.



## Sb = 4 m

- very small housing 12 mm
- 100 kHz high clock frequency
- aluminum housing material rugged

| general data | |
|---|---|
| measuring field | 150 mm |
| actual range Sb | < 4 m |
| beam distance | 50 mm |
| resolution | 50 mm |
| number of beams | 4 |
| alignment aid | LED green |
| light source | infrared diode |
| wave length | 950 nm |
| clock frequency | 91 kHz |
| clock speed per beam | 11 µs |
| analysis time | 150 µs |
| **electrical data** | |
| voltage supply range +Vs | 24 VDC ± 10% |
| residual ripple | < 200 mV |
| current consumption max. | 500 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 12 mm |
| height / length | 252 mm |
| depth | 40 mm |
| type | rectangular |
| housing material | aluminum |
| **ambient conditions** | |
| operating temperature | -25 ... +55 °C |
| humidity | 0 ... 90 % (non condensed) |
| protection class | IP 65 |

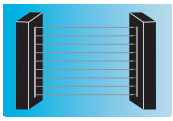
**cable**

included in delivery:
power/data cable — length 3 m
synchronization cable — length 5 m
specify other lengths when ordering

**accessory**

remote access kit:
software "SpiderView",
interface cable with converter,
manual

| order reference | output circuit | output current | interface |
|---|---|---|---|
| **FCDM 012P0150/50.0** | PNP | < 100 mA | - |
| **FCDM 012J0150/50.0** | - | - | RS 422 |

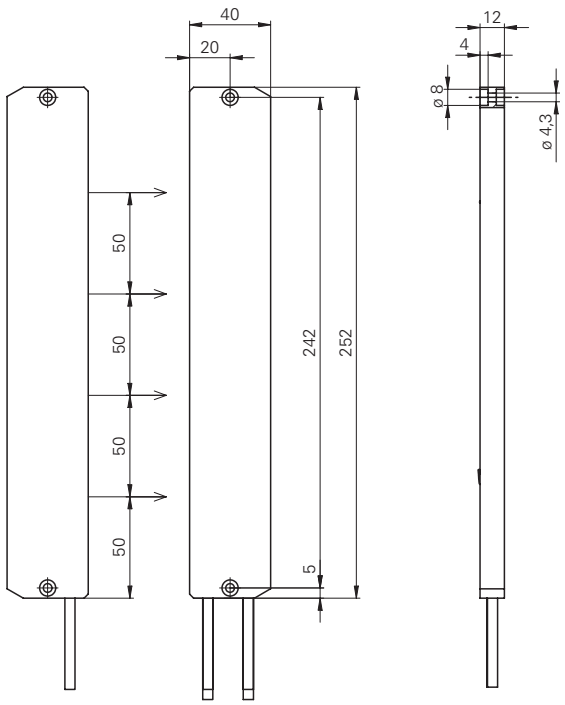


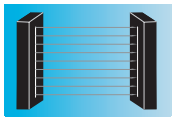
## configuration

If a configuration different from the factory setting is desired, this must be specified in the order. Other settings can also be made with the programming kit. In this case, it is essential that a version with RS 422 interface is ordered.

| | factory setup | optional |
|---|---|---|
| data format | normal | "largest blocked area" oder "over all" |
| actual range | 1,2 ... 2 m | ... m (min. 0,5 m/max. 4 m) |
| double scanning | no | yes |
| smoothing data | 1 beam | number of beams |

## dimension drawing





## Sb = 6,5 m

- high resolution
- 100 kHz high clock frequency
- rugged aluminum housing material

| general data | |
|---|---|
| measuring field | 237,5 ... 1677,5 mm |
| actual range Sb | < 6,5 m |
| beam distance | 2,5 mm |
| resolution | 2,5 mm |
| number of beams | 96 ... 672 |
| alignment aid | LED green |
| light source | infrared diode |
| wave length | 950 nm |
| clock frequency | 100 kHz |
| clock speed per beam | 10 µs |
| analysis time | 200 µs |
| **electrical data** | |
| voltage supply range +Vs | 24 VDC ± 10% |
| residual ripple | < 200 mV |
| current consumption max. | 1,2 A |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 82 mm |
| depth | 40 mm |
| type | rectangular |
| housing material | aluminum |

| ambient conditions | |
|---|---|
| operating temperature | -25 ... +55 °C |
| humidity | 0 ... 90 % (non condensed) |
| protection class | IP 65 |

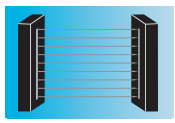
| cable | |
|---|---|
| included in delivery: | |
| synchronization cable | length 5 m |
| connector 7 pin | |
| connector RS-422 | |
| other connectors, interfaces and cable lengths on request | |

| accessory | |
|---|---|
| remote access kit:<br>software "SpiderView",<br>interface cable with converter,<br>manual | 163150 |

| order reference | number of beams | measuring field Lm | height/length L | L1 |
|---|---|---|---|---|
| **FCDM 082x0237/02.5** | 96 | 237,5 mm | 390 mm | 128,5 mm |
| **FCDM 082x0477/02.5** | 192 | 477,5 mm | 630 mm | 128,5 mm |
| **FCDM 082x0717/02.5** | 288 | 717,5 mm | 870 mm | 128,5 mm |
| **FCDM 082x0957/02.5** | 384 | 957,5 mm | 1110 mm | 128,5 mm |
| **FCDM 082x1197/02.5** | 480 | 1197,5 mm | 1350 mm | 128,5 mm |
| **FCDM 082x1437/02.5** | 576 | 1437,5 mm | 1590 mm | 128,5 mm |
| **FCDM 082x1677/02.5** | 672 | 1677,5 mm | 1830 mm | 128,5 mm |

**interface**

| | |
|---|---|
| J | RS 422 |
| I | SSI + RS 422 |
| B | Parallel 10 Bit + RS 422 |

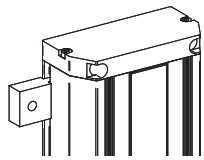


## configuration

If a configuration different from the factory setting is desired, this must be specified in the order. Other settings can also be made with the programming kit.

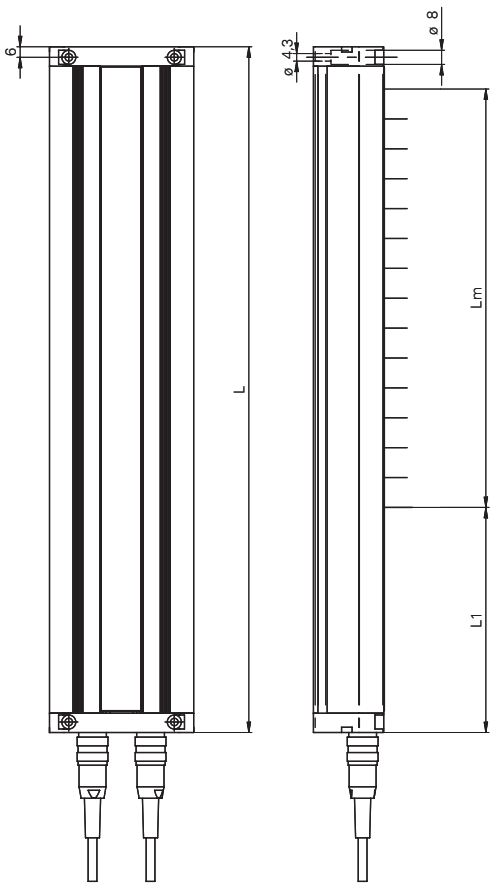
| | factory setup | optional |
|---|---|---|
| data format | normal | "largest blocked area" or "over all" |
| actual range | 0,6 ... 1 m | ... m (min. 0,2 m / max. 6,5 m) |
| output mode | number of beams | mm |
| coding | binary | «Gray» or «BCD» |
| double scanning | no | yes |
| smoothing data | 1 beam | ... beams |

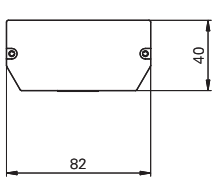
## mounting

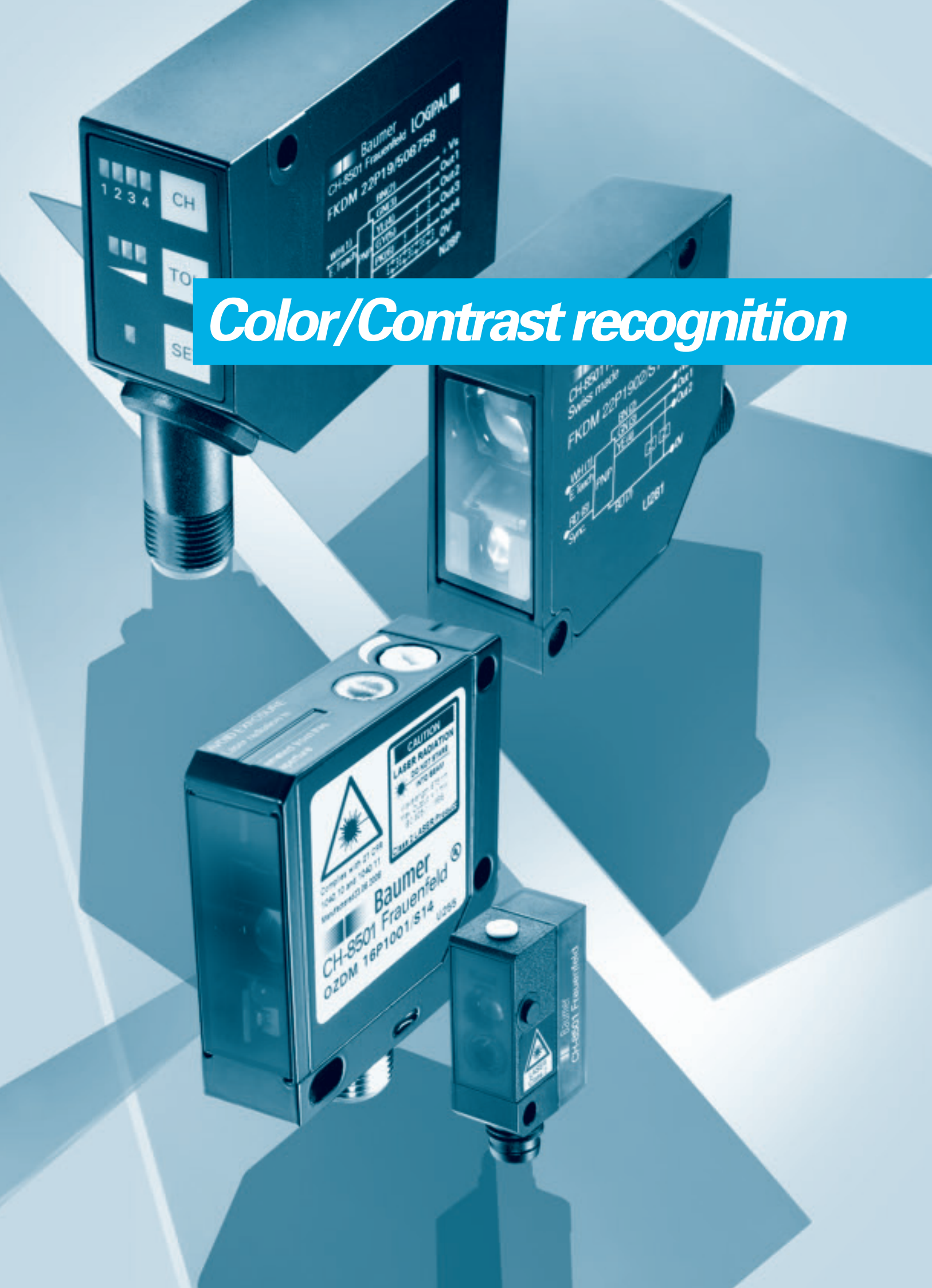


groove plate part nr. 161963

## dimension drawing




Color/Contrast recognition
Baumer
CH-8501 Frauenfeld
LOGIPAL
FKDM 22P19/S08758
1 2 3 4
CH
Baumer
CH-8501 Frauenfeld
OZDM 16P1001/S14
CAUTION
LASER RADIATION

| **product family** | **FKDM 22** | **FKDM 22** | **FKDM 22** |
|---|---|---|---|
| | | | |
| | *LOGIPAL* | *LOGIPAL* | *LOGIPAL* |
| sensing distance Tw | 40 mm | 40 mm | 25 mm |
| sensor channels | 4 (teachable) | 2 (teachable) | 4 (teachable) |
| size of measuring spot | 3 mm x 5 mm | 3 mm x 5 mm | 0,7 mm x 1,3 mm |
| response time / release time | < 0,34 ms | < 0,34 ms | < 0,34 ms |
| NPN | ■ | ■ | ■ |
| PNP | ■ | ■ | ■ |
| device plug | rotatable by 180° | rotatable by 180° | rotatable by 180° |
| housing material | metal | metal | metal |
| **Page** | **542** | **543** | **544** |

## General information

With the ***LOGIPAL*** color detection sensor, you can now use the color as a solution for sorting, quality monitoring and automation in your processes.

## Applications

- Products marked with colored marks can be monitored and sorted.
- The correct color of objects can be inspected or the objects can be sorted by their color.

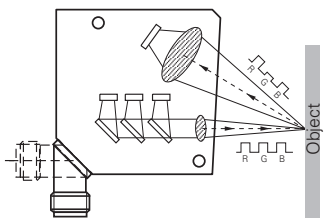
## Characteristics and advantages

- Simple operation:
  Four different colors can be programmed with just three buttons.
- Finest color graduation:
  One of five tolerance stages can be chosen for each color.
- Short response time:
  With a response time of only 0,34 ms, high detection rates can be achieved.
- Synchronization input:
  Permits controlled measurement of the color.
- External Teach-in input:
  Permits complete remote control of all teach-in functions by serial data transfer. An RS 232 interface transducer with galvanic isolation is available as an accessory.

## Technology and operation

The sensor operates by the three-stage principle, meaning that it emits the three colors red, green and blue and then measures the color proportions of the three colors reflected by the object.

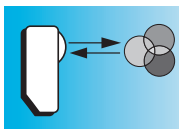
The color of an object is programmed in the teach-in procedure. If the sensor recognizes this color again during operation, it activates the corresponding output. Optional tolerances permit it to detect large or small differences in color.




## Mounting and adjustment

The use of the color sensor is as simple as for a diffuse sensor. Only the points below must be observed.

- For glossy objects, tilt the sensor to the side by approx. 15 °.
- If you wish to detect very fine differences in color, the sensing distance of 40 mm must be complied with as closely as possible.

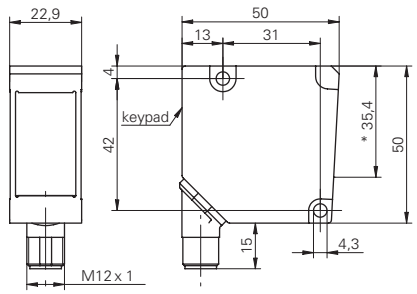


## Tw = 40 mm

- up to 4 colors can be distinguished properly
- spot size 3 x 5 mm
- rugged metal housing

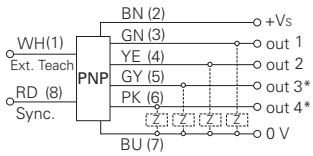
| general data | |
|---|---|
| sensing distance Tw | 40 mm |
| sensor channels | 4 (teachable) |
| tolerance ranges | 5-step teachable (LEDs) |
| size of measuring spot | 3 mm x 5 mm |
| light source | LED red / green / blue |
| signal display (Teach) | LED orange |
| channel status display | LED yellow per channel |
| power on indication | LED green |
| **electrical data** | |
| response time / release time | < 0,34 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| power consumption | < 2 W |
| voltage drop Vd | < 1,8 VDC |
| output current (per channel) | < 100 mA |
| remote Teach-In input | protocol with return signal through channel 1-output |
| level (sync., teach) | high: 2/3 Vs...Vs low: 0 V...1/3 Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| device plug | rotatable by 180° |
| **ambient conditions** | |
| operating temperature | -10 ... +55 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 34FP0200B 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| mounting bracket | 126220 |
| for details, see accessories section | |

**dimension drawing**

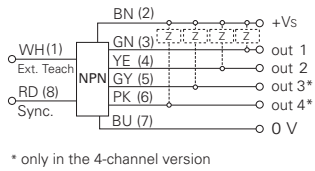



* emitter axis

**connection diagrams**

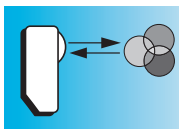



* only in the 4-channel version




* only in the 4-channel version

| order reference | output circuit | output function | sync. input |
|---|---|---|---|
| **FKDM 22N1901/S14F** | NPN | light operate | high active |
| **FKDM 22P1901/S14F** | PNP | light operate | low active |
| **FKDM 22P3901/S14F** | PNP | dark operate | low active |

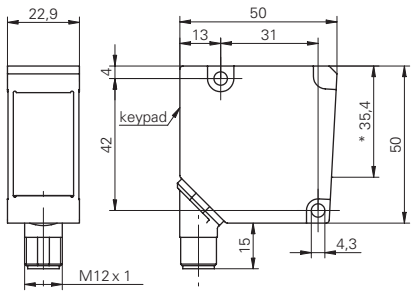


## Tw = 40 mm

- up to 2 colors can be distinguished properly
- spot size 3 x 5 mm
- rugged metal housing

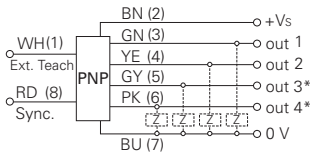
| general data | |
|---|---|
| sensing distance Tw | 40 mm |
| sensor channels | 2 (teachable) |
| tolerance ranges | 5-step teachable (LEDs) |
| size of measuring spot | 3 mm x 5 mm |
| light source | LED red / green / blue |
| signal display (Teach) | LED orange |
| channel status display | LED yellow per channel |
| power on indication | LED green |
| **electrical data** | |
| response time / release time | < 0,34 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| power consumption | < 2 W |
| voltage drop Vd | < 1,8 VDC |
| output current (per channel) | < 100 mA |
| remote Teach-In input | protocol with return signal through channel 1-output |
| level (sync., teach) | high: 2/3 Vs...Vs low: 0 V...1/3 Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| device plug | rotatable by 180° |
| **ambient conditions** | |
| operating temperature | -10 ... +55 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 34FP0200B 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| mounting bracket | 126220 |
| for details, see accessories section | |

**dimension drawing**

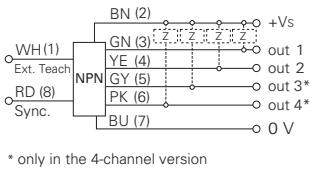



* emitter axis

**connection diagrams**

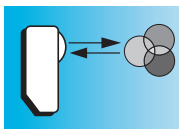



* only in the 4-channel version




* only in the 4-channel version

| order reference | output circuit | output function | sync. input |
|---|---|---|---|
| **FKDM 22N1902/S14F** | NPN | light operate | high active |
| **FKDM 22P1902/S14F** | PNP | light operate | low active |
| **FKDM 22P3902/S14F** | PNP | dark operate | low active |

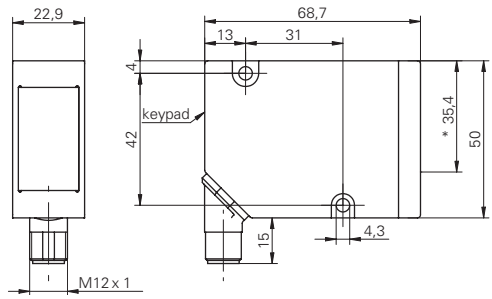


## Tw = 25 mm

- up to 4 colors can be distinguished properly
- spot size 0,7 x 1,3 mm
- rugged metal housing

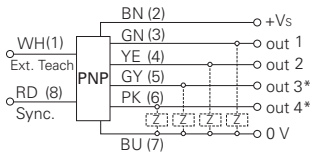
| general data | |
|---|---|
| sensing distance Tw | 25 mm |
| sensor channels | 4 (teachable) |
| tolerance ranges | 5-step teachable (LEDs) |
| size of measuring spot | 0,7 mm x 1,3 mm |
| light source | LED red / green / blue |
| signal display (Teach) | LED orange |
| channel status display | LED yellow per channel |
| power on indication | LED green |
| **electrical data** | |
| response time / release time | < 0,34 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| power consumption | < 2 W |
| output function | light operate |
| voltage drop Vd | < 1,8 VDC |
| output current (per channel) | < 100 mA |
| remote Teach-In input | protocol with return signal through channel 1-output |
| level (sync., teach) | high: 2/3 Vs...Vs low: 0 V...1/3 Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | aluminum anodized |
| front (optics) | glass |
| device plug | rotatable by 180° |
| **ambient conditions** | |
| operating temperature | -10 ... +55 °C |
| protection class | IP 67 |
| **connectors** | |
| ESG 34FP0200B 8 pin | 2 m straight (shielded) |
| additional cable connectors and field wireable connectors, see accessories | |
| **accessories** | |
| mounting bracket | 126220 |
| for details, see accessories section | |

**dimension drawing**

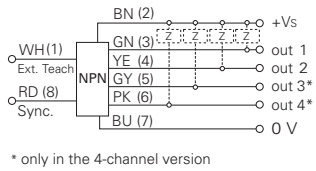



* emitter axis

**connection diagrams**




* only in the 4-channel version




* only in the 4-channel version

| order reference | output circuit | sync. input |
|---|---|---|
| **FKDM 22N1911/S14F** | NPN | high active |
| **FKDM 22P1911/S14F** | PNP | low active |

| product family | OZDK 10 | OZDK 10 | OZDK 14 | OZDM 16 | OZDM 16 |
|---|---|---|---|---|---|
| | | | | | |
| width / diameter | 10,4 mm | 10,4 mm | 14,8 mm | 15,4 mm | 15,4 mm |
| sensing distance Tw | 3 ... 150 mm | 3 ... 150 mm | 20 ... 300 mm | 0 ... 250 mm | 0 ... 250 mm |
| response time / release time | < 0,05 ms | < 0,05 ms | < 0,15 ms | < 0,05 ms | < 0,1 ms |
| sensitivity adjustment | Pot, 5 turn | Pot, 5 turn | teach-in | Pot, 14 turn | Pot, 14 turn |
| NPN | ■ | ■ | ■ | ■ | |
| PNP | ■ | ■ | ■ | ■ | ■ |
| cable | ■ | ■ | | ■ | ■ |
| connector | ■ | ■ | ■ | ■ | ■ |
| housing material | plastic | plastic | plastic | metal | metal |
| **Page** | **548** | **550** | **552** | **554** | **556** |

# Contrast sensors

## General information

This diffuse laser sensor permits the finest differences in contrast to be detected. Due to the very small light spot, the sensor can precisely detect such states down to a size of 0,1 mm.

## Applications

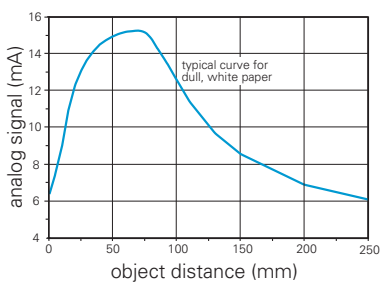
- Registration:
  Printed marks on objects used to align the printing mechanism or trigger an event.
- Indentations, grooves, edges:
  If a surface is observed from an oblique angle, the reflection behavior changes at an indentation, which is equivalent to a change in contrast for the sensor.
- Analog output:
  This makes it possible to read the desired nominal values and to detect deviations from these.

## Characteristics and advantages

- Red laser light:
  Easily visible measuring spot.
- Adjustable laser spot size:
  Very small diameter due to focused laser beam.
- Fast reaction time:
  Reaction times of down to 0,1 ms.
- Low laser class:
  No problems in use.
- Switching output:
  For simpler sensing problems.
- Switching output:
  With high linearity with regard to brightness.

## Technology and operation

This sensor is based on the intensity difference principle with a clearly defined, small light spot (laser). At the ideal working distance, it is optimized so that contrasts are detected almost independently of small changes in the distance ("plateau" in the signal curve). The sensor issues a signal proportional to the brightness with good linearity for all matt objects (= linear range) at the analog output. Glossy objects up to reflective sheet metal are also detected. This is due to a deliberate non-linearity with regard to the brightness with a strong receiving signal.



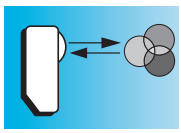

## Mounting and adjustment

The sensor should normally be installed tilted by 5° to 20° to the object surface, particularly if glossy materials are scanned.

If edges, grooves or indentations are scanned, the sensor must be aimed so that the direct reflection is detected when the indentation, groove or edge enters the light beam.

The working distance must be adjusted according to the measuring task:

- Scanning at the laser focus permits positioning with high accuracy.
- With a light spot approx. 1 mm in size, small differences in contrast are detected even with slight surface roughness and non-homogenous colors.



## Tw = 3 ... 150 mm

- subminiature housing
- high repeatability
- very short response time

| general data | |
|---|---|
| type | diffuse contrast sensor |
| light source | pulsed red laser diode |
| sensing distance Tw | 3 ... 150 mm |
| optimum operating distance | 20 ... 40 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Pot, 5 turn |
| laser class | 2 |
| distance to laser focus | 40 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 16,3 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |

**connection diagrams**

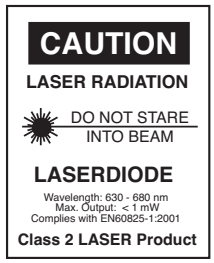
**connectors**

| | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

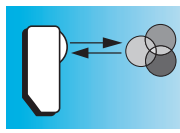
**accessories**

| | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

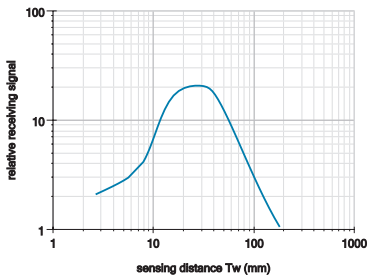
**laser warning**



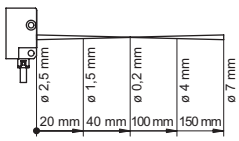

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **OZDK 10N5101** | cable 4 pin | NPN | IP 65 |
| **OZDK 10N5101/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **OZDK 10P5101** | cable 4 pin | PNP | IP 65 |
| **OZDK 10P5101/S35A** | connector M8, 4 pin | PNP | IP 67 |



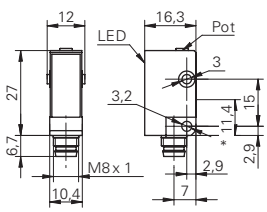
## relative receiving signal



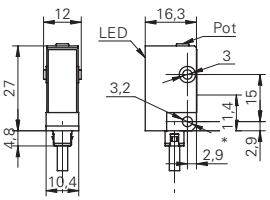

## beam characteristic



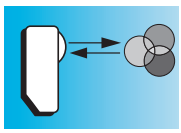

## dimension drawings




* emitter axis




* emitter axis



## Tw = 3 ... 150 mm

- subminiature housing
- high repeatability
- very short response time

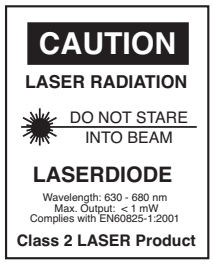
| general data | |
|---|---|
| type | diffuse contrast sensor |
| version | line beam |
| light source | pulsed red laser diode |
| sensing distance Tw | 3 ... 150 mm |
| optimum operating distance | 35 ... 45 mm |
| repeatability | < 0,2 mm at laser focus |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Pot, 5 turn |
| laser class | 2 |
| distance to laser focus | 40 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 50 mA |
| current consumption typ. | 40 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light / dark operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 16,3 mm |
| type | rectangular |
| housing material | plastic (ASA) |
| front (optics) | PMMA |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |

**connection diagrams**

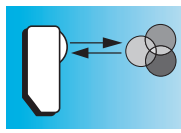
| connectors | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 150326 |
| mounting bracket (cable type) | 114501 |
| mounting bracket (connector type) | 133792 |
| for details, see accessories section | |

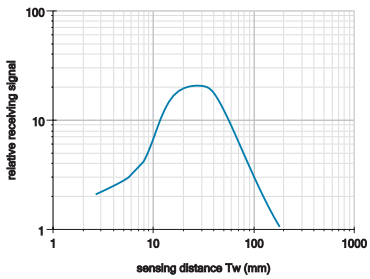
**laser warning**



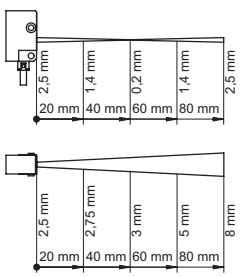

| order reference | connection types | output circuit | protection class |
|---|---|---|---|
| **OZDK 10N5150** | cable 4 pin | NPN | IP 65 |
| **OZDK 10N5150/S35A** | connector M8, 4 pin | NPN | IP 67 |
| **OZDK 10P5150** | cable 4 pin | PNP | IP 65 |
| **OZDK 10P5150/S35A** | connector M8, 4 pin | PNP | IP 67 |



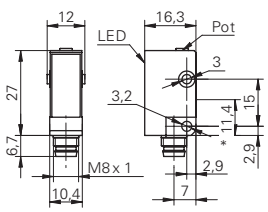
## relative receiving signal



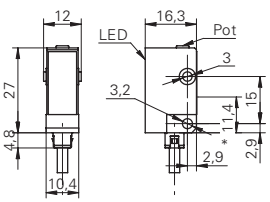

## beam characteristic



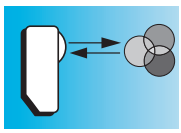

## dimension drawings




* emitter axis




* emitter axis



## Tw = 20 ... 300 mm

- very short response time
- high repeatability
- sensing distance adjustable via Teach-in

| general data | |
|---|---|
| type | diffuse contrast sensor |
| light source | pulsed red laser diode |
| sensing distance Tw | 20 ... 300 mm |
| repeatability | < 0,2 mm at laser focus |
| alignment / soiled lens indicator | flashing light indicator |
| light indicator | LED yellow |
| power on indication | LED green |
| sensitivity adjustment | Teach-in |
| laser class | 2 |
| distance to laser focus | 115 mm |
| wave length | 650 nm |
| **electrical data** | |
| response time / release time | < 0,15 ms |
| voltage supply range +Vs | 10 ... 30 VDC |
| current consumption max. | 35 mA |
| current consumption typ. | 25 mA |
| voltage drop Vd | < 2,2 VDC |
| output function | light operate |
| output current | < 100 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 14,8 mm |
| height / length | 43 mm |
| depth | 31 mm |
| type | rectangular |
| housing material | plastic (PA12) |
| front (optics) | PMMA |
| connection types | connector M8, 4 pin |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

| order reference | output circuit |
|---|---|
| **OZDK 14N1901/S35A** | NPN |
| **OZDK 14P1901/S35A** | PNP |

**connection diagrams**

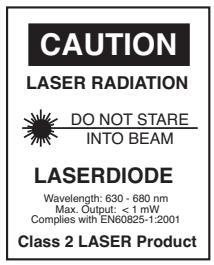
**connectors**

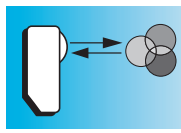
| | | |
|---|---|---|
| ESG 32AH0200 | 4 pin | 2 m straight |
| ESW 31AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

**accessories**

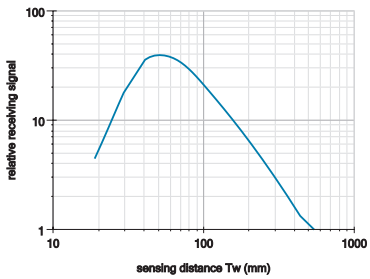
| | |
|---|---|
| *SENSOFIX* mounting kit | 149011 |
| mounting bracket | 134964 |
| for details, see accessories section | |

**laser warning**

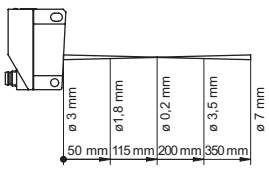




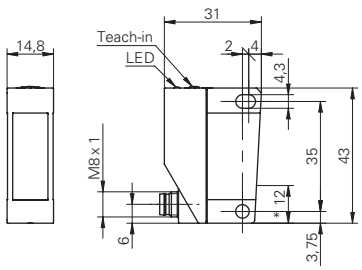
## relative receiving signal



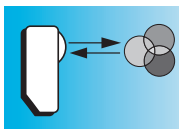

## beam characteristic




## dimension drawing




* emitter axis

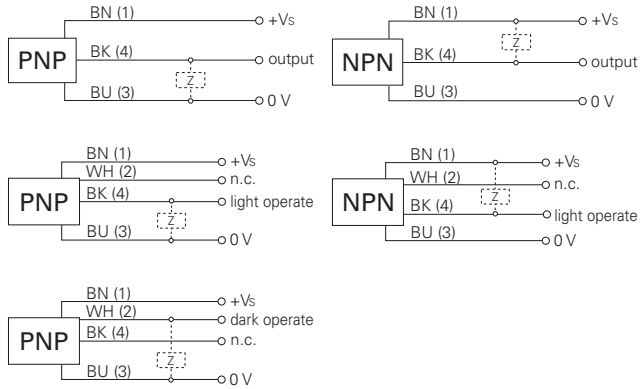


## Tw = 0 ... 250 mm

- rugged metal housing
- high repeatability
- very short response time

| general data | |
|---|---|
| type | diffuse contrast sensor |
| light source | pulsed red laser diode |
| sensing distance Tw | 0 ... 250 mm |
| optimum operating distance | 40 ... 80 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| sensitivity adjustment | Pot, 14 turn |
| laser class | 2 |
| distance to laser focus | 80 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,05 ms |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 65 mA |
| current consumption typ. | 60 mA |
| voltage drop Vd | < 1,8 VDC |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

**connection diagrams**

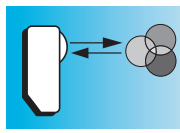



| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

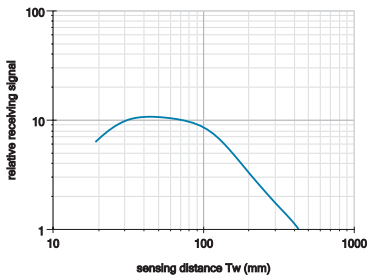
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| for details, see accessories section | |

**laser warning**

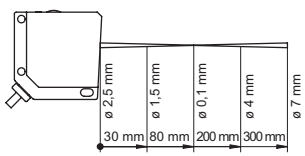
| order reference | connection types | output circuit | output function |
|---|---|---|---|
| **OZDM 16N1001** | cable 3 pin | NPN | light operate |
| **OZDM 16N1001/S14** | connector M12, 4 pin | NPN | light operate |
| **OZDM 16P1001** | cable 3 pin | PNP | light operate |
| **OZDM 16P1001/S14** | connector M12, 4 pin | PNP | light operate |
| **OZDM 16P3001** | cable 3 pin | PNP | dark operate |
| **OZDM 16P3001/S14** | connector M12, 4 pin | PNP | dark operate |



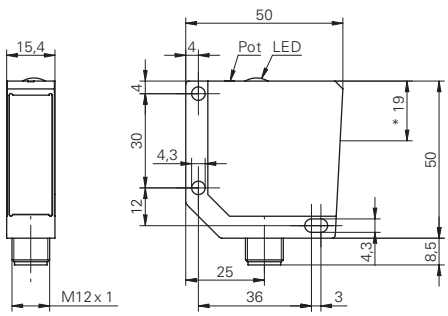
## relative receiving signal



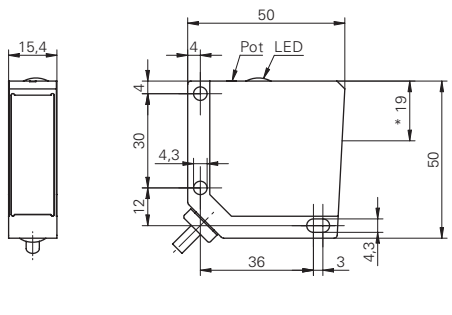

## beam characteristic



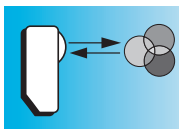

## dimension drawings




* emitter axis




* emitter axis



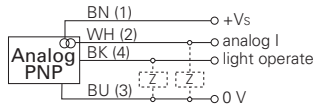
## Tw = 0 ... 250 mm

- with analog output
- high repeatability
- very short response time

| general data | |
|---|---|
| type | diffuse contrast sensor |
| light source | pulsed red laser diode |
| sensing distance Tw | 0 ... 250 mm |
| optimum operating distance | 40 ... 80 mm |
| detectable remission difference (on grey) | > 8 % |
| repeatability | < 0,1 mm at laser focus |
| output indicator | LED yellow |
| sensitivity adjustment | Pot, 14 turn |
| laser class | 2 |
| distance to laser focus | 80 mm |
| wave length | 675 nm |
| **electrical data** | |
| response time / release time | < 0,1 ms |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 65 mA |
| current consumption typ. | 60 mA |
| voltage drop Vd | < 1,8 VDC |
| output function | light operate |
| output circuit | PNP / analog 4 ... 20 mA |
| output current | < 200 mA |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| width / diameter | 15,4 mm |
| height / length | 50 mm |
| depth | 50 mm |
| type | rectangular |
| housing material | die-cast zinc |
| front (optics) | glass |
| **ambient conditions** | |
| operating temperature | -10 ... +50 °C |
| protection class | IP 67 |

| order reference | connection types |
|---|---|
| **OZDM 16P1901** | cable 4 pin |
| **OZDM 16P1901/S14** | connector M12, 4 pin |

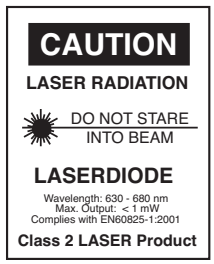
**connection diagram**

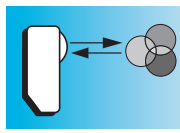



| connectors | | |
|---|---|---|
| ESG 34AH0200 | 4 pin | 2 m straight |
| ESW 33AH0200 | 4 pin | 2 m angular |
| additional cable connectors and field wireable connectors, see accessories | | |

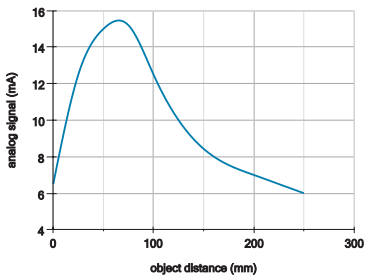
| accessories | |
|---|---|
| *SENSOFIX* mounting kit | 151721 |
| mounting bracket | 113917 |
| for details, see accessories section | |

**laser warning**

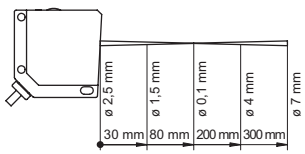




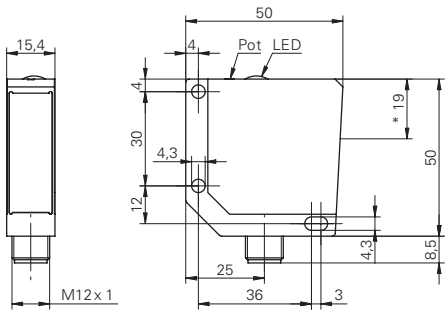
## signal progression



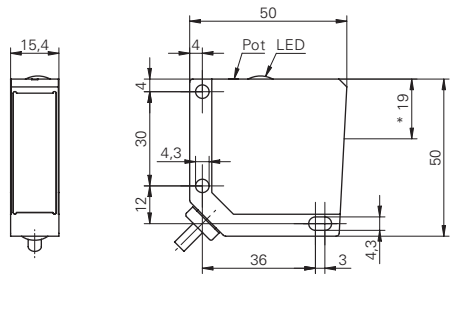

## beam characteristic




## dimension drawings



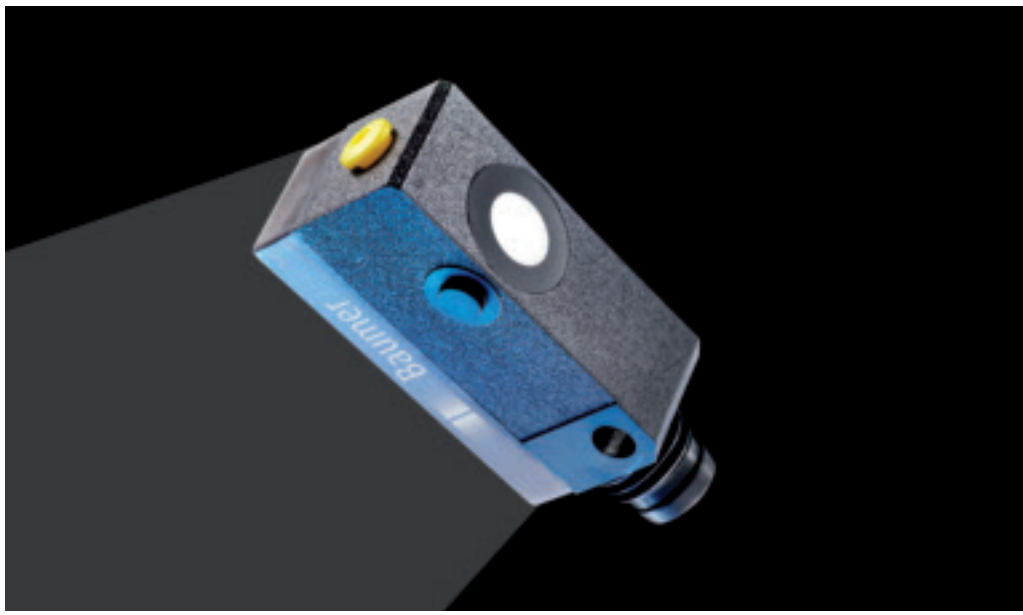

* emitter axis




* emitter axis

Baumer

# Compact, multi-purpose, robust.
# Ultrasonic sensors.




Sensor Solutions
Motion Control
Vision Technologies

Most ultrasonic sensors are based on the principle of measuring the propagation time of sound in air. Packages of ultrasonic sound, so-called bursts, are emitted by the sensor, reflected by an object and received again by the sensor. The transducers in the sensors, with sonic frequencies far outside the range of human hearing, constantly change between transmission and reception during operation. The returned echo signals are evaluated by the integrated electronics of the sensor. Depending on the sensor type, either digital or analog information is then issued at the output.

Unlike optical sensors, influences such as changing colors, transparency or high reflectivity have no bearing on the detection of objects. Ultrasonic sensors maintain their excellence even in harsh environments. They are extremely resistant to dirt, and process reliability is not impaired by dust, smoke, vapors, or other contaminants.

The following types are available:

- Ultrasonic proximity sensors with one or two outputs
- Ultrasonic retro-reflective sensors
- Ultrasonic through beam sensors
- Measuring ultrasonic sensors with analog output signals

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## *Ultrasonic proximity sensors*

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## *Ultrasonic proximity sensors with analog output*

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## *Ultrasonic 2 point proximity switch*

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## *Ultrasonic through beam sensors*

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# *Miniature sensors – When space is scarce!*

In this modern age of automation, Baumer ultrasonic sensors are the answer to the continuing trend towards miniaturization and higher integration.

This trend has led Baumer's small and compact ultrasonic sensors, with their hardy performance, to enjoy a major focus of interest.

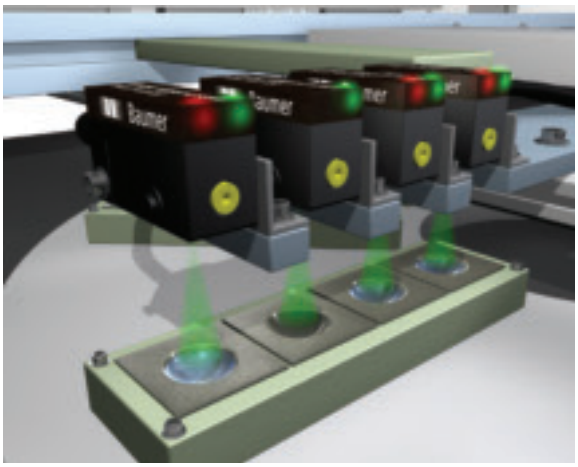
This performance is available in four different types:

- Ultrasonic proximity switches
- Ultrasonic retro-reflective sensors
- Ultrasonic through beam sensors
- Distance measuring ultrasonic sensors with analog output signals

Despite the extra emphasis placed on its miniature design, no compromises of any kind need be made when applying these mighty minis.

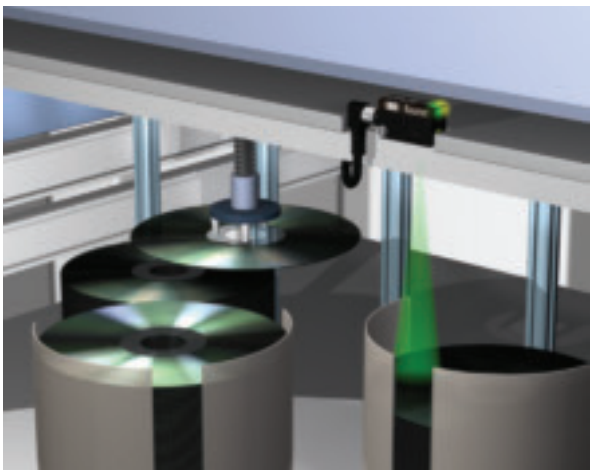
- Distinctly narrow sonic cone profiles enable the sensors to look and measure into smallest cavities
- Mutual influence between sensors mounted closely is minimized thanks to synchronized and multiplexed operation
- Some housing types are mechanically compatible with sensors using different technologies. They could be exchanged on short notice should the need arise in case of changing application conditions
- All miniature sensor variations feature Teach-in technology using a standardized Teach-in routine

# Miniature sensor applications



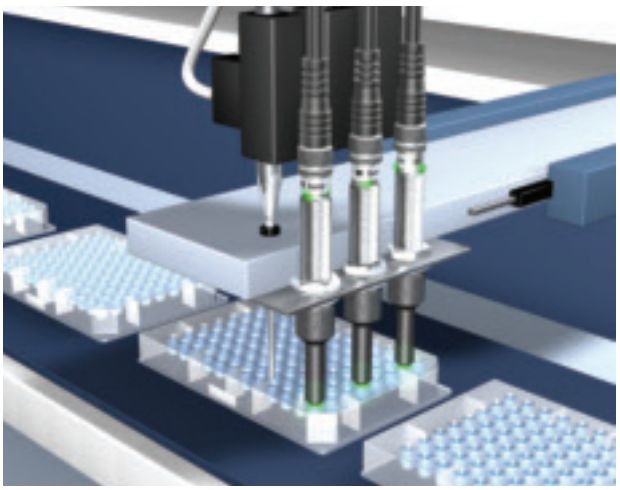
**Liquid level detection**

- Miniaturized ultrasonic sensors are ideally suited to measure liquid levels in small containers. The miniature housing design allows the installation of several sensors in close proximity.



**Height measurement**

- Distance to objects can be reliably measured regardless of the surface color, reflectivity or transparency with miniaturized ultrasonic sensors.



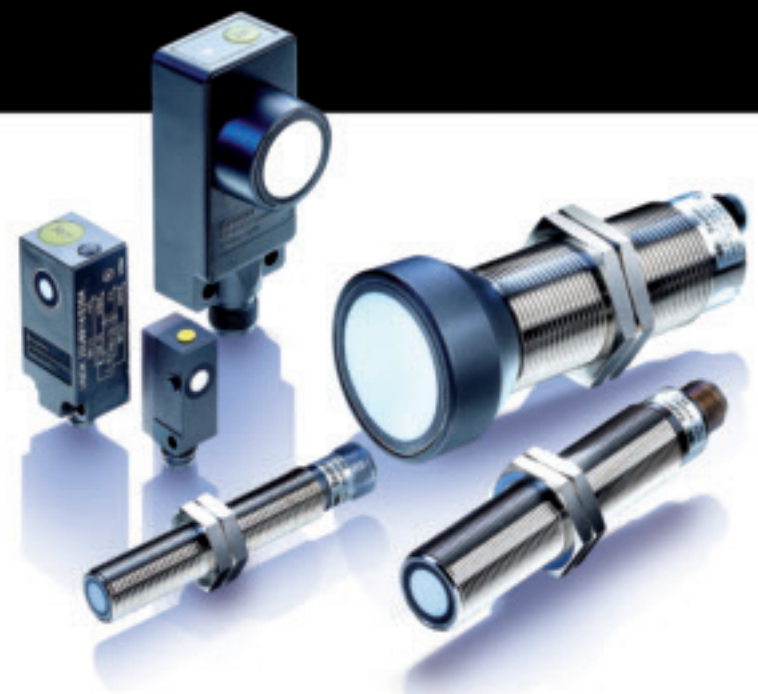
**Looking into small cavities**

- The M12 sensor equipped with the screw-on beam columnator has been especially designed for:
  - liquid level detection in test tubes and small bottles
  - liquid level detection in micro titration

  Versions with analog or digital output signals are available.

# *Distance measuring sensors – Detecting more!*





Ultrasonic distance measuring sensors provide information on an absolute position of a target or moving object. For shiny surfaces, for transparent objects, or environment with dust and high humidity, the ultrasonic technologies are often the only alternative to mechanical probing.

Applications for ultrasonic distance measuring sensors include level detection, stack height control as well as absolute position feedback.

Baumer offers a broad selection of ultrasonic distance measuring sensors:

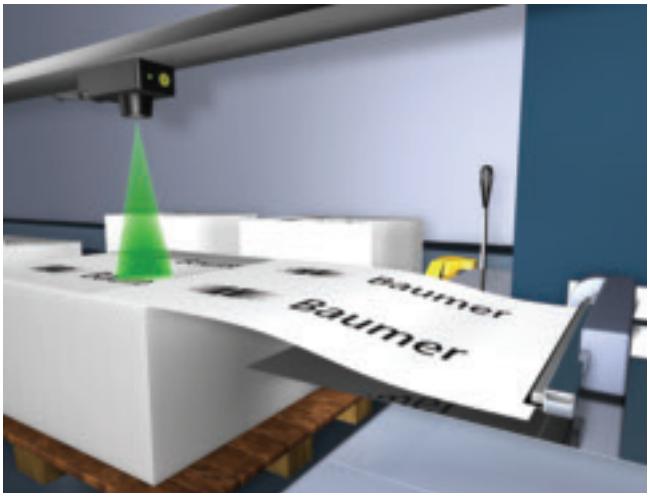
- Sensing range Sd of 20…200 mm up to Sd of 400…2500 mm
- A constant resolution of 0,3 mm applies across the entire family
- Distinctly narrow sonic cone profiles enable the sensors to look and measure into smallest cavities
- Available output signals 0…10 VDC and 4…20 mA or inverted from 10…0 VDC and 20…4 mA
- Output signals adjusted to required sensing range of an object - through potentiometer, Teach-in button or remote Teach-in input

# Distance measuring sensor applications



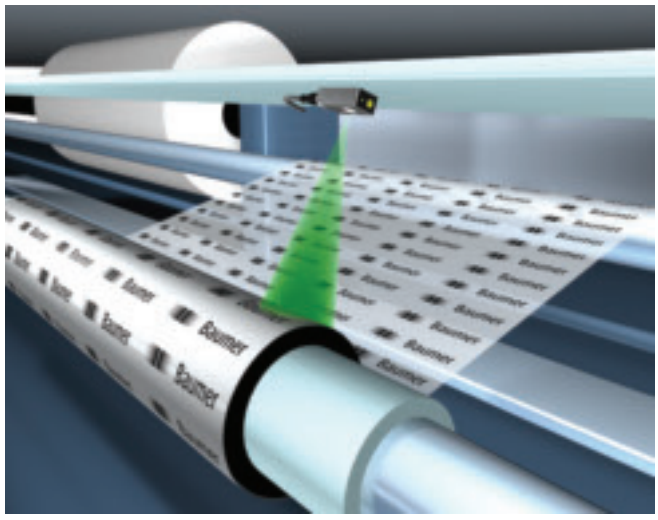
**Distance detection**

- With its small shape and low weight, the miniaturized ultrasonic sensors can also be installed in small microgrippers with limited space to accomodate ultrasonic sensors.




**Stacking level control**

- Utrasonic sensors with analog outputs provide a distance proportional output signal highly independent of the target material encountered. The resolution is a uniform 0,3 mm even for the maximum scanning range of 2000 mm.



**Determination of roll diameter**

- In winding and unwinding operations distance measuring ultrasonic sensors accurately measure the outer diameter of rolls containing materials such as plastic films, sheet metal, paper and cardboard, veneer etc.

# Through beam and retro-reflective sensors

For the detection of sound absorbing or fast moving objects the range of ultrasonic barriers is perfectly featured. Used for counting or the detection of a jam on conveyor belts, these sensors allow the recognition of objects which could not even be detected by simple ultrasonic proximity or optical sensors.

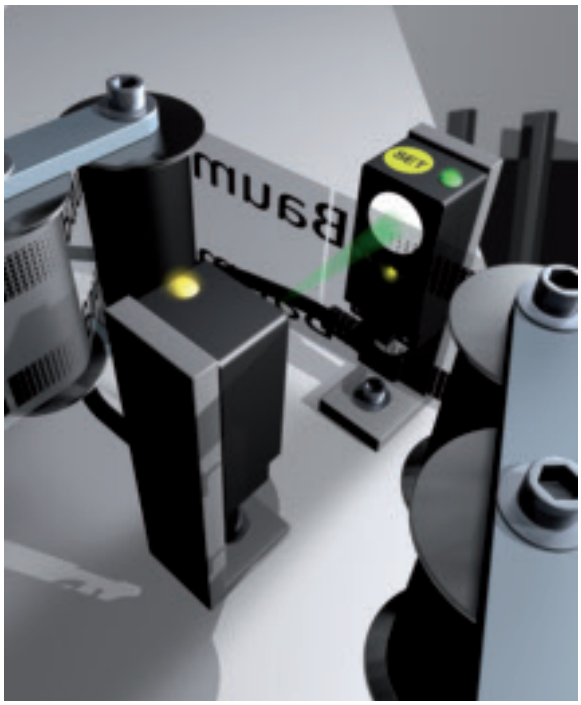
Through beam sensors, often used for the rupture control of paper, fabric, metal- or plastic films are capable to detect even high transparent objects.

In front of a reference surface retro reflective sensors recognize all kinds of objects reliably, no matter if sound absorbing or sound dispersing.

Generally the following features characterize the Baumer range of ultrasonic sensors

- No blind range in front of the active sensing face
- Sensing range Sd 0…200 mm up to 0…3000 mm
- Short response time of less than 5 ms
- Any kind of sound reflecting material can be used as reference surface (retro-reflective sensors)

# Through beam and retro-reflective sensors applications

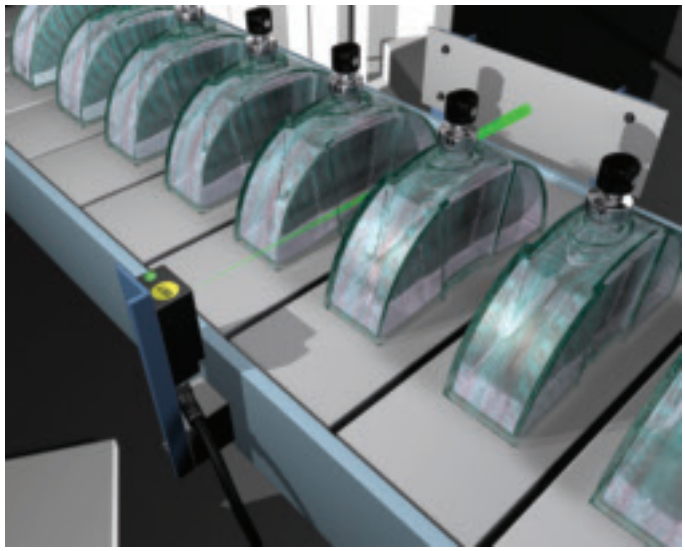


**Through beam sensors**

- Due to their non-pulsed operation, through beam sensors, consisting of emitter and receiver, exhibit the fastest response time of all ultrasonic sensors.

Applications include:

- detection of objects following each other in quick succession
- counting of objects made of materials which are difficult to detect (glass jars, PET bottles)
- monitoring transparent materials like plastic and glass
- film rupture control



**Retro-reflective sensors**

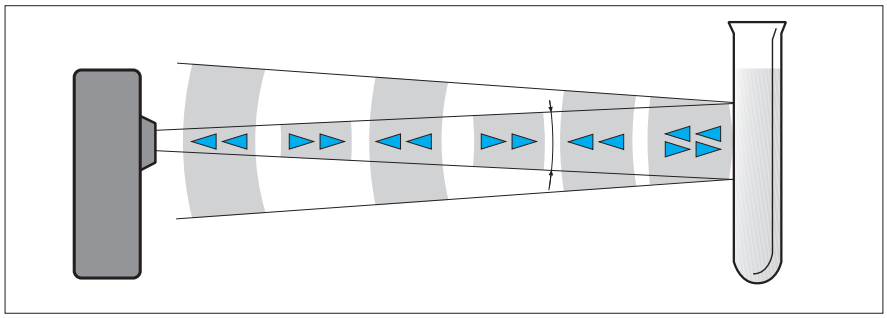
- Retro-reflective sensors require a fixed reflector or reference target for operation.

They are ideally suited to reliably detect:

- odd shaped and non-aligned objects
- sound deflecting targets
- sound absorbing materials like cotton-wool and foam rubber

## Design and operation

A special sonic transducer is used for the ultrasonic proximity sensors, which allows for alternate transmission and reception of sound waves. The transducer emits a number of sonic waves which are reflected by an object, back to the transducer. After emission of the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.



### Digital and analog output

Sensing is only possible within the detection area. The required sensing range can be adjusted with the sensor's potentiometer or by electronic Teach-in (Teach-in button or remote Teach-in). If an object is detected within the set area, the output changes its state. The built-in LED indicates this change.

## Target detection

Sonic waves are best reflected from hard surfaces. Targets may be solids, liquids, granules or powders. In fact, ultrasonic sensors are used in many applications where objects are difficult to detect with optical devices.

### Standard target

The standard target is defined as a square flat object of following sizes:

- 15 x 15 mm for Sde up to 250 mm
- 30 x 30 mm for Sde up to 1000 mm
- 100 x 100 mm for Sde > 1000 mm

The target should be mounted perpendicular to the axis of the sensor.

### Size

To ensure a reliable object detection, the reflected signal must be large enough. The intensity of the signal depends on the size of the object. Using a standard object, the full scanning range Sd is available.

### Surfaces

Detection of sound absorbent materials will result in a reduction of the maximum sensing distance.

The maximum sensing distance can be achieved as long as the maximum roughness of the object does not exceed 0,2 mm.

Typical sound absorbing materials are:

- foam rubber
- cotton / wool / cloth / felt
- very porous materials

# Typical sonic cone profile

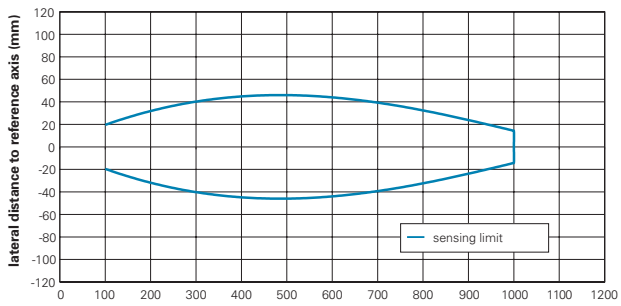
## Sonic cone profiles

The sonic cone profile charts as found in the spec sheets of this catalog represent the active sensing areas for ultrasonic sensors. The charts demonstrate the short-range sonic side lobes, which widen the sensor's close-range aperture angle. Due to sound absorption and air diffusion, the lobes decrease at longer ranges.

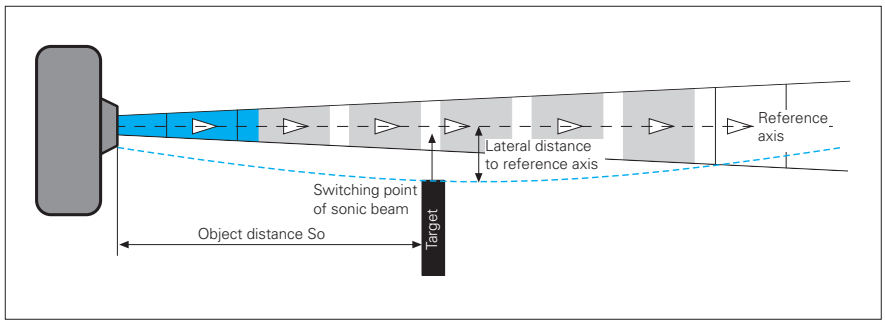
Size, shape, surface properties and the direction of target detection have very high influence on the lateral detecting region of an ultrasonic sensor.

Sonic beam profiles are typical for their whole family, eg. the profile for 100 - 1000 mm represents all types - digital and analog outputs, etc. of sensors with that sensing range.

**typical sonic beam of ultrasonic sensors with sensing range 100...1000 mm**
standard target with 30 x 30 mm, directed rectangular to sensor's reference axis




## Measuring method




When determining the shape of typical sonic cone profiles standard square targets made of steel are used.

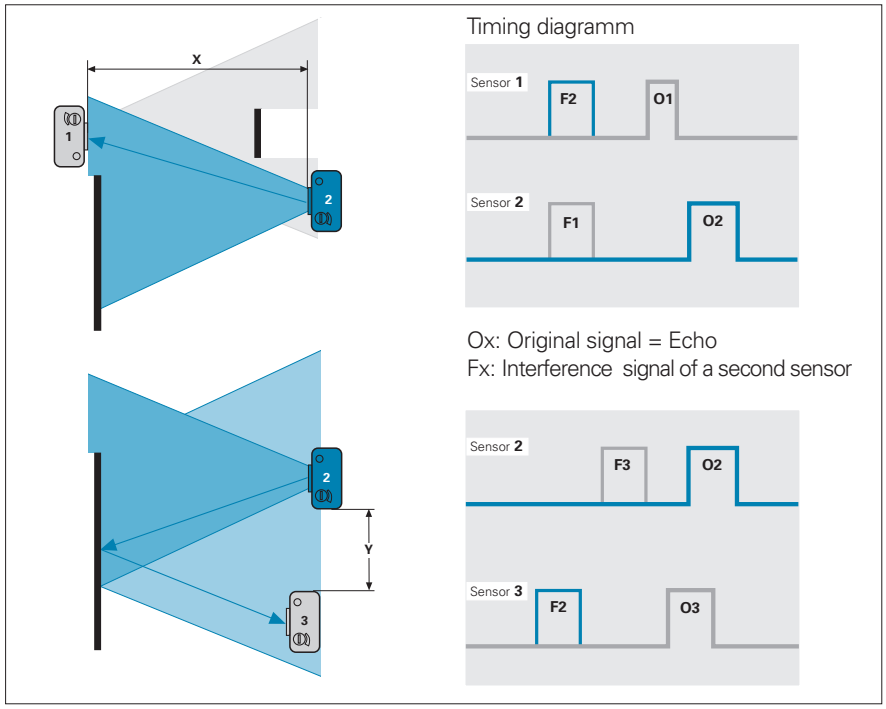
- 15 x 15 mm for Sde up to 250 mm
- 30 x 30 mm for Sde up to 1000 mm
- 100 x 100 mm for Sde > 1000 mm

The targets are positioned perpendicularly to the sensor's reference axis, approached sideways at different distances. The sonic cone profile is then plotted by connecting the measured points with a line.

The cone shape can vary if round or differently shaped objects are detected.

## Minimum spacings

Possible errors caused by the installation of two sensors




### Minimum spacings table

| Sensor type | x | y | max. no. of sensors | Action to take | Order reference | max. control wire | Response time |
|---|---|---|---|---|---|---|---|
| Standard - without multiplex or synch. | 3 x Sd | 2 x Sd | no limit | none | all standard sensors | - | according to technical specs. |
| with multiplex feature | 2 x Sd | no space required | 2 | connect control pin | Uxxx xxxx8xx | 5 m | 2 x technical specs. |
| with synchronization feature | 3 x Sd | 1 x Sd | 8 | connect control pin | Uxxx xxxx7xx | 7 m | according to technical specs. |

### Synchronization feature

Link the control pin of all sensors within a limited area to each other. This triggers the measurement of all sensors at the same time. Interference signals which arrive due to their longer sensing distance later at the sensor, will be ignored. Up to eight sensors can be synchronized via control pin.

### Multiplex feature

Link the control pin of both sensors to each other. While the first sensor is measuring, the second is enabled. After the first measurement is completed, the second sensor is allowed to send and receive its signals. In maximum two sensors can be interconnected. The multiplex function increase the sensor response time to the double of the specified value.

Note: At sensors with synchronization or multiplex feature, the control pin must not stay open. If the feature is not in use the pin must be connected to following potential to assure the standard response time:

Synchronization: Connect the control pin to supply voltage (+Vs)
Multiplex: Connect the control pin to ground (GND)

## Multiplexing ultrasonic sensors

In this mode two sensors may be mounted without any spacing, since they operate alternately. The response and release time of the specific sensors is therefore doubled. The connecting “control” wire must be connected to ground, if the sensor is not multiplexed.

## Installation

Synchronization and multiplexing operations are accomplished by connecting the fourth wire (control) of the specific sensors. Only two ultrasonic sensors may be multiplexed at a time; when using the synchronization mode, eight sensors may be used in conjunction. The maximum length of the connecting wire should not exceed 5 meters.

## Stand-alone operation synchronous and multiplex sensors

If these sensors are used as stand-alone devices, the "control" connection wire must be connected to +Vs in the synchronous type and to GND in the multiplex type to achieve the maximum possible reaction speed.

## Adjustment aid

The LED indicates the intensity of the signal which has been reflected by the object, as well as the switching state of the output.

LED on
The object is reliably detected with a signal strength reserve of 50%. The output is switched.

LED off
No target detected, output is not switched.

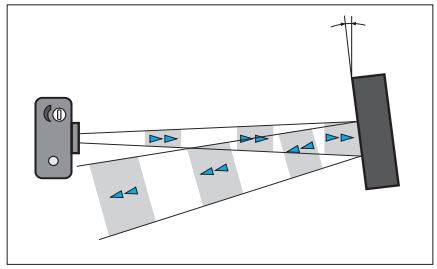
LED flashing
Unreliable detection of the target. The output is activated / switched.

## Teach-in locking

The Teach-in locking is active 5 minutes after power-up or after the end of the last Teach-in process. Teach-in locking is reset by disconnecting the power supply.

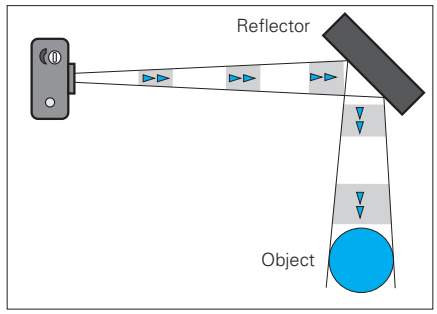
## Angular deflection

Sound waves, like light waves, are reflected from flat surfaces. It is therefore possible that the reflected sonic beam from an angled surface might be too small for the accurate recognition of a target.
The influence of tilting increases when the distance between the sensor and the target increases.



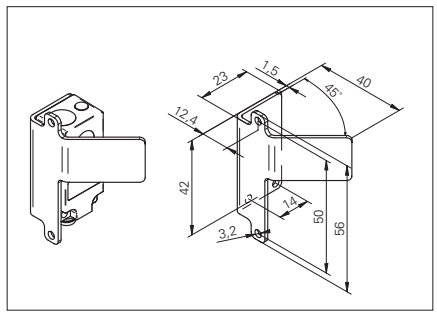
This effect can also be used to advantage as shown here to remotely detect a target.

The reflector must be large enough and have smooth surfaces and edges.

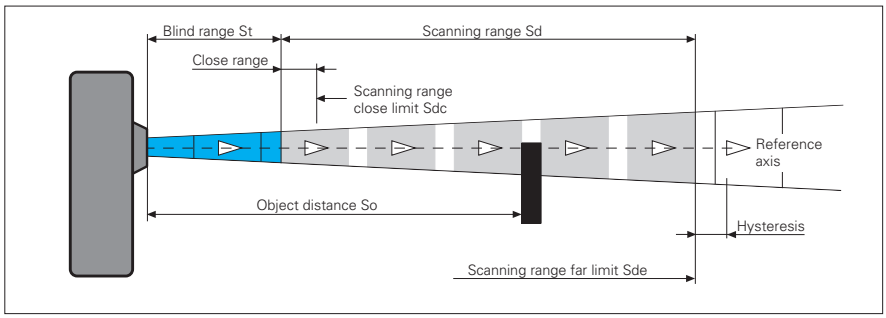



Sonic beam deflector Series 20

- see accessories section



## Technical definitions and environmental influences




**Blind range St**

Reliable object recognition is not possible within the blind range (St). Objects within this blind range may cause false switching of the sensor.

**Scanning range Sd**

Objects within the scanning range (Sd) are correctly detected up to the set far limit (Sde) of the scanning range.

**Scanning range close limit Sdc**

The close limit (Sdc) can be programmed by a Teach-in button.

**Scanning range far limit Sde**

By means of a built-in potentiometer or a Teach-in button the user can change the far limit (Sde) of the scanning range (Sd).

**Object distance So**

The object distance is defined as the distance between the front end of the sensor and the object itself.

**Hysteresis**

After recognizing the object the effective scanning range (Sd) is enlarged in the axial direction by the hysteresis value.

**Repeatability**

Repeatability is defined as the difference between two subsequent measurements under identical circumstances and with a standard object.

**Sensitivity to noise**

The extremely high sonic frequency used for ultrasonic sensors ensures that most extraneous noise will not affect operational accuracy. Pressurized air might interfere with the proper operation of the sensor under extreme conditions.

**Humidity**

A relative humidity up to 90 % has nominal effect on the sensing distance of the sonic sensors. Direct moisture or dirt however may lead to a reduction of the scanning range Sd.

**Air stream**

The narrow sonic beam angle may be affected by strong air streams in excess of 10 m/second.

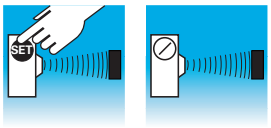
**Temperature**

Heat radiation from hot targets produces strong air turbulence. This can affect the sonic propagation and hence, the proper recognition of an object.

**Temperature drift**

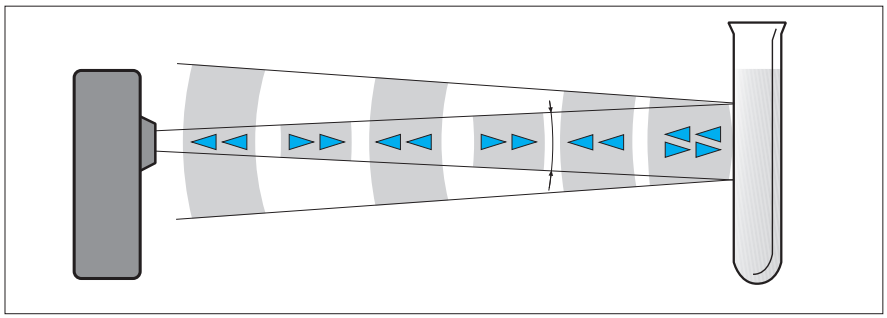
The speed of sound depends on temperature. Deviation can be up to 0,18%/K. Temperature drift of the ambient air is mostly compensated within the sensor itself. The specification for temperature compensation is valid for stationary conditions.

# Ultrasonic proximity sensors




## Design and operation

A special sonic transducer is used for the ultrasonic proximity sensors, which allows for alternate transmission and reception of sound waves. The transducer emits a number of sonic waves which are reflected by an object, back to the transducer. After emission of the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.



**Digital output**

Sensing is only possible within the detection area. The required sensing range can be adjusted with the sensor's potentiometer. If an object is detected within the set area, the output changes its state. The built-in LED indicates this change.

## ... with Teach-in

**Teach-in procedures**

All adjustments are carried out via the internal Teach-in button or the external Teach-in wire.

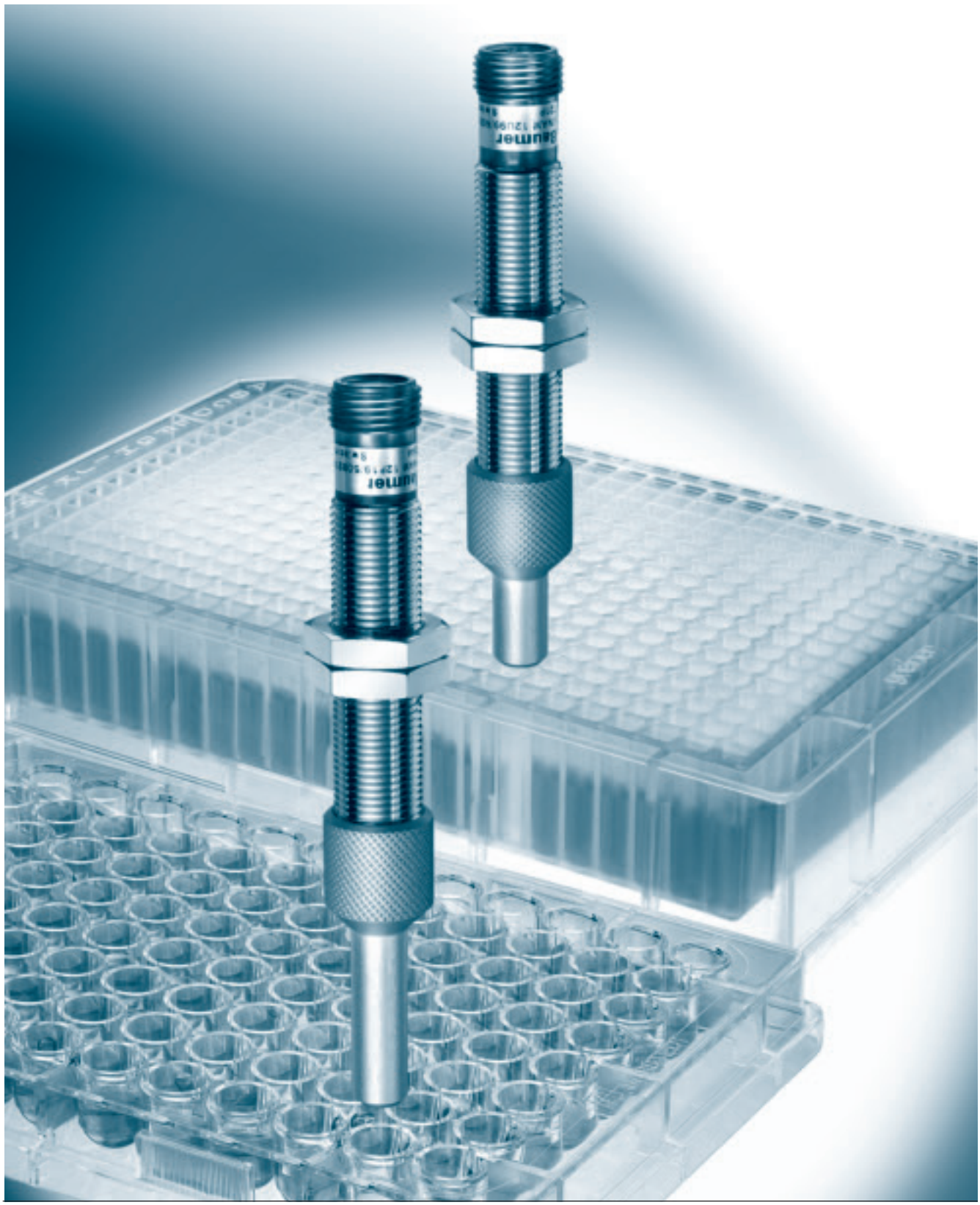
**Adjustment switching point Sde**

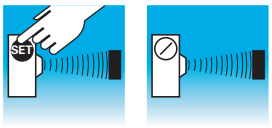
1. Adjustment mode:
   Press the Teach-in button or connect the white Teach-in wire to +Vs for approx. 2 secs until the LED flashes green. Release the button or disconnect Teach-in wire.
2. LED flashes green. Place the target at the required scanning range and press the Teach-in button or connect the external white Teach-in wire shortly to +Vs.
3. Succesful completion of Teach-in procedure is confirmed by LED being „on“ for approx. 2 secs.

In order to re-teach the sensor it must be shortly disconnected from the power supply.

**Resetting to original factory settings**

Holding the button down or connecting the white Teach-in wire to +Vs for > 6 secs, will automatically restore the original factory setting. Fast flashing of the green LED indicates successful completion of the resetting.






## rectangular designs

| product family | UNDK 10 | UNDK 20 | UNDK 20 | UNDK 20 | UNDK 30 | UNDK 30 | UNDK 30 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *SONUS* | | | | | | |
| width / diameter | 10,4 mm | 20 mm | 20 mm | 20 mm | 30 mm | 30 mm | 30 mm |
| sensing range sd | 10 ... 200 mm | 10 ... 200 mm | 40 ... 400 mm | 100 ... 1000 mm | 30 ... 250 mm | 60 ... 400 mm | 100 ... 1000 mm |
| potentiometer | | | | | ■ | ■ | ■ |
| Teach-in | ■ | ■ | ■ | ■ | | | |
| repeatability | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -25 ... +60 °C | -25 ... +60 °C | -10 ... +60 °C |
| housing material | plastic (ASA) | polyester | polyester | polyester | polyester / die-cast zinc | polyester / die-cast zinc | polyester / die-cast zinc |
| cable | ■ | | | | ■ | ■ | ■ |
| flylead connector M8 | ■ | | | | | | |
| connector M8 | ■ | ■ | ■ | ■ | | | |
| connector M12 | | | | | ■ | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **580** | **581** | **582** | **583** | **584** | **585** | **586** |

## cylindrical designs

| product family | UNAM 12 | UNAM 12 | UNAM 12 | UNAR 18 | UNAM 18 | UNAM 18 | UNAR 18 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 12 mm | 12 mm | 12 mm | 18 mm | 18 mm | 18 mm | 18 mm |
| sensing range sd | 5 ... 70 mm | 10 ... 200 mm | 40 ... 400 mm | 60 ... 400 mm | 100 ... 700 mm | 100 ... 1000 mm | 100 ... 1000 mm |
| potentiometer | | | | | ■ | | |
| external Teach-in | ■ | ■ | ■ | | | | |
| Teach-in | | | | ■ | | ■ | ■ |
| repeatability | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 1 mm | < 0,5 mm | < 0,5 mm |
| operating temperature | 0 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | 0 ... +60 °C | -20 ... +60 °C | -10 ... +60 °C | 0 ... +60 °C |
| housing material | brass nickel plated | brass nickel plated | brass nickel plated | stainless steel 1.4435 (A4) | brass nickel plated | brass nickel plated | stainless steel 1.4435 (A4) |
| cable | | | | | ■ | | |
| connector M12 | ■ | ■ | ■ | ■ | | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **587** | **588** | **589** | **594** | **590** | **591** | **595** |

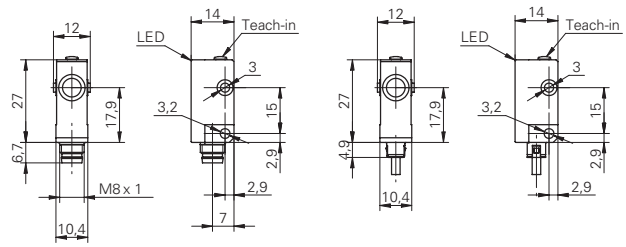
| UNAM 30 | UNAM 50 |
|---|---|
| | |
| 30 mm | 30 mm |
| 200 ... 1500 mm | 350 ... 2500 mm |
| ■ | ■ |
| | |
| < 1 mm | < 1 mm |
| -25 ... +60 °C | -25 ... +60 °C |
| brass nickel plated | brass nickel plated |
| ■ | ■ |
| ■ | ■ |
| IP 67 | IP 67 |
| **592** | **593** |

## Sd = 200 mm

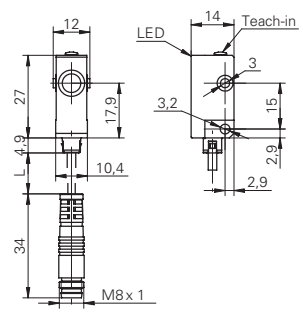
- small housing dimensions
- very low mass (4 g)
- long sensing range/small blind range

| general data | |
|---|---|
| sensing range sd | 10 ... 200 mm |
| scanning range far limit Sde | 30 ... 200 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 15 ms |
| release time toff | < 15 ms |
| alignment aid | target display flashing |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | plastic (ASA) |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

### dimension drawings

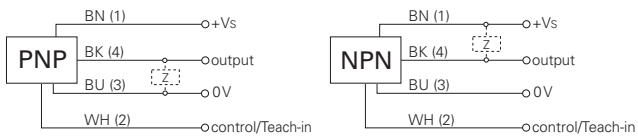



### flylead connector version

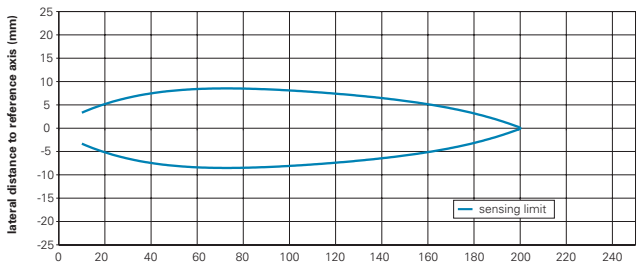



standard cable length 200 mm

### connection diagrams




### typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

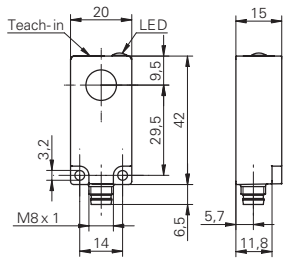
| order reference | output circuit | connection types |
|---|---|---|
| **UNDK 10N8914** | NPN make function (NO) / break function (NC) | cable |
| **UNDK 10N8914/KS35A** | NPN make function (NO) / break function (NC) | flylead connector M8 |
| **UNDK 10N8914/S35A** | NPN make function (NO) / break function (NC) | connector M8 |
| **UNDK 10P8914** | PNP make function (NO) / break function (NC) | cable |
| **UNDK 10P8914/KS35A** | PNP make function (NO) / break function (NC) | flylead connector M8 |
| **UNDK 10P8914/S35A** | PNP make function (NO) / break function (NC) | connector M8 |

# Sd = 200 mm

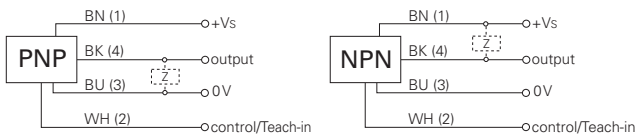
- internal and external Teach-in
- small sonic beam angle

| general data | |
|---|---|
| sensing range sd | 10 ... 200 mm |
| scanning range far limit Sde | 30 ... 200 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 10 ms |
| release time toff | < 10 ms |
| alignment aid | target display flashing |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

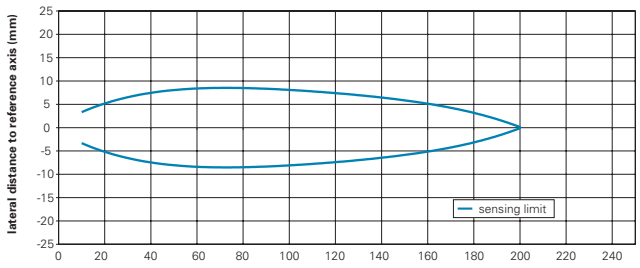
## dimension drawing




## connection diagrams




## typical sonic cone profile




**object distance (So) from sensor front (mm)**

standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit |
|---|---|
| **UNDK 20N6914/S35A** | NPN make function (NO) |
| **UNDK 20N7914/S35A** | NPN break function (NC) |
| **UNDK 20P6914/S35A** | PNP make function (NO) |
| **UNDK 20P7914/S35A** | PNP break function (NC) |

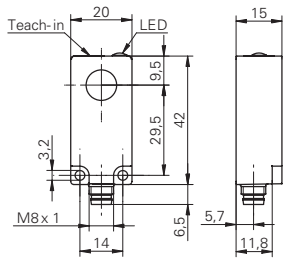
# Sd = 400 mm

- internal and external Teach-in
- wide sonic beam angle

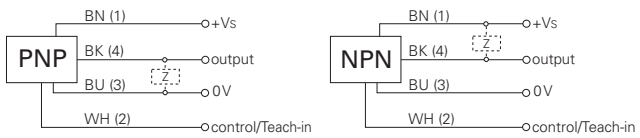
| general data | |
|---|---|
| sensing range sd | 40 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 25 ms |
| release time toff | < 25 ms |
| alignment aid | target display flashing |
| sonic frequency | 290 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **UNDK 20N6912/S35A** | NPN make function (NO) |
| **UNDK 20N7912/S35A** | NPN break function (NC) |
| **UNDK 20P6912/S35A** | PNP make function (NO) |
| **UNDK 20P7912/S35A** | PNP break function (NC) |

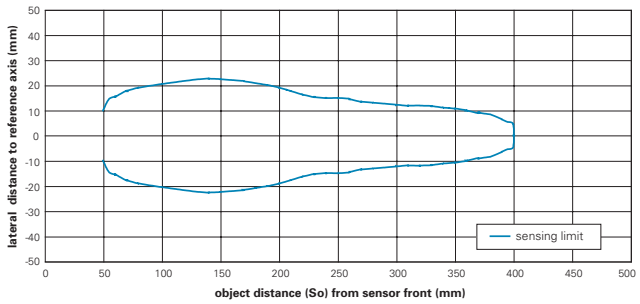
## dimension drawing

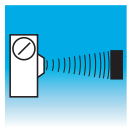



## connection diagrams




## typical sonic cone profile





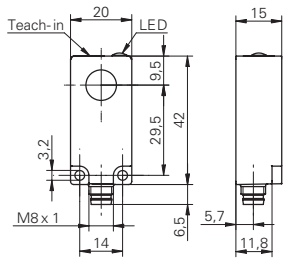
## Sd = 1000 mm

- internal and external Teach-in
- long sensing range

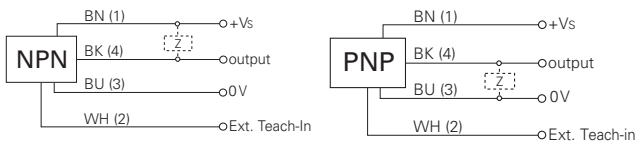
| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 50 ms |
| release time toff | < 50 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **UNDK 20N6903/S35A** | NPN make function (NO) |
| **UNDK 20N7903/S35A** | NPN break function (NC) |
| **UNDK 20P6903/S35A** | PNP make function (NO) |
| **UNDK 20P7903/S35A** | PNP break function (NC) |

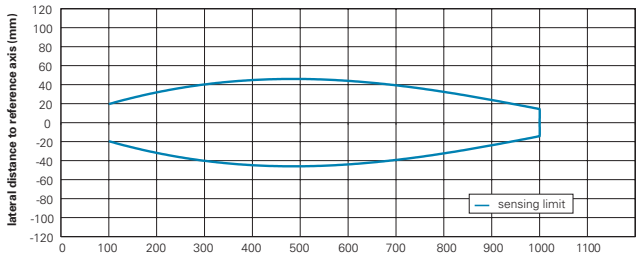
### dimension drawing



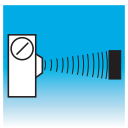

### connection diagrams




### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

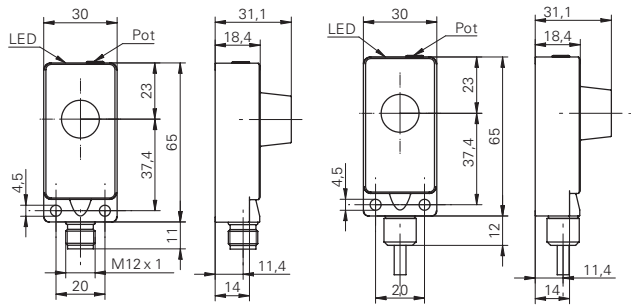


## Sd = 250 mm

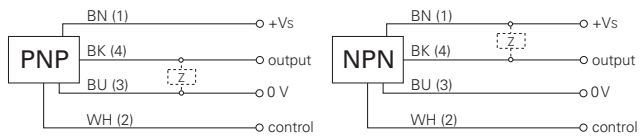
- potentiometer
- synchronization output
- small blind range

| general data | |
|---|---|
| sensing range sd | 30 ... 250 mm |
| scanning range far limit Sde | 30 ... 250 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| synchronization | yes |
| multiplex version | on request |
| temperature drift | < 0,18% Sde/K |
| adjustment | potentiometer |
| response time ton (synch on) | < 10 ms |
| release time toff (sync on) | < 10 ms |
| alignment aid | target display flashing |
| sonic frequency | 300 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

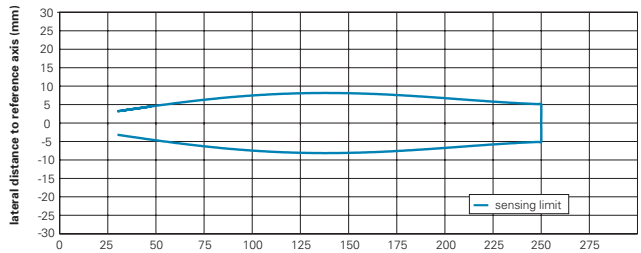
### dimension drawings




### connection diagrams

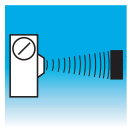



### typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UNDK 30N1713** | NPN make function (NO) | cable |
| **UNDK 30N1713/S14** | NPN make function (NO) | connector M12 |
| **UNDK 30N3713** | NPN break function (NC) | cable |
| **UNDK 30N3713/S14** | NPN break function (NC) | connector M12 |
| **UNDK 30P1713** | PNP make function (NO) | cable |
| **UNDK 30P1713/S14** | PNP make function (NO) | connector M12 |
| **UNDK 30P3713** | PNP break function (NC) | cable |
| **UNDK 30P3713/S14** | PNP break function (NC) | connector M12 |

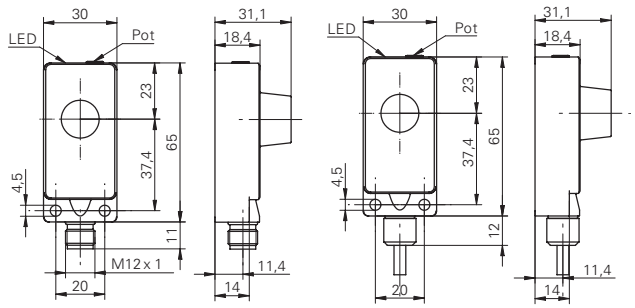


## Sd = 400 mm

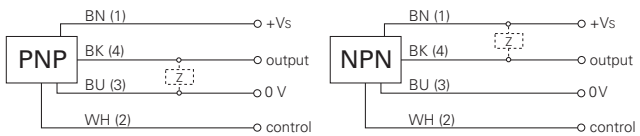
- potentiometer
- synchronisation output

| general data | |
|---|---|
| sensing range sd | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| synchronization | yes |
| multiplex version | on request |
| temperature drift | < 0,18% Sde/K |
| adjustment | potentiometer |
| response time ton (synch on) | < 25 ms |
| release time toff (sync on) | < 25 ms |
| alignment aid | target display flashing |
| sonic frequency | 400 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

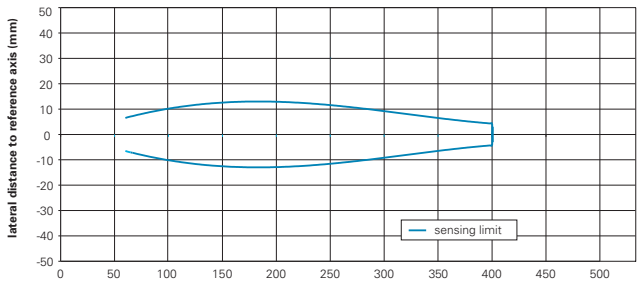
### dimension drawings




### connection diagrams

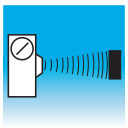



### typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UNDK 30N1712** | NPN make function (NO) | cable |
| **UNDK 30N1712/S14** | NPN make function (NO) | connector M12 |
| **UNDK 30N3712** | NPN break function (NC) | cable |
| **UNDK 30N3712/S14** | NPN break function (NC) | connector M12 |
| **UNDK 30P1712** | PNP make function (NO) | cable |
| **UNDK 30P1712/S14** | PNP make function (NO) | connector M12 |
| **UNDK 30P3712** | PNP break function (NC) | cable |
| **UNDK 30P3712/S14** | PNP break function (NC) | connector M12 |

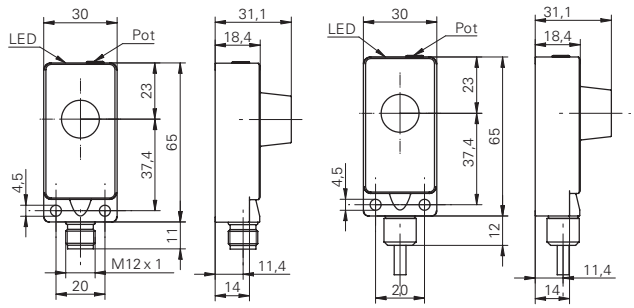


## Sd = 1000 mm

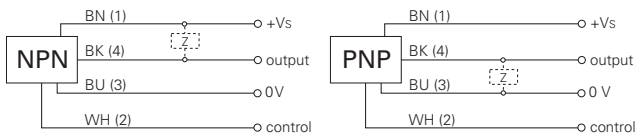
- potentiometer
- synchronisation output
- temperature compensation

| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| synchronization | yes |
| multiplex version | on request |
| temperature drift | < 0,1% Sde/K |
| adjustment | potentiometer |
| response time ton (synch on) | < 50 ms |
| release time toff (sync on) | < 50 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

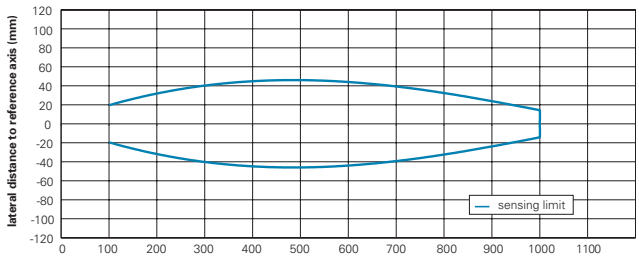
### dimension drawings




### connection diagrams




### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UNDK 30N1703** | NPN make function (NO) | cable |
| **UNDK 30N1703/S14** | NPN make function (NO) | connector M12 |
| **UNDK 30N3703** | NPN break function (NC) | cable |
| **UNDK 30N3703/S14** | NPN break function (NC) | connector M12 |
| **UNDK 30P1703** | PNP make function (NO) | cable |
| **UNDK 30P1703/S14** | PNP make function (NO) | connector M12 |
| **UNDK 30P3703** | PNP break function (NC) | cable |
| **UNDK 30P3703/S14** | PNP break function (NC) | connector M12 |

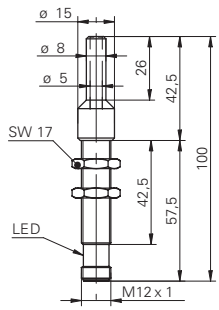
# Sd = 70 mm

- with beam columnator for measurement in very small containers
- external Teach-in

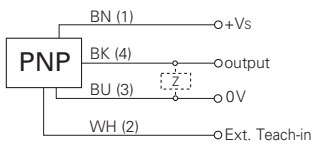
| general data | |
|---|---|
| special type | with beam columnator |
| sensing range sd | 5 ... 70 mm |
| scanning range far limit Sde | 5 ... 70 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | external Teach-in |
| response time ton | < 10 ms |
| release time toff | < 10 ms |
| alignment aid | target display flashing |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |
| Teach-in-adapter | Nr. 141584 |

| order reference |
|---|
| **UNAM 12P1914/S14D** |

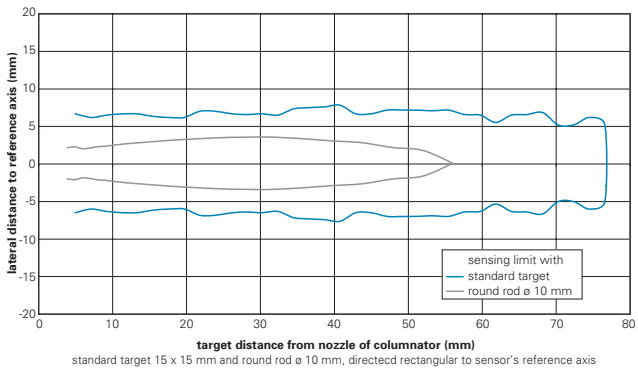
## dimension drawing




## connection diagram




## typical sonic cone profile




**target distance from nozzle of columnator (mm)**

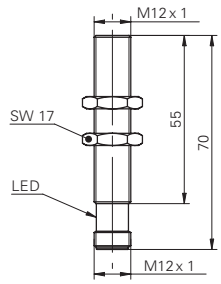
standard target 15 x 15 mm and round rod ø 10 mm, directecd rectangular to sensor's reference axis

# Sd = 200 mm

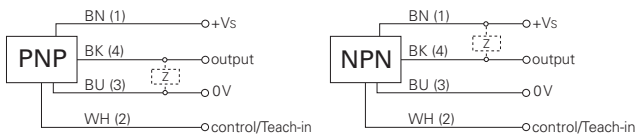
- external Teach-in
- Teach-in adapter
- small sonic beam angle

| general data | |
|---|---|
| sensing range sd | 10 ... 200 mm |
| scanning range far limit Sde | 30 ... 200 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | external Teach-in |
| response time ton | < 10 ms |
| release time toff | < 10 ms |
| alignment aid | target display flashing |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |
| Teach-in-adapter | Nr. 141584 |

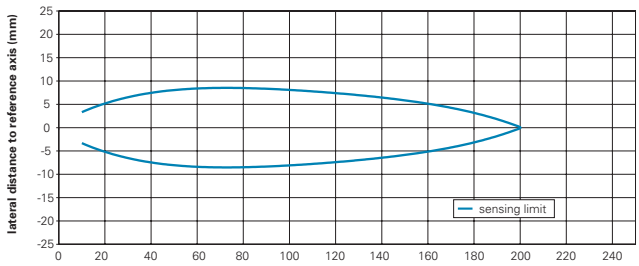
## dimension drawing




## connection diagrams




## typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit |
|---|---|
| **UNAM 12N1914/S14** | NPN make function (NO) |
| **UNAM 12N3914/S14** | NPN break function (NC) |
| **UNAM 12P1914/S14** | PNP make function (NO) |
| **UNAM 12P3914/S14** | PNP break function (NC) |

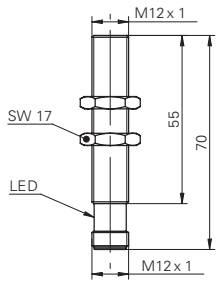
# Sd = 400 mm

- external Teach-in
- Teach-in adapter
- wide sonic beam angle

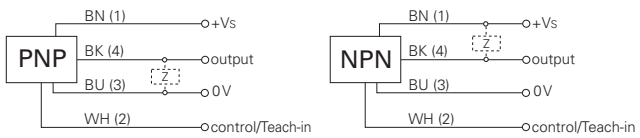
| general data | |
|---|---|
| sensing range sd | 40 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | external Teach-in |
| response time ton | < 25 ms |
| release time toff | < 25 ms |
| alignment aid | target display flashing |
| sonic frequency | 290 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |
| Teach-in-adapter | Nr. 141584 |

| order reference | output circuit |
|---|---|
| **UNAM 12N1912/S14** | NPN make function (NO) |
| **UNAM 12N3912/S14** | NPN break function (NC) |
| **UNAM 12P1912/S14** | PNP make function (NO) |
| **UNAM 12P3912/S14** | PNP break function (NC) |

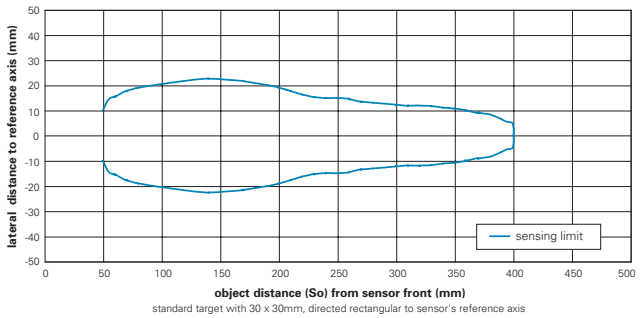
## dimension drawing



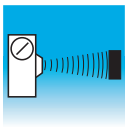

## connection diagrams




## typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

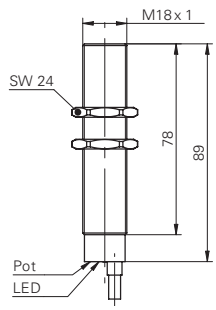


## Sd = 700 mm

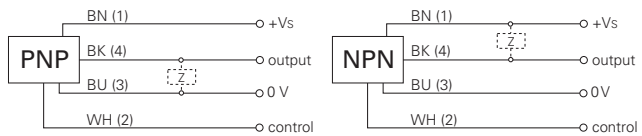
- potentiometer
- synchronisation output

| general data | |
|---|---|
| sensing range sd | 100 ... 700 mm |
| scanning range far limit Sde | 110 ... 700 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 1 mm |
| synchronization | yes |
| temperature drift | < 0,18% Sde/K |
| adjustment | potentiometer |
| response time ton (synch on) | < 100 ms |
| release time toff (sync on) | < 100 ms |
| alignment aid | target display flashing |
| sonic frequency | 230 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 30 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 18 mm |
| height / length | 89 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -20 ... +60 °C |
| protection class | IP 67 |

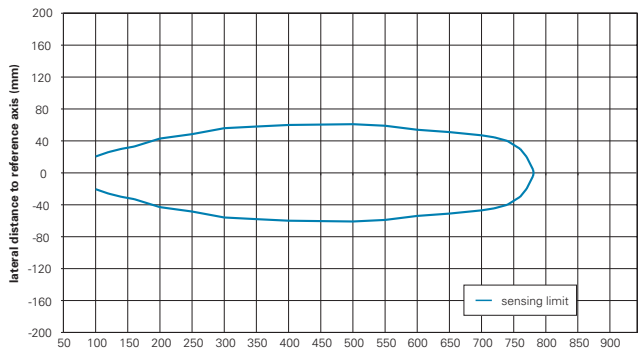
### dimension drawing




### connection diagrams




### typical sonic cone profile




standard square target, size 30 x 30 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit |
|---|---|
| **UNAM 18N1703** | NPN make function (NO) |
| **UNAM 18N3703** | NPN break function (NC) |
| **UNAM 18P1703** | PNP make function (NO) |
| **UNAM 18P3703** | PNP break function (NC) |

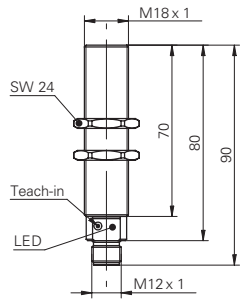
# Sd = 1000 mm

- internal and external Teach-in

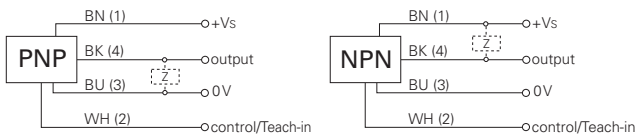
| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 50 ms |
| release time toff | < 50 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 18 mm |
| height / length | 90 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAM 18N6903/S14** | NPN make function (NO) |
| **UNAM 18N7903/S14** | NPN break function (NC) |
| **UNAM 18P6903/S14** | PNP make function (NO) |
| **UNAM 18P7903/S14** | PNP break function (NC) |

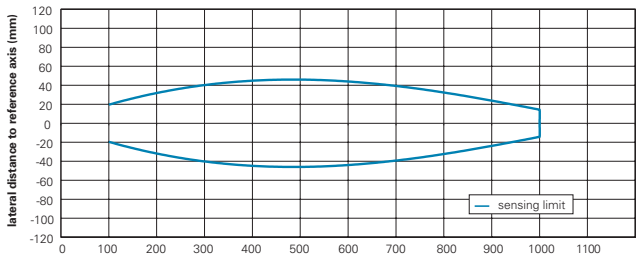
## dimension drawing



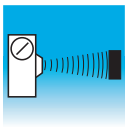

## connection diagrams




## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

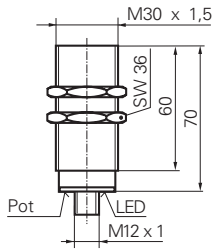


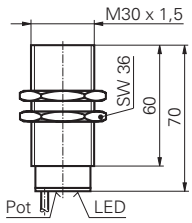
## Sd = 1500 mm

- potentiometer
- increased sensing range

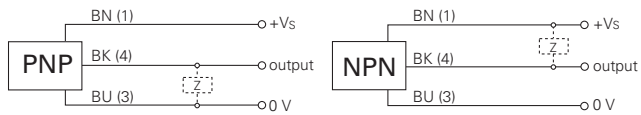
| general data | |
|---|---|
| sensing range sd | 200 ... 1500 mm |
| scanning range far limit Sde | 200 ... 1500 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 1 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | potentiometer |
| response time ton | < 100 ms |
| release time toff | < 100 ms |
| alignment aid | target display flashing |
| sonic frequency | 200 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 30 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 70 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

### dimension drawings

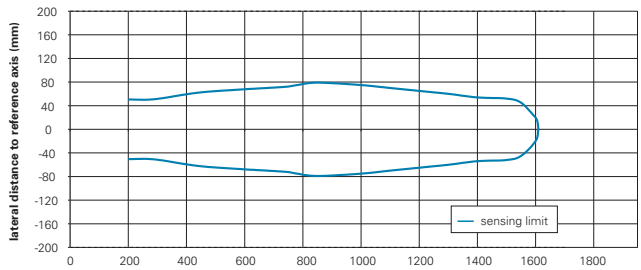



### connection diagrams

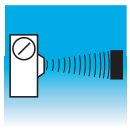



### typical sonic cone profile




standard target 100 x 100 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UNAM 30N1104** | NPN make function (NO) | cable |
| **UNAM 30N1104/S14** | NPN make function (NO) | connector M12 |
| **UNAM 30N3104** | NPN break function (NC) | cable |
| **UNAM 30N3104/S14** | NPN break function (NC) | connector M12 |
| **UNAM 30P1104** | PNP make function (NO) | cable |
| **UNAM 30P1104/S14** | PNP make function (NO) | connector M12 |
| **UNAM 30P3104** | PNP break function (NC) | cable |
| **UNAM 30P3104/S14** | PNP break function (NC) | connector M12 |

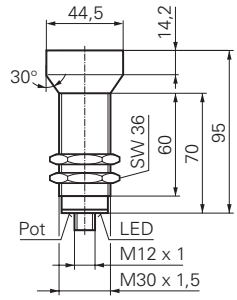


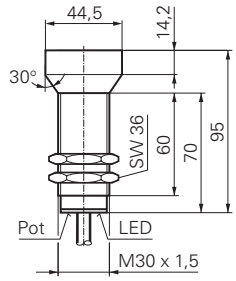
## Sd = 2500 mm

- potentiometer
- synchronisation output
- long sensing range

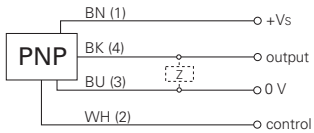
| general data | |
|---|---|
| sensing range sd | 350 ... 2500 mm |
| scanning range far limit Sde | 350 ... 2500 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 1 mm |
| synchronization | yes |
| temperature drift | < 0,18% Sde/K |
| adjustment | potentiometer |
| response time ton | < 160 ms |
| release time toff | < 160 ms |
| alignment aid | target display flashing |
| sonic frequency | 120 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 95 mm |
| **ambient conditions** | |
| operating temperature | -25 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

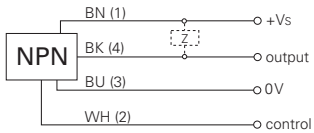
### dimension drawings



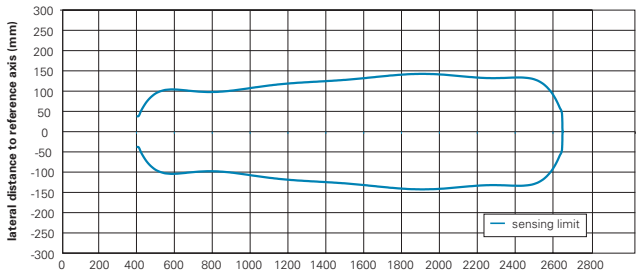




### connection diagrams




### typical sonic cone profile




standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UNAM 50N1721** | NPN make function (NO) | cable |
| **UNAM 50N1721/S14** | NPN make function (NO) | connector M12 |
| **UNAM 50N3721** | NPN break function (NC) | cable |
| **UNAM 50N3721/S14** | NPN break function (NC) | connector M12 |
| **UNAM 50P1721** | PNP make function (NO) | cable |
| **UNAM 50P1721/S14** | PNP make function (NO) | connector M12 |
| **UNAM 50P3721** | PNP break function (NC) | cable |
| **UNAM 50P3721/S14** | PNP break function (NC) | connector M12 |

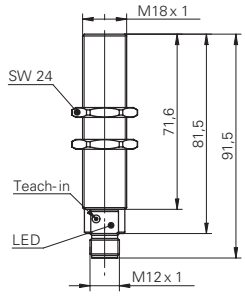
# Sd = 400 mm

- internal and external Teach-in
- sensorfront chemically resistant
- stainless steel housing

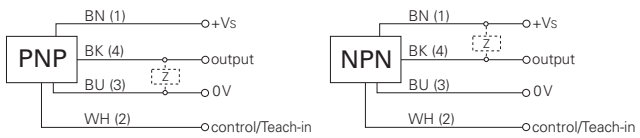
| general data | |
|---|---|
| special type | chemically resistant |
| sensing range sd | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| sonic frequency | 400 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | stainless steel 1.4435 (A4) |
| coating active face | Parylene |
| material O-Ring | FFKM |
| width / diameter | 18 mm |
| height / length | 91,5 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAR 18N6912/S14G** | NPN make function (NO) |
| **UNAR 18N7912/S14G** | NPN break function (NC) |
| **UNAR 18P6912/S14G** | PNP make function (NO) |
| **UNAR 18P7912/S14G** | PNP break function (NC) |

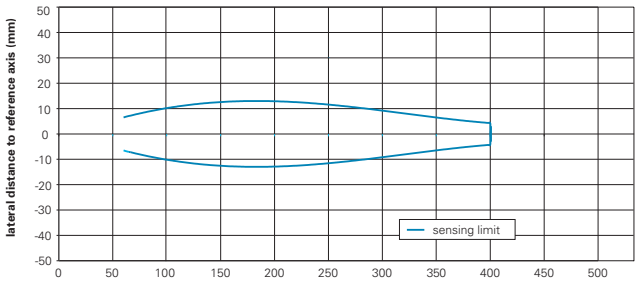
## dimension drawing




## connection diagrams




## typical sonic cone profile



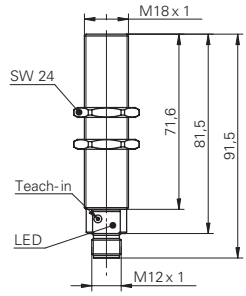

standard target with 30 x 30mm, directed rectangular to sensor's reference axis

# Sd = 1000 mm

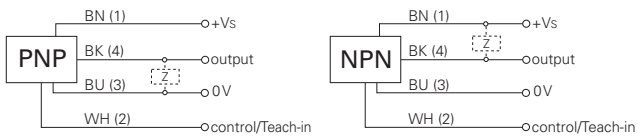
- internal and external Teach-in
- sensorfront chemically resistant
- stainless steel housing

| general data | |
|---|---|
| special type | chemically resistant |
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 0,18% Sde/K |
| adjustment | Teach-in |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | stainless steel 1.4435 (A4) |
| coating active face | Parylene |
| material O-Ring | FFKM |
| width / diameter | 18 mm |
| height / length | 91,5 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

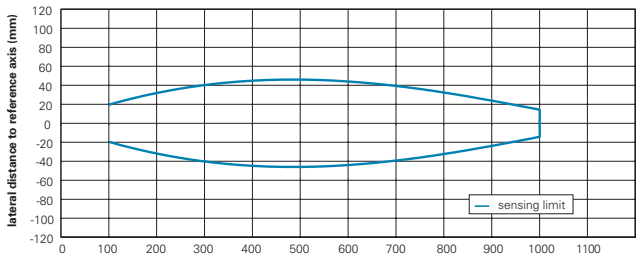
## dimension drawing




## connection diagrams



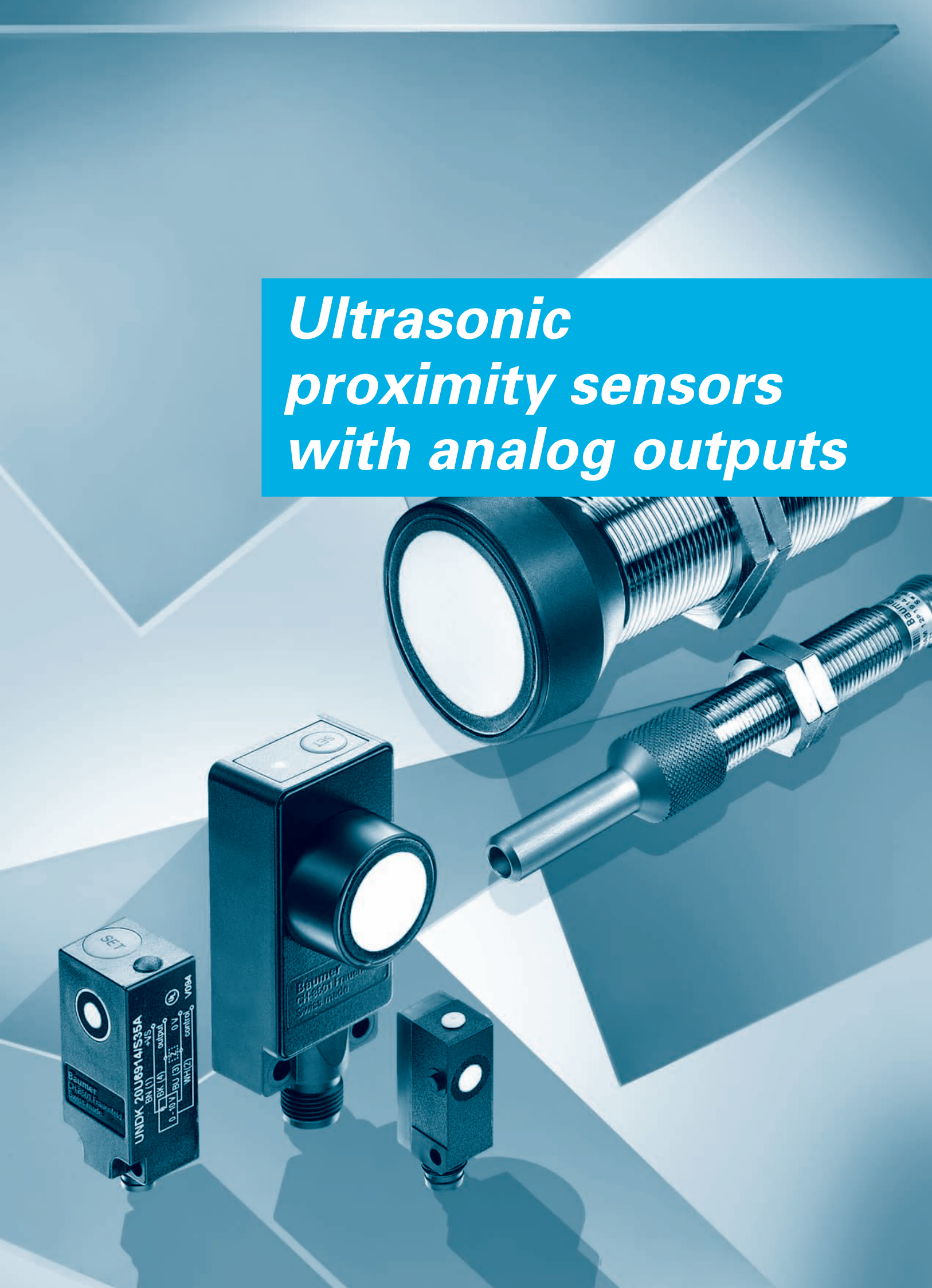

## typical sonic cone profile



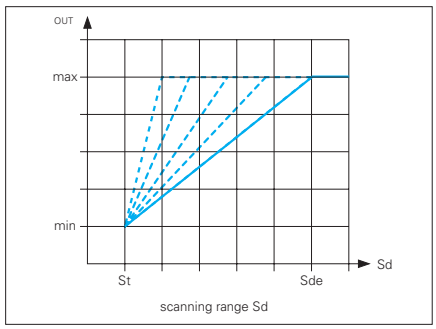

standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

| order reference | output circuit |
|---|---|
| **UNAR 18N6903/S14G** | NPN make function (NO) |
| **UNAR 18N7903/S14G** | NPN break function (NC) |
| **UNAR 18P6903/S14G** | PNP make function (NO) |
| **UNAR 18P7903/S14G** | PNP break function (NC) |

# Ultrasonic proximity sensors with analog outputs



## Sensors with potentiometer

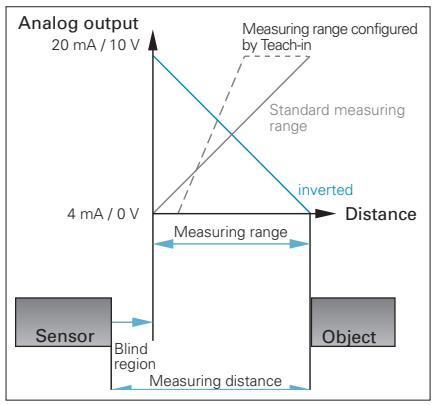



The sensor provides a distance proportional analog current or analog voltage output, allowing simply applied, non-contact distance measurement. The user can change the slope of the output curve using the built-in potentiometer. By doing so, they are able to define the required resolution. Sensor versions, which have a built-in D/A-Converter, generate output signals divided into discrete steps. Applications having long cable runs where there might be EMI or RFI interferences, should use sensors with an analog current output.

## Sensors with Teach-in

**Adjustment of 0 ... 10 V output function**

To switch the sensor into Teach mode, hold the Teach-in button, or connect the external Teach-in wire (WH) to +VS for 2 seconds or more. Successful entry into Teach-mode is signaled by the flashing bicolor LED. Upon release of the Teach button or disconnection of external Teach wire from the +VS source, the red LED will flash. At this point, you may set the close limit (Sdc) by placing the target at the required distance from the sensor (the closest the target will be to the sensor face) and briefly pushing the button or connecting the Teach-in wire with +VS. The LED will then flash Amber. Far limit (Sde) may now be programmed by placing the target at the farthest required distance from the sensor by briefly pressing the button or connecting the Teach-in wire with + VS. Both LEDs will be „on“ for 2 seconds to confirm proper completion of Teach-in process.




**Programmable output curve**

**Optional on request**

Separate digital PNP output with one switching point which may be set using the Teach-in function.

**Inverting the output function to 10 ... 0 V**

Sensor output signal can be inverted to 10 ... 0 V by teaching the far limit Sde first and the sensor close limit Sdc second.

**Resetting to original factory settings or improper set up**

Teaching the sensor without an object within its scanning range, teaching only one instead of the required two limits of the scanning range or simply pressing the button for more than 6 seconds will automatically restore the original factory settings. Fast flashing of both LEDs indicates successful completion of the resetting.

## Linearity

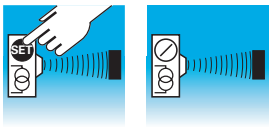
Deviations in linearity are mainly generated within the sensor and by changes in ambient temperature. Resolution, temperature drift and repeatability define the linearity error.

## Minimum load resistance

The voltage drop across the load resistance is proportional to the current, using a sensor with current output. To ensure a proper functioning of the output stage do not exceed the maximum permissible load resistance as stated in the data sheet.

## Resolution

Defines the smallest position change of the object which causes a change in voltage or current at the sensor output.




## rectangular designs

| product family | UNDK 10 | UNDK 20 | UNDK 20 | UNDK 20 | UNDK 30 | UNDK 30 | UNDK 30 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | *SONUS* | | | | | | |
| width / diameter | 10,4 mm | 20 mm | 20 mm | 20 mm | 30 mm | 30 mm | 30 mm |
| sensing range sd | 20 ... 200 mm | 20 ... 200 mm | 60 ... 400 mm | 100 ... 1000 mm | 30 ... 250 mm | 60 ... 400 mm | 100 ... 1000 mm |
| potentiometer | | | | | ■ | ■ | ■ |
| Teach-in | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| repeatability | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C |
| housing material | plastic (ASA) | polyester | polyester | polyester | polyester / die-cast zinc | polyester / die-cast zinc | polyester / die-cast zinc |
| cable | ■ | | | | ■ | ■ | ■ |
| flylead connector M8 | ■ | | | | | | |
| connector M8 | ■ | ■ | ■ | ■ | | | |
| connector M12 | | | | | ■ | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **602** | **603** | **604** | **605** | **606** | **607** | **608** |

## cylindrical designs

| product family | UNAM 12 | UNAM 12 | UNAM 12 | UNAR 18 | UNAM 18 | UNAR 18 | UNAM 30 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| width / diameter | 12 mm | 12 mm | 12 mm | 18 mm | 18 mm | 18 mm | 30 mm |
| sensing range sd | 2 ... 82 mm | 20 ... 200 mm | 60 ... 400 mm | 60 ... 400 mm | 100 ... 1000 mm | 100 ... 1000 mm | 100 ... 1000 mm |
| potentiometer | | | | | | | ■ |
| external Teach-in | ■ | ■ | ■ | | | | |
| Teach-in | | | | ■ | ■ | ■ | ■ |
| repeatability | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 0,5 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | 0 ... +60 °C | -10 ... +60 °C | 0 ... +60 °C | -10 ... +60 °C |
| housing material | brass nickel plated | brass nickel plated | brass nickel plated | stainless steel 1.4435 (A4) | brass nickel plated | stainless steel 1.4435 (A4) | brass nickel plated |
| cable | | | | | | | ■ |
| connector M12 | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **610** | **611** | **612** | **616** | **613** | **617** | **614** |

**UNDK 30**

30 mm

200 ... 2000 mm

■

< 1 mm

-10 ... +60 °C

polyester /
die-cast zinc

■

■

IP 67

609

**UNAM 50**

30 mm

400 ... 2500 mm

■

■

< 1 mm

-10 ... +60 °C

brass nickel
plated

■

■

IP 67

615

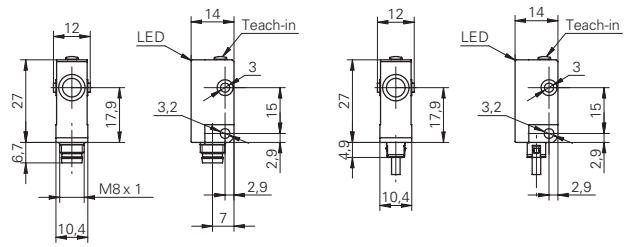
# Sd = 200 mm

- small housing dimensions
- very low mass (4 g)
- high resolution

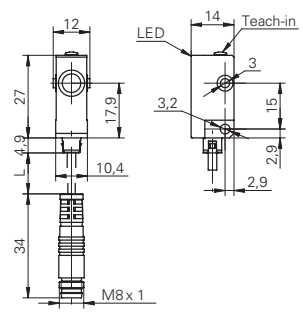
| general data | |
|---|---|
| sensing range sd | 20 ... 200 mm |
| scanning range close limit Sdc | 20 ... 200 mm |
| scanning range far limit Sde | 20 ... 200 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 380 kHz |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 35 mA |
| output circuit | voltage output |
| output signal | 0 ... 10 V / 10 ... 0 V |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | plastic (ASA) |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | connection types |
|---|---|
| **UNDK 10U6914** | cable |
| **UNDK 10U6914/KS35A** | flylead connector M8 |
| **UNDK 10U6914/S35A** | connector M8 |

## dimension drawings

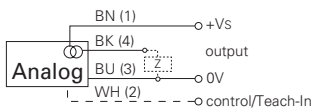



## flylead connector version

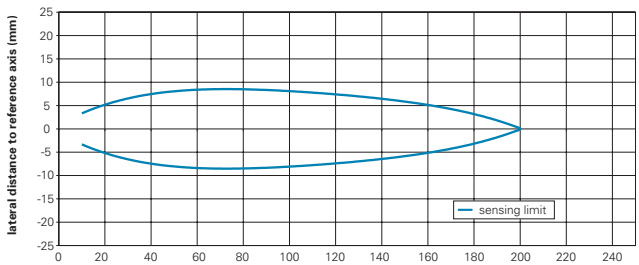



standard cable length 200 mm

## connection diagram




## typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

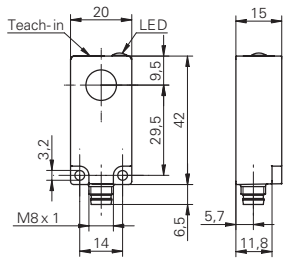
# Sd = 200 mm

- internal and external Teach-in
- 0 ... 10 V / 4 ... 20 mA invertible
- small sonic beam angle

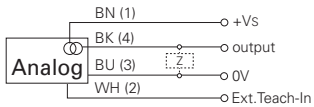
| general data | |
|---|---|
| sensing range sd | 20 ... 200 mm |
| scanning range close limit Sdc | 20 ... 200 mm |
| scanning range far limit Sde | 20 ... 200 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 380 kHz |
| response time ton | < 30 ms |
| release time toff | < 30 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **UNDK 20I6914/S35A** | current output |
| **UNDK 20U6914/S35A** | voltage output |

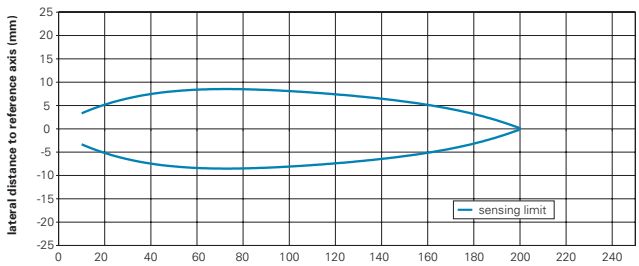
## dimension drawing




## connection diagram




## typical sonic cone profile




**object distance (So) from sensor front (mm)**

standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

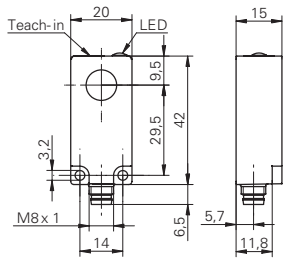
# Sd = 400 mm

- internal and external Teach-in
- 0 ... 10 V / 4 ... 20 mA invertible
- wide sonic beam angle

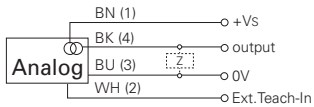
| general data | |
|---|---|
| sensing range sd | 60 ... 400 mm |
| scanning range close limit Sdc | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 290 kHz |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **UNDK 20I6912/S35A** | current output |
| **UNDK 20U6912/S35A** | voltage output |

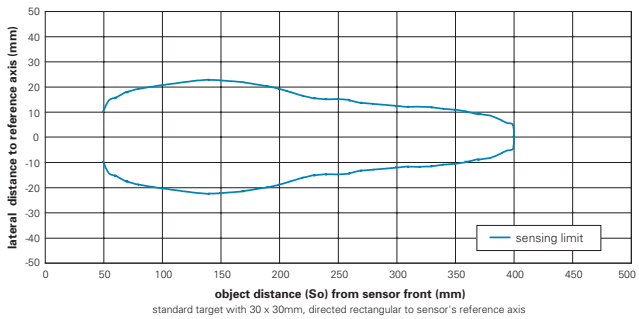
## dimension drawing




## connection diagram




## typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

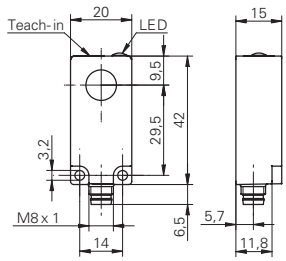
# Sd = 1000 mm

- internal and external Teach-in
- 0 ... 10 V / 4 ... 20 mA invertible
- long sensing distance

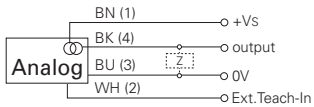
| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range close limit Sdc | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 240 kHz |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **UNDK 20I6903/S35A** | current output |
| **UNDK 20U6903/S35A** | voltage output |

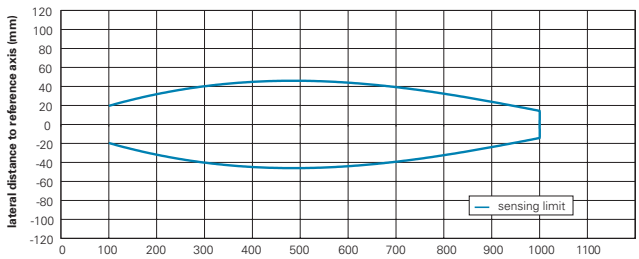
## dimension drawing



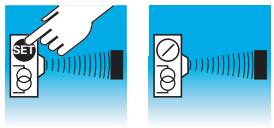

## connection diagram




## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

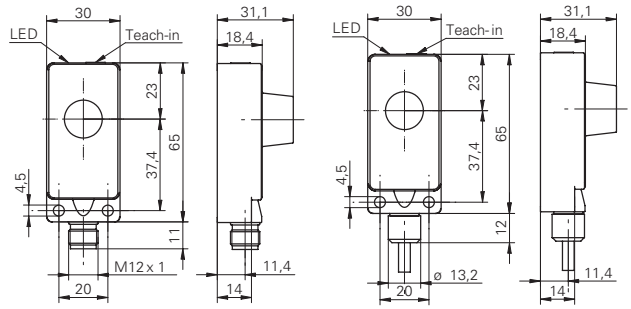



## Sd = 250 mm

- Teach-in or potentiometer
- 0 ... 10 V / 4 ... 20 mA
- output of Teach-in version invertible

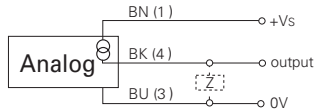
| general data | |
|---|---|
| sensing range sd | 30 ... 250 mm |
| scanning range far limit Sde | 30 ... 250 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| sonic frequency | 300 kHz |
| response time ton | < 50 ms |
| release time toff | < 50 ms |
| alignment aid | target display flashing |
| temperature drift | < 2% of distance to target So |
| **potentiometer** | |
| light indicator | LED green |
| **Teach-in** | |
| scanning range close limit Sdc | 30 ... 250 mm |
| light indicator | yellow LED / red LED |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| **current output** | |
| current consumption max. | 55 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33S, ESG 34S |

### dimension drawings

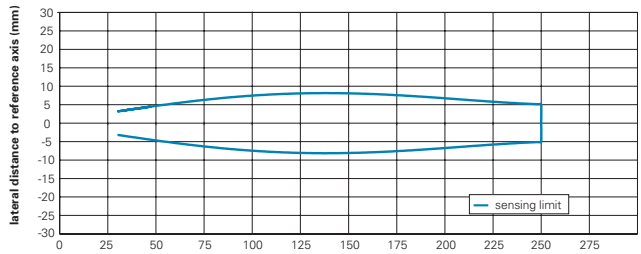



Teach-in = Teach-in or potentiometer

### connection diagram

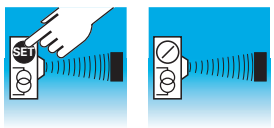



### typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

| order reference | adjustment | output circuit | output signal | connection types |
|---|---|---|---|---|
| **UNDK 30I6113** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | cable |
| **UNDK 30I6113/S14** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNDK 30U6113** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | cable |
| **UNDK 30U6113/S14** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | connector M12 |
| **UNDK 30U9113** | potentiometer | voltage output | 0 ... 10 VDC | cable |
| **UNDK 30U9113/S14** | potentiometer | voltage output | 0 ... 10 VDC | connector M12 |

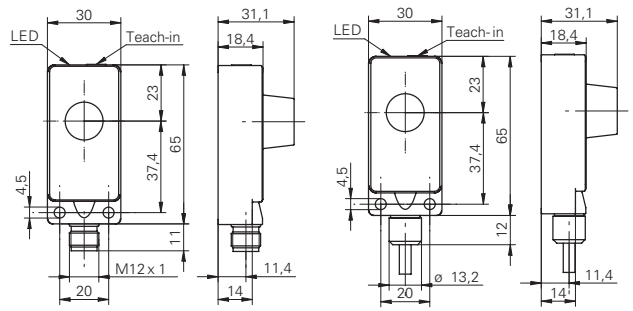



# Sd = 400 mm

- Teach-in or potentiometer
- 0 ... 10 V / 4 ... 20 mA
- output of Teach-in version invertible

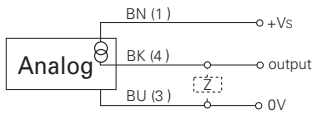
| general data | |
|---|---|
| sensing range sd | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| sonic frequency | 400 kHz |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| temperature drift | < 2% of distance to target So |
| **potentiometer** | |
| light indicator | LED green |
| **Teach-in** | |
| scanning range close limit Sdc | 60 ... 400 mm |
| light indicator | yellow LED / red LED |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| **current output** | |
| current consumption max. | 55 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33S, ESG 34S |

## dimension drawings

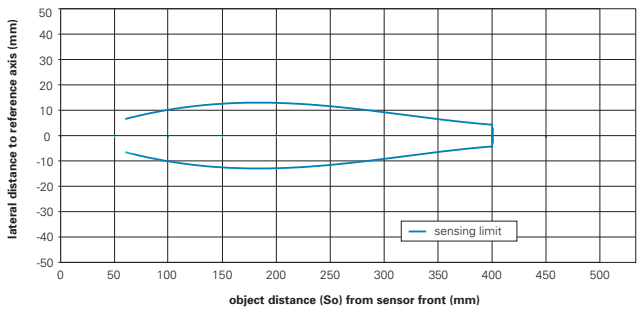



Teach-in = Teach-in or potentiometer

## connection diagram

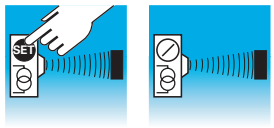



## typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

| order reference | adjustment | output circuit | output signal | connection types |
|---|---|---|---|---|
| **UNDK 30I6112** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | cable |
| **UNDK 30I6112/S14** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNDK 30U6112** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | cable |
| **UNDK 30U6112/S14** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | connector M12 |
| **UNDK 30U9112** | potentiometer | voltage output | 0 ... 10 VDC | cable |
| **UNDK 30U9112/S14** | potentiometer | voltage output | 0 ... 10 VDC | connector M12 |

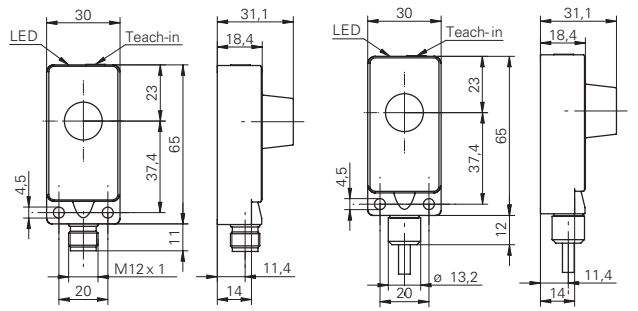



## Sd = 1000 mm

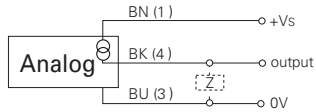
- Teach-in or potentiometer
- 0 ... 10 V / 4 ... 20 mA
- output of Teach-in version invertible

| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| sonic frequency | 240 kHz |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| temperature drift | < 2% of distance to target So |
| **potentiometer** | |
| light indicator | LED green |
| **Teach-in** | |
| scanning range close limit Sdc | 100 ... 1000 mm |
| light indicator | yellow LED / red LED |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| **current output** | |
| current consumption max. | 55 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33A, ESG 34A |

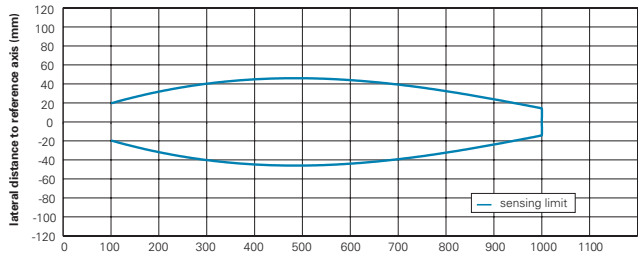
### dimension drawings




### connection diagram




### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

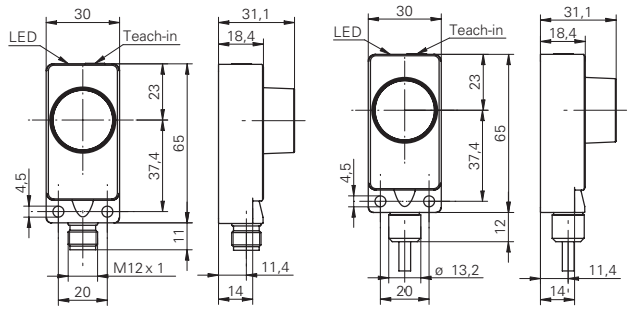
| order reference | adjustment | output circuit | output signal | connection types |
|---|---|---|---|---|
| **UNDK 30I6103** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | cable |
| **UNDK 30I6103/S14** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNDK 30U6103** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | cable |
| **UNDK 30U6103/S14** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | connector M12 |
| **UNDK 30U9103** | potentiometer | voltage output | 0 ... 10 VDC | cable |
| **UNDK 30U9103/S14** | potentiometer | voltage output | 0 ... 10 VDC | connector M12 |

## Sd = 2000 mm

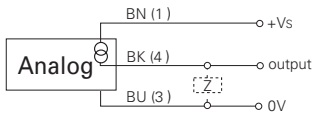
- Teach-in
- 0 ... 10 V / 4 ... 20 mA
- output of Teach-in version invertible

| general data | |
|---|---|
| sensing range sd | 200 ... 2000 mm |
| scanning range close limit Sdc | 200 ... 2000 mm |
| scanning range far limit Sde | 200 ... 2000 mm |
| repeatability | < 1 mm |
| resolution | < 0,5 mm |
| adjustment | Teach-in |
| sonic frequency | 200 kHz |
| response time ton | < 150 ms |
| release time toff | < 150 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33A, ESG 34A |

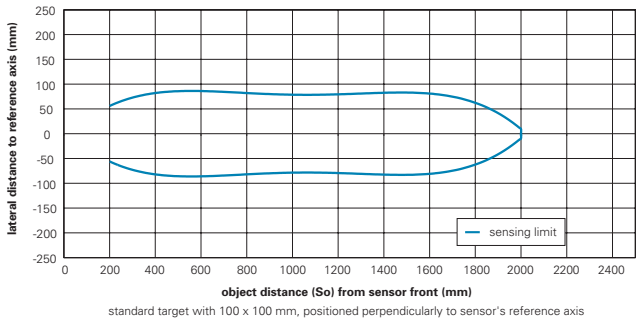
### dimension drawings




### connection diagram




### typical sonic cone profile




standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

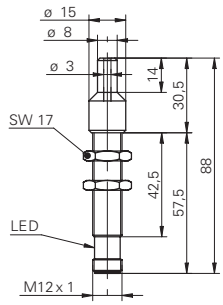
| order reference | output circuit | connection types |
|---|---|---|
| **UNDK 30I6104/S14** | current output | connector M12 |
| **UNDK 30U6104** | voltage output | cable |
| **UNDK 30U6104/S14** | voltage output | connector M12 |

# Sd = 82 mm

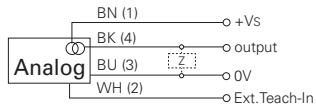
- external Teach-in
- with beam columnator for measurement in very small containers

| general data | |
|---|---|
| special type | with beam columnator |
| sensing range sd | 2 ... 82 mm |
| scanning range close limit Sdc | 2 ... 82 mm |
| scanning range far limit Sde | 2 ... 82 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | external Teach-in |
| sonic frequency | 380 kHz |
| response time ton | < 30 ms |
| release time toff | < 30 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| current consumption max. | 35 mA |
| output circuit | voltage output |
| output signal | 0 ... 10 V / 10 ... 0 V |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| Teach-in-adapter | Nr. 141584 |
| connectors | ESW 33A, ESG 34A |

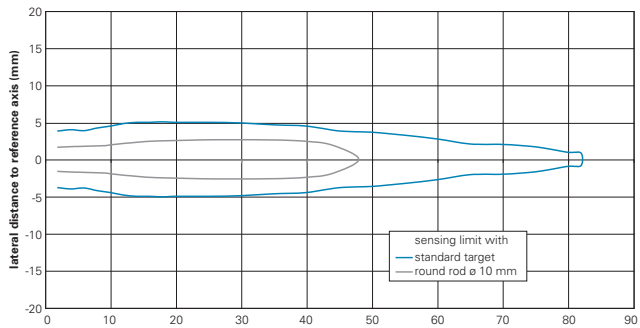
**dimension drawing**




**connection diagram**




**typical sonic cone profile**




standard target 15 x 15 mm and round rod ø 10 mm, directecd rectangular to sensor's reference axis

| order reference |
|---|
| **UNAM 12U9914/S14D** |

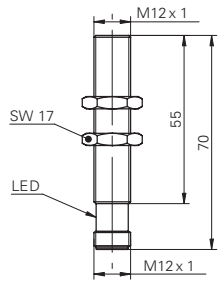
# Sd = 200 mm

- external Teach-in
- 0 ... 10 V / 0 ... 10 mA invertible
- Teach-in adapter

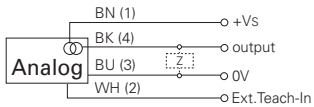
| general data | |
|---|---|
| sensing range sd | 20 ... 200 mm |
| scanning range close limit Sdc | 20 ... 200 mm |
| scanning range far limit Sde | 20 ... 200 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | external Teach-in |
| sonic frequency | 380 kHz |
| response time ton | < 30 ms |
| release time toff | < 30 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 45 mA |
| output signal | 0 ... 10 mA / 10 ... 0 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| Teach-in-adapter | Nr. 141584 |
| connectors | ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAM 12I9914/S14** | current output |
| **UNAM 12U9914/S14** | voltage output |

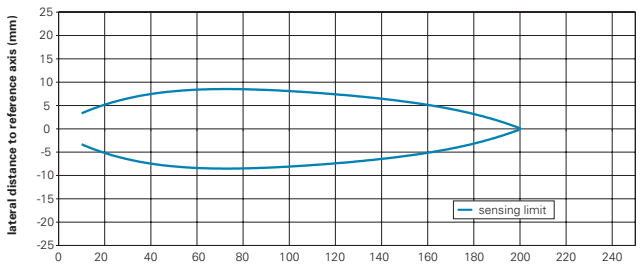
## dimension drawing




## connection diagram




## typical sonic cone profile




**object distance (So) from sensor front (mm)**

standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

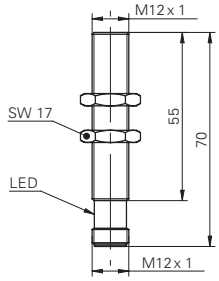
# Sd = 400 mm

- external Teach-in
- 0 ... 10 V / 0 ... 10 mA invertible
- Teach-in adapter

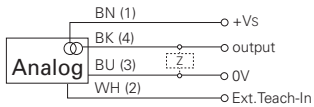
| general data | |
|---|---|
| sensing range sd | 60 ... 400 mm |
| scanning range close limit Sdc | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | external Teach-in |
| sonic frequency | 290 kHz |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 45 mA |
| output signal | 0 ... 10 mA / 10 ... 0 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 12 mm |
| height / length | 70 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| Teach-in-adapter | Nr. 141584 |
| connectors | ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAM 12I9912/S14** | current output |
| **UNAM 12U9912/S14** | voltage output |

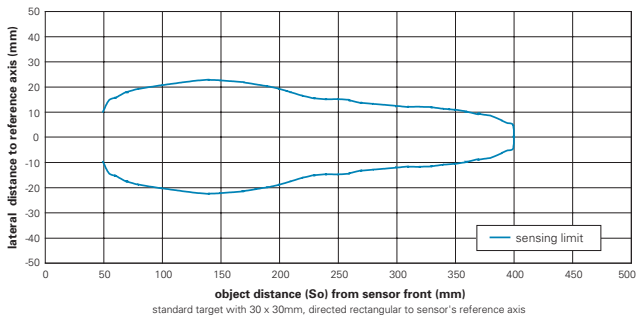
## dimension drawing




## connection diagram




## typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

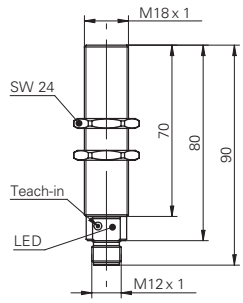
# Sd = 1000 mm

- internal and external Teach-in
- 0 ... 10 V / 4 ... 20 mA
- output signals invertible

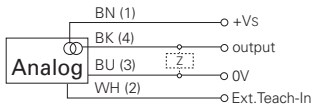
| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range close limit Sdc | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 240 kHz |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 18 mm |
| height / length | 90 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAM 18I6903/S14** | current output |
| **UNAM 18U6903/S14** | voltage output |

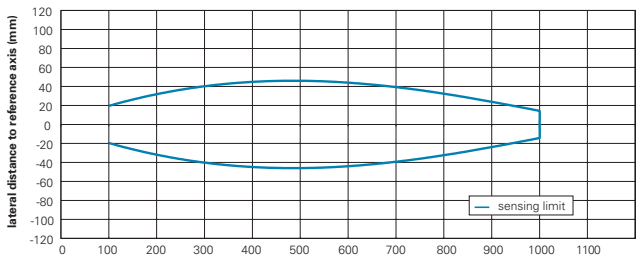
## dimension drawing



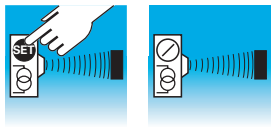

## connection diagram




## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

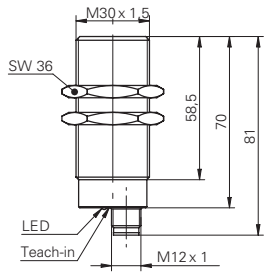


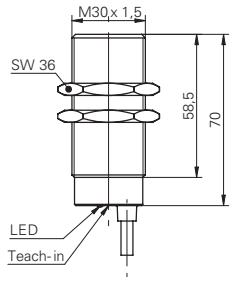

## Sd = 1000 mm

- Teach-in or potentiometer
- 0 ... 10 V / 4 ... 20 mA
- signals of Teach-in version invertible

| general data | |
|---|---|
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| sonic frequency | 240 kHz |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| temperature drift | < 2% of distance to target So |
| **potentiometer** | |
| light indicator | LED green |
| **Teach-in** | |
| scanning range close limit Sdc | 100 ... 1000 mm |
| light indicator | yellow LED / red LED |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| **current output** | |
| current consumption max. | 55 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 70 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33S, ESG 34S |

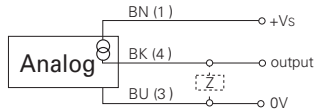
### dimension drawings



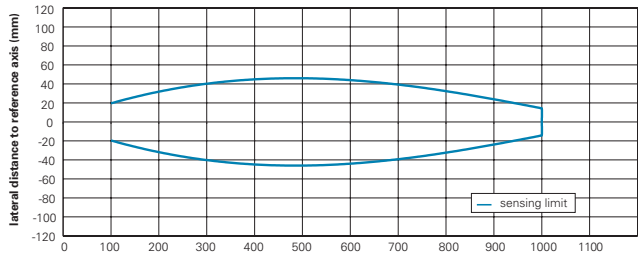




Teach-in = Teach-in or potentiometer

### connection diagram

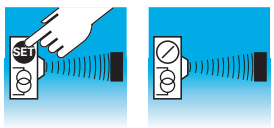



### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

| order reference | version | adjustment | output circuit | output signal | connection types |
|---|---|---|---|---|---|
| **UNAM 30I6103** | standard | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | cable |
| **UNAM 30I6103/S14** | standard | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNAM 30I6803/S14** | multiplex version | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNAM 30U6103** | standard | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | cable |
| **UNAM 30U6103/S14** | standard | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | connector M12 |
| **UNAM 30U9103** | standard | potentiometer | voltage output | 0 ... 10 VDC | cable |
| **UNAM 30U9103/S14** | standard | potentiometer | voltage output | 0 ... 10 VDC | connector M12 |

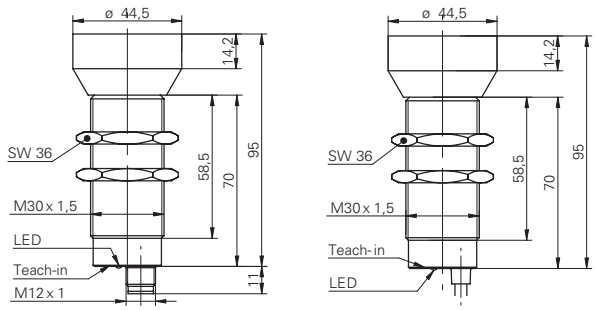



## Sd = 2500 mm

- Teach-in or potentiometer
- 0 ... 10 V / 4 ... 20 mA
- signals of Teach-in version invertible

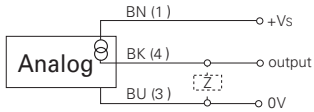
| general data | |
|---|---|
| sensing range sd | 400 ... 2500 mm |
| scanning range far limit Sde | 400 ... 2500 mm |
| repeatability | < 1 mm |
| resolution | < 0,3 mm |
| sonic frequency | 120 kHz |
| response time ton | < 160 ms |
| release time toff | < 160 ms |
| alignment aid | target display flashing |
| temperature drift | < 2% of distance to target So |
| **potentiometer** | |
| light indicator | LED green |
| **Teach-in** | |
| scanning range close limit Sdc | 400 ... 2500 mm |
| light indicator | yellow LED / red LED |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| **current output** | |
| current consumption max. | 55 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 95 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33S, ESG 34S |

### dimension drawings

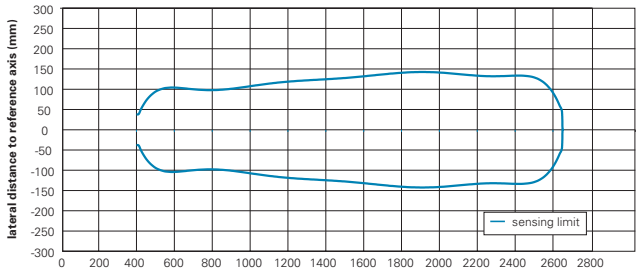



Teach-in = Teach-in or potentiometer

### connection diagram




### typical sonic cone profile




standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

| order reference | adjustment | output circuit | output signal | connection types |
|---|---|---|---|---|
| **UNAM 50I6121** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | cable |
| **UNAM 50I6121/S14** | Teach-in | current output | 4 ... 20 mA / 20 ... 4 mA | connector M12 |
| **UNAM 50U6121** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | cable |
| **UNAM 50U6121/S14** | Teach-in | voltage output | 0 ... 10 V / 10 ... 0 V | connector M12 |
| **UNAM 50U9121** | potentiometer | voltage output | 0 ... 10 VDC | cable |
| **UNAM 50U9121/S14** | potentiometer | voltage output | 0 ... 10 VDC | connector M12 |

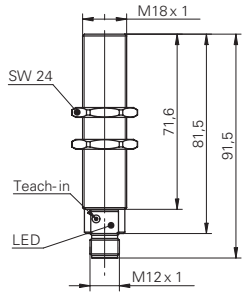
# Sd = 400 mm

- internal and external Teach-in
- sensorfront chemically resistant
- stainless steel housing

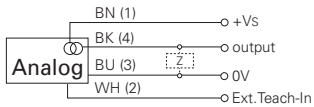
| general data | |
|---|---|
| special type | chemically resistant |
| sensing range sd | 60 ... 400 mm |
| scanning range close limit Sdc | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 400 kHz |
| response time ton | < 60 ms |
| release time toff | < 60 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | stainless steel 1.4435 (A4) |
| coating active face | Parylene |
| material O-Ring | FFKM |
| width / diameter | 18 mm |
| height / length | 91,5 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| **UNAR 18I6912/S14G** | current output |
| **UNAR 18U6912/S14G** | voltage output |

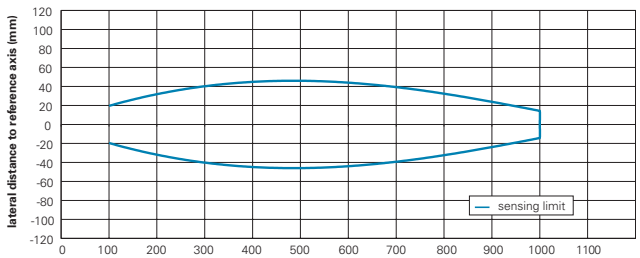
## dimension drawing




## connection diagram




## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

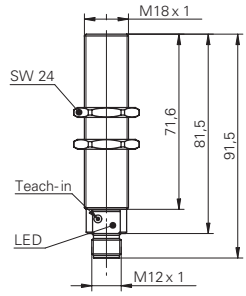
# Sd = 1000 mm

- internal and external Teach-in
- sensorfront chemically resistant
- stainless steel housing

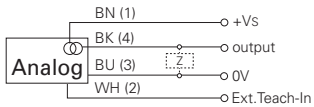
| general data | |
|---|---|
| special type | chemically resistant |
| sensing range sd | 100 ... 1000 mm |
| scanning range close limit Sdc | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| repeatability | < 0,5 mm |
| resolution | < 0,3 mm |
| adjustment | Teach-in |
| sonic frequency | 240 kHz |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| light indicator | yellow LED / red LED |
| temperature drift | < 2% of distance to target So |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| output current | < 20 mA |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **voltage output** | |
| current consumption max. | 35 mA |
| output signal | 0 ... 10 V / 10 ... 0 V |
| **current output** | |
| current consumption max. | 55 mA |
| output signal | 4 ... 20 mA / 20 ... 4 mA |
| load resistance +Vs max. | < 1100 Ohm |
| load resistance +Vs min. | < 400 Ohm |
| **mechanical data** | |
| type | cylindrical |
| housing material | stainless steel 1.4435 (A4) |
| coating active face | Parylene |
| material O-Ring | FFKM |
| width / diameter | 18 mm |
| height / length | 91,5 mm |
| connection types | connector M12 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 33A, ESG 34A |

| order reference | output circuit |
|---|---|
| UNAR 18I6903/S14G | current output |
| UNAR 18U6903/S14G | voltage output |

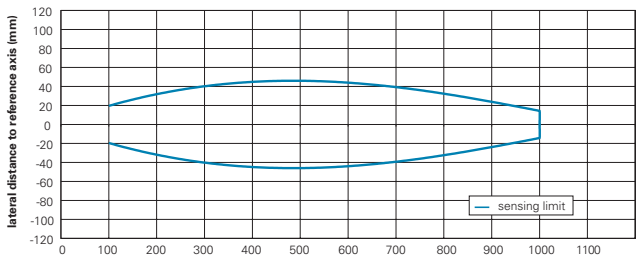
## dimension drawing




## connection diagram



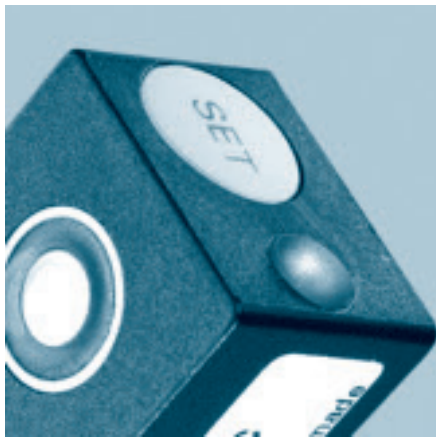

## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

# Ultrasonic 2 point proximity switch

## The button that thinks




Ultrasonic sensors with the "Teach-in" function are similar to the standard range of products but have the added versatility of a simple touch key set up. The switching points (Sde 1 and Sde 2) may be easily programmed within the sensing range by means of the built-in Teach-in button.

## Simple operation

### Adjustment switching point Sde 1

1. Adjustment mode:

   Press the Teach-in button for approximately 2 secs until the LED flashes green. Release button.
2. LED flashes green. Place the target at the required scanning range and press the Teach-in button.
3. Successful completion of Teach-in procedure is confirmed by LED „on“ for approximately 2 secs.

### Adjustment switching point Sde 2

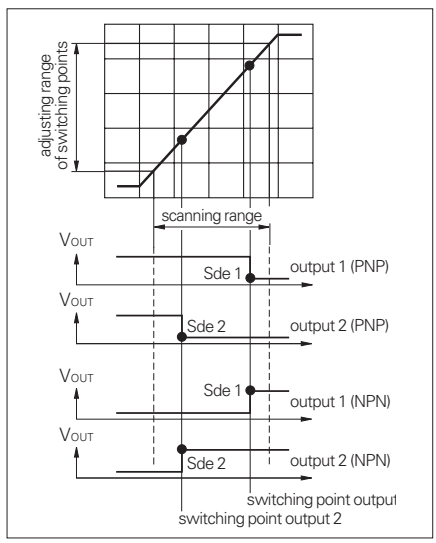
1. Adjustment mode:

   Press the Teach-in button for approximately 4 secs until the LED flashes yellow. Release button.
2. LED flashes yellow. Place the target at the required scanning range and press the Teach-in button.
3. Successful completion of Teach-in procedure is confirmed by LED „on“ for approximately 2 secs.

### Resetting to original factory settings

Holding the button down for > 6 secs, will automatically restore the original factory setting. Fast flashing of the green/yellow LED indicates successful completion of the resetting.

### Functional diagram




## Options

- Remote Teach-in input
- Synchronization- / Multiplex output

## Advantages

- Set up configuration is saved on an internal EEPROM ensuring long term stability.
- Simple one button set up, no tools required.
- Teach-in locking: the Teach-in function is locked five minutes after power up or five minutes after the end of the last Teach-in process.

## rectangular designs

| product family | UZDK 30 | UZDK 30 | UZDK 30 | UZDK 30 |
|---|---|---|---|---|
| | | | | |
| width / diameter | 30 mm | 30 mm | 30 mm | 30 mm |
| sensing range sd | 30 ... 250 mm | 60 ... 400 mm | 100 ... 1000 mm | 200 ... 2000 mm |
| Teach-in | ■ | ■ | ■ | ■ |
| repeatability | < 0,5 mm | < 0,5 mm | < 0,5 mm | < 1 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C |
| housing material | polyester / die-cast zinc | polyester / die-cast zinc | polyester / die-cast zinc | polyester / die-cast zinc |
| cable | ■ | ■ | ■ | ■ |
| connector M12 | ■ | ■ | ■ | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **622** | **623** | **624** | **625** |

## cylindrical designs

| product family | UZAM 30 | UZAM 50 |
|---|---|---|
| | | |
| width / diameter | 30 mm | 30 mm |
| sensing range sd | 100 ... 1000 mm | 350 ... 2500 mm |
| Teach-in | ■ | ■ |
| repeatability | < 0,5 mm | < 1 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C |
| housing material | brass nickel plated | brass nickel plated |
| cable | ■ | ■ |
| connector M12 | ■ | ■ |
| protection class | IP 67 | IP 67 |
| **Page** | **626** | **627** |

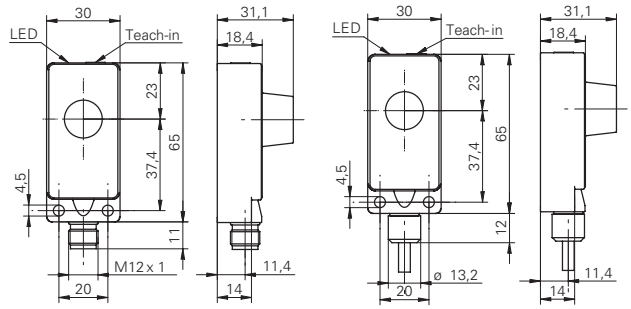
## Sd = 250 mm

- Teach-in
- small blind range
- two separate outputs

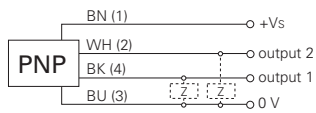
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 30 ... 250 mm |
| scanning range far limit Sde | 30 ... 250 mm |
| hysteresis typ. | 5% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 20 ms |
| release time toff | < 20 ms |
| alignment aid | target display flashing |
| sonic frequency | 300 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 40 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

| order reference | connection types |
|---|---|
| **UZDK 30P6113** | cable |
| **UZDK 30P6113/S14** | connector M12 |

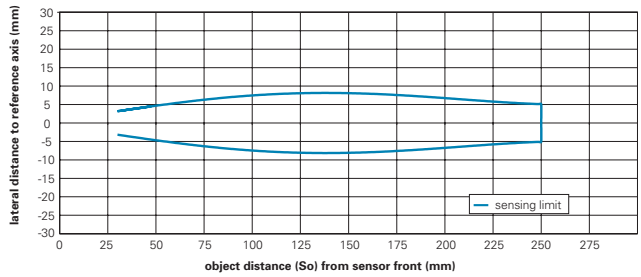
### dimension drawings




### connection diagram




### typical sonic cone profile



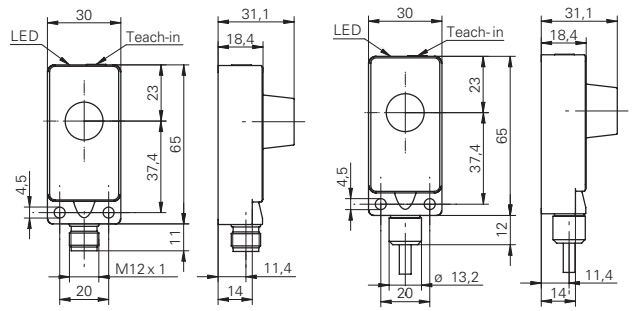

standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

## Sd = 400 mm

- Teach-in
- two separate outputs

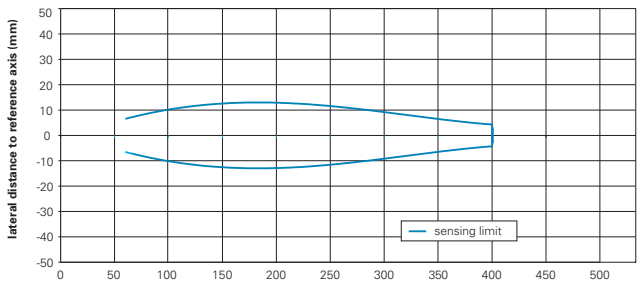
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 60 ... 400 mm |
| scanning range far limit Sde | 60 ... 400 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 30 ms |
| release time toff | < 30 ms |
| alignment aid | target display flashing |
| sonic frequency | 400 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 40 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

### dimension drawings




### connection diagrams

### typical sonic cone profile




standard target with 30 x 30mm, directed rectangular to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UZDK 30N6112/S14** | NPN make function (NO) | connector M12 |
| **UZDK 30P6112** | PNP make function (NO) | cable |
| **UZDK 30P6112/S14** | PNP make function (NO) | connector M12 |

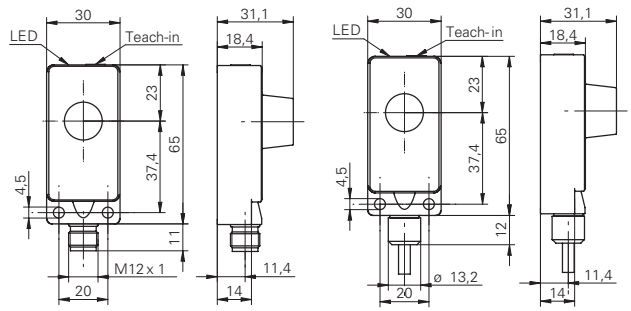
## Sd = 1000 mm

- Teach-in
- two separate outputs

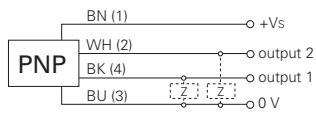
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 40 ms |
| release time toff | < 40 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 40 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

| order reference | connection types |
|---|---|
| **UZDK 30P6103** | cable |
| **UZDK 30P6103/S14** | connector M12 |

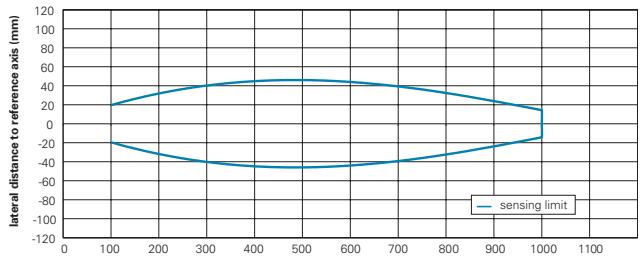
### dimension drawings




### connection diagram




### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

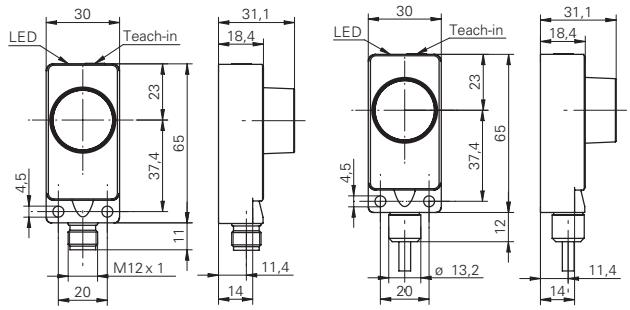
## Sd = 2000 mm

- Teach-in
- two separate outputs

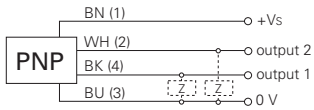
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 200 ... 2000 mm |
| scanning range far limit Sde | 200 ... 2000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 1 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 80 ms |
| release time toff | < 80 ms |
| alignment aid | target display flashing |
| sonic frequency | 200 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 40 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

| order reference | connection types |
|---|---|
| **UZDK 30P6104** | cable |
| **UZDK 30P6104/S14** | connector M12 |

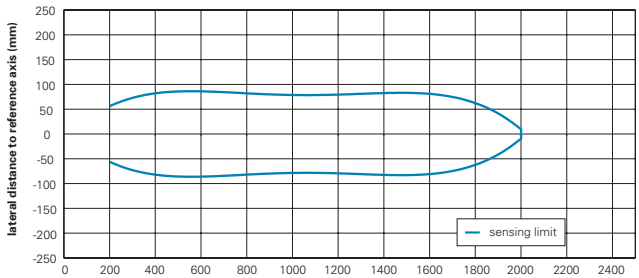
### dimension drawings




### connection diagram




### typical sonic cone profile



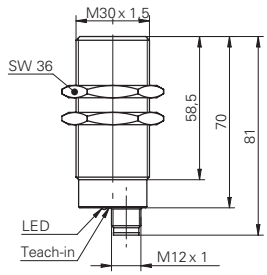

standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

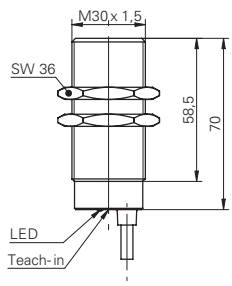
## Sd = 1000 mm

- Teach-in
- two separate outputs
- multiplex-function

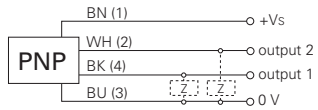
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 100 ... 1000 mm |
| scanning range far limit Sde | 100 ... 1000 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 0,5 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 40 ms |
| release time toff | < 40 ms |
| alignment aid | target display flashing |
| sonic frequency | 240 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 70 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| **standard** | |
| connectors | ES 14, ESW 33A, ESG 34A |
| **multiplex version** | |
| connectors | ES 33C, ES 34C |

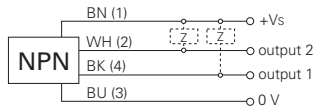
### dimension drawings



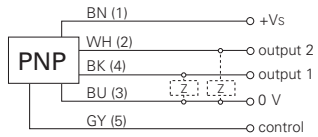




### connection diagrams

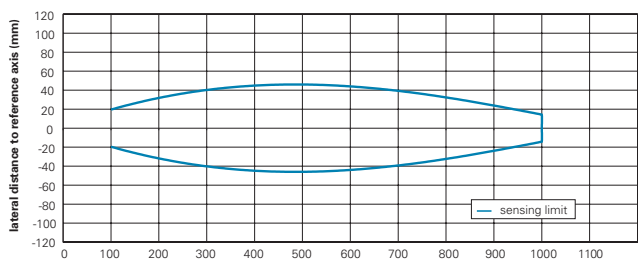



### connection diagram multiplex version




### typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

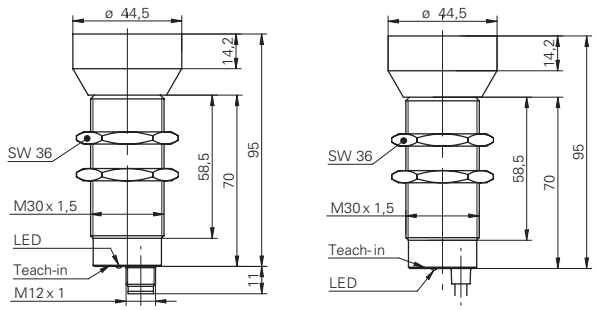
| order reference | version | output circuit | connection types |
|---|---|---|---|
| **UZAM 30N6103/S14** | standard | NPN make function (NO) | connector M12 |
| **UZAM 30P6103** | standard | PNP make function (NO) | cable |
| **UZAM 30P6103/S14** | standard | PNP make function (NO) | connector M12 |
| **UZAM 30P6803** | multiplex version | PNP make function (NO) | cable |
| **UZAM 30P6803/S14C** | multiplex version | PNP make function (NO) | connector M12 |

## Sd = 2500 mm

- Teach-in
- two separate outputs
- long sensing distance

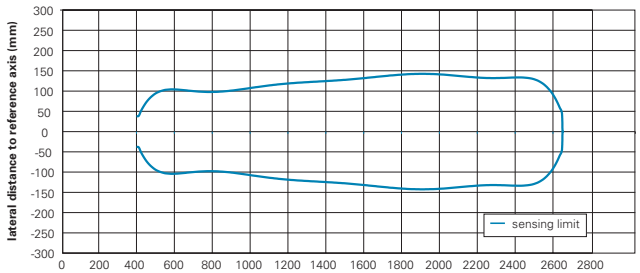
| general data | |
|---|---|
| special type | 2 point proximity switch |
| sensing range sd | 350 ... 2500 mm |
| scanning range far limit Sde | 350 ... 2500 mm |
| hysteresis typ. | 4% Sde |
| repeatability | < 1 mm |
| temperature drift | < 2% Sde |
| adjustment | Teach-in |
| response time ton | < 160 ms |
| release time toff | < 160 ms |
| alignment aid | target display flashing |
| sonic frequency | 120 kHz |
| output indicator | green / yellow LED |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 40 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 95 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

### dimension drawings




### connection diagrams

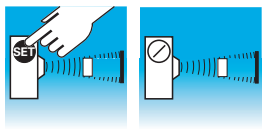
### typical sonic cone profile




standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **UZAM 50N6121** | NPN make function (NO) | cable |
| **UZAM 50N6121/S14** | NPN make function (NO) | connector M12 |
| **UZAM 50P6121** | PNP make function (NO) | cable |
| **UZAM 50P6121/S14** | PNP make function (NO) | connector M12 |

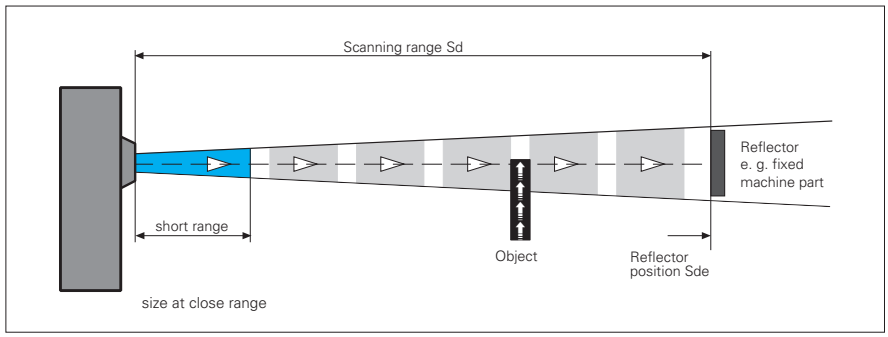
# Ultrasonic retro-reflective sensors




## Description

The retro-reflective ultrasonic sensor is similar in operation to the ultrasonic proximity sensor. The distance from the sensor to the reflector or to an object within the sensing distance is determined by measuring the propagation time. Any sound reflecting, stationary object can be used as a reflector. The sensing distance Sd (distance sensor-reflector) can be adjusted to the set up conditions with the sensor's potentiometer.

As long as the measured propagation time of the ultrasonic signal corresponds to the distance from the sensor to the reflector, the device is in the non-active state. When an object comes within the sensing distance, the propagation time changes and the sensor changes to the active state. This also allows detection of sound absorbent and sound deflecting objects.

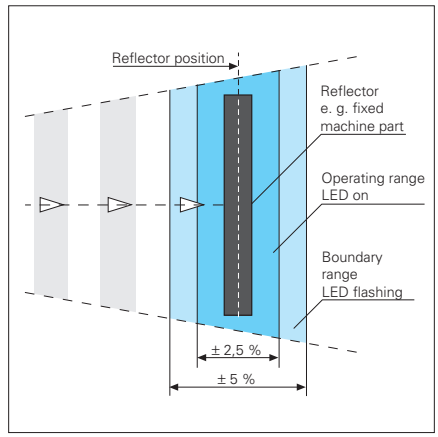



## Setting Sde reflector distance

The sensor's potentiometer allows the user to adjust the set up conditions for a specific reflector position (Sde). The output LED is also an adjustment aid as follows:

**1. Reflector in operating range**
If the setting of Sde deviates from the actual reflector position by less than ±2,5%, the reflector is in the operating range. The LED lights steadily, the output is inactive.

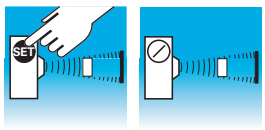
**2. Reflector in the boundary range**
Up to a deviation of ±5% the output remains inactive but the LED flashes. This indicates that the setting of Sde is not optimal and needs to be corrected.




## Retro-reflective sensor with Teach-in

All adjustments are made using the single built-in Teach-in button.

**Teach-in of reflector's position**
To enter the adjustment mode, push the Teach-in button for more than two seconds. You will know you have pushed it long enough by the indicating LED flashing green. When the button is released, the LED continues to flash. Any subsequent push of the button will teach the position of the reflector.



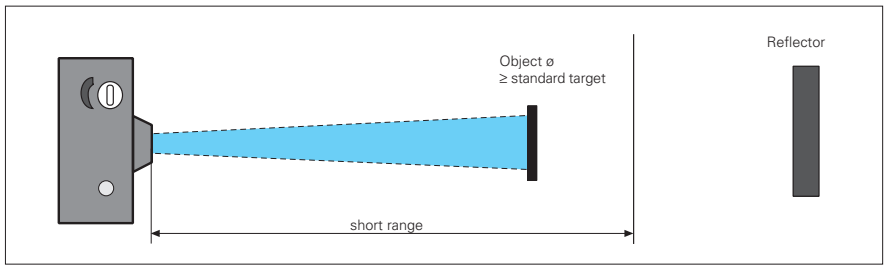

## Object detection

### Standard object /reflector

The standard target is defined as a square, level object with an edge length of 30 mm (Sde > 1000 mm: 100 mm edge length, Sde ≥ 2500 mm: 300 mm edge length) which is perpendicular to the sensor reference axis. The reflector must be made of a material with good sound reflection properties and be at least the same size as the target.

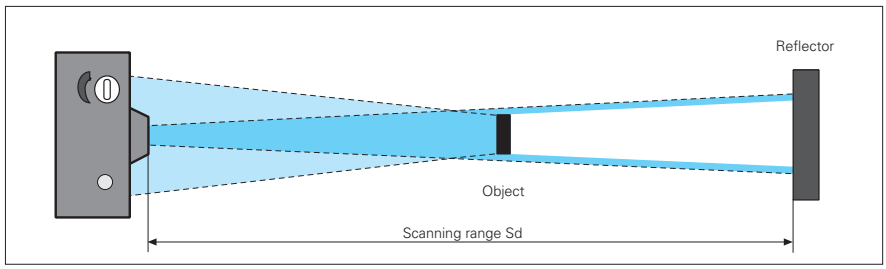
### Object at close range

For reliable detection, the sound cone must be covered completely so that no echo is returned from the reflector. The object diameter necessary for this is at least 30 mm in URDK 30 and at least 100 mm in URAM 50.



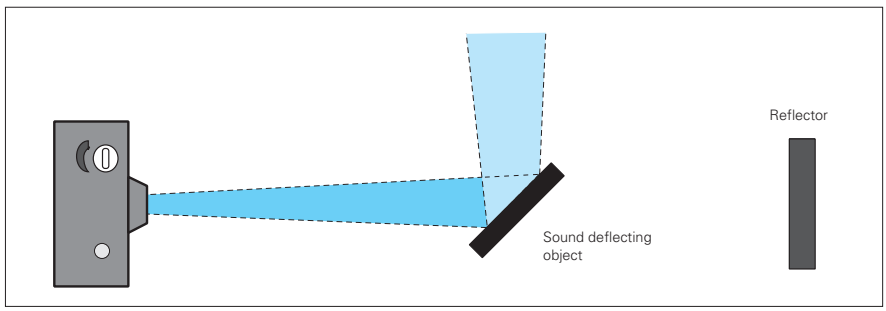

### Object in the rest of the operating range

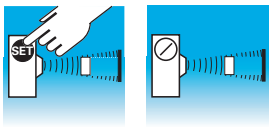
To ensure reliable object detection, the reflected signal must be strong enough. The strength of the reflected signal is dependent on the size of the object. For a standard object, or larger, the full sensing distance Sd is available.




## Advantages

- Easy detection even for 100% sound absorbent materials
- Reliable detection of sound deflecting objects
- No blind region in front of the sensor for objects ≥ standard object





## rectangular designs

| product family | URDK 10 | URDK 20 | URDK 20 | URDK 20 | URDK 30 |
|---|---|---|---|---|---|
| | | | | | |
| | *SONUS* | | | | |
| width / diameter | 10,4 mm | 20 mm | 20 mm | 20 mm | 30 mm |
| sensing range sd | 0 ... 200 mm | 0 ... 200 mm | 0 ... 400 mm | 0 ... 1000 mm | 0 ... 1000 mm |
| potentiometer | | | | | ■ |
| Teach-in | ■ | ■ | ■ | ■ | |
| repeatability | < 1,5 mm | < 1,5 mm | < 1,5 mm | < 1,5 mm | < 3 mm |
| operating temperature | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C | -10 ... +60 °C |
| housing material | plastic (ASA) | polyester | polyester | polyester | polyester / die-cast zinc |
| cable | ■ | | | | ■ |
| flylead connector M8 | ■ | | | | |
| connector M8 | ■ | ■ | ■ | ■ | |
| connector M12 | | | | | ■ |
| protection class | IP 67 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **633** | **634** | **635** | **636** | **637** |

## cylindrical designs

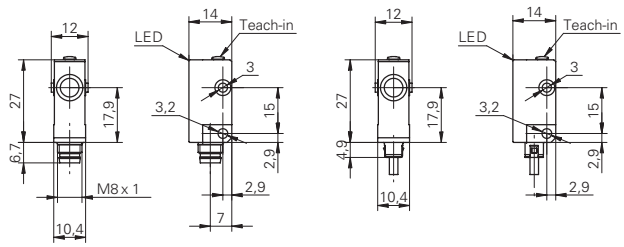
| product family | URAM 50 |
|---|---|
| | |
| width / diameter | 30 mm |
| sensing range sd | 0 ... 3000 mm |
| potentiometer | ■ |
| Teach-in | ■ |
| repeatability | < 3 mm |
| operating temperature | -10 ... +60 °C |
| housing material | brass nickel plated |
| cable | ■ |
| connector M12 | ■ |
| protection class | IP 67 |
| | |
| **Page** | **638** |

# Sd = 200 mm

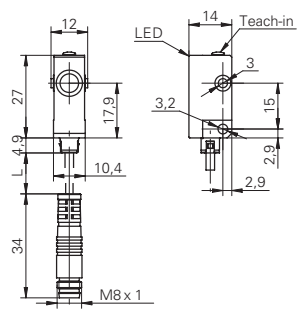
- small housing dimensions
- very low mass (4 g)
- low sensing range/no blind range

| general data | |
|---|---|
| sensing range sd | 0 ... 200 mm |
| reflector position Sde | 40 ... 200 mm |
| adjusting range reflector (operating range) | ± 2,5% Sde |
| adjusting range reflector (limit range) | ± 5% Sde |
| repeatability | < 1,5 mm |
| alignment aid | target display flashing |
| adjustment | Teach-in |
| temperature drift | < 2% Sde |
| response time ton | < 15 ms |
| release time toff | < 15 ms |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 30 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | plastic (ASA) |
| width / diameter | 10,4 mm |
| height / length | 27 mm |
| depth | 14 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

## dimension drawings

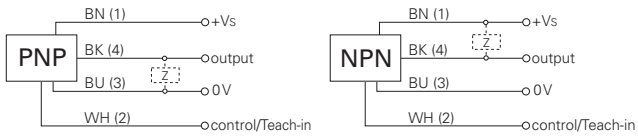



## flylead connector version

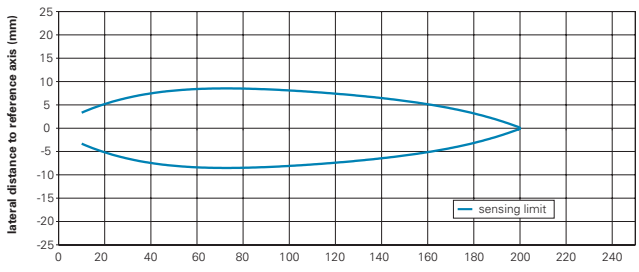



standard cable length 200 mm

## connection diagrams




## typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **URDK 10N8914** | NPN make function (NO) / break function (NC) | cable |
| **URDK 10N8914/KS35A** | NPN make function (NO) / break function (NC) | flylead connector M8 |
| **URDK 10N8914/S35A** | NPN make function (NO) / break function (NC) | connector M8 |
| **URDK 10P8914** | PNP make function (NO) / break function (NC) | cable |
| **URDK 10P8914/KS35A** | PNP make function (NO) / break function (NC) | flylead connector M8 |
| **URDK 10P8914/S35A** | PNP make function (NO) / break function (NC) | connector M8 |

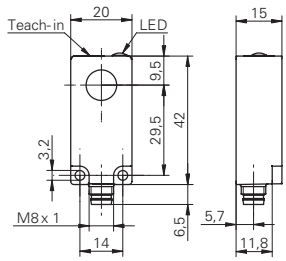
# Sd = 200 mm

- internal and external Teach-in
- small sonic beam angle
- compact housing

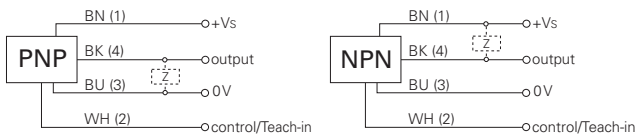
| general data | |
|---|---|
| sensing range sd | 0 ... 200 mm |
| reflector position Sde | 40 ... 200 mm |
| adjusting range reflector (operating range) | ± 2,5% Sde |
| adjusting range reflector (limit range) | ± 5% Sde |
| repeatability | < 1,5 mm |
| alignment aid | target display flashing |
| adjustment | Teach-in |
| temperature drift | < 2% Sde |
| response time ton | < 10 ms |
| release time toff | < 10 ms |
| sonic frequency | 380 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **URDK 20N6914/S35A** | NPN make function (NO) |
| **URDK 20N7914/S35A** | NPN break function (NC) |
| **URDK 20P6914/S35A** | PNP make function (NO) |
| **URDK 20P7914/S35A** | PNP break function (NC) |

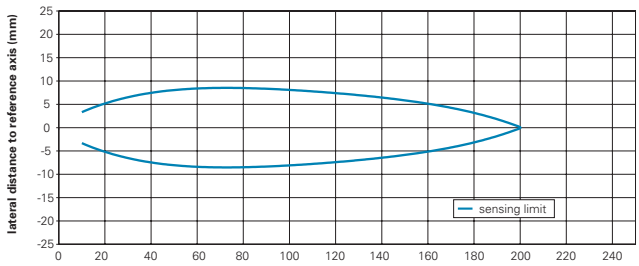
## dimension drawing




## connection diagrams




## typical sonic cone profile




standard square target, size 15 x 15 mm, positioned perpendicularly to sensor's reference axis

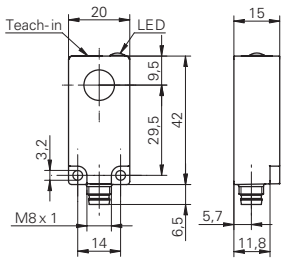
# Sd = 400 mm

- internal and external Teach-in
- wide sonic beam angle
- compact housing

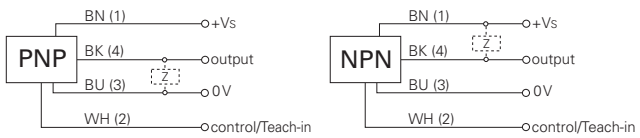
| general data | |
|---|---|
| sensing range sd | 0 ... 400 mm |
| reflector position Sde | 100 ... 400 mm |
| adjusting range reflector (operating range) | ± 2,5% Sde |
| adjusting range reflector (limit range) | ± 5% Sde |
| repeatability | < 1,5 mm |
| alignment aid | target display flashing |
| adjustment | Teach-in |
| temperature drift | < 2% Sde |
| response time ton | < 25 ms |
| release time toff | < 25 ms |
| sonic frequency | 290 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **URDK 20N6912/S35A** | NPN make function (NO) |
| **URDK 20N7912/S35A** | NPN break function (NC) |
| **URDK 20P6912/S35A** | PNP make function (NO) |
| **URDK 20P7912/S35A** | PNP break function (NC) |

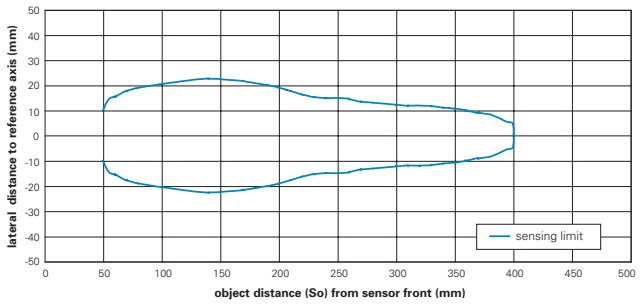
## dimension drawing




## connection diagrams




## typical sonic cone profile



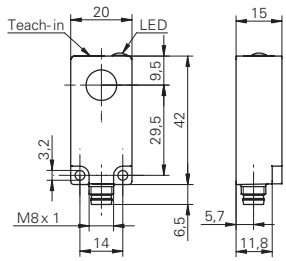
# Sd = 1000 mm

- internal and external Teach-in
- small sonic beam angle
- compact housing

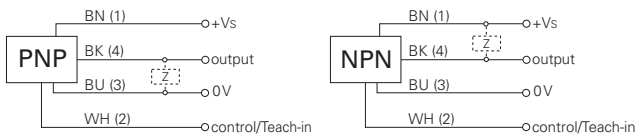
| general data | |
|---|---|
| sensing range sd | 0 ... 1000 mm |
| reflector position Sde | 200 ... 1000 mm |
| adjusting range reflector (operating range) | ± 2,5% Sde |
| adjusting range reflector (limit range) | ± 5% Sde |
| repeatability | < 1,5 mm |
| alignment aid | target display flashing |
| adjustment | Teach-in |
| temperature drift | < 2% Sde |
| response time ton | < 50 ms |
| release time toff | < 50 ms |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | output circuit |
|---|---|
| **URDK 20N6903/S35A** | NPN make function (NO) |
| **URDK 20N7903/S35A** | NPN break function (NC) |
| **URDK 20P6903/S35A** | PNP make function (NO) |
| **URDK 20P7903/S35A** | PNP break function (NC) |

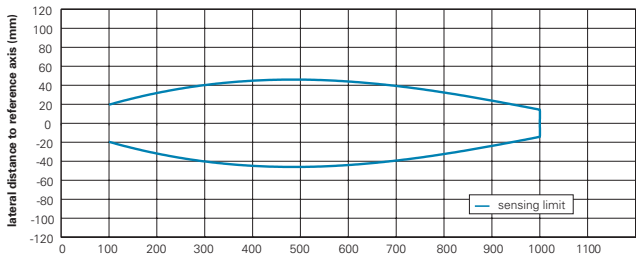
## dimension drawing



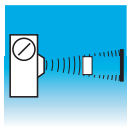

## connection diagrams




## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

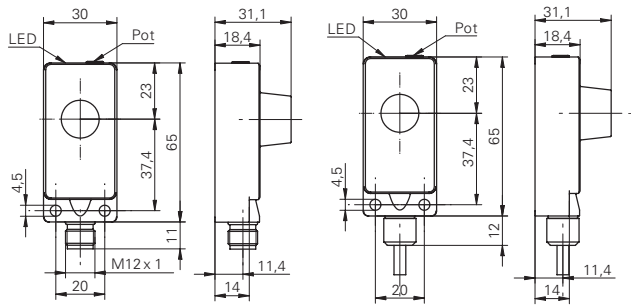


# Sd = 1000 mm

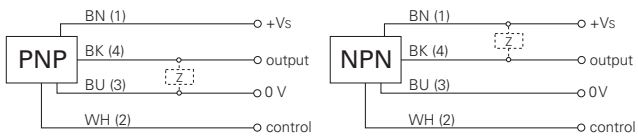
- potentiometer
- synchronisation output
- detects sound absorbing objects

| general data | |
|---|---|
| sensing range sd | 0 ... 1000 mm |
| reflector position Sde | 200 ... 1000 mm |
| limit range (reflector) | ± 5% Sde |
| adjusting range reflector (operating range) | ± 2,5% Sde |
| adjusting range reflector (limit range) | yes |
| repeatability | < 3 mm |
| alignment aid | target display flashing |
| adjustment | potentiometer |
| temperature drift | < 2% Sde |
| synchronization | yes |
| multiplex version | on request |
| response time ton (synch on) | < 50 ms |
| release time toff (sync on) | < 50 ms |
| sonic frequency | 240 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 31 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

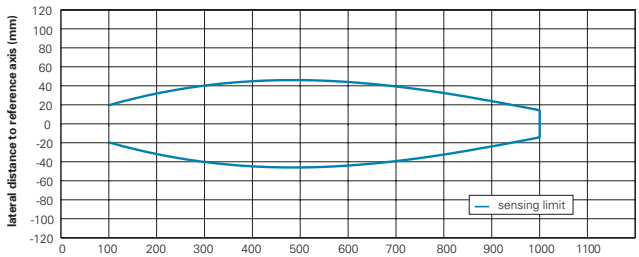
## dimension drawings




## connection diagrams

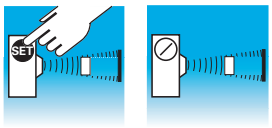



## typical sonic cone profile




standard target with 30 x 30 mm, directed rectangular to sensor's reference axis

| order reference | output circuit | connection types |
|---|---|---|
| **URDK 30N1703** | NPN make function (NO) | cable |
| **URDK 30N1703/S14** | NPN make function (NO) | connector M12 |
| **URDK 30N3703** | NPN break function (NC) | cable |
| **URDK 30N3703/S14** | NPN break function (NC) | connector M12 |
| **URDK 30P1703** | PNP make function (NO) | cable |
| **URDK 30P1703/S14** | PNP make function (NO) | connector M12 |
| **URDK 30P3703** | PNP break function (NC) | cable |
| **URDK 30P3703/S14** | PNP break function (NC) | connector M12 |

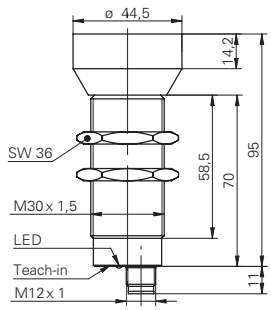


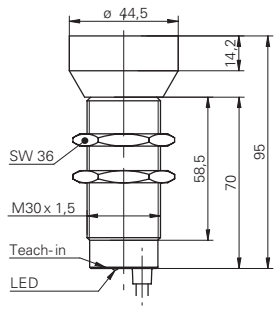

## Sd = 3000 mm

- Teach-in or potentiometer
- synchronisation output
- long sensing distance

| general data | |
|---|---|
| sensing range sd | 0 ... 3000 mm |
| reflector position Sde | 600 ... 3000 mm |
| limit range (reflector) | ± 6% Sde |
| adjusting range reflector (operating range) | ± 4% Sde |
| adjusting range reflector (limit range) | yes |
| repeatability | < 3 mm |
| alignment aid | target display flashing |
| synchronization | yes |
| multiplex version | on request |
| response time ton | < 160 ms |
| release time toff | < 160 ms |
| sonic frequency | 120 kHz |
| output indicator | LED green |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| current consumption max. | 35 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **mechanical data** | |
| type | cylindrical |
| housing material | brass nickel plated |
| width / diameter | 30 mm |
| height / length | 95 mm |
| **ambient conditions** | |
| operating temperature | -10 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

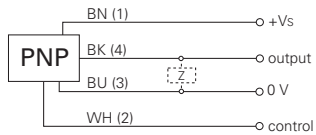
### dimension drawings

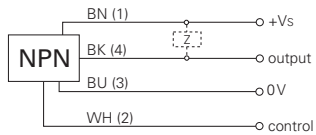


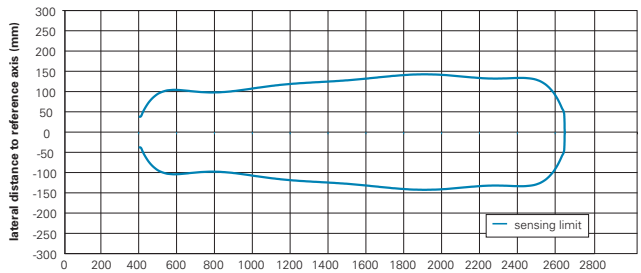

Teach-in = Teach-in or potentiometer

### connection diagrams



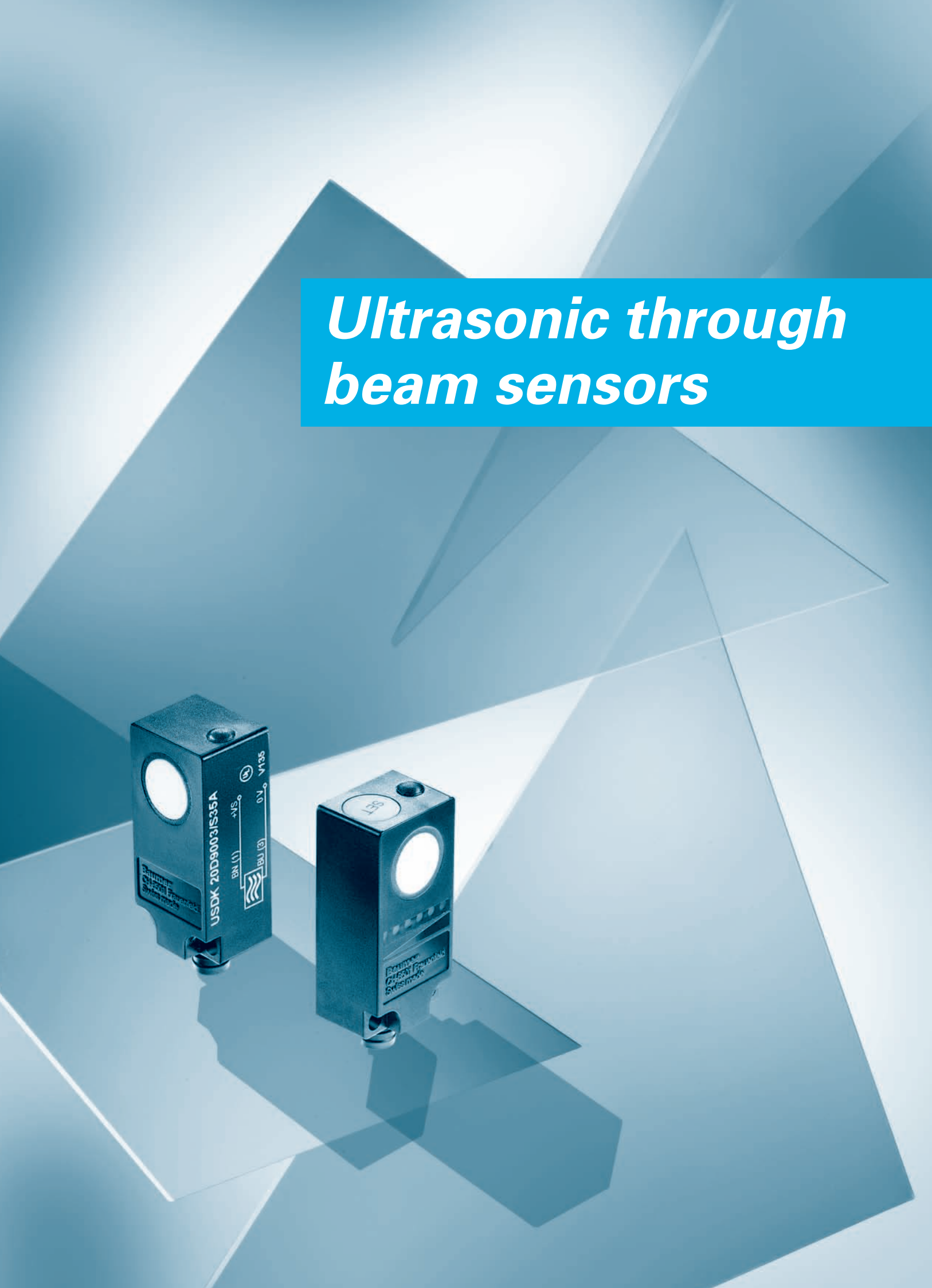

### typical sonic cone profile

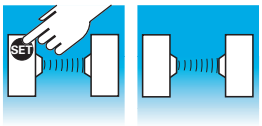



standard target with 100 x 100 mm, positioned perpendicularly to sensor's reference axis

| order reference | adjustment | output circuit | temperature drift | connection types |
|---|---|---|---|---|
| **URAM 50N1721** | potentiometer | NPN make function (NO) | < 0,18% Sde/K | cable |
| **URAM 50N1721/S14** | potentiometer | NPN make function (NO) | < 0,18% Sde/K | connector M12 |
| **URAM 50N3721** | potentiometer | NPN break function (NC) | < 0,18% Sde/K | cable |
| **URAM 50N3721/S14** | potentiometer | NPN break function (NC) | < 0,18% Sde/K | connector M12 |
| **URAM 50P1721** | potentiometer | PNP make function (NO) | < 0,18% Sde/K | cable |
| **URAM 50P1721/S14** | potentiometer | PNP make function (NO) | < 0,18% Sde/K | connector M12 |
| **URAM 50P3721** | potentiometer | PNP break function (NC) | < 0,18% Sde/K | cable |
| **URAM 50P3721/S14** | potentiometer | PNP break function (NC) | < 0,18% Sde/K | connector M12 |
| **URAM 50P6121** | Teach-in | PNP make function (NO) | < 2% Sde | cable |
| **URAM 50P6121/S14** | Teach-in | PNP make function (NO) | < 2% Sde | connector M12 |
| **URAM 50P7121** | Teach-in | PNP break function (NC) | < 2% Sde | cable |
| **URAM 50P7121/S14** | Teach-in | PNP break function (NC) | < 2% Sde | connector M12 |

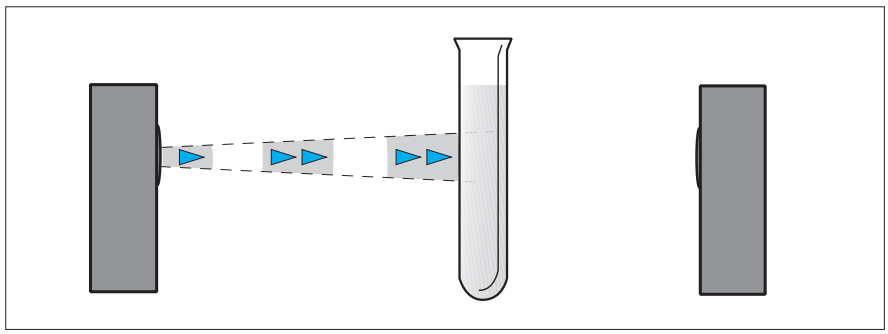
# Ultrasonic through beam sensors






## Description

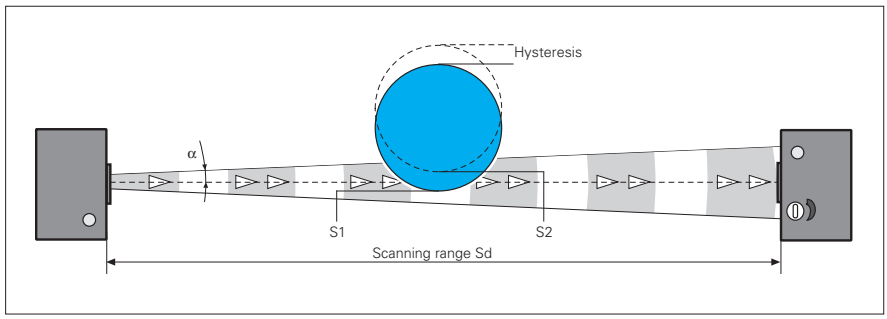
The emitter and the receiver are in two separate housings. The emitter sends a continuous signal which is picked up by the receiver.
When an object interrupts the sonic beam, the receiver will react and give an output signal. With the help of the built in potentiometer, the user can adjust the amplification of the input signal, as necessary.
The state of the output stage as well as the signal intensity are indicated by an LED.

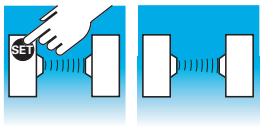


**Hysteresis**
Hysteresis is the difference between the operating point (S1) and the release point (S2). If an object interrupts the sonic beam, the signal level must be increased by about 75% in order to reset the output signal. Objects which follow one another in quick succession can therefore be easily detected.

**Sonic beam angle $\alpha$**
The sonic beam angle ($\alpha$) defines the boundaries of the emitted conical beam of the ultrasonic through beam sensor.

**Repeatability**
Due to the narrow angle of the sonic beam the repeatability of the switching point of two successive targets, under identical conditions, is better than 3 mm.






## Teach-in procedure Series 20

All adjustments can be made with the internal Teach-in key.

### Sensitivity Adjustment

The LEDs on the display indicate the receiver's sensitivity. The sensitivity can be called up at any time by pressing the Teach-in key, even when the Teach-in function is locked out.

Move the emitter and receiver to the desired position.

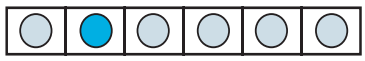
Switch the emitter to its adjustment mode by pressing and holding the Teach-in key for approx. two seconds until the green LED begins flashing. Release the Teach-in key. The green LED now indicates the switching state. Press the Teach-in key repeatedly until the desired sensitivity is achieved and the green LED is continuously on. Sensitivity is indicated by the yellow LEDs on the display.

To complete the Teach-in process, press and hold the Teach-in key for approx. two seconds until the green LED begins flashing rapidly. Release the Teach-in key. The LED goes out!

### Response Time

Switch the sensor to its adjustment mode by pressing and holding the Teach-in key for approx. four seconds until the red LED begins flashing. Release the Teach-in key. The red LED now stays on continuously. Press the Teach-in key repeatedly until the desired response time is achieved.

LED display:



1 2 3 4 5 6

no LED on; approximately 5 ms response time delay
1. LED on; approximately 10 ms response time delay
2. LED on; approximately 20 ms response time delay
3. LED on; approximately 40 ms response time delay
4. LED on; approximately 80 ms response time delay
5. LED on; approximately 160 ms response time delay
6. LED on; approximately 320 ms response time delay

To complete the Teach-in process, press and hold the Teach-in key for approx. two seconds until the red LED begins flashing rapidly. Release the Teach-in key. The response time is now set.

### Resetting the receiver to its original factory settings

Pressing and holding the Teach-in key for longer than six seconds will return the sensor to its factory settings. This is indicated on the receiver by the rapid flashing of the green/red LED.

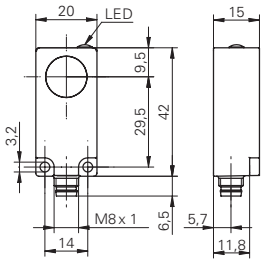
# Sd = 1000 mm

- Teach-in
- LED Display
- response time adjustable <=5 … 320 ms

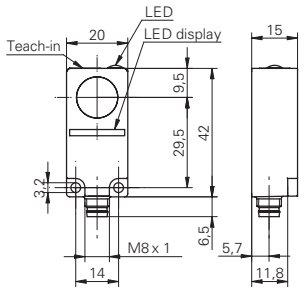
| general data | |
|---|---|
| sensing range sd | 0 ... 1000 mm |
| scanning range far limit Sde | 0 ... 1000 mm |
| alignment aid | target display flashing |
| **receiver** | |
| object size (at Sd = 50 mm) | > 2 cm² |
| hysteresis typ. | 5 mm |
| repeatability | < 3 mm |
| response time ton | < 5 ms |
| release time toff | < 5 ms |
| adjustment | Teach-in |
| output indicator | LED green |
| **emitter** | |
| sonic frequency | 250 kHz |
| power on indication | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 15 ... 30 VDC |
| residual ripple | < 10% Vs |
| short circuit protection | yes |
| reverse polarity protection | yes |
| **receiver** | |
| current consumption max. | 30 mA |
| output circuit | PNP make function (NO) |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| **emitter** | |
| current consumption max. | 40 mA |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester |
| width / diameter | 20 mm |
| height / length | 42 mm |
| depth | 15 mm |
| connection types | connector M8 |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESW 31A, ESG 32A |

| order reference | emitter / receiver |
|---|---|
| **UEDK 20P6103/S35A** | receiver |
| **USDK 20D9003/S35A** | emitter |

## dimension drawings

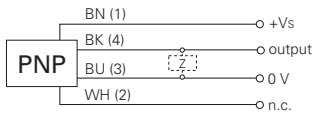


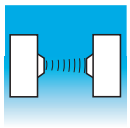

emitter




receiver

## connection diagram



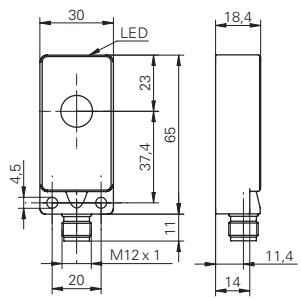


## Sd = 700 mm

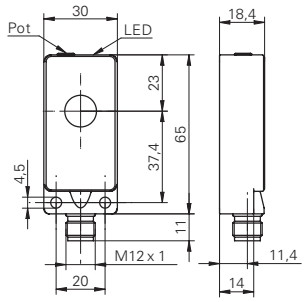
- potentiometer
- complementary outputs
- response time <= 5 ms

| general data | |
|---|---|
| sensing range sd | 0 ... 700 mm |
| scanning range far limit Sde | 0 ... 700 mm |
| alignment aid | target display flashing |
| **receiver** | |
| object size (at Sd = 50 mm) | > 2 cm² |
| hysteresis typ. | 5 mm |
| repeatability | < 3 mm |
| response time ton | < 5 ms |
| release time toff | < 5 ms |
| adjustment | potentiometer |
| output indicator | LED green |
| **emitter** | |
| sonic frequency | 220 kHz |
| power on indication | LED yellow |
| **electrical data** | |
| voltage supply range +Vs | 12 ... 30 VDC |
| residual ripple | < 10% Vs |
| reverse polarity protection | yes |
| **receiver** | |
| current consumption max. | 30 mA |
| output current | < 200 mA |
| voltage drop Vd | < 2 VDC |
| short circuit protection | yes |
| **emitter** | |
| current consumption max. | 22 mA |
| **mechanical data** | |
| type | rectangular |
| housing material | polyester / die-cast zinc |
| width / diameter | 30 mm |
| height / length | 65 mm |
| depth | 18,5 mm |
| **ambient conditions** | |
| operating temperature | 0 ... +60 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ES 14, ESW 33A, ESG 34A |

### dimension drawings connector

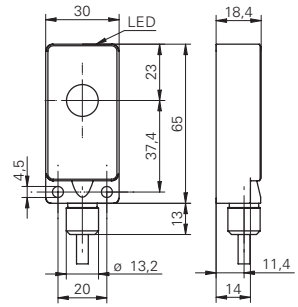



emitter

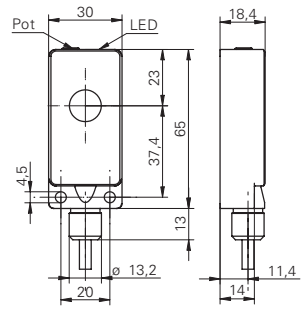



receiver

### dimension drawings cable

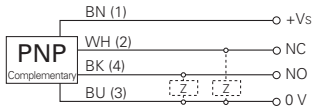


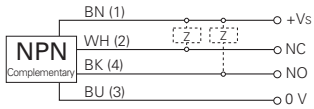

emitter




receiver

### connection diagrams

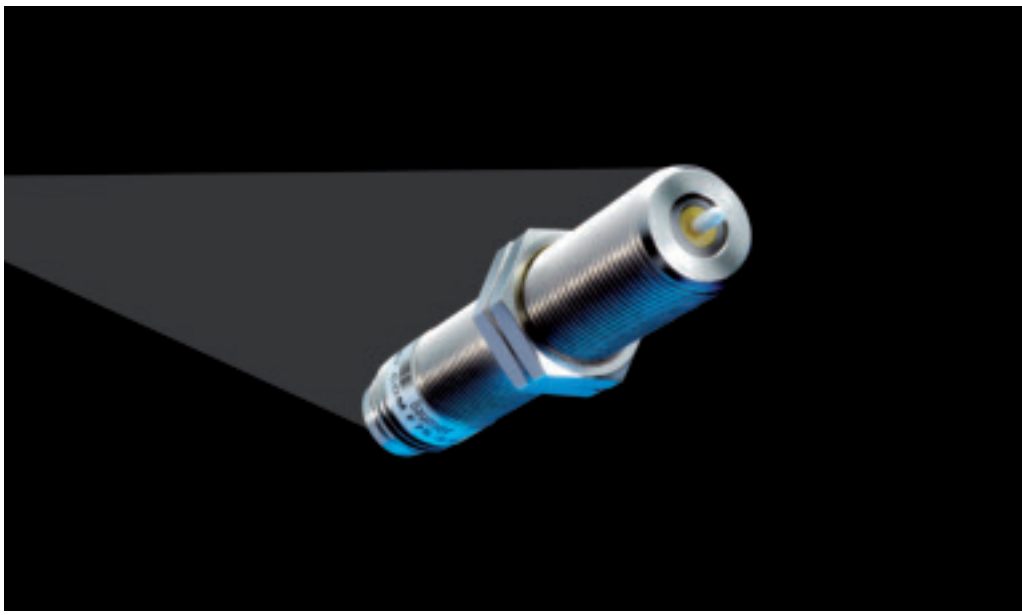



| order reference | emitter / receiver | output circuit | connection types |
|---|---|---|---|
| **UEDK 30N5103** | receiver | NPN complementary | cable |
| **UEDK 30N5103/S14** | receiver | NPN complementary | connector M12 |
| **UEDK 30P5103** | receiver | PNP complementary | cable |
| **UEDK 30P5103/S14** | receiver | PNP complementary | connector M12 |
| **USDK 30D9003** | emitter | - | cable |
| **USDK 30D9003/S14** | emitter | - | connector M12 |

Baumer

# Fast, reliable, ultra-precise.
# My-Com Precision switches.



Sensor Solutions
Motion Control
Vision Technologies

## Unrivaled 1 µm repeatability

Setting reference points, monitoring tolerances, controlling, adjusting.

Fast, reliable, ultra-precise. Uncompromising accuracy tried and tested millions of times in industrial applications. Negligible activating forces. A compact precision switch in task matching packages. IP 67 versions for applications in contaminated areas. Repeatability of 1 micrometer. For critical applications where spot-on precision is not enough. Baumer helps you make exactly the right choice.

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## *My-Com precisions switches*

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## *Amplifiers for precision switches – Socket base housing*

*Amplifier in panel mount housing* *Page 664*
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## *Mounting guidelines*

*Mounting guidelines* *Page 666*

# My-Com *precision switches – Unrivaled 1 µm repeatability*

With a repeatability of 1 micron, the My-Com remains undisputedly the most accurate and most compact mechanical switch in the world.

The standard My-Com range of the most diverse mechanical and electric types largely reflects the requirements of the market. With its extremely compact design, the My-Com can also be easily integrated in very constrained surroundings.

Typical applications for the My-Com high-precision switches are:

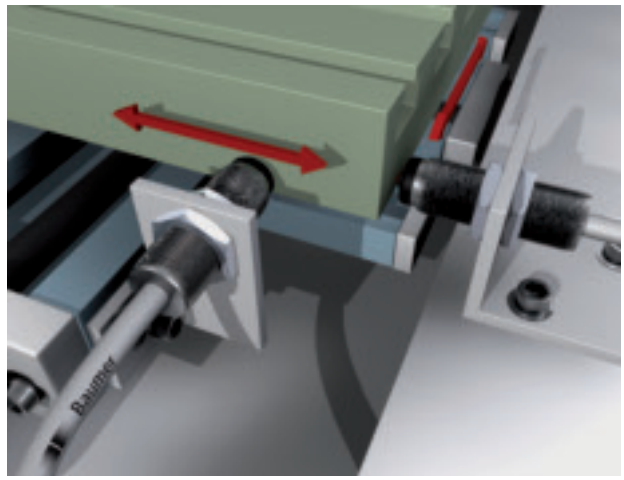
- Reference point setting in X/Y tables and machine tools
- Monitoring of the closing and locking accuracy of injection molding dies
- Detection of the smallest deflections, movements and deformations
- Integration in measuring sensors, gauges and activating pins
- Calibration of measuring instruments in quality control
- Monitoring of surface roughness
- Other applications in precision mechanical engineering

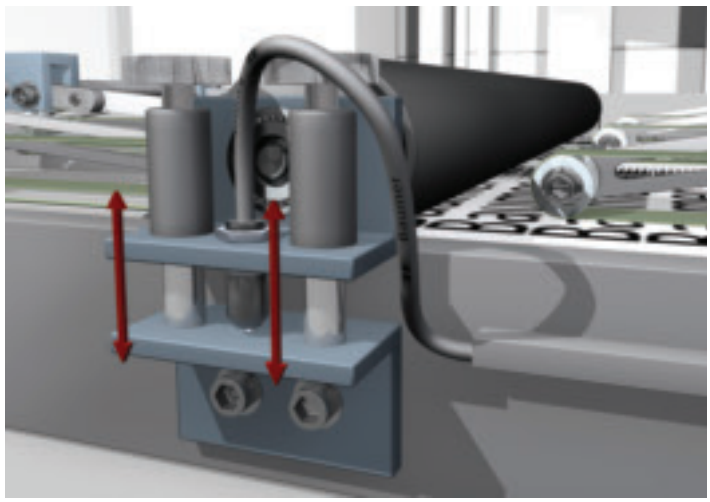
Rigorous attention was paid to the design of the My-Com precision switch to reduce the number of components to an absolute minimum. Just three moving parts and high-quality materials guarantee a large number of switching operations with constant repeatability. Short, linear displacements in just two directions and low activating forces further increase the reliability and service life of the My-Com precision switch. The My-Com has proven its impressive reliability in over 1 million applications.

# Applications

**Precision finishing**

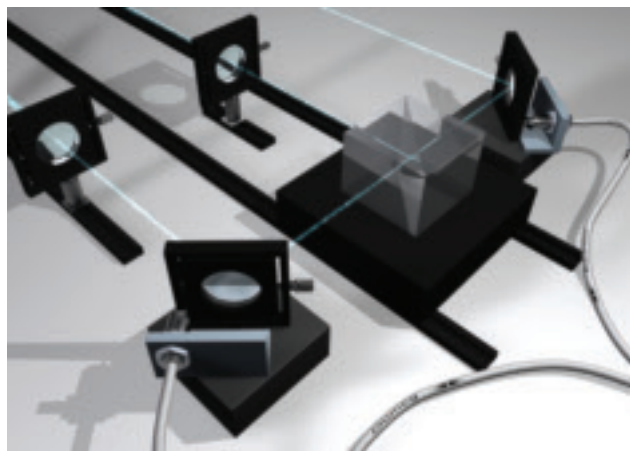
- The My-Com is used as a control and guiding instrument for processing machines, for example as a control stop on positioning tables for drilling, milling, turning and grinding on automatic equipment.





**Quality control**

- Built into measuring and control gauges, the My-Com can indicate whether the articles concerned are within manufacturing tolerances, such as of correct thickness (double sheet control), diameter or concentricity.



**Referencing mirrors and beam-splitters**

- Optical laboratory test setups
- Space exploration
- Home position sensor

# Technical specifications



**Mechanical data**

| | |
|---|---|
| Repeatability | ± 0,001 mm (1 micron) |
| Mechanical lifetime | 10'000'000 switchings |
| Switching frequency | 0 - 10 Hz |
| Max. activating velocity | < 30 mm/s |
| Temperature range | -20 °C to +75 °C (-5 °F to +165 °F) |
| Standard cable length | 80 cm |
| Standard cable material | PVC |
| Standard conductor cross section | < 0,14 mm$^2$ |
| Protection class (standard) | IP 50 |

**LED indicator**

The My-Com types with transistor output are available with LED output indicators.

**Transistor output**

The My-Com types L, G and M are available with a transistorized output. When supplied with this configuration, the output circuit is supplied normally open (NO). A protective diode is incorporated into the circuit to protect against transients.

**Increased environmental protection (IP 67)**

For applications in harsh environments (dust, oil, cooling fluid) we recommend the waterproof My-Com D, H or M. The My-Com type L, with transistor output, is also available with the same protection (IP 67). The sealing membrane for all of these is made of Viton.

**Maximum installation torque (not lubricated)**

If the published installation torque specifications prove to be insufficient for your application, we recommend using a nut locking liquid to secure the My-Com.
The published specifications for maximum torque must not be exceeded!

**Wire color code**

BN = Brown
BK = Black
BU = Blue

**Max. torque figures (not lubricated)**

| | |
|---|---|
| My-Com D | 20 Nm |
| My-Com E | 5,5 Nm |
| All others | 3,5 Nm |

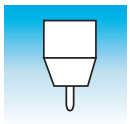
## Part number key

**MY-COM F 50 / 80**
**MY-COM L 75 N 80 /L**

- Type
- Activating force in gram force (cN)
- Transistor output
  N = NPN or P = PNP
- Cable length in cm
- LED

| product family | MY-COM A | MY-COM B | MY-COM C | MY-COM D | MY-COM E | MY-COM F |
|---|---|---|---|---|---|---|
| | | | | | | |
| housing material | brass nickel plated | brass nickel plated | brass nickel plated | browned brass | brass nickel plated | brass nickel plated |
| housing length | 20 mm<br>30 mm | 20 mm<br>30 mm | 20 mm<br>30 mm | 56 mm<br>74 mm | 36 mm | 28 mm<br>38 mm |
| cable | ■ | ■ | ■ | ■ | ■ | ■ |
| connector M8 | ■ | | ■ | ■ | | ■ |
| connector S30 | | ■ | | | | |
| NPN make function (NO) | | | | | | |
| PNP make function (NO) | | | | | | |
| break function (NC) mechanical | ■ | ■ | ■ | ■ | ■ | ■ |
| protection class | IP 50 | IP 50 | IP 50 | IP 67 | IP 50 | IP 50 |
| **Page** | **652** | **653** | **654** | **655** | **656** | **657** |

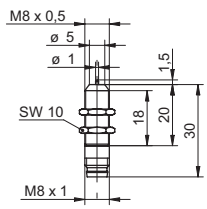
| product family | MY-COM G | MY-COM H | MY-COM L | MY-COM M | MY-COM M |
|---|---|---|---|---|---|
| | | | | | |
| housing material | brass nickel plated | brass nickel plated | brass nickel plated | brass nickel plated | brass nickel plated |
| housing length | 28 mm<br>38 mm | 21 mm<br>40 mm | 30 mm<br>40 mm | 27 mm<br>37 mm | 27 mm<br>37 mm |
| cable | ■ | ■ | ■ | ■ | ■ |
| connector M8 | ■ | ■ | ■ | ■ | ■ |
| connector S30 | | | | | |
| NPN make function (NO) | ■ | | ■ | | ■ |
| PNP make function (NO) | ■ | | ■ | | ■ |
| break function (NC) mechanical | | ■ | | ■ | |
| protection class | IP 50 | IP 67 | IP 67 | IP 67 | IP 67 |
| **Page** | **658** | **659** | **660** | **661** | **662** |

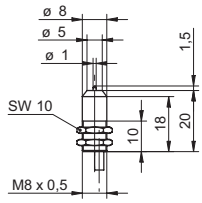


- conical housing front
- two wire break function (NC)

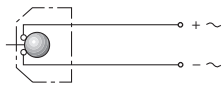
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| other activating force on request | |

**dimension drawings**

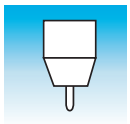



**connection diagram**



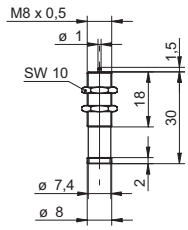

| order reference | activating force | housing length | connection types |
|---|---|---|---|
| **MY-COM A100/80** | 100 cN | 20 mm | cable |
| **MY-COM A100/S35** | 100 cN | 30 mm | connector M8 |
| **MY-COM A75/80** | 75 cN | 20 mm | cable |
| **MY-COM A75/S35** | 75 cN | 30 mm | connector M8 |
| **MY-COM A50/80** | 50 cN | 20 mm | cable |
| **MY-COM A50/S35** | 50 cN | 30 mm | connector M8 |
| **MY-COM A30/80** | 30 cN | 20 mm | cable |
| **MY-COM A30/S35** | 30 cN | 30 mm | connector M8 |

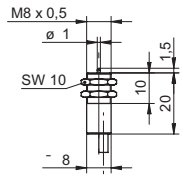


- flat housing front
- two wire break function (NC)

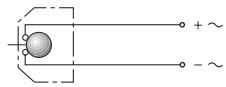
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **accessories** | |
| connector | ES 30 |
| **remarks** | |
| other activating force on request | |

**dimension drawings**

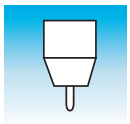



**connection diagram**



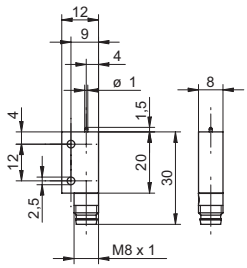

| order reference | activating force | housing length | connection types |
|---|---|---|---|
| **MY-COM B100/80** | 100 cN | 20 mm | cable |
| **MY-COM BS100** | 100 cN | 30 mm | connector S30 |
| **MY-COM B75/80** | 75 cN | 20 mm | cable |
| **MY-COM BS75** | 75 cN | 30 mm | connector S30 |
| **MY-COM B50/80** | 50 cN | 20 mm | cable |
| **MY-COM BS50** | 50 cN | 30 mm | connector S30 |
| **MY-COM B30/80** | 30 cN | 20 mm | cable |
| **MY-COM BS30** | 30 cN | 30 mm | connector S30 |

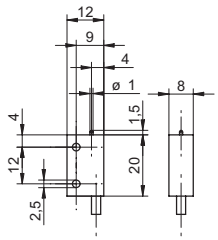


- rectangular brass housing
- two bore mounting
- two wire break function (NC)

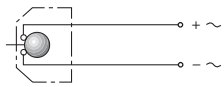
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| other activating force on request | |

**dimension drawings**

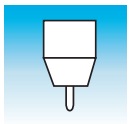



**connection diagram**



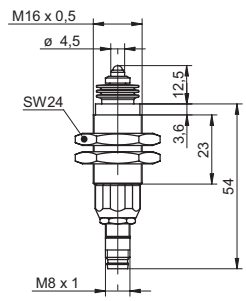

| order reference | activating force | housing length | connection types |
|---|---|---|---|
| **MY-COM C100/80** | 100 cN | 20 mm | cable |
| **MY-COM C100/S35** | 100 cN | 30 mm | connector M8 |
| **MY-COM C75/80** | 75 cN | 20 mm | cable |
| **MY-COM C75/S35** | 75 cN | 30 mm | connector M8 |
| **MY-COM C50/80** | 50 cN | 20 mm | cable |
| **MY-COM C50/S35** | 50 cN | 30 mm | connector M8 |
| **MY-COM C30/80** | 30 cN | 20 mm | cable |
| **MY-COM C30/S35** | 30 cN | 30 mm | connector M8 |

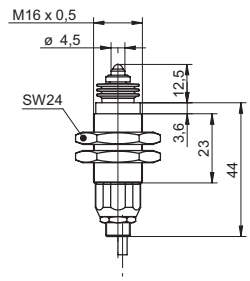


- steel housing
- two wire break function (NC)
- protection class IP 67

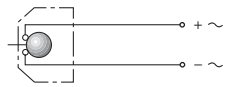
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 250 cN |
| mech. pre-run / overrun | 1 mm / 1 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | hardened steel |
| housing material | browned brass |
| dimension | 16 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |

**dimension drawings**

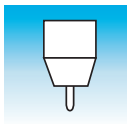



**connection diagram**



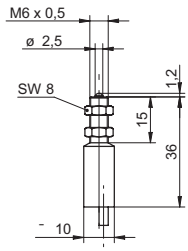

| order reference | housing length | connection types |
|---|---|---|
| **MY-COM D250/80** | 56 mm | cable |
| **MY-COM D250/S35** | 66 mm | connector M8 |



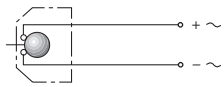
- spherical hard metal tip
- thread M6 x 0,5
- two wire break function (NC)

| general data | |
|---|---|
| repeatability | < 0,001 mm |
| mech. pre-run / overrun | - / 0,8 ... 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | hardened steel |
| housing material | brass nickel plated |
| dimension | 6 mm |
| housing length | 36 mm |
| connection types | cable |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **remarks** | |
| other activating force on request | |

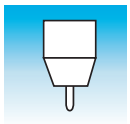
**dimension drawing**




**connection diagram**



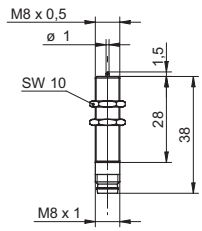

| order reference | activating force |
|---|---|
| **MY-COM E100/80** | 100 cN |
| **MY-COM E75/80** | 75 cN |

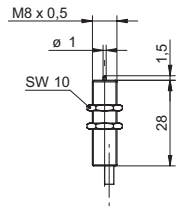


- long housing design
- long thread length
- two wire break function (NC)

| general data | |
|---|---|
| repeatability | < 0,001 mm |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| other activating force on request | |

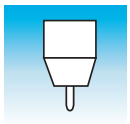
**dimension drawings**




**connection diagram**

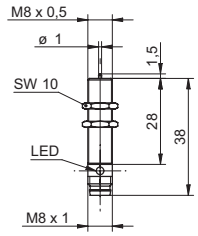
| order reference | activating force | housing length | connection types |
|---|---|---|---|
| **MY-COM F100/80** | 100 cN | 28 mm | cable |
| **MY-COM F100/S35** | 100 cN | 38 mm | connector M8 |
| **MY-COM F75/80** | 75 cN | 28 mm | cable |
| **MY-COM F75/S35** | 75 cN | 38 mm | connector M8 |
| **MY-COM F50/80** | 50 cN | 28 mm | cable |
| **MY-COM F50/S35** | 50 cN | 38 mm | connector M8 |
| **MY-COM F30/80** | 30 cN | 28 mm | cable |
| **MY-COM F30/S35** | 30 cN | 38 mm | connector M8 |

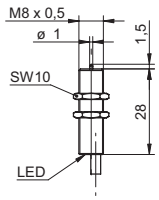


- transistor output NPN / PNP
- long thread length
- three wire make function (NO)

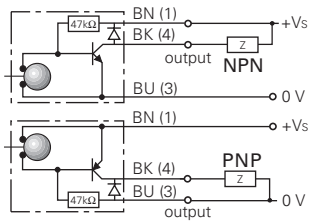
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 75 cN |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| voltage supply range +Vs | 5 ... 36 VDC |
| load current max. at 24 VDC | 50 mA |
| load resistance min. | 480 Ohm |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 50 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| other activating force on request | |

**dimension drawings**

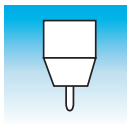



**connection diagram**



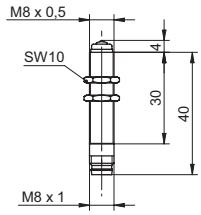

| order reference | output circuit | housing length | connection types |
|---|---|---|---|
| **MY-COM G75N/S35L** | NPN make function (NO) | 28 mm | connector M8 |
| **MY-COM G75N80/L** | NPN make function (NO) | 38 mm | cable |
| **MY-COM G75P/S35L** | PNP make function (NO) | 28 mm | connector M8 |
| **MY-COM G75P80/L** | PNP make function (NO) | 38 mm | cable |

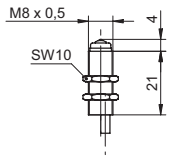


- spherical ruby tip
- two wire break function (NC)
- protection class IP 67

| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 75 cN |
| mech. pre-run / overrun | - / 0,6 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | ruby |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| Gasket made of Viton 60° Shore A<br>other activating force on request | |

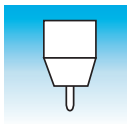
**dimension drawings**




**connection diagram**

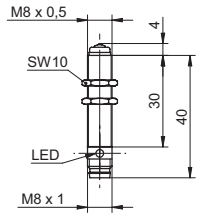
| order reference | housing length | connection types |
|---|---|---|
| **MY-COM H75/80** | 21 mm | cable |
| **MY-COM H75/S35** | 40 mm | connector M8 |

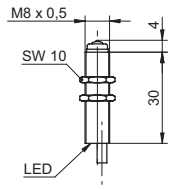


- transistor output NPN / PNP
- three wire make function (NO)
- protection class IP 67

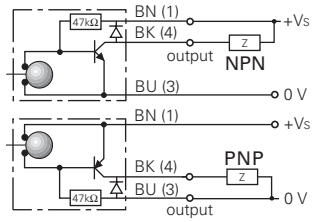
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 75 cN |
| mech. pre-run / overrun | - / 0,6 mm approx. |
| **electrical data** | |
| voltage supply range +Vs | 5 ... 36 VDC |
| load current max. at 24 VDC | 50 mA |
| load resistance min. | 480 Ohm |
| **mechanical data** | |
| activating pin | ruby |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| Gasket made of Viton 60° Shore A<br>other activating force on request | |

**dimension drawings**

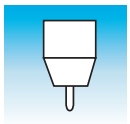



**connection diagram**



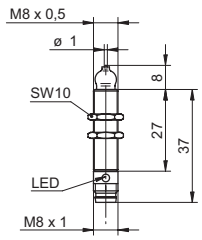

| order reference | output circuit | housing length | connection types |
|---|---|---|---|
| **MY-COM L75N/S35L** | NPN make function (NO) | 30 mm | connector M8 |
| **MY-COM L75N80/L** | NPN make function (NO) | 40 mm | cable |
| **MY-COM L75P/S35L** | PNP make function (NO) | 30 mm | connector M8 |
| **MY-COM L75P80/L** | PNP make function (NO) | 40 mm | cable |

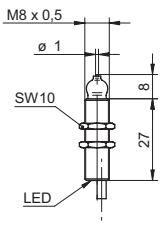


- silicone gasket
- protection class IP 67
- two wire break function (NC)

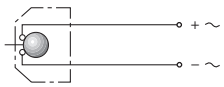
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 75 cN |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| DC voltage max. | 15 VDC |
| switch. current DC max. | 2 mA |
| AC voltage max. | 24 VAC |
| switch. current AC max. | 50 mA |
| output circuit | break function (NC) mechanical |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| Gasket made of Viton 60° Shore A<br>other activating force on request | |

**dimension drawings**

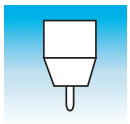



**connection diagram**



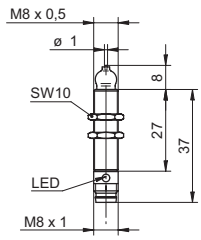

| order reference | housing length | connection types |
|---|---|---|
| **MY-COM M75/80** | 27 mm | cable |
| **MY-COM M75/S35** | 37 mm | connector M8 |

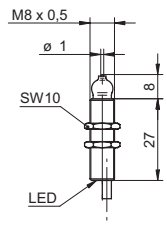


- silicone gasket
- protection class IP 67
- three wire make function (NO)

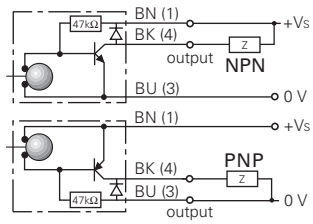
| general data | |
|---|---|
| repeatability | < 0,001 mm |
| activating force | 75 cN |
| mech. pre-run / overrun | - / 1,5 mm approx. |
| **electrical data** | |
| voltage supply range +Vs | 5 ... 36 VDC |
| load current max. at 24 VDC | 50 mA |
| load resistance min. | 480 Ohm |
| **mechanical data** | |
| activating pin | zirconium oxide $ZrO_2$ |
| housing material | brass nickel plated |
| dimension | 8 mm |
| **ambient conditions** | |
| operating temperature | -20 ... +75 °C |
| protection class | IP 67 |
| **accessories** | |
| connectors | ESG 32S, ESW 31S |
| **remarks** | |
| Gasket made of Viton 60° Shore A<br>other activating force on request | |

**dimension drawings**




**connection diagram**




| order reference | output circuit | housing length | connection types |
|---|---|---|---|
| **MY-COM M75N/S35** | NPN make function (NO) | 27 mm | connector M8 |
| **MY-COM M75N80** | NPN make function (NO) | 37 mm | cable |
| **MY-COM M75P/S35** | PNP make function (NO) | 27 mm | connector M8 |
| **MY-COM M75P80** | PNP make function (NO) | 37 mm | cable |

# Amplifiers

Baumer
CH-8500 Frauenfeld
SVN 110.82.2
NAMUR
Baumer
CH-8500 Frauenfeld
SVP 220.24.2
PNP

# Amplifier in panel mount housing SAEB

PERIPHERAL

- compatible with two-wire devices complying with EN 50227
- line break and short circuit detection

| technical data | |
|---|---|
| power consumption | max. 2 VA |
| NAMUR input | acc. to EN 50227 |
| no-load voltage | 8,2 VDC ±5% |
| internal resistance | 1 kΩ |
| switching threshold | 1,8 mA |
| hysteresis | ±0,2 mA |
| line break detection | <0,2 mA |
| short-circuit detection | >6 mA |
| switching capacity | 250 VAC 8A, AC1, 2 kVA |
| response time | typ. 10 ms |
| release time | typ. 4 ms |
| bounce time NO/NC contact | typ. 1ms / typ. 2,5 ms |
| switching frequency | max. 20 Hz |
| nominal isolation voltage | 250 VAC |
| | |
| output mode | adjustable |
| load state | green LED |
| switch state | red LED |
| **ambient conditions** | |
| operating temperature | -20 ... +40 °C |
| protection class | IP 67 |

**remarks**

When used in conjunction with a My-Com the «line monitoring» jumper must be in the «OFF» position.

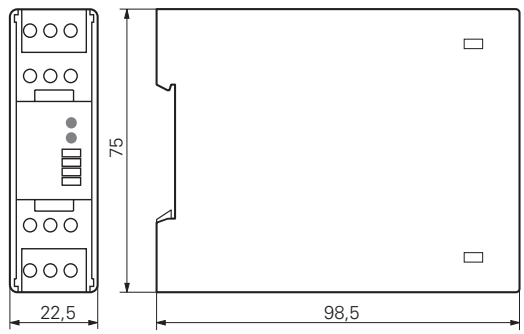
**DIN / EN 50022**

Amplifiers in panel mount housings are designed for assembly on mounting rails complying with DIN EN 50022. The plug-in jumpers for setting the operating modes are located underneath the detachable front panel.

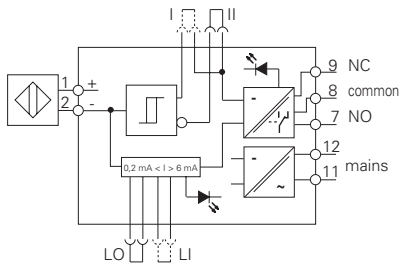
The terminals on the front panel are shockproof and have conductor cross sections of max. 2,5 mm².

| order reference | nominal operating range |
|---|---|
| **SAEB 28R72** | 230 VAC |
| **SAEB 18R72** | 115 VAC ±10% |

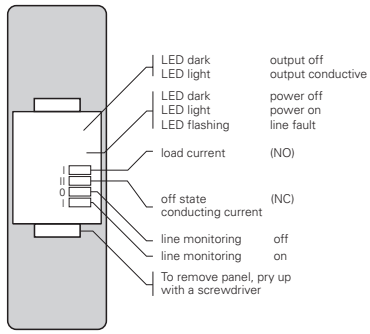
**dimension drawing**




**connection diagram**




**for devices with two-wire input**



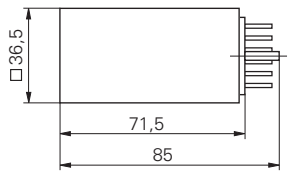
PERIPHERAL

- compatible with two-wire devices
- switching amplifier for AC connection
- high-capacity carbide silver relay contacts

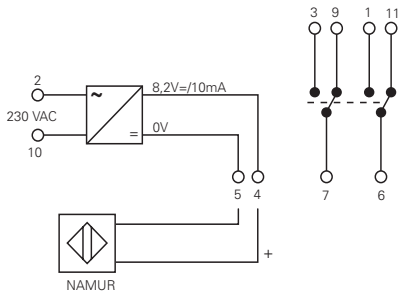
| technical data | |
|---|---|
| power consumption | approx. 4 VA |
| test voltage | 2,5 kV |
| NAMUR input | acc. to EN 50227 |
| sensor supply voltage | 8,2 VDC ±10% |
| sensor supply current | - |
| internal resistance | 1 kΩ |
| switching point | ≤ 1,8 mA |
| switching element | relay changeover |
| switching capacity | 250 VAC 4A, AC-1 |
| switch state | yellow LED |
| **ambient conditions** | |
| operating temperature | -25 ... +50 °C |
| storage temperature | -40 ... +85 °C |
| protection class | IP 20 |
| **accessoires** | |
| socket base | ZKR 118 |

| order reference | nominal operating range |
|---|---|
| **SVN 220.82.2** | 230 VAC ±10% |
| **SVN 110.82.2** | 115 VAC ±10% |

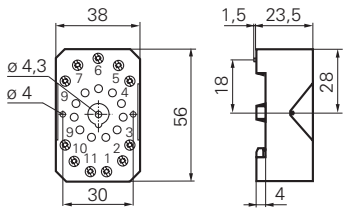
## dimension drawing



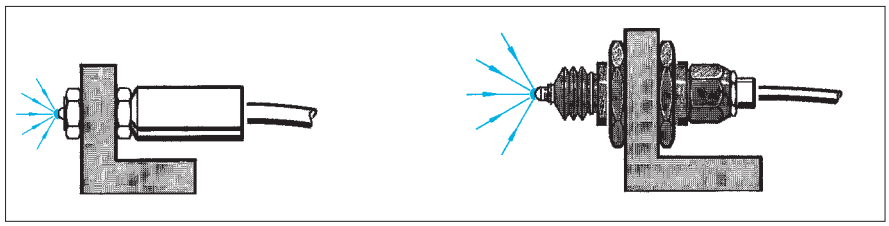

## connection diagram




## socket base ZKR 118 with pin configuration

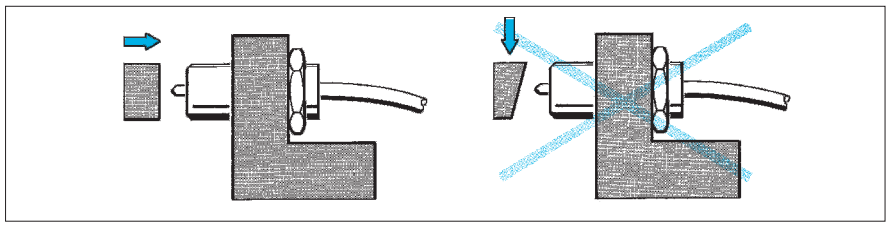


## with hardened steel stylus



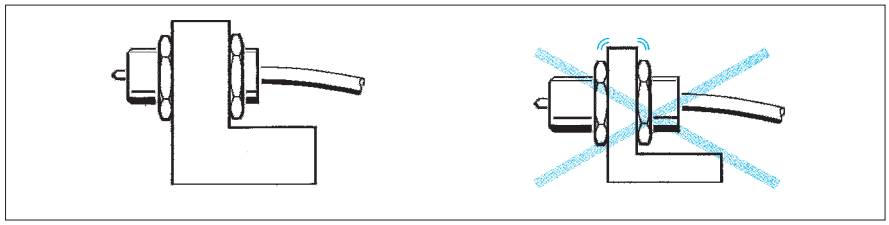
My-Com E and D have spherical hardened steel tips which allow lateral approach of an object, such as a tapered plate.

## with $ZrO_2$ actuator tip



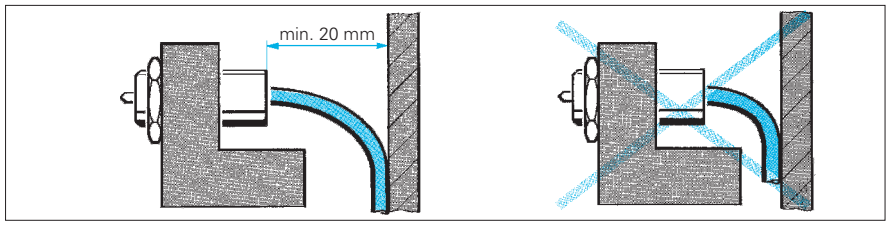
My-Com A, B, BS, C, F, G and M must be approached axially. Lateral approach will break the stylus.

## mounting



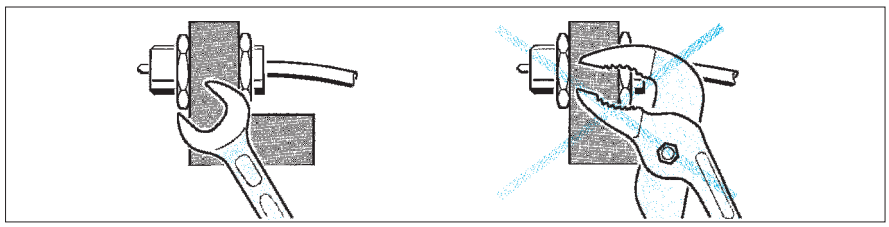
To guarantee accuracy, the My-Com precision switch must be mounted on a substantial surface. My-Com's must always be installed in a static (stationary) part of the machine. The inertia of the contact ball might cause false triggering if the vibration or acceleration of a moving part is great enough.

## cable considerations




To avoid cable breakage, the My-Com should be mounted with adequate clearance.

## installation

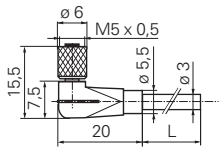


My-Com precision switches should be installed with care. For suggested maximum torque figures see page 650.

# Accessories

# Connectors M5 x 0,5 / M8 x 1

## Connector ESW 05S



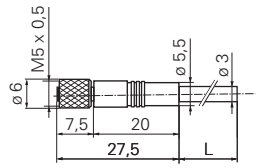

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 05SP0200** | 3 pin | 2 m PUR |
| **ESW 05SP0500** | 3 pin | 5 m PUR |

- with cap nut

## Connector ESG 05S




see color code for wiring

**Part number**

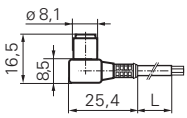
| | | |
|---|---|---|
| **ESG 05SP0200** | 3 pin | 2 m PUR |
| **ESG 05SP0500** | 3 pin | 5 m PUR |

- with cap nut

## Pin-assignment connector M5 x 0,5

| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 2 | n.c. |
| 3 | BU (Blue) |
| 4 | BK (Black) |

## Connector ESW 08S / ES 8A



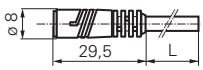

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 08SH0200** | 3 pin | 2 m PUR |
| **ESW 08SH0500** | 3 pin | 5 m PUR |
| **ES 8A** | 4 pin | 2 m PVC |
| **ES 8A5** | 4 pin | 5 m PVC |

- with clip fastener
- PUR, halogen-free

## Connector ESG 09S / ES 9A



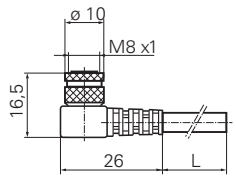

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESG 09SH0200** | 3 pin | 2 m PUR |
| **ESG 09SH0500** | 3 pin | 5 m PUR |
| **ES 9A** | 4 pin | 2 m PVC |
| **ES 9A5** | 4 pin | 5 m PVC |

- with clip fastener
- PUR, halogen-free

## Connector ESW 31S



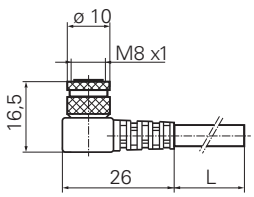

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 31SH0200** | 3 pin | 2 m PUR |
| **ESW 31SH0500** | 3 pin | 5 m PUR |
| **ESW 31SH1000** | 3 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESW 31A



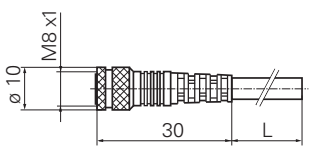

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 31AH0200** | 4 pin | 2 m PUR |
| **ESW 31AH0500** | 4 pin | 5 m PUR |
| **ESW 31AH1000** | 4 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESG 32S



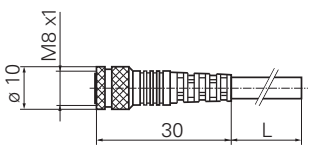

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESG 32SH0200** | 3 pin | 2 m PUR |
| **ESG 32SH0500** | 3 pin | 5 m PUR |
| **ESG 32SH1000** | 3 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESG 32A




see color code for wiring

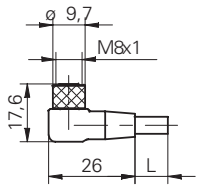
**Part number**

| | | |
|---|---|---|
| **ESG 32AH0200** | 4 pin | 2 m PUR |
| **ESG 32AH0500** | 4 pin | 5 m PUR |
| **ESG 32AH1000** | 4 pin | 10 m PUR |

- with cap nut
- halogen-free

# Connectors M8 x 1

## Connector ESW 31AP

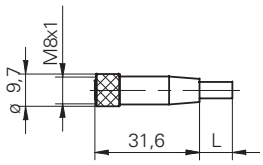



see color code for wiring

**Part number**
**ESW 31AP0500G** 4 pin 5 m PUR

- shielded
- screen connected with cap nut
- PUR, halogen-free

## Connector ESG 32AP

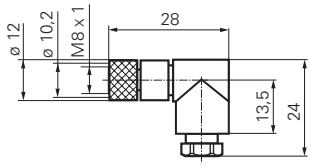



see color code for wiring

**Part number**
**ESG 32AP0500G** 4 pin 5 m PUR

- shielded
- screen connected with cap nut
- PUR, halogen-free

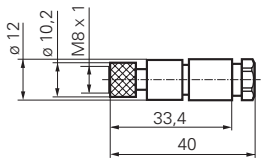
## Connector ES 22 / ES 22A




**Part number**
**ES 22** 3 pin
**ES 22A** 4 pin

- for self-assembly
- with cap nut

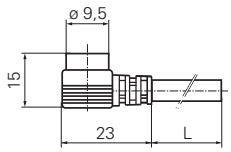
## Connector ES 21 / ES 21A




**Part number**
**ES 21** 3 pin
**ES 21A** 4 pin

- for self-assembly
- with cap nut

## Connector ES 30




**Part number**
**ES 30.2** 2 pin 2 m PVC

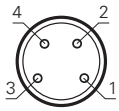
- for My-Com BS only
- with clip fastener

## Pin-assignment connector 3-pin (M8)

viewed from rear of connector

| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 3 | BU (Blue) |
| 4 | BK (Black) |

## Pin-assignment connector 4-pin (M8)



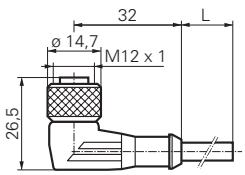

viewed from rear of connector

| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 2 | WH (White) |
| 3 | BU (Blue) |
| 4 | BK (Black |

# Connectors M12 x 1



## Connector ESW 33S



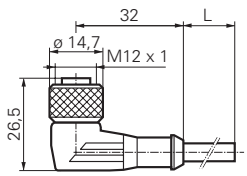

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 33SH0200** | 3 pin | 2 m PUR |
| **ESW 33SH0500** | 3 pin | 5 m PUR |
| **ESW 33SH1000** | 3 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESW 33A



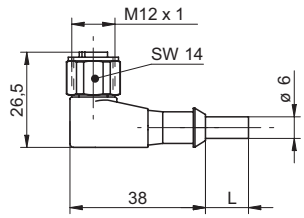

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESW 33AH0200** | 4 pin | 2 m PUR |
| **ESW 33AH0500** | 4 pin | 5 m PUR |
| **ESW 33AH1000** | 4 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESW 33AF

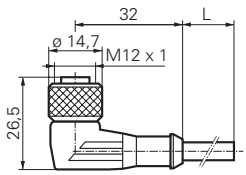



**Part number**

| | | |
|---|---|---|
| **ESW 33AF0500** | 4 pin | 5 m PVC |

- with stainless steel cap nut

## Connector ES 33C



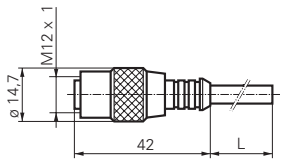

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ES 33CP2** | 5 pin | 2 m PUR |
| **ES 33CP5** | 5 pin | 5 m PUR |

- with cap nut

## Connector ESG 34S



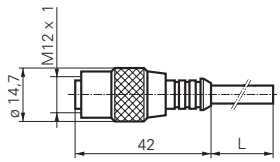

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESG 34SH0200** | 3 pin | 2 m PUR |
| **ESG 34SH0500** | 3 pin | 5 m PUR |
| **ESG 34SH1000** | 3 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESG 34A



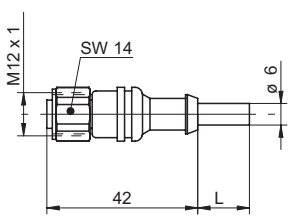

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ESG 34AH0200** | 4 pin | 2 m PUR |
| **ESG 34AH0500** | 4 pin | 5 m PUR |
| **ESG 34AH1000** | 4 pin | 10 m PUR |

- with cap nut
- halogen-free

## Connector ESG 34AF

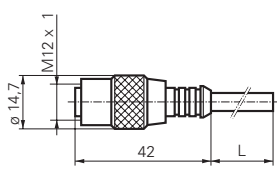



**Part number**

| | | |
|---|---|---|
| **ESG 34AF0500** | 4 pin | 5 m PVC |

- with stainless steel cap nut

## Connector ES 34C




see color code for wiring

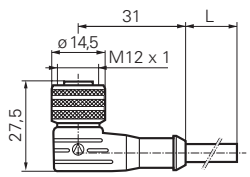
**Part number**

| | | |
|---|---|---|
| **ES 34CP2** | 5 pin | 2 m PUR |
| **ES 34CP5** | 5 pin | 5 m PUR |

- with cap nut

# Connectors M12 x 1

## Connector ES 33A



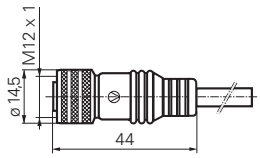

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ES 33AP2B** | 4 pin | 2 m PUR |
| **ES 33AP5B** | 4 pin | 5 m PUR |
| **ES 33AP10B** | 4 pin | 10 m PUR |

- shielded
- screen connected with cap nut

## Connector ES 34A



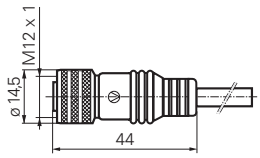

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ES 34AP2B** | 4 pin | 2 m PUR |
| **ES 34AP5B** | 4 pin | 5 m PUR |
| **ES 34AP10B** | 4 pin | 10 m PUR |

- shielded
- screen connected with cap nut

## Connector ES 34C



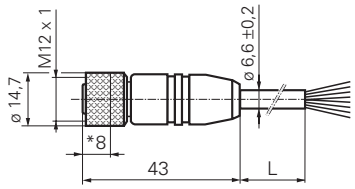

see color code for wiring

**Part number**

| | | |
|---|---|---|
| **ES 34CP2B** | 5 pin | 2 m PUR |
| **ES 34CP5B** | 5 pin | 5 m PUR |
| **ES 34CP10B** | 5 pin | 10 m PUR |

- shielded
- screen connected with cap nut

## Connector ESG 34F

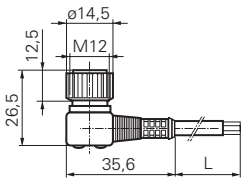



**Part number**

| | | |
|---|---|---|
| **ESG 34FP0200B** | 8 pin | 2 m PUR |
| **ESG 34FP0500B** | 8 pin | 5 m PUR |

- shielded
- screen connected with cap nut

## Connector ES 4A



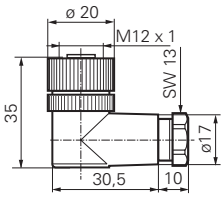

see color code for wiring

**Part number**

| | | | |
|---|---|---|---|
| **ES 4AP5L** | PNP | 4 pin | 5 m PUR |
| **ES 4AN5L** | NPN | 4 pin | 5 m PUR |

LED 1: +Vs
LED 2: output 1

## Connector ES 14 / ES 14C

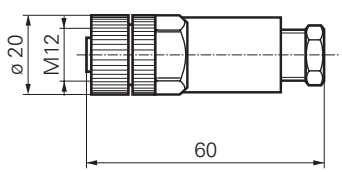



**Part number**

| | |
|---|---|
| **ES 14 PG7** | 4 pin |
| **ES 14C PG7** | 5 pin |

- for self-assembly
- with cap nut

## Connector ES 18 / ES 18C

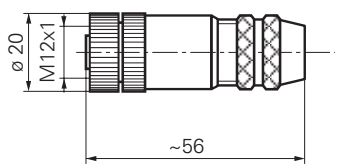



**Part number**

| | |
|---|---|
| **ES 18 PG7** | 4 pin |
| **ES 18C PG7** | 5 pin |

- for self-assembly
- with cap nut

## Connector M12 x 1




**Part number**

| | |
|---|---|
| **135462** | 5 pin |
| **146775** | 8 pin |

- for self-assembly
- screen can be connected with cap nut (necessary for sensors with analog output)

## Note

| | |
|---|---|
| jacket insulation material: | Polyetherurethane TPU 11YH1 |
| flame retardent according to: | IEC 332-2 |
| strand insulation: | halogen-free |

**Connectors with halogen-free cables**

- strands UL-style 10493
- PVC- and halogen-free
- suitable for flexible cable carriers

## Pin-assignment connector 3-pin (M 12)

viewed from rear of connector

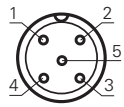
| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 2 | n.c. |
| 3 | BU (Blue) |
| 4 | BK (Black) |

## Pin-assignment connector 4-pin (M 12)

viewed from rear of connector

| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 2 | WH (White) |
| 3 | BU (Blue) |
| 4 | BK (Black) |

## Pin-assignment connector 5-pin (M 12)



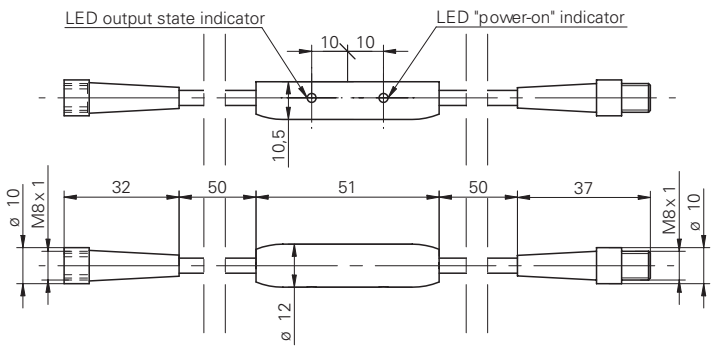

viewed from rear of connector

| Pin-Nr. | Color |
|---|---|
| 1 | BN (Brown) |
| 2 | WH (White) |
| 3 | BU (Blue) |
| 4 | BK (Black) |
| 5 | GY (Grey) |

## Pin-assignment connector 8-pin (M 12)

| Pin-Nr. | Color |
|---|---|
| 1 | WH (White) |
| 2 | BN (Brown) |
| 3 | GN (Green) |
| 4 | YE (Yellow) |
| 5 | GY (Gray) |
| 6 | PK (Pink) |
| 7 | BU (Blue) |
| 8 | RD (Red) |

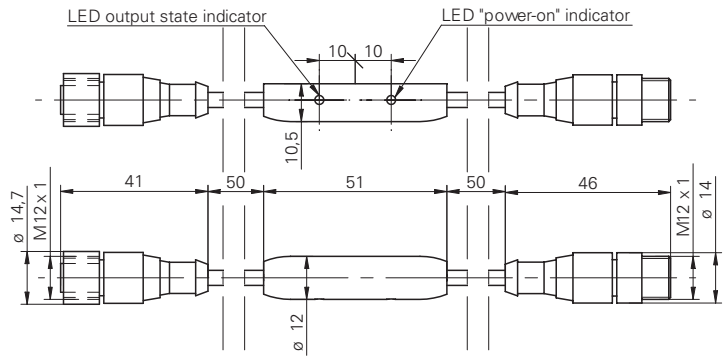
## PNP to NPN Converter - M8 x 1 — 161959



| Pin-Nr. | Color | Signal |
|---|---|---|
| 1 | BN (Brown) | +Vs |
| 3 | BU (Blue) | 0 V |
| 4 | BK (Black) | NPN |

for sensors with M8 x 1 three-pin connectors only

## PNP to NPN Converter - M12 x 1 — 161958



| Pin-Nr. | Color | Signal |
|---|---|---|
| 1 | BN (Brown) | +Vs |
| 2 | n.c. | n.c. |
| 3 | BU (Blue) | 0 V |
| 4 | BK (Black) | NPN |

for sensors with M12 x 1 three-pin connectors only

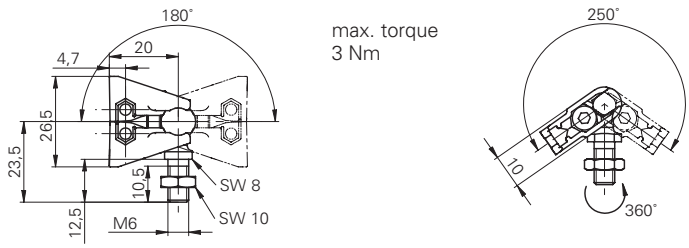
## Teach-in Adapter - M12 x 1 — 141584

| Pin-Nr. | Ultrasonic | Inductive |
|---|---|---|
| 1 | +Vs | +Vs |
| 2 | control/Teach-in | output digital |
| 3 | 0 V | 0 V |
| 4 | output | output analog |

for inductive analog sensors and ultrasonic sensors only

## *SENSOFIX* - **Base module**

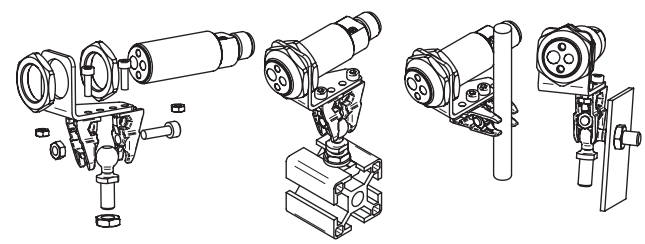
- Sensor can be aligned in any direction
- Quick and secure mounting
- Several mounting variations



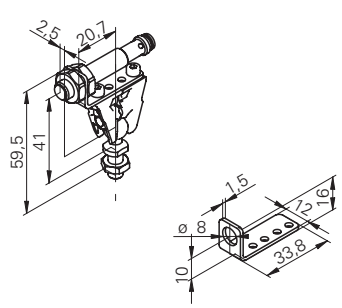

**Part number** **149010**
- clamps and mounting panel made of stainless steel
- ball pivots made of galvanized steel

## *SENSOFIX* - **Mounting variations**

- Can be mounted on panels, profiles or sheets metal - anywhere an M 6 hole can be drilled
- Mountable on 8 mm diameter rails
- Mounting screws supplied with kit

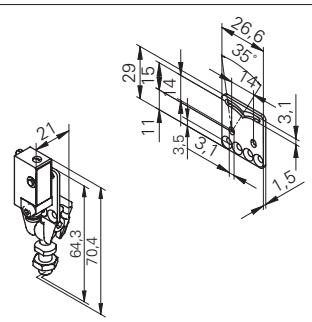


## *SENSOFIX* **Series 08 cylindrical**



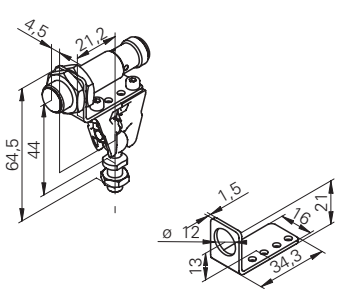

**Part number** **151719**
- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

## *SENSOFIX* **Series 10 rectangular**



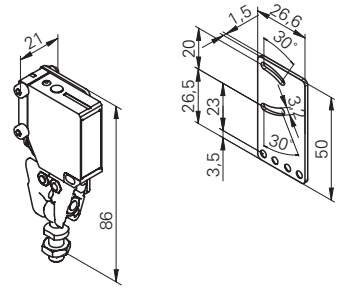

**Part number** **150326**
- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

## *SENSOFIX* **Series 12 cylindrical**




**Part number** **151720**
- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

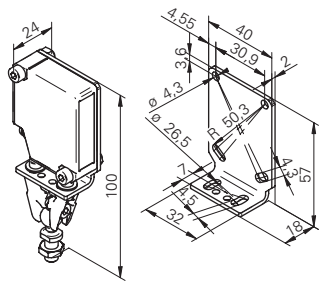
## *SENSOFIX* Series 12 rectangular




**Part number** **150328**

- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

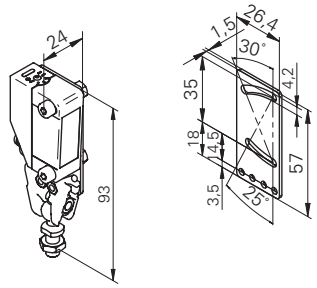
## *SENSOFIX* Series 13 rectangular




**Part number** **161829**

- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

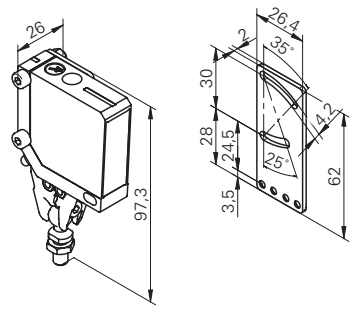
## *SENSOFIX* Series 14 rectangular




**Part number** **149011**

- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

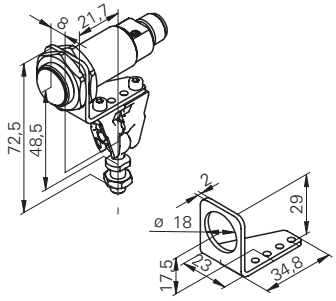
## *SENSOFIX* Series 16 rectangular




**Part number** **151721**

- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

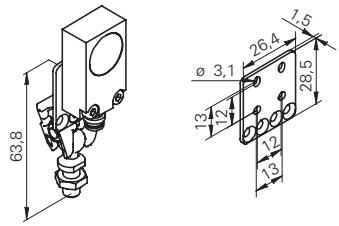
## *SENSOFIX* Series 18 cylindrical




**Part number** **151658**

- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

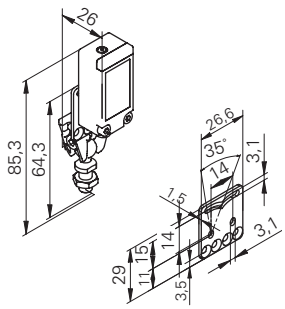
## *SENSOFIX* Series 18/20 rectangular




**Part number** **152385**

- for IWFM 18 housing styles
- for 20 series inductive and capacitive sensors

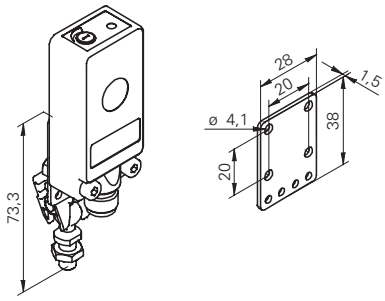
## *SENSOFIX* Series 20 rectangular




**Part number** **150326**

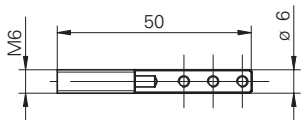
- clamps made of stainless steel
- ball pivots made of galvanized steel
- mounting panel made of stainless steel

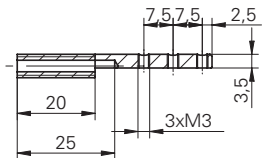
## *SENSOFIX* Series 30 rectangular

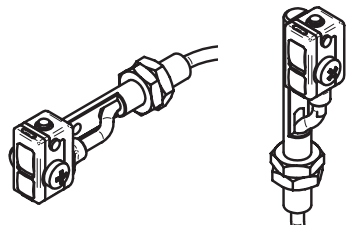



**Part number** **152386**

## *MINOFIX*- **Mounting kit**



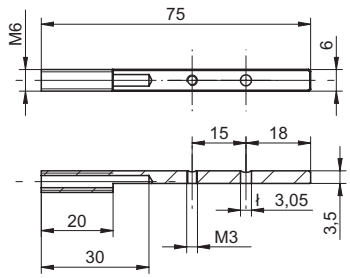



**Part number** **150844**

- Material: nickel-plated brass
- For use with *MINOS*
- Kit includes screws and nuts

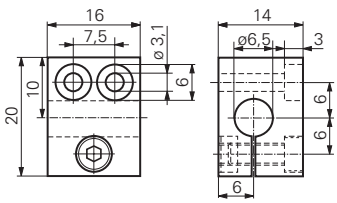
## Mounting kit F04




**Part number** **163196**

- Material: nickel-plated brass
- For use with **FHDK 04**

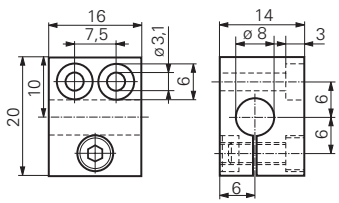
## Mounting bracket 109474




for 6,5 mm diameter proximity switches material plastic (PA 6.6. black)

for mounting use M 3 (3 mm ø) screws

## Mounting bracket 109475

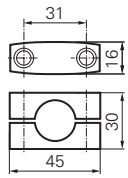



for 8 mm diameter proximity switches material plastic (PA 6.6. black)

for mounting use M3 (3 mm ø) screws

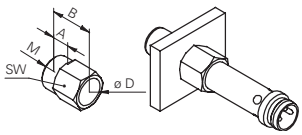
## Mounting bracket (2 pcs) 143377

for M5 hexagon socket




for 20 mm diameter proximity switches material plastic (PA 6.6. black)

## Clamping nuts




| Type | ø D | M | SW | B | A |
|---|---|---|---|---|---|
| E 3 | ø 3 | M5 x 0,75 | 5 | 7 | 3 |
| E 4 | ø 4 | M6 x 0,75 | 6 | 8 | 3 |
| E 6,5 | ø 6,5 | M8 x 0,75 | 8 | 11 | 4 |

for proximity switches ø 3, ø 4 and ø 6,5 mm

| Type | Part number |
|---|---|
| E 3 | 137021 |
| E 4 | 119345 |
| E 6,5 | 117742 |

## Test set 115437

This sensor test unit has been designed primarily to test and demonstrate three wire NPN and/or PNP proximity DC switches. Sensor connection is simple using the three spring loaded terminals.

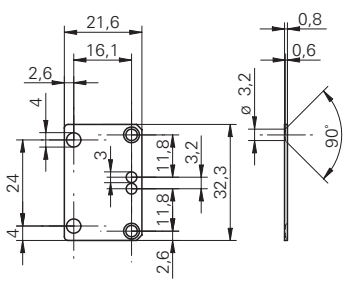
Red LED indicates PNP output
Green LED indicates NPN output.

An internal beeper is also audible when the sensor output is conducting.

The unit is powered by two 9 V batteries which are accessed by removing the back panel.

# Mounting brackets

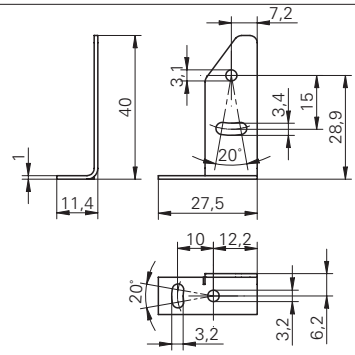
## Mounting plate — Series 10




**Part number** **162083**

- Material: steel

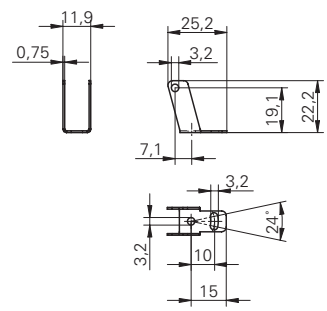
## Mounting bracket — Series 10




**Part number** **118798**

- Material: steel

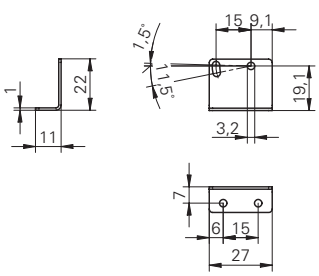
## Mounting bracket — Series 10




**Part number** **114501**

- Material: steel
- for cabel version series 10

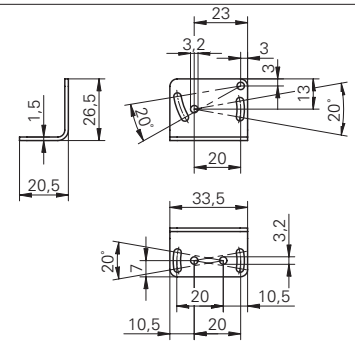
## Mounting bracket — Series 10




**Part number** **133792**

- Material: steel
- for connector version series 10

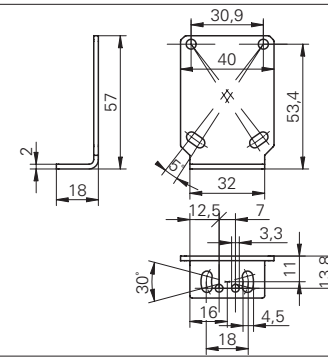
## Mounting bracket — Series 12




**Part number** **113873**

- Material: steel

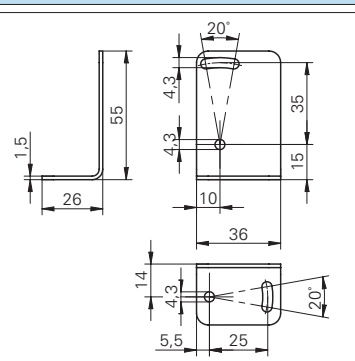
## Mounting bracket — Series 13




**Part number** **161695**

- Material: steel

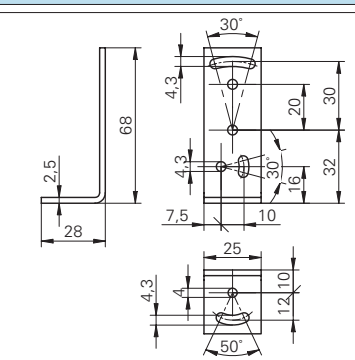
## Mounting bracket — Series 14




**Part number** **134964**

- Material: steel

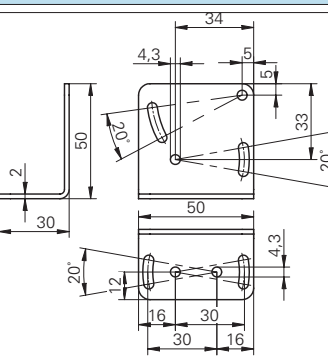
## Mounting bracket — Series 15




**Part number** **103415**

- Material: steel

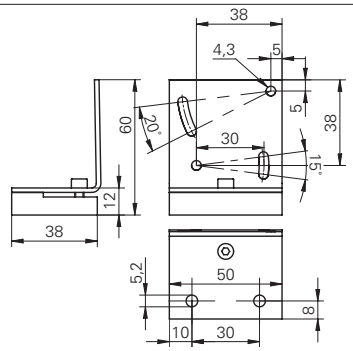
## Mounting bracket — Series 16




**Part number** **113917**

- Material: steel

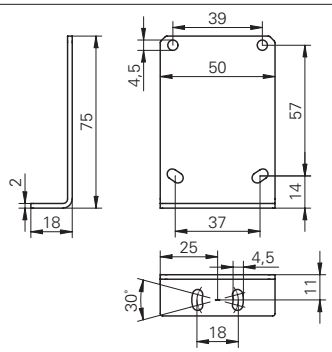
## Mounting bracket Series 16




**Part number** **119373**

- Material: steel
- for fine adjustment OSDM 16

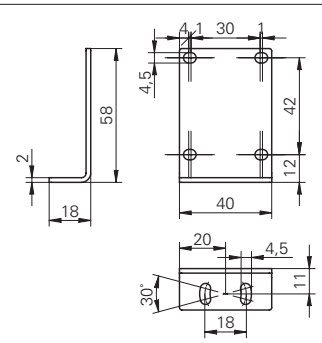
## Mounting bracket OADM 20




**Part number** **131521**

- Material: steel

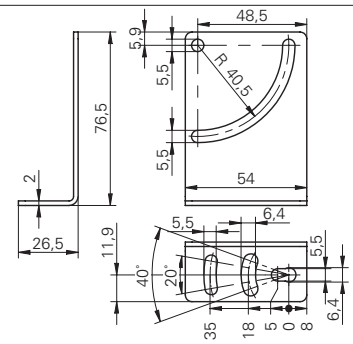
## Mounting bracket Series 22




**Part number** **126220**

- Material: steel
- for *LOGIPAL* and *PosCon*

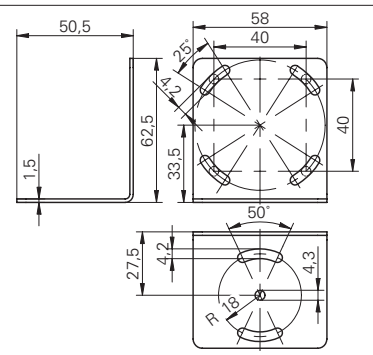
## Mounting bracket Series 26




**Part number** **112477**

- Material: steel

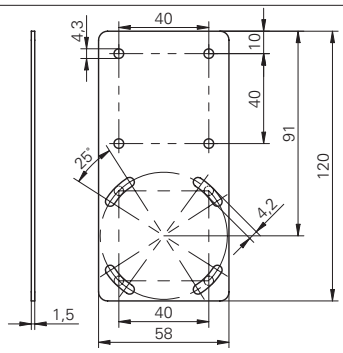
## Mounting bracket *VeriSens*




**Part number** **159906**

- Material: steel
- for *VeriSens*

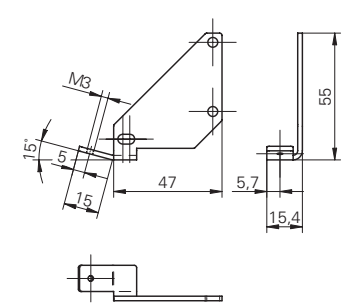
## Mounting bracket *VeriSens*




**Part number** **159905**

- Material: steel
- for *VeriSens*

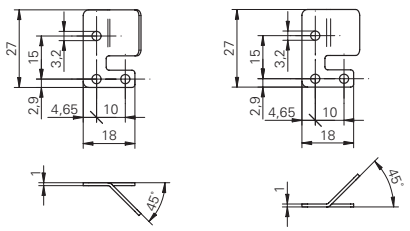
## Lens cleaning air nozzle bracket Series 16




**Part number** **116407**

- Material: steel
- incl. nozzle

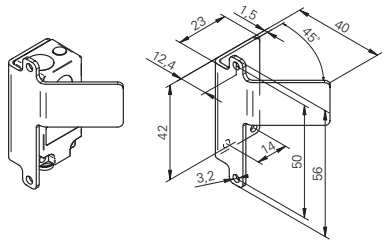
## Sonic beam deflector Series 10




**Part number** **162376**

- Material: steel
- Set of two (left / right)

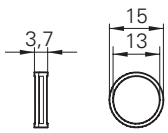
## Sonic beam deflector Series 20




**Part number** **153290**

- Material: steel

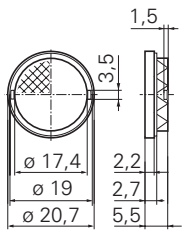
## Reflector round




**Part number** **FTAR 013A000**

- Fastening method self-adhesive
- micro structure

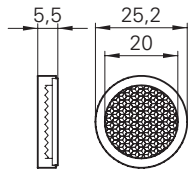
## Reflector round




**Part number** **FTAR 017A000**

- Fastening method self-adhesive

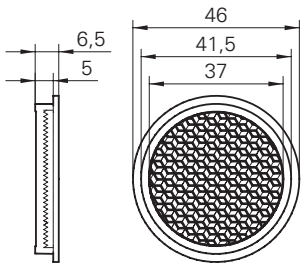
## Reflector round




**Part number** **FTAR 020A000**

- Fastening method self-adhesive

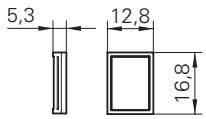
## Reflector round




**Part number** **FTAR 036A000**

- Fastening method self-adhesive

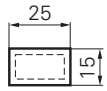
## Reflector rectangular




**Part number** **FTDR 010A014**

- Fastening method self-adhesive

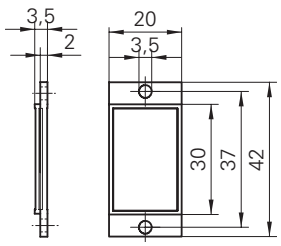
## Reflector rectangular




**Part number** **FTDR 010D020**

- Fastening method self-adhesive
- for laser light sensors

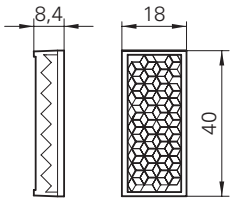
## Reflector rectangular




**Part number** **FTDR 017A027**

- Fastening method screw mounting
- micro structure

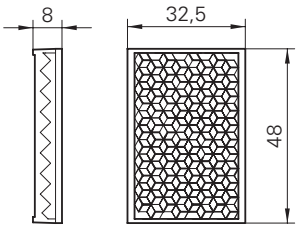
## Reflector rectangular




**Part number** **FTDR 015A038**

- Fastening method self-adhesive

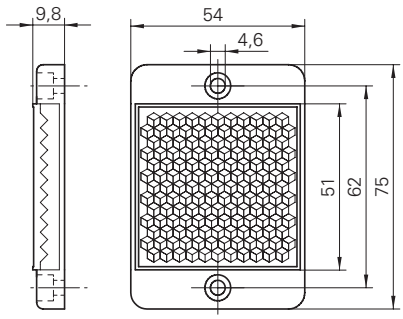
## Reflector rectangular




**Part number** **FTDR 029A046**

- Fastening method self-adhesive

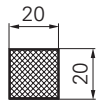
## Reflector rectangular




**Part number** **FTDR 047A048**

- Fastening method screw mounting

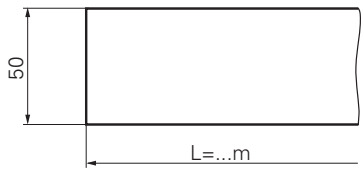
## Reflective tape rectangular




**Part number** **FTDF 020F020**

- Fastening method self-adhesive
- for laser light sensors

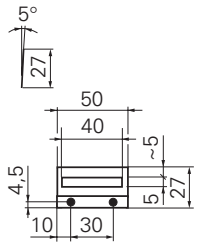
## Reflective tape By the meter




**Part number** **FTDL 050K000/ ... m**

- Fastening method self-adhesive

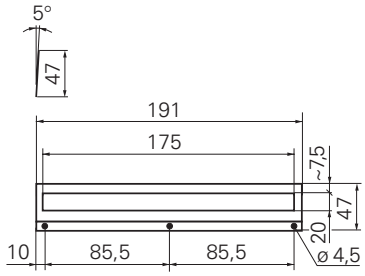
## Reflector rectangular




**Part number** **FTDR 005I040**

- Fastening method screw mounting
- for pocket-size line sensor *PosCon*

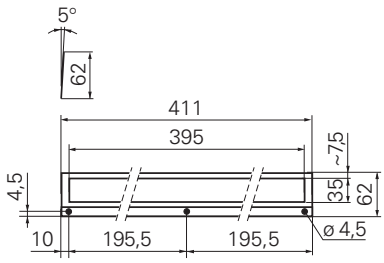
## Reflector rectangular




**Part number** **FTDR 020I175**

- Fastening method screw mounting
- for pocket-size line sensor *PosCon*

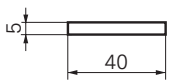
## Reflector rectangular




**Part number** **FTDR 035I395**

- Fastening method screw mounting
- for pocket-size line sensor *PosCon*

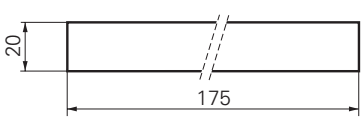
## Reflective tape rectangular




**Part number** **FTDF 005I040**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

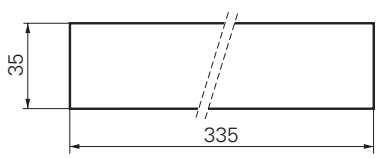
## Reflective tape rectangular




**Part number** **FTDF 020I175**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

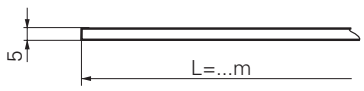
## Reflective tape rectangular




**Part number** **FTDF 035I395**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

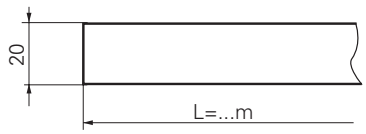
## Reflective tape By the meter




**Part number** **FTDL 005l000/ ... m**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

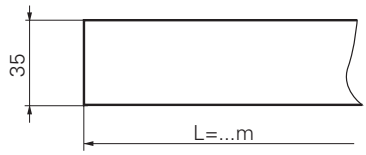
## Reflective tape By the meter




**Part number** **FTDL 020l000/ ... m**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

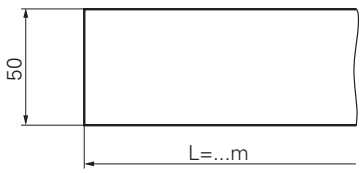
## Reflective tape By the meter




**Part number** **FTDL 035l000/ ... m**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

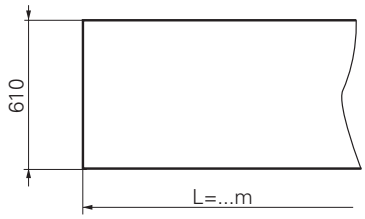
## Reflective tape By the meter




**Part number** **FTDL 050l000/ ... m**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

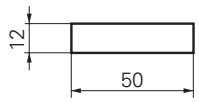
## Reflective tape By the meter




**Part number** **FTDL 610l000/ ... m**

- Fastening method self-adhesive
- for pocket-size line sensor *PosCon*

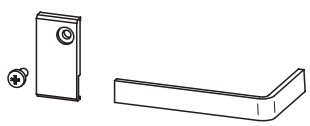
## Reflective tape rectangular




**Part number** **FTDF 012M050**

- Fastening method self-adhesive
- for pocket-size line sensor *ParCon*

## Reflector bracket



**Part number** **FTDR 008M030/01**

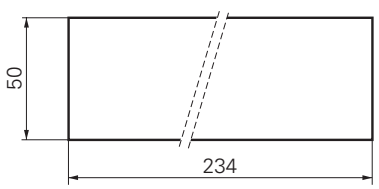
- Bracket with reflector film
- for pocket-size line sensor *ParCon*

## Reflector bracket

**Part number** **FTDR 008M030/21**

- Bracket with reflector film
- for pocket-size line sensor *ParCon*

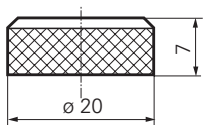
## Reflective tape rectangular




**Part number** **FTDF 050M234**

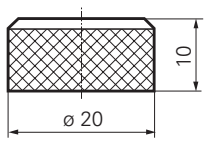
- Fastening method self-adhesive
- for pocket-size line sensor *ParCon*

## Cap nut Series 18



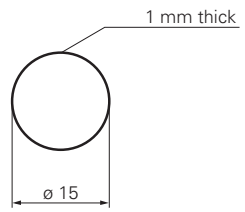

**Part number** **103067**
- for glass cover

## Cap nut Series 18



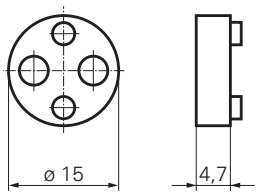

**Part number** **115913**
- for doubling lens and glass cover

## Glass cover Series 18



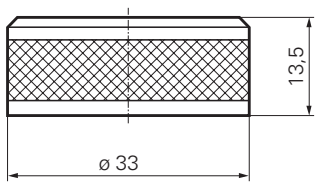

**Part number** **103068**

## Doubling lens Series 18



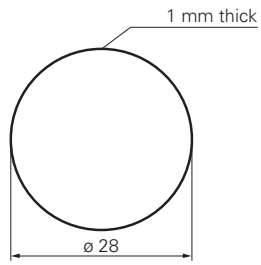

**Part number** **107250**
- to double the sensing distance FZAM 18

## Cap nut Series 30



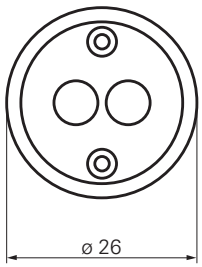

**Part number** **102801**
- for glass cover

## Glass cover Series 30



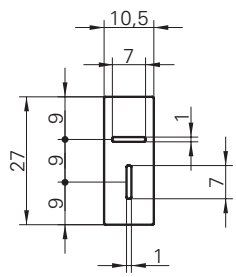

**Part number** **103226**

## Doubling lens Series 30

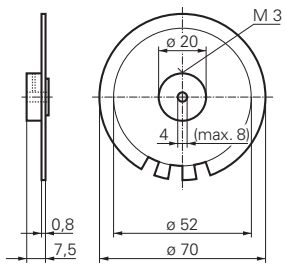
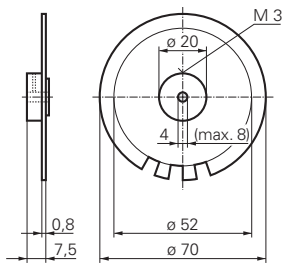
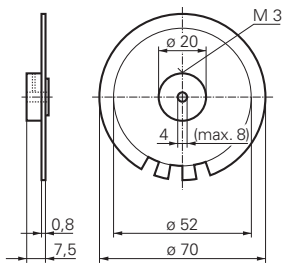



**Part number** **107408**
- to double the sensing distance FZAM 30

## Slot aperture stickers Series 14




**Part number** **144075**
- contents: 2
- self-adhesive

| Pulse disk | IPS 70 | Pulse disk | IPS 70 | Pulse disk | IPS 70 |
|---|---|---|---|---|---|
|  | |  | |  | |
| **Part number** | **IPS 70/1** | **Part number** | **IPS 70/60** | **Part number** | **IPS 70/100** |
| - Number of pulses: 1<br>- for fork sensors | | - Number of pulses: 60<br>- for fork sensors | | - Number of pulses: 100<br>- for fork sensors | |

Analog

IP65

PNP

Teach-in

EMV

NPN

# Glossary

# Glossary



## A

**Active zone**

The zone in which an object can be detected in front of the sensor. With diffuse sensors,this is approximately equivalent to the zone within the maximum sensing distance, where the emitted beam and the reception angle intersect. With retro-reflective sensors, this is the zone from the emitted beam exit plane to the reflector and from there back to the receiver entrance plane. With through beam sensors, this is the zone from the emitted beam exit plane to the receiver entrance plane.

**Actual range Sb**

As the nominal range Sn, but taking into account a 50% functional reserve, i.e. the maximum distance at which reliable operation of the sensor is possible.

**Actual sensing range Tb**

The sensing range Tb lies between the adjusted sensing distance and the blind region. The blind region defines the range immediately in front of the sensor where an object cannot be reliably detected. Within the actual sensing range Tb, a standard Kodak white target will always be reliably detected.

**Adjustment aid**

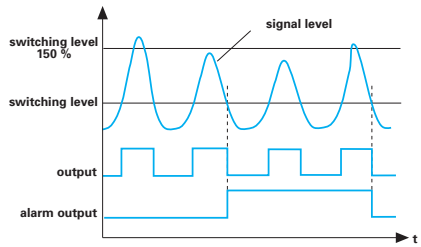
The LED indicates the intensity of the signal that has been reflected by the object, as well as the switching state of the output. See «Output indicator»

**Air stream**

The narrox ultrasonic beam angle may be affected by strong air streams in excess of 10 m/s.

**Alarm output**

Output function thatindicates an inadequate signal level. The alarm output usually has a «dynamic» function: This indicates whether the excess gain of 150% of theswitching threshold was not exceeded during the last light switching operation. It is also usually available as a «static» function:In this case, the alarm output indicates whether the current value of the signal is within the «critical range» between 100% and 150% of the switching threshold.




*AlphaProx*

Inductive Distance Measuring Sensors with analog output signals.

**Ambient light immunity**

Maximum permissible light intensity of the ambient light measured with a non-pulsed light source to IEC60947-5-2 and directed together with the receiver at a white reference paper that significantly covers the received beam. The light intensity is measured on the reference paper. With nearly all ranges of sensors, direct sunlight falling on the white object has no effect on the measurement. However, direct sunlight falling in the received beam almost certainly causes measuring errors.

**Analog output**

In contrast to the binary output with two possible output states, the analog output permits a continuous value such as a voltage or current to be issued and thereby a higher resolution of the measured values (see <Resolution>). Usually available as a voltage output 0 … 10 V and current output 0 … 20 mA or 4 ... 20 mA. The analog value can also be transmitted via a digital interface such as RS 485.

**Angular deflection**

Sound waves, like light waves, are reflected from flat surfaces. It is therefore possible that the reflected sonic beam from an angled surface might be too small for the accurate recognition of a target. The influence of tilting increases when the distance between the sensor and the target increases.

**ATEX**

Since July 1, 2003, electrical equipment for hazardous areas may only be sold and installed provided it has been designed according to the ATEX guidelines as laid out in the specification paper 95/9/EG.

# Glossary

## B

**Background suppression**

Diffuse sensors usually operate by the triangulation principle. With this accurate distance measurement, a background may be located close behind the adjusted switching point without interfering with the measurement. The background is <suppressed>.

**Banking screw**

Banking screws made of hardened steel provide limited mechanical protection to the inductive sensors buried therein when hit by an object. Advantage: very robust, quick and easy change of sensors.

**Beam alignment, squint**

By the addition of production tolerances of the optical and mechanical components that cannot be compensated by adjustment during manufacture, a squint between the emitter and receiver beams of up to several degrees can occur. From a light distance of more than approx. 40 cm, retro-reflective sensors usually must be aligned. (Exception: OAxx/OBxx range is factory-adjusted.)

**Beam-interrupting**

Sensor class in which the presence of an object is detected by interruption of the light beam between an emitter (and possible reflector) and an associated receiver.

**Binary output**

Output that can assume two states, or a switching output.

**Black-white (gray-white) offset**

For diffuse sensors with foreground and background suppression, there is a reduction in the sensing distance on gray or black reference paper in comparison with white reference paper (foreground suppression: increased sensing distance). This is also known as the black-white and gray-white offset. The sensing distance diagram shows the reduction in the sensing distance to gray or black as a function of the adjusted sensing distance.

**Blind region**

As the emitter and receiver axes are usually offset to each other, it is possible at very close distances to the object that no light in the emitted beam is within the detected angle of the receiver. In this situation, the sensor is dark-switched, or «blind». (See «Foreground suppression» for an exception)

**Blind range St**

Reliable object recognition is not possible within the blind range (St) of an ultrasonic sensor. Objects within this blind range may cause false switching of the sensor.

## C

**CENELEC**

This is a European standards committee, similar to UL or NEMA. It covers standardized dimensions and operating characteristics.

**CE conformity**

Designates compliance of the products with the directives of the European Union. The CE marking of the products is conditional on instrumental proof of their electromagnetic compatibility (EMC). Please also observe the information on the safety concept.

**Code delay**

Output function that extends the dark-switched state of a binary sensor by a specific time. This causes to delay the switching of a light-switching output and the dark-switching output switches later.

**Code reader**

A code reader contains up to 6 identical inductive sensors. Advantage: common supply rail, quick installation, reduced distance between individual sensors, very compact.

**Color sensor *LOGIPAL***

A color sensor determines the magnitude of deviation of the color components between a taught-in color and the color reflected by the object. The switching output indicates if at least one color component is outside the specified tolerance bands.

**Color/Contrast recognition**

Sensor class that detects a specific composition of the reflected light spectrum, meaning colors or gray scales (=contrast). The distance and received light intensity are secondary.

# Glossary

**Correction factor**

For an inductive sensor, if the target material differs from the standard target then the applicable published sensing distance must be multiplied by the appropriate correction factor (Cf).

Note: The published figures should be taken as a guideline only. Targets that differ in size and shape from the standard geometry may also give a different sensing distance when compared to the figures stated in the data sheets. When sensing aluminum foil or non-metallic materials coated with a thin layer of aluminum or copper, the sensing distance achieved maybe close to the value of mild steel. Actual Sn depends on the thickness of the layer as well as the alloy composition.

For a photoelectric sensor, the material and surface texture of the object affect the switching distance of a diffuse sensor with intensity difference. To determine the corrected switching distance, the following values must therefore be applied to the relative receiving signal (KFs) and as an approximation to the distance (KFd).

| Material | KFs | KFd |
|---|---|---|
| Kodak test card | 100% | 100% |
| Light, planed wood | 80% | 90% |
| Rough wood | 20% | 45% |
| Drawn aluminum | 25% | 50% |
| Cardboard, matt black | 7% | 26% |

**Current consumption**

As photoelectric sensors usually operate with pulsed light, their operating current is not constant, but adopts a saw-tooth waveform due to the internal smoothing of the current. An average value and a maximum value can be specified from this. Usually this is the maximum value.

## D

**Degree of remission**

The degree of remission designates the diffuse proportion of the reflected light, i.e. without the reflective proportion.

**Diffuse sensor**

Diffuse sensors detect the presence of an object by illuminating it with emitted light, which is then reflected by the object to the receiver in a diffuse form (remitted).

**Direction of approach**

With triangulation sensors, the approach of an object edge in the direction from the emitter lens to the receiver lens or the reverse can lead to incorrect results. The directions of approach from the front or the side cause no errors.

**Distance-based**

Sensor class in which the distance to the object is primarily processed as the measured value. The intensity of the received signal, colors or gray scales are secondary.

***DuroProx***

Inductive Sensors with Full Metal Housings. The inductive sensors with their full metal housing provide IP 69K class protection have been designed for harsh and demanding industrial applications. Thanks to an operating temperature range from -25 … +100 °C and a housing made of V4A stainless steel, these sensors are equally at home in food handling applications, cutting oil environments and any other applications where heavy contamination is a factor.

**Dynamic Resolution**

Signal noise exerts full effect on signal processing during very rapid measurements (high scan rates). Filtration without influencing the useful signal is only possible to a limited extent, if at all.

## E

**EMC**

All sensors pass through a type test with regard to their electromagnetic compatibility (EMC) according to the standards EN 60947-5-2, EN 61000-6-x.

# Glossary

**Error correction**

Photoelectric sensors usually operate by measuring pulsed light reflected by the object to the receiver. A measurement of this kind can be influenced by various effects from the surroundings, e.g. rapid changes in the ambient light (switching fluorescent lighting on and off, welding sparks etc), so that not all received light pulses appear in their correct magnitude. This could lead to switching errors. Fault correction evaluates the received pulses and only changes the switching state when a significant majority of pulses received within a time window indicate the need to change the switching state.

**Excess gain**

As signal losses can occur in applications with optical sensors due to soiling of the optics and aging of the light source, an excess gain must be allowed in the design of the application by presuming a shorter distance to the object than that indicated by the switching point. For reliable operation, an excess gain of at least 150% of the switching threshold is required. This distance correction can either be read off from the excess gain diagram or by exploiting the point at which the output indicator stops flashing. There are corresponding correction factors for diffuse sensors with intensity difference.

**External teach-in input**

Sensors with external teach wire have the added advantage that certain parameters can be remotely changed and set. See also <Teach-in>.

## F

**Fiber optic sensor**

An intensity-based sensor with which the emitter and receiver optics are replaced by an optical fiber connection.

**Focusing**

Particularly for sensors operating by the triangulation principle, it is ideal when the size of the light spot is as small as possible. However, according to the laws of optics, it is only possible to bundle the light rays at one point of the light path, the so-called point of focus. For this reason, light sources are focused at a specific distance. This distance is optimum to detect very small objects.

**Foreground suppression**

Diffuse sensor operating by the triangulation principle, as with background suppression. In contrast to this, the diffuse sensor with foreground suppression is switched on when the object reflects no light, i.e. a defined background must first exist before it switches off. It can then be switched on by the object. Advantage: no blind region because no light is received there and the sensor remains switched on.

## G

***GammaProx***

Inductive sensors with Increased Sensing Distances. The sensing distances of the ***GammaProx*** line of sensors is up to five times that required by the CENELEC standard. This allows both steel and nonferrous metals to be effectively and reliably detected. The increased sensing distance generally permits greater distances to the moving objects to be selected which, in turn, allows greater mounting tolerances and helps to prevent mechanical damage and increase the overall reliability of the equipment.

## H

**Hall sensor**

Hall sensors employ a magnetically biased semiconductor Hall element to sense moving ferromagnetic objects.

**Hysteresis**

At approach and removal of the target, there is a difference between operating and release point that is defined as Hysteresis. Hysteresis is designed into a sensor's characteristics to guard against possible incorrect pick-up due to vibration.

**Humidity**

A relative humidity up to 90 % has nominal effect on the sensing distance of the ultrasonic sensors. Direct moisture or dirt, however, may lead to a reduction of the scanning range Sd.

## I

**Infrared light**

Light in a long-wave range that is invisible to the human eye. In comparison with red light LEDs, IR LEDs can supply a higher radiated power. Unsuitable for use with plastic optical fibers, but suitable for glass optical fibers.

# Glossary

**Interpolation**

Using electronics and the laws of trigonometry, the basic period is subdivided into smaller units. 100 times the basic resolution is possible.

**Intensity-based**

Sensor class with which the light intensity impinging on the receiver is processed as a measured value (which is only an indirect measure of the distance to the object). The distance, colors or gray scales (= contrast) are secondary.

**Inverted output**

Depending on the wiring the output can be used as light-switching or dark-switching. Both output variants exist at the same time.

**IO-Link**

This is a communications standard for point-to-point connections between a master (connecting module) and a slave (sensor/actor). Non-screened standard sensor cables can be used as the transmission medium. Process data (analog / binary) and service data (parameters / diagnostics) can be transmitted by serial communication. IO-Link compatible sensors can be connected to existing I/O modules (without using the serial communications). The advantage of IO-Link is the reduction in project planning and installation costs by a uniform interface and convenient parameter adjustment and management.

**Laser diode**

Light source with the feature that the exit zone of the light is very small and can therefore be focused by following optics to form a very small measuring point (light spot). Another feature is that the light intensity is regulated by a monitor function and therefore remains practically unchanged during the service life of the laser diode.

**Laser protection class**

Lasers are subdivided into different protection classes according to their danger to the human eye (EN 60825-1):

1: Harmless
1M: Harmless as long as not further bundled by optical measure
2: Laser radiation exists only in the visible spectral range (400 … 700 nm). Harm less for short periods of irradiation (max. 0.25s, as normally given by the natural protective reflex of the eyelid)
2M: Like class 2, as long as not further bundled by optical measures

**Light/dark operation**

Light operation: the output switches when the receiver receives light. Dark operation: the output switches when the receiver receives no light.

**Linearity deviation**

Deviation from a proportional linear function (straight line). This is specified absolute in mm or relative in percentage of the far limit of the measuring range.

**Linearity FS**

Linearity defines the deviation between the output signal and a straight line. It is given as a percentage of the measuring range end value (FS or Full Scale). The following alternatives are available for applications where the indicated linearity is insufficient:
- Sensors with linearized output curves
- Polynomials for the mathematical linearization of the sensor curve in the controller

**Linking capability of outputs**

Parallel connection of the outputs (OR function)
Sensors with identical output stages (NPN or PNP) can be connected in parallel if they are connected to the same power supply unit. The number of sensors that can be connected in parallel depends on the respective load current and the currents flowing through the internal pull-up and pull-down resistors (typically 3 mA). The sum of all load currents plus the sum of all internal currents must not exceed the specified maximum switching current of a single sensor.

Series connection of sensors (AND function)
Relay outputs may be connected in series. For sensors with electronic outputs, it is not permissible to switch on the supply of one sensor by the output of a preceding sensor and thereby to implement an AND function. As a sensor represents a high capacitive load, this would activate the short circuit protection.

# Glossary

| | |
|---|---|
| LPC | Liquid crystal polymer (a plastic material). |
| **M** | |
| Magnetic sensor | Magnetic sensors are controlled magnetically by a small rotor closely positioned in front of the active sensing face. |
| Magnetic sensor for linear applications | The MLFK type of magnetic encoders has been designed to provide linear position information with < 20 micrometers resolution. Short and medium distance applications are preferred. Advantages: non contact length measuring, no moving parts, housing sealed to IP 67. |
| Magnetic sensor for rotary applications | The MDFK type of magnetic encoder consists of a magnet rotor and a magneto resistive sensor. May be used just like a standard incremental encoder. Advantages: easy installation, low cost alternative to standard encoders, up/down recognition possible |
| Maximum cable length | A large cable length means a capacitive load for the output circuit and increases the influence of interference. Length should therefore be kept as short as possible. |
| Measuring range | The sensor supplies a valid measurement result within this range. The measuring range and the limits of the measuring range are adjustable with some sensors. |
| Minimum pulse length | Output function that forces a minimum length, e.g. 4 ms, for the two output states of a binary sensor, so that even a slow controller can detect such a state without difficulty. In contrast to release/response delay, an output state longer than the minimum impulse length is not extended. |
| Minimum spacing | To avoid mutual interference between sensors, a minimum spacing should be observed. |
| Mounting distance | Distance between sensors (with diffuse sensors between the emitted light spots on the object) to prevent optical interference. Sensors with measures to reduce optical interference are not affected by this, but if the number of 3 is exceeded, the specified mounting distance for the next sensor but one is applicable. |
| Mounting instructions (MAL) | Mounting instructions (MAL) are enclosed with some sensors and contain detailed notes on the connection and operation of the sensor. |
| Multiplex operation | In this mode two ultrasonic sensors may be mounted without any spacing, since they operate alternately. The response and release time of the specific sensors is therefore doubled. |
| MY-COM | Mechanical precision switch with 1 micron repeatability. |
| **N** | |
| NAMUR | Metal brought into the active field of a NAMUR type proximity sensor causes its current consumption to change. This change in current consumption or the change of the sensor's internal resistance is used as output signal. In conjunction with properly homologated remote amplifiers NAMUR sensors may be operated in hazardous areas (for more information consult also ATEX). |
| Nominal range Sn | The guaranteed maximum switching distance of retro-reflective sensors under ideal conditions (at +25 °C, not soiled, sensors adjusted to each other). |
| Nominal sensing distance Sn | Nominal sensing distance is defined as a classification, that does not take into account either manufacturing tolerances or variations due to external conditions. |

# Glossary



**Non contact potentiometer**

MDRM & MDFM magnet sensors can be used as non-contact potentiometers. A rotor positioned in front of the active face controls them magnetically. Advantage: for applications in harsh environments, no moving parts, sine / cosine output signals, linear 1 ... 9 VDC/4 ... 20 mA absolute values.

**NPN output**

Binary open collector switching output with NPN transistor switching to 0 V. The load current thereby flows from the switching output through the load resistance to +Vs. A suppressor diode is integrated and also an internal load resistor of approx. 10 … 50 kΩ for measurement purposes.

## O

**Object distance So**

The object distance is defined as the distance between the front end of the sensor and the object itself.

**Optical fiber**

Cable made of glass or plastic fibers that conveys the light of a photoelectric sensor and permits the detection of an object at a constrained point due to its small size.

**Optical interference**

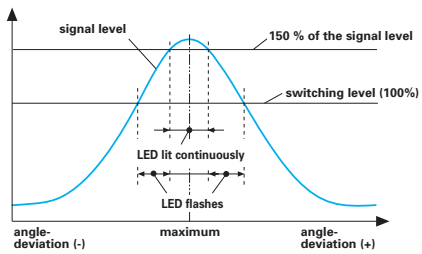
Without countermeasures, pulsed light sources that illuminate the same point on an object can overlap, which can cause switching errors. Sensors that are insensitive to optical interference use methods by which the pulses can evade each other and reduce situations in which switching errors are possible to a minimum. These methods permit the operation of up to 3 sensors in the same operating range, i.e. each sensor may "see" 2 interfering neighbors. The method becomes more reliable the better the neighboring sensors can be "seen", permitting the evasion algorithms to be suitably adjusted.

**Output current**

Maximum permissible current load at the outputs. Because the short-circuit protection secures all outputs together in sensors with several outputs and therefore monitors the sum of all output currents, it must be observed that the output current specification refers to this sum.

**Output indicator**

Visual display on the sensor, usually a yellow LED which indicates the status of the sensor receiver. LED off: receiving signal < switching threshold, LED flashing: receiving signal between 100%…150% of the switching threshold, LED steady on: receiving signal > 150% of the switching threshold.




**Overvoltage protection**

Protection against brief voltage surges in compliance with the standard IEC 61000-4-4

## P

***ParCon*/*PosCon* line sensor**

The line sensor is capable of detecting edges, widths and positions of objects without additional illumination. The measured value is issued with high accuracy as an analog value or via a serial interface.

**PNP output**

Binary open collector switching output with PNP transistor switching to +Vs. The load current thereby flows from the switching output through the load resistance to 0 V. A suppressor diode is integrated and also an internal load resistor of approx. 10 … 50 kΩ for measurement purposes.

**Point source LED**

Form of LED in which, in contrast to conventional LEDs, the light exit is not diffuse and distributed around the entire chip, but exits from the front in a circular and therefore clearly defined shape. A very small light spot can be created in this way (ideal for diffuse sensors with background suppression), similar to a laser, but at a loss of the total light intensity.

# Glossary

**Polarization filter**

Polarization filters only permit light to pass that is polarized in a specific plane. Retro-reflective sensors with polarization filters have polarization planes at the emitter and receiver offset by 90° to each other and therefore they only detect light reflected by a retro-reflector and depolarized. For this reason, the light beam itself is always reliably interrupted by reflective objects (which leave the polarization plane unchanged).

**Protection class (to IEC 60529)**

IP 65: Protection against the penetration of dust and full protection against electrical contact. Protection against a water jet from any direction. IP 67: Protection against the penetration of dust and full protection against electrical contact. Protection against water when the housing is immersed in water under specific pressure and time conditions.

**Pulsed light**

Using pulsed light can substantially reduce the sensitivity of a photoelectric sensor to the ambient light. The emitter LEDs can emit a higher peak power in pulsed operation. A differential measurement is possible, where the difference in the received light when the light source is switched on or off can be evaluated and non-pulsed light can be effectively compensated.

**Push-pull output**

In contrast to the open collector output variants PNP (load connected to 0V) and NPN (load connected to +Vs), the push-pull output permits any desired switching of the load within the limits of the supply voltage. However, in contrast to the open collector output variants, outputs may not be connected in parallel.

## Q

**Quasi-Shielded Installation Method**

When installing quasi-shielded sensors in ferromagnetic metals, special installationinstructions must be observed. In non-ferromagnetic materials such as copper, brass, and aluminum, the sensors can be installed shielded. When mounted in ferromagnetic material, these sensors require a space (x) behind the active area that is free of metal. Sensors can be installed shielded (flush) when mounted in non-ferrous materials.

## R

**Range sensor**

Diffuse sensor with a switching output with which two switching points can be set. This permits the presence of an object within a specified distance range to be detected.

**Red light**

Standard light color in the visible range, also suitable for use with plastic optical fibers. Advantage: due to its visibility, this improves the adjustment and monitoring of the application.

**(Retro-) reflector**

Reflector that casts light back at the angle of incidence and thereby, in contrast to a mirror, requires no exact alignment. These are available in the form of a triple reflector or a reflective film.

**Reflective film**

See «(retro-) reflector»

**Relative receiving signal**

With diffuse sensors operating by the intensity difference principle, the relative receiving signal is specified. This represents the signal level received from a white object as a function of the distance. With the aid of this diagram, it is possible to determine the sensing distance for an object that is not white. The correction factor of the respective material is required for this purpose.

**Release delay**

Output function that extends the light-switched state of a binary sensor by a specific time. The light-switched output opens later and the dark-switched output is switched after a delay.

**Release time**

The minimum necessary time for which an object must have left the scanning range to cause a change in the output state. This change in state is direct, unless a signal processing time is also specified by which this change in state is further delayed. Compliance with this release time is conditional on the switching threshold falling by max. 50%. If it is necessary for the sensor to take measures to reduce interference with others, this time may be extended by up to 50 µs.

# Glossary

| | |
|---|---|
| Repeatability | The repeatability of the actual switching point of two successive commutations within 8 hours, at an ambient temperature between +15 °C and +30 °C, and a voltage of ±5% deviation from nominal, is ±5%. (max. deviation between two measurements under identical conditions like object position, soiling, temperature, duty cycle etc.). |
| Repeat accuracy (*AlphaProx*) | See repeatability |
| Residual ripple | Maximum proportion of alternating current which may be superimposed on the DC voltage supply, of which the momentary values must not leave the specified voltage supply range. Specified in percent of the mean value of +Vs. |
| Resolution | The smallest possible change in the measured value to cause a discernable change in the output signal. Resolution can be impaired by high frequency electrical interference (noise) or by the resolution of digital/analog converters. |
| Response time | The minimum necessary time that an object must be within the sensing distance to cause a change in the output state. This change in state is direct, unless a signal processing time is also specified by which this change in state is further delayed. Compliance with this response time is conditional on an excess gain of at least 50% (the output indicator does not flash). If it is necessary for the sensor to take measures to reduce interference with others, this time may be extended by up to 50 µs.<br>For analog sensors, the response time is the time that the signal output of a sensor requires to rise from 10% to 90% of the maximum signal level. |
| Reverse polarity protection | Protection against reverse polarity is generally ensured between any connections of the sensor unless otherwise specified (e.g. only supply connections). |
| S<br>Safety concept | The safety concept determines the technical, instructional and legal measures that ensure the user (machine manufacturer, owner, user) a high degree of safety when handling our components. The safety concept also serves as the basis for the CE marking of our products and can be obtained in German, English or French. |
| Scanning range Sd | Objects within the scanning range (Sd) of an ultrasonic sensor are correctly detected up to the set far limit (Sde) of the scanning range. |
| Scanning range close limit Sdc | The close limit (Sdc) of an ultrasonic sensor can be programmed by a Teach-in button. |
| Scanning range far limit Sde | By means of a built-in potentiometer or a Teach-in button the user can change the far limit (Sde) of the scanning range (Sd) of an ultrasonic sensor. |
| *SCATEC* (Copy counter) | Laser copy counters are primarily developed for non-contact counting of printed matter in a lap stream. Basically a ***SCATEC*** responds to an edge passing through the laser beam with an output pulse. |
| Sensing distance Tw | The sensing distance Tw is the maximum achievable distance of a diffuse sensor measured at +25 °C on white paper (Kodak Card No. 1 527 795) of size 200 x 200 mm. With a max. sensing distance of under 400 mm, the reference paper size is 100 x 100 mm. The excess gain necessary for reliable operation under ideal conditions (50%) is already included. Sensors with adjusting aids indicate this point by a steadily lit reception indicator. |
| Sensitivity to noise | The extremely high sonic frequency used for ultrasonic sensors ensures that most extraneous noise will not affect operational accuracy. Pressurized air might interfere with the proper operation of the sensor under extreme conditions. |

# Glossary

**Sensitivity adjustment**

Sensors operating with intensity difference or as retro-reflective sensors may have adjustable sensitivity. The sensitivity can then be adjusted to the application using a potentiometer or by Teach-in.

**Sensor standard**

The sensor standard IEC60947-5-2 forms the basis for all type tests on photoelectric sensors.

**Edge/Profile recognition**

Sensor class that detects specific features of shape, e.g. edges, the height of newspaper copies etc. The distance, received light intensity, colors or gray scales are secondary.

**Shielded (flush) mounting**

Sensor may be mounted flush in a metal plate. Choice of carrier material can have an influence on sensing distance.

**Short circuit protection**

All photoelectric sensors have reverse polarity protection. All sensors have short circuit protection. In case of a short circuit or overload, the output switches off immediately. After a short duration (30 ms) the output is tested again for overload. If there is still a short circuit condition, the output is switched off within microseconds to protect it against damage. If the overload disappears the output is switched on again after the test.

In optical sensors, short circuit protection is clocked (switches the output off for approx. 20 ms), self-resetting (attempts to switch the output again after the shut-off time has elapsed) and start-delayed (to overcome capacitive loads of up to 50 nF occurring with longer cables).

**Signal processing time**

Delay between the detection of the future output state and its appearance at the output caused by signal processing. This has no effect on the maximum measurement frequency.

**Smallest object**

If the optical prerequisites for the detection of small objects are fulfilled, i.e. a sufficient signal difference exists, it is generally applicable to detect moving objects with diffuse sensors that: time in the scanning range > response time. For retro-reflective sensors: time in the scanning range > release time. The time in the scanning range te can be calculated by
te = distance in the scanning range / object speed

**Soiled lens indicator**

See <Output indicator>

**Sonic cone profiles**

The sonic cone profile charts as found in the spec sheets of this catalog represent the active sensing areas for ultrasonic sensors. The charts demonstrate the short-range sonic side lobes, which widen the sensor's close-range aperture angle. Due to sound absorption and air diffusion, the lobes decrease at longer ranges. Size, shape, surface properties and the direction of target detection have very high influence on the lateral detecting region of an ultrasonic sensor.

***SONUS***

Miniature Ultrasonic Sensor family

***SpiderScan***

The through-beam light curtains are a series of infrared light through beams, mounted in a tower type emitter and receiver housing. It can be used to recognize objects or to make continuous measurements.

**Stand-alone operation synchronous and multiplex sensors**

If these sensors are used as stand-alone devices, the „control" connection wire must be connected to +Vs in the synchronous type and to GND in the multiplex type to achieve the maximum possible reaction speed.

# Glossary

**Static Resolution**

Very slow object movements (low scan rates) such as the temperature expansion of shafts allow the high-frequency interference to be filtered. The carrier signal is not influenced by this filtration. Using this technique significantly increases the resolution when compared to dynamic measurements.

**Switching frequency**

Meeting EN 50010 standards, the switching frequency is the highest possible number of switches per second.

**Synchronization**

Optionally a number of sensors are available with a synchronization input. When operating in synchronization mode, the minimum distances between ultrasonic sensors may be substantially smaller than shown on the graph above. As a rule the minimum safety spacing required, is equal to the furthest, adjusted, scanning range far limit Sde. Synchronization mode is activated by connecting the fourth wire of all the sensors to be synchronized; a maximum of eight sensors per group can be connected to each other. Once linked together, the sensor with the biggest Sde takes over control, ensuring the ultrasonic pulse emitted by all the sensors is sent at precisely the same time. The emission of all synchronized sensors is restricted until the master, the sensor with the biggest Sde, has completed its time of flight measuring cycle. By applying such a measure, the danger of mutual interference amongst ultrasonic sensors is greatly reduced. The length of the interlinking wires, between the sensors, is limited to a maximum of 5 meters. If synchronization is not used, the "control" wire must be connected to +Vs.

**Teach-in**

Electronic teaching of an operating parameter (e.g. sensitivity adjustment) by pressing a button or via an external teach-in input. In standard versions, the <static teach-in> function is available. Teach-in occurs at the on position and off position and the sensor calculates the optimum switching point from this. The on position is always used as a normally open function and the off position always as a normally closed function. Also, <dynamic teach-in> exists, in which the maximum and minimum values of the results measured over a desired time are analyzed and a switching threshold optimum for this situation is then automatically adjusted.

**Teach-in – Lock-out**

The Teach-in locking is active 5 minutes after power-up or after the end of the last. Teach-in process. Disconnecting the power supply resets teach-in locking.

**Temperature**

Heat radiation from hot targets produces strong air turbulence. This can affect the sonic propagation and hence, the proper recognition of an object.

**Temperature drift (Ultrasonic)**

The speed of sound depends on temperature. Deviation can be up to 0,18%/K. Temperature drift of the ambient air is mostly compensated within the sensor itself. The specification for temperature compensation is valid for stationary conditions.

**Temperature drift**

In photoelectric sensors, the emitter light sources (apart from laser diodes), receiver elements and amplifiers are subject to certain thermal effects. This dependency of the measured values on the temperature is designated with the specification <temperature drift>.

**Test input**

Some sensors provide a means of switching off the emitter for a function test by activating an input. If the sensor was previously switched to light, the output of the sensor must consequentially change to the dark switching state.

**Triangulation principle**

Measurement principle used in diffuse sensors with background suppression and in distance-measuring sensors. The emitter, the object and the receiver form a triangular arrangement. The receiver is designed so that the angle between the beams from the emitter to the object and from the object to the receiver can be measured, which depends on the distance to the object. The distance to the object is determined by the position at which the received beam strikes the receiver element.

# Glossary

## U

**UL test mark**

The UL mark on a product indicates that samples of the complete product were tested by UL according to nationally acknowledged safety standards and are free of unacceptable, foreseeable risks such as fire, electric shocks and similar hazards and that the product was manufactured under UL supervision. Most products from Baumer electric are UL-listed. The files with the listed products can be viewed at http://www.ul.com.

**Unshielded (non-flush) mounting**

There must be a space equal to the diameter of the sensing head, with no metal interference. Following this rule the electrical field strength is less attenuated, which enables a larger sensing distance.

## V

***VistaProx***

Wireless sensors

**Voltage supply range**

The voltage supply must be within a specified voltage supply range at all times to ensure the correct function of the sensor.

# Safety concept / International conformity marks

The safety concept lays down the technical, instructive and statutory measures which ensure the user (system manufacturers, owners and operators) a high degree of safety when handling our components. The detailed safety concept is available in the languages German, English and French.

**Safety instructions**
To ensure conformity with the markings on our products as listed below, the following safety instructions must be generally followed:

- Mounting, commissioning and safety instructions in data sheets, operating and mounting instructions must be followed.
- Connection, mounting and commissioning may only be executed by specialized personnel.
- Products which are not specifically classified as safety components shall not be used as stand-alone operator protection.

**International conformity marks**
The size of many products from Baumer is too small to attach all markings directly to the product. For this reason, the following marks are applied to the leaflets, mounting instructions and packages.

CE

**CE Mark**
Guidelines exist in the EU which include the fundamental requirements to protect safety, health and the environment in order to ensure free trading in goods and services within the EU. The CE mark is not a quality mark, but a pure administration mark which indicates to the authorities that the marked product may be freely put into circulation in the internal EU market. The CE mark indicates that the product marked in this way fulfils the fundamental requirements of the applicable guidelines. To ensure this, the harmonized European standards are applied wherever applicable. The following relevant EU guidelines are applied for the various products manufactured by Baumer:

- Machine directive (98/37/EEC, 2006/42/EC)
- Low voltage directive (73/23/EEC, 2006/95EC)
- EMC directive (89/336/EEC, 2004/108/EC)
- Radio equipment and telecommunication terminal equipment directive (1999/5/EC)

The declarations of conformity for the products are available to the party putting them into circulation.

c UL us
LISTED

**C-UL-US Listing Mark**
UL (Underwriters Laboratory Inc.) introduced this new Listing Mark in early 1998. According to UL it indicates compliance with both Canadian and U.S. requirements. The UL Listing Mark on a product is the manufacturer's representation that samples of that complete product have been tested by UL to nationally recognized Safety Standards and found to be free from reasonably foreseeable risk of fire, electric shock and related hazards and that the product was manufactured under UL's Follow-Up Services program. Most of the products of Baumer electric are UL listed. The file with the listed products can be looked into **http://www.ul.com**

ES 12A5
IFRM 06P3503/S35L
FEAM08N1002/S35L
IFRM 18N1501/S35L
CFAK 12N1600
FEDM 08P3001
CFAM 18N1600/S14
FEG 12.24.25
FHDK10N1101
FPDM 12P3401
FPDK 26R7103/S27
FSE 050B2002
IFRM 06N3503/S35L
IFRM 08N1707
FZA 18A1001
IFF 40N51B15
IARM 12P1501/AL
FVDK 22P6101
IFFK 12N1101/L
IFFM 08P3501/O1S35L
FEDK 26R7103
IFRM 12X9103
MY COM A100/80
SAEB 18R72
IWRM 12I9501
OHDM 16P5101/S14
IPS 70/100
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