Sensor solutions in feeder technology

Guide
Maximum system availability with application stability and flexible sensor solutions.

The automation of assembly processes begins by feeding the individual parts or work pieces. Whether connecting elements, washers, O-rings or plastic parts: the diversity of the elements is as great as their field of application in a wide variety of industries, ranging from automotive through pharmaceutical / medical technology to consumer goods, electronics, food and packaging.

Regardless of the application in question, the task of feeding systems is always to sort the parts as gently as possible and to make them available singly in a defined position for the subsequent process steps. In addition, integrated test stations can ensure that bad parts are ejected from the value stream at an early stage in order to guarantee the best possible material flow.

With over 60 years of experience in assembly automation, Baumer offers the best sensor solutions to achieve maximum process quality and reliability using controlled feeding systems.

Allow the following pages to inspire you, and discover the right solution for your sensor applications when it is a question of feeding work pieces.
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Your benefits at a glance.

Feeding a wide range of components in the right position requires feeder systems that offer a high degree of flexibility and process reliability. With over 60 years of experience in assembly automation, Baumer offers a comprehensive portfolio of proven sensor solutions. The choice of the right sensor, tailored to your application and taking account of ambient conditions, is a critical factor in the maximization of system availability as well as the minimization of costs for service and maintenance.

Reliable and efficient processes
Robust product design, high performance reserves and intelligent signal conditioning guarantee process reliability and maximum system availability even in critical areas.

Flexible sensor solutions
A wide range of products and technologies offers you the optimum solution for your requirements in a wide range of ambient conditions.

Easy integration and operation
Baumer gives customer benefit top priority, and develops innovative sensor solutions to take account of all aspects, from installation and commissioning through day-to-day operation to maintenance.

Quality
Baumer sensors are “made in Switzerland”. They stand for top quality and durability.

Industry expertise
With over a half a century of experience in the field of assembly automation, Baumer offers you industry-proven and cost-effective solutions in conjunction with sound advice.
Product portfolio – sensor solutions in feeder technology.

**Light barriers and light scanners**

**Ultrasonic sensors**

**Light conductors and light amplifiers**

**Forked light barriers**

**Inductive proximity switches**

**Inductive distance sensors** *AlphaProx*

**VeriSens® Vision sensors**

**Incremental rotary encoders**

**Cylinder sensors**
Application-optimized sensor solutions.

Maximized system availability is of utmost importance in automated assembly stations and can be ensured by using components which are stable in use and resistant to their ambient conditions. In the field of feeder technology the focus also lies on particularly flexible sensor solutions which are able to reliably detect the whole range of various components. These guidelines provide the user with suggestions and possible solutions utilizing sensors within classical feeder systems.

Filling level monitoring in the parts hopper
To avoid downtimes, you need reliable sensors which are not influenced by ambient conditions such as ambient light, reflections, and dirt. Here, Baumer offers you the right sensors for your range of parts and for different assembly situations.

Vibrating spiral feeder: Filling level monitoring and drive control
In order to guarantee the flow of material, a particularly position-tolerant, shape, size and color-independent part identification system is required. Sensory control of the drive allows gentle operation at the optimum working point, thus reducing energy consumption and noise emissions.

Checking position and presence at the outlet of the vibrating spiral feeder
A prerequisite for trouble-free feeding is the exact orientation of the part. With Baumer VeriSens® vision sensors, not only part orientation but also numerous other test criteria can be checked. Bad parts are thus detected at an early stage and ejected from the value stream.

Find out more about sensor solutions from Page 8
Find out more about sensor solutions from Page 10
Find out more about sensor solutions from Page 14
Buffer zone monitoring
To avoid downtimes, the presence of parts is detected at several points in the buffer zone and the conveyor speed adjusted accordingly. A large number of parts of different size, shape and material can be detected by the same sensor. Baumer SmartReflect® light barriers allow easy installation without a reflector.

Separation
At the end of the buffer zone, the presence of parts in the nest is checked. Magnetic cylinder sensors monitor the position of the pneumatic actuators.
Filling level monitoring in the parts hopper.

Light barriers and light sensors

Baumer optical sensors offer high performance reserves in a compact design, and allow flexible installation.

High performance reserves thanks to powerful processors
- Trigger safety even with highly reflective parts
- Enormous resistance to dirt

Flexibility in machine design
- Installation solutions from the side or from above
- Miniaturized sensors for minimal interference contours

Easy installation and start-up
- Automated parameterization with IO-Link
- Simple and well-guided qTeach® teach-in method allows rapid training, saves time and improves protection against manipulation
- Universal push/pull sensor with selectable mode (NO/NC) reduces the number of different parts in stock

Solution portfolio of light barriers and light sensors, page 24
Ultrasonic sensors

Ultrasonic sensors detect the parts in the hopper, regardless of their color and transparency properties. The characteristic of the sonic cone allows reliable level detection even in the case of cluster-forming parts, such as longer pins or rivets. Variants with one or two independent switching signals as well as an analog measuring signal are available.

High process reliability with a large range of parts
- Independent of object color, gloss, or transparency
- Unsusceptible to dust, dirt and moisture
- U500 and UR18 are uniquely resistant to chemical and mechanical influences, thanks to the hermetically sealed sensor element
- Sensor adjustment to the properties of the object, thanks to parameterization with IO-Link

Flexibility in machine design
- Cylindrical or rectangular design allows installation in practically any installation situation
- Miniaturized sensors for minimal interference contours
- Short blind regions allow measuring almost up to the sensor surface

Easy installation and start-up
- Automated parameterization with IO-Link
- Simple and well-guided qTeach® teach-in method allows rapid training, saves time and improves protection against manipulation
- Universal push/pull sensor with selectable mode (NO / NC) reduces the number of different parts in stock

Optical fibers and amplifiers

Baumer optical fibers and amplifiers are characterized by their robustness and easy handling.

Vibration-resistant optical fibers
- Robust sheaths made of plastic or metal

Flexibility in machine design
- Large selection of sensing heads
- Cylindrical or rectangular optical fiber amplifier allows installation in practically any installation situation

Easy installation and start-up
- Minimal installation effort for optical fiber
- Amplifier also available in 18mm metal housing for the use of standard mounting elements
- Fast adjustment through teach-in function or potentiometer
SmartReflect® light barriers

SmartReflect® optical sensors by Baumer are suitable for reliable level control in the vibrating spiral feeder. Thanks to their design and intelligent signal processing, they detect objects reliably and without contact, regardless of their color or shape.

- High performance reserves thanks to powerful processors
  - Trigger safely even with highly reflective parts
  - Extremely dirt-resistant
- Easy installation and start-up
  - Teach-in takes place on the bottom of the container. When the light beam is interrupted by parts, the switching output is activated
  - Automated parameterization with IO-Link
  - Simple and well-guided qTeach® teach-in method allows rapid training, saves time and improves protection against manipulation, or by potentiometer
  - Universal push/pull sensor with selectable mode (NO / NC) reduces the number of different parts in stock
- Flexibility in machine design
  - The Baumer OneBox Design allows for easy exchange between optical and ultrasonic sensors of the U500 and O500 series thanks to an identical housing

SmartReflect® light barrier solution portfolio, page 24
Ultrasonic sensors

Ultrasonic sensors detect the parts in the hopper, regardless of their color or transparency properties. The characteristic of the sonic cone allows reliable level detection even in the case of cluster-forming parts, such as longer pins or rivets. Variants with one or two independent switching signals as well as an analog measuring signal are available.

High process reliability with a large range of parts
- Independent of object color, gloss, or transparency
- Unsusceptible or highly resistant to dust, dirt and moisture
- U500 and UR18 are uniquely resistant to chemical and mechanical influences, thanks to the hermetically sealed sensor element
- Sensor adjustment to the properties of the object, thanks to parameterization with IO-Link

Flexibility in machine design
- Cylindrical or rectangular design allows installation in practically any installation situation
- Miniaturized sensors for minimal interference contours
- Short blind regions allow measuring almost up to the sensor surface

Easy installation and start-up
- Automated parameterization with IO-Link
- Simple and well-guided qTeach® teach-in method allows rapid training, saves time and improves protection against manipulation
- Universal push/pull sensor with selectable mode (NO / NC) reduces the number of different parts in stock

Inductive proximity switches

To use in conjunction with the sensor arm on your level control device. Baumer offers a very wide range of inductive proximity switches. With their robust metal housing and fully encapsulated electronics, inductive sensors guarantee robustness and process reliability, even in applications exposed to vibrations.

High process reliability even in demanding environments
- High repeat accuracy and precise switching point
- Vibration resistant encapsulated electronics
- Robust metal housing
- Independent of object color
- High degree of temperature stability and very good EMC properties

Flexibility in machine design
- Large selection of sizes and shapes allow installation in practically any installation situation
The IFFM20 inductive sensor with a particularly large sensing distance is ideal for detecting the level of metallic parts in vibrating spiral feeders made of plastic.

Discrete assembly from below
- Gentle, non-contact detection
- Free access from above without wiring getting in the way
- Very small footprint thanks to flat and compact design

High process reliability
- Reliable detection of metal parts such as washers or nuts through the plastic floor thanks to the extra large sensing distance of up to 8 mm
- Metal housing with encapsulated electronics for maximum robustness, particularly in applications exposed to vibrations
- High repeat accuracy and precise switching point
- High degree of temperature stability and very good EMC properties

Inductive proximity switch solution portfolio, page 36
AlphaProx inductive distance sensors

The detection of the current vibration frequency and amplitude means that the system always operates at the optimum working point. AlphaProx inductive distance sensors offer many advantages compared to current-controlled systems.

Demand-driven, intelligent drive control
- Accurately adjustable material flow thanks to high resolution
- Fast response times from 1 ms
- High repeat accuracy
- Reduction of noise emissions
- Maximum energy efficiency

Easy installation and handling
- Fully integrated electronics without external amplifier
- Discrete wiring below the spiral feeder
- IO-Link for easy sensor adjustment and the use of additional measurement functions and analysis data

Inductive distance sensor solution portfolio, page 40
The parts are checked for position and orientation at the outlet of the vibrating feeder. The VeriSens® vision sensor ejects parts with the wrong orientation at an early stage, so that a reliable process flow is guaranteed and downtimes avoided.

Maximum process reliability
- *FEX®* image processor calculates contours in real time
- *FEXLoc®* automatic part location for variable object positions and reliable detection of vibrating parts
- Up to 144 feature checks per second

Cost-effectiveness
- VeriSens® Application Suite – Simple, user-friendly and time-saving parameterization of all VeriSens® vision sensors
- VeriSens® web interface – configurable user interface for fast adjustments during operation
- Flash Sync signal to synchronize illumination with flash controller
- Integrated lenses and illumination
- Digital I/O for the direct addressing of diverters

Long service life
- Robust metal housing in IP 67
- Stainless steel housing with IP 69K available for medical pharmaceutical or food and beverage applications

VeriSens® vision sensor solution portfolio, page 40
Setting the trigger for the vision sensor
To set a trigger for the VeriSens® vision sensor, reliable object detection at the outlet of the vibrating spiral feeder is essential. Baumer offers an extensive portfolio of different technologies for this – suitable for each installation situation and ambient conditions.

Solution portfolio for light barriers and sensors, optical fibers and amplifiers and fork sensors from page 24

Recommended sensor solution
VeriSens® vision sensors – position and quality control with one sensor

VeriSens® vision sensors offer the opportunity to check quality criteria at the outlet of the vibrating spiral feeder. In addition to the early ejection of parts on account of incorrect orientation, bad parts can also be detected prematurely and ejected from the value stream. The vision sensors of the VeriSens® family can check up to 32 characteristics: their range of features includes contours, colors as well as code reading.
Buffer zone monitoring.

**SmartReflect®** light barriers without reflectors

Baumer SmartReflect® light barriers offer the reliability of through beam sensors with half the time and expense needed for installation: The reflector, potentially subject to wear and tear, is eliminated, as a part of the machine is used as the background. Transparent and highly reflective objects of any shape or structure are reliably detected.

- **High performance reserves thanks to powerful processors**
  - Trigger safety even with highly reflective parts
  - Extremely dirt resistant
  - Detection of very small parts with up to 0.1 mm fine laser beam

- **Easy installation and start-up**
  - Simple and well-guided qTeach® teach-in method allows rapid training, saves time and improves protection against manipulation
  - Automated parameterization with IO-Link
  - Installation is also possible from above
  - Universal push/pull sensor with selectable mode (NO / NC) reduces the number of different parts in stock

- **Low running costs**
  - Installation time can be cut by 50% since no reflector is required
  - Replacement of the reflector due to wear and tear is no longer necessary

Light barrier solution portfolio, page 24
Fork sensors

Baumer fork sensors can be installed quickly and easily. Different fork widths up to 120 mm are available, as well as several light sources.

Quick and easy initial start-up
- No alignment of transmitter and receiver necessary
Reliable object detection even under difficult conditions
- Object recognition regardless of color or surface
- Laser versions for very small parts in the 1/100 mm range
- High ambient light immunity
- Robust metal housing and encapsulated electronics for continuous use in environments subject to vibrations

High system efficiency
- Detection of fast-moving parts thanks to short response times of up to 0.125 ms
- High repeat accuracy

Fork sensor solution portfolio, page 28

Miniature diffuse sensors with background suppression

Our miniature models are ideal for installation in tight spaces. Even our smallest sensors feature integrated evaluation electronics for top performance.

Reliable and stable detection of complicated parts such as springs, spirally wound filaments
- Narrow line spot (LED: 3.5 mm, laser: 0.2 mm)
Space saving in spatially critical conditions
- Housing in miniature design
Stable processes
- High repeat accuracy of < 0.2 mm
Fast start-up and adjustment
- Classical mechanical adjustment with potentiometer

Miniature light sensor solution portfolio, page 26
Optical fibers and amplifiers

Optical fiber sensors are suitable for particularly narrow and tight installation conditions.

Use in very tight or inaccessible spaces
- Compact sensing heads with cylindrical and rectangular shapes with straight or right-angle light emission
- Small light spots of 0.1 mm

Robustness
- PTFE-coated for protection against aggressive media
- Robust sheaths made of plastic or metal

Easy installation and start-up
- Fast adjustment through auto-teach-in function or potentiometer

Fiber optic sensor solution portfolio, page 28

Inductive proximity switches with factor 1

Factor 1 means identical sensing distance with all metals. This means that only one sensor is required for the detection of different parts made of stainless steel, aluminum or non-ferrous metal.

Flexibility in design and installation
- Same sensing distance for all metals
- Little customization required for faster installation
- Choice of four cylindrical sizes

Maximum operational reliability
- Switching frequencies of up to 3 kHz allow high conveyor speeds
- Resistant even to vibrating parts
- High EMC resistance
- Wide temperature range, also suitable for changing ambient conditions

Solution portfolio for inductive proximity switches with Factor 1, page 34

Recommended sensor solution

Light barriers without reflector – SmartReflect®

The intelligent Baumer SmartReflect® technology combines process safety of through-beam light barriers with the simplicity of reflected light barriers. No separate reflector is needed however – as any part of the machine can function as such. Objects are reliably detected; regardless of their color or degree of reflection.
Incremental encoders

For the use of conveyor belts, for example in conjunction with Pick & Place applications, the actual belt speed for control processes is required.

- Long service life even in harsh environments
- Heavy duty version – vibration and shock-tested (DIN EN 60068)
- Quick and easy initial start-up
- Resolution setting by means of switch
- Reduced installation costs thanks to the availability of 16 factory presets
- Maximum flexibility and reduced number of variants in stock
- Setting range from 100 ... 25000
- Perfect adaptation to the conveyor belt
- Adjustable spring pressure
- Space-saving solution, for retrofitting as well
- Compact size (40 mm housing)

Incremental encoder solution portfolio, page 42
Perfectly suited to your needs, reduction in stocks
- Modular product design
- Reduced diversity of parts in stock
- Programmable version
- Perfect adaptation to the application
- Large selection of accessories
- Reliable even under harsh conditions
- Robust mechanical design
- Outstanding signal quality
- High-precision optical measurement

Incremental encoder solution portfolio, page 42
Fork sensors

Different light sources with different-sized spots provide maximum detection reliability even for the smallest parts. Fork widths of 20 to 120 mm are available.

Quick and easy initial start-up
- No alignment of transmitter and receiver necessary
- Reliable object detection even under difficult conditions
- Object recognition regardless of color or surface
- Laser versions for very small parts in the 1/100 mm range
- High ambient light immunity
- Robust metal housing and encapsulated electronics for continuous use in environments subject to vibrations

High system efficiency
- Detection of fast-moving parts thanks to short response times of up to 0.125 ms
- High repeat accuracy

Separation – presence of parts in the nest.

Fork sensor solution portfolio, page 28
Optical fibers and amplifiers

Optical fiber sensors are suitable for particularly narrow and tight installation conditions.

Use in very tight or inaccessible spaces
- Small, light sensing heads in cylindrical and rectangular shapes
- Small light spots of 0.1 mm
For particularly adverse environmental conditions — very robust sensors resistant to heat and chemicals
- PTFE-coated for protection against aggressive media
- Ambient temperatures of −60 ... +350 °C
- Robust sheaths made of plastic or metal
Easy installation and start-up
- Fast adjustment through teach-in function or potentiometer

Solution portfolio of light sensors and amplifiers, page 28

Inductive proximity switches

The wide Baumer range of inductive sensors is characterized by very small sensors with fully integrated evaluation electronics and large sensing distances. This ensures simple and precise integration.

Highly reliable part detection and easy integration
- Large sensing distance even with the smallest sensor housing
The ideal sensor solution for all applications
- Wide portfolio diversity
Reduced false trigger setting when mounted in the vicinity of drives
- High EMC resistance
Reliable signal even in unstable ambient conditions
- Wide temperature range
Long sensor service life
- High quality (Swiss made)
- Encapsulated electronics
- Low series deviation

Inductive proximity switch solution portfolio, page 34
Cylinder sensors

Cylinder sensors in different styles and a wide range of mounting accessories ensure maximum flexibility. They are contactless and absolutely wear-free.

High process reliability and durability
- Magneto-resistive technology
- Robust design and IP 67
- Resistant to harsh conditions such as moisture, dirt, vibrations

Flexibility in machine design
- Wide range of sensor types (for C or T-slot cylinders) and accessories
- Can be inserted into the slot from above

Cylinder sensor solution portfolio, page 38
# Overview sensor solutions.

<table>
<thead>
<tr>
<th>Sensor principle</th>
<th>Size</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch</td>
<td></td>
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<tr>
<td>Diffuse reflective sensor</td>
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<tr>
<td>Reflective barrier</td>
<td></td>
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<tr>
<td>Through-beam sensor</td>
<td></td>
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<tr>
<td>Reflective light sensor with background suppression</td>
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</tbody>
</table>

### Ultrasonic sensors

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDK 10 SONUS</td>
<td>10.4 × 27 × 14 mm</td>
<td>10 ... 200 mm</td>
</tr>
<tr>
<td>U500</td>
<td>18 × 45.1 × 32.2 mm</td>
<td>0 ... 1000 mm</td>
</tr>
<tr>
<td>UR18</td>
<td>M18 × 64 mm</td>
<td>0 ... 1000 mm</td>
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</tbody>
</table>

### Light barriers and light sensors

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>O300</td>
<td>12.9 × 32.3 × 23 mm</td>
<td>30 ... 300 mm</td>
</tr>
<tr>
<td>O500</td>
<td>18 × 45 × 32 mm</td>
<td>60 ... 600 mm</td>
</tr>
</tbody>
</table>

- SmartReflect® light barrier without reflector (O300.SP)
- SmartReflect® transparent light barrier without reflector (O300.SP.T)
- Through-beam light barrier (O300.TR and O300.ER)
- Reflective light sensor with background suppression (O300GP)

- Through-beam light barrier (O500.TR and O500.ER)
- Reflective light sensor with background suppression (O500GP)
<table>
<thead>
<tr>
<th>Response time</th>
<th>Electric connection / interface points</th>
<th>IO link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 15 ms</td>
<td>Plug M8, 4-pole, Cable 2 m, 4-pole</td>
<td>Plastic</td>
<td>IP 67</td>
<td>Smallest ultrasonic sensor</td>
<td>Minimum weight 4 g Narrow sonic beam</td>
<td>Fill level controls in parts hoppers</td>
</tr>
<tr>
<td>&lt; 40 ms</td>
<td>Plug M12, 5-pole</td>
<td>Plastic</td>
<td>IP 67</td>
<td>Uniquely robust thanks to hermetically-sealed sensor element</td>
<td>Short blind range of 70 mm</td>
<td>qTeach®: easy to use, safe and wear-free OneBox Design: allows flexible planning</td>
</tr>
<tr>
<td>&lt; 40 ms</td>
<td>Plug M12, 5-pole</td>
<td>Stainless steel</td>
<td>IP 67</td>
<td>Uniquely robust thanks to hermetically-sealed sensor element</td>
<td>Short blind range of 70 mm qTeach®: easy to use, safe and wear-free Short design</td>
<td></td>
</tr>
<tr>
<td>&lt; 49 ms (SP, GP and TR)</td>
<td>Cable 2 m, 4-pole, Plug M8, 4-pole, Cable plug M8, 4-pole, Cable plug M12, 4-pole</td>
<td>Plastic or stainless steel</td>
<td>Plastic: IP 67 Stainless steel: IP 68 / IP 69K proTect+</td>
<td>Versions for transparent objects</td>
<td>Miniature sensors</td>
<td></td>
</tr>
<tr>
<td>&lt; 49 ms (SP, GP and TR)</td>
<td>Cable 2 m, 3-pole, Plug M12, 4-pole, Plug M12, 3-pole</td>
<td>Plastic or stainless steel</td>
<td>Plastic: IP 67 Stainless steel: IP 68 / IP 69K proTect+</td>
<td>Sensors for transparent objects</td>
<td>Adjustable signal</td>
<td></td>
</tr>
<tr>
<td>Sensor principle</td>
<td>Size</td>
<td>Detection area</td>
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<tr>
<td>Proximity switch</td>
<td>FHDK04</td>
<td>100 mm</td>
<td></td>
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<tr>
<td>Diffuse-reflective sensor</td>
<td>4 × 44.8 × 6.2 mm</td>
<td>20 … 500 mm</td>
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<tr>
<td>Reflective barrier</td>
<td></td>
<td>50 … 800 mm</td>
<td></td>
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</tr>
<tr>
<td>Through-beam sensor</td>
<td>FHDK07</td>
<td>100 mm</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>8 × 16.2 × 10.8 mm</td>
<td>10 … 60 mm</td>
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<td></td>
</tr>
<tr>
<td>SmartReflect® light barrier without reflector</td>
<td>FHDK 10 / OHDK 10 (Laser)</td>
<td>10 … 300 mm</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reflective light barrier with background suppression</td>
<td>10.4 × 27 × 14 mm</td>
<td>Reflective light barrier with background suppression (FHDK)</td>
<td></td>
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</tr>
<tr>
<td>Reflective light barrier with background suppression (FHDK)</td>
<td>FxDK 14</td>
<td>20 … 500 mm</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Reflective light barrier with background suppression (FHDK)</td>
<td>OR 18.SP</td>
<td>55 … 300 mm</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reflective light barrier with background suppression (FHDK)</td>
<td>M18 × 65 mm</td>
<td>20 … 500 mm</td>
<td></td>
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</tr>
</tbody>
</table>

**Summary**

- **FHDK04**: 4 × 44.8 × 6.2 mm, max. 50 mm
- **FHDK07**: 8 × 16.2 × 10.8 mm, 10 … 60 mm
- **FHDK 10 / OHDK 10 (Laser)**: 10.4 × 27 × 14 mm, 10 … 300 mm, Reflective light barrier with background suppression (FHDK)
- **FxDK 14**: 14.8 × 43 × 31 mm, 20 … 500 mm, Reflective light barrier with background suppression (FHDK)
- **OR 18.SP**: M18 × 65 mm, 55 … 300 mm
<table>
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<tr>
<th>Response time</th>
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<tr>
<td>&lt; 0.5 ms</td>
<td>Cable 2 m, 3-pole</td>
<td>Plastic</td>
<td>IP 65</td>
<td>Sub-miniature</td>
<td>Assembly in snap-on rail method</td>
</tr>
<tr>
<td></td>
<td>Cable plug M8, 4-pole</td>
<td></td>
<td></td>
<td>Fixed scanning range</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.5 ms</td>
<td>Cable 2 m, 4-pole</td>
<td>Plastic</td>
<td>IP 65</td>
<td>Worldwide, the smallest adjustable sensor family</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.5 ms</td>
<td>Cable 4-pole, 2 m</td>
<td>Plastic</td>
<td>IP 65 / IP 67</td>
<td>Miniature</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.5 ms</td>
<td>Plug M12, 4-pole</td>
<td>Plastic</td>
<td>IP 67</td>
<td>Versions for transparent objects</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.49 ms</td>
<td>Plug M12, 4-pole</td>
<td>Brass nickel-plated</td>
<td>IP 67</td>
<td>qTeach®: easy to use safe and wear-free</td>
<td></td>
</tr>
</tbody>
</table>

**Applications in feeder technology**
- Fill level controls in parts hoppers
- Fill level controls in vibrating spiral feeders
- Drive control of vibrating feeders
- Checking position and parts presence at outlet of the vibrating spiral feeders
- Buffer zone monitoring
- Buffer zone belt speed control
- Separation – position of pneumatic cylinder
- Separation – position of pneumatic cylinder

- **Sizes**
  - FHDK04: 4 × 44.8 × 6.2 mm
  - FHDK07: 8 × 16.2 × 10.8 mm
  - FHDK 10 / OHDK 10 (Laser): 10.4 × 27 × 14 mm
  - FxDK 14: 14.8 × 43 × 31 mm
  - OR 18.SP: 18 × 65 mm

- **Detection area**
  - 100 mm
  - 500 mm
  - 1000 mm
  - 1500 mm

- **Response time**
  - Electrical: < 0.5 ms
  - Electrical (Laser): < 0.05 ms

- **Connection / interface points**
  - 2 m
  - 4-pole
  - Cable plug M8
  - Cable plug M12

- **Housing material**
  - Plastic
  - ASA, MABS
  - Brass nickel-plated

- **Protection class**
  - IP 65
  - IP 65 / IP 67
  - IP 67
  - IP 65

- **Other features**
  - Snap-on rail method
  - Assembly in snap-on rail method
  - Fixed scanning range
  - Miniature

- **Worldwide, the smallest adjustable sensor family**

- **qTeach®** easy to use, safe and wear-free
<table>
<thead>
<tr>
<th>Sensor principle</th>
<th>Size</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch</td>
<td>100 mm</td>
<td>500 mm</td>
</tr>
<tr>
<td>Diffuse reflective sensor</td>
<td>1000 mm</td>
<td>1500 mm</td>
</tr>
<tr>
<td>Reflective barrier</td>
<td>100 mm</td>
<td>500 mm</td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td>1000 mm</td>
<td>1500 mm</td>
</tr>
<tr>
<td>SmartReflect® light barrier without reflector</td>
<td>100 mm</td>
<td>500 mm</td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>1000 mm</td>
<td>1500 mm</td>
</tr>
</tbody>
</table>

### Forked light barriers

**FGUM**  
Fork width:  
- 20 mm  
- 30 mm  
- 50 mm  
- 80 mm  
- 120 mm  
- 170 mm

**OGUM**  
Fork width:  
- 30 mm  
- 50 mm  
- 80 mm  
- 120 mm

**OGUM basic**  
Fork width:  
- 30 mm  
- 50 mm  
- 80 mm  
- 120 mm

### Light conductors and light amplifiers

**FVDK 66**  
- 10 × 33.8 × 70.2 mm  
- 1.5 m (max.)

**FVDK 67**  
- 10 × 33.8 × 70.2 mm  
- 4 m (max.)
<table>
<thead>
<tr>
<th>Response time</th>
<th>Electric connection / interface points</th>
<th>IO link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.125 ms</td>
<td>Plug M8, 3-pole</td>
<td>Die-cast zinc</td>
<td>IP 67</td>
<td>Potentiometer or Teach-in Version</td>
<td>Narrow, almost parallel light beam</td>
<td>Fill level controls in parts hoppers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill level controls in vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Checking position and parts presence at outlet of the vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buffer zone monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buffer zone belt speed control</td>
</tr>
<tr>
<td>&lt;0.166 ms</td>
<td>Plug M8, 3-pole</td>
<td>Aluminum</td>
<td>IP 67</td>
<td>Very high resolution</td>
<td>Extremely narrow laser light beam</td>
<td>Separation – parts presence in nest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sensors can be assembled in series</td>
</tr>
<tr>
<td>&lt;0.50 ms</td>
<td>Plug M8, 3-pole</td>
<td>Aluminum</td>
<td>IP 67</td>
<td>High resolution</td>
<td>Short response time</td>
<td>Separation – position of pneumatic cylinder</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Sensors can be assembled in series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sensors in laser class 1</td>
</tr>
<tr>
<td>0.25 … 1 ms</td>
<td>Cable 2 m, Plug M8, 4-pole</td>
<td>Plastic</td>
<td>IP 40</td>
<td>Adjustable sensitivity with Teach-in</td>
<td>Minimized wiring work (Master-Slave)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Timer functions</td>
</tr>
<tr>
<td>0.05 … 5 ms</td>
<td>Cable 2 m, Plug M8, 4-pole</td>
<td>Plastic</td>
<td>IP 40</td>
<td>Multi-functional instrument</td>
<td>Adjustable sensitivity with Teach-in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minimized wiring work (Master-Slave)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Timer functions</td>
</tr>
<tr>
<td>Sensor principle</td>
<td>Size</td>
<td>Detection area</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity switch</td>
<td></td>
<td>100 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diffuse reflective sensor</td>
<td>19.5 x 27 x 10.4 mm</td>
<td>500 mm (max.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflective barrier</td>
<td>20 mm</td>
<td>1000 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td>27 mm</td>
<td>1500 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SmartReflect® light barrier without reflector suppression</td>
<td>19.5 mm</td>
<td>2000 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>20 mm</td>
<td>27 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FVDK 10**

- **Size**: 10.4 x 27 x 19.5 mm
- **Detection area**: 600 mm (max.)
- **Type**: Beam-through light conductor
- **Material**: Plastic IP 40
- **Sensitivity**: Adjustable by means of potentiometer

**FSE 200C1002**

- **Size**: 4 mm width / diameter (head)
- **Detection area**: 1200 mm (max.)
- **Material (light conductor)**: Plastic
- **Outer casing**: PE
- **Head**: Brass

**FSE 200C4002**

- **Size**: 4 mm width / diameter (head)
- **Detection area**: 750 mm (max.)
- **Material (light conductor)**: Plastic
- **Outer casing**: PE
- **Head**: Brass

**FSE 200F4Y00**

- **Size**: 2.5 mm width / diameter (head)
- **Detection area**: 52 mm (max.)
- **Material (light conductor)**: Plastic
- **Outer casing**: PE
- **Head**: Stainless steel

**FCE 200D1Y01**

- **Size**: 3 mm width / diameter (head)
- **Detection area**: 1 ... 95 mm (max.)
- **Material (light conductor)**: Plastic
- **Outer casing**: PE
- **Head**: Stainless steel

**FCE 200C1Y00**

- **Size**: 6 mm width / diameter (head)
- **Detection area**: 1 ... 400 mm (max.)
- **Material (light conductor)**: Plastic
- **Outer casing**: PE
- **Head**: Stainless steel
<table>
<thead>
<tr>
<th>Sensor principle</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch</td>
<td>Fill level controls in parts hoppers</td>
</tr>
<tr>
<td>Diffuse reflective sensor</td>
<td>Fill level controls in vibrating spiral feeders</td>
</tr>
<tr>
<td>Reflective barrier</td>
<td>Drive control of vibrating feeders</td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td>Checking position and parts presence at outlet of the vibrating spiral feeders</td>
</tr>
<tr>
<td>SmartReflect® light barrier without reflector</td>
<td>Buffer zone monitoring</td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>Buffer zone belt speed control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>Separation - parts presence in nest</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td></td>
</tr>
<tr>
<td>500 mm</td>
<td></td>
</tr>
<tr>
<td>1000 mm</td>
<td></td>
</tr>
<tr>
<td>1500 mm</td>
<td></td>
</tr>
</tbody>
</table>

| Detection area         |                                     |
|------------------------|                                     |
| 100 mm                 |                                     |
| 500 mm                 |                                     |
| 1000 mm                |                                     |
| 1500 mm                |                                     |

<table>
<thead>
<tr>
<th>Response time</th>
<th>Electric connection / interface points</th>
<th>IO link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing features</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 ms</td>
<td>Kabel 2 m</td>
<td>Plugged</td>
<td>Plastic</td>
<td>IP 40</td>
<td>Smallest light conductor instrument</td>
</tr>
<tr>
<td></td>
<td>Stecker M8, 4-Pol</td>
<td></td>
<td></td>
<td></td>
<td>Sensitivity adjustable by means of potentiometer</td>
</tr>
<tr>
<td></td>
<td>Kabelstecker M8, 4-Pol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 0.05 ... 5 ms          | Material (light conductor): plastic    | Plastic | Outer casing: PE | Head: brass      |                                        |
|                       |                                      |         |                  |                  |                                        |
|                        |                                      |         |                  |                  |                                        |

| 0.05 ... 5 ms          | Material (light conductor): plastic    | Plastic | Outer casing: PE | Head: brass      | Lateral light emission                  |
|                       |                                      |         |                  |                  |                                        |
|                        |                                      |         |                  |                  |                                        |

| 0.05 ... 5 ms          | Material (light conductor): plastic    | Plastic | Outer casing: PE | Head: stainless steel | Lateral light emission |
|                       |                                      |         |                  |                  |                                        |
|                        |                                      |         |                  |                  |                                        |

| 0.05 ... 5 ms          | Material (light conductor): plastic    | Plastic | Outer casing: PE | Head: stainless steel | Co-axial optics                  |
|                       |                                      |         |                  |                  |                                        |
|                        |                                      |         |                  |                  |                                        |

<p>| 0.05 ... 5 ms          | Material (light conductor): plastic    | Plastic | Outer casing: PE | Head: stainless steel | Co-axial optics                  |
|                       |                                      |         |                  |                  |                                        |</p>
<table>
<thead>
<tr>
<th>Sensor principle</th>
<th>Size</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch</td>
<td>M18 x 50 mm</td>
<td>800 mm (max.)</td>
</tr>
<tr>
<td>Diffuse reflective sensor</td>
<td></td>
<td>150 mm (max.)</td>
</tr>
<tr>
<td>Reflective barrier</td>
<td></td>
<td>100 mm</td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td></td>
<td>500 mm</td>
</tr>
<tr>
<td>Reflective light sensor</td>
<td></td>
<td>1000 mm</td>
</tr>
<tr>
<td>SmartReflect® light barrier without reflector</td>
<td>FZAM 18</td>
<td>1500 mm</td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| FSE100A1003               | 3 mm (width / diameter (head)) | 1400 mm (max.) |
|                          | 12 mm (height / length (head)) |               |
| FSF100A1001              | 3 mm (width / diameter (head)) | 1400 mm (max.) |
|                          | 12 mm (height / length (head)) |               |

FZAM 18: 800 mm (max.)

FSE100A1003: 1400 mm (max.)

FSF100A1001: 1400 mm (max.)
<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>Electric connection / interface points</th>
<th>IO link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 ms</td>
<td>Cable 2 m, 3-pole</td>
<td>Brass nickel-plated / PC</td>
<td>IP 67</td>
<td>Adjustable sensitivity by means of Teach-In or potentiometer</td>
<td>Fill level controls in parts hoppers</td>
<td></td>
</tr>
<tr>
<td>&lt;0.5 ms</td>
<td>Cable 2 m, 4-pole</td>
<td>Plug M12, 4-pole</td>
<td></td>
<td>Robust metal housing</td>
<td>Fill level controls in vibrating spiral feeders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer casing: PVC</td>
<td></td>
<td></td>
<td>Drive control of vibrating feeders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer casing: Brass</td>
<td></td>
<td></td>
<td>Checking position and parts presence at outlet of vibrating spiral feeders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>chromium-plated</td>
<td></td>
<td></td>
<td>Buffer zone monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer casing: PVC</td>
<td></td>
<td></td>
<td>Buffer zone belt speed control</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer casing: Brass</td>
<td></td>
<td></td>
<td>Separation – parts presence in nest</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>chromium-plated</td>
<td></td>
<td></td>
<td>Separation – position of pneumatic cylinder</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>Sensor principle</td>
<td>Detection area</td>
<td></td>
<td></td>
<td></td>
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<td>----------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proximity switch</td>
<td>1 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diffuse-reflective sensor</td>
<td>5 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflective barrier</td>
<td>10 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Through-beam sensor</td>
<td>20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SmartReflect® light barrier without reflector</td>
<td>30 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflective light sensor with background suppression</td>
<td>40 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Inductive proximity switch

#### IFRM 03
- Size: 3 mm × 12 ... 22 mm
- max. 1 mm

#### IFRM 04
- Size: 4 mm × 15 ... 45 mm
- max. 1,6 mm

#### IFRM 05
- Size: 5 mm × 15 ... 45 mm
- max. 1,6 mm

#### IFRM 06
- Size: 6,5 mm × 30 ... 56 mm
- max. 6 mm

#### IFRM 08
- Size: 8 mm × 22 ... 56 mm
- max. 6 mm

#### IFRM 12
- Size: 12 mm × 30.4 ... 60 mm
- max. 10 mm
<table>
<thead>
<tr>
<th>Response time</th>
<th>Electric connection / interface points</th>
<th>IO link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing Features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 4 kHz</td>
<td>Cable, 2 m Cable plug M8, 3-pole</td>
<td>Stainless steel</td>
<td>IP 67</td>
<td>Sub-miniature</td>
<td>Completely integrated electronics</td>
<td>Fill level controls in parts hoppers</td>
</tr>
<tr>
<td></td>
<td>Cable Stranded wire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill level controls in vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td>Cable plug M8, 3-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Drive control of vibrating feeders</td>
</tr>
<tr>
<td></td>
<td>Cable Stranded wire 0.5 m</td>
<td></td>
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<td></td>
<td></td>
<td>Checking position and parts presence at outlet of the vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td>Plug M8, 3-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buffer zone monitoring</td>
</tr>
<tr>
<td></td>
<td>Plug M8, 3-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buffer zone belt speed control</td>
</tr>
<tr>
<td></td>
<td>Plug M8, 3-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Separation – position of pneumatic cylinder</td>
</tr>
</tbody>
</table>

- **Sensor principle:**
  - Proximity switch
  - Diffuse reflective sensor
  - Reflective barrier
  - Through-beam sensor
  - SmartReflect® light barrier without reflector
  - Reflective light sensor with background suppression

- **Detection area:**
  - 1 mm
  - 5 mm
  - 10 mm
  - 15 mm

- **Response time:**
  - Electric connection / interface points

- **IO link:**
  - Cable, 2 m
  - Cable plug M8, 3-pole
  - Stranded wire

- **Housing material:**
  - Stainless steel

- **Protection class:**
  - IP 67

- **Distinguishing Features:**
  - Sub-miniature
  - Completely integrated electronics

- **Applications in feeder technology:**
  - Fill level controls in parts hoppers
  - Fill level controls in vibrating spiral feeders
  - Drive control of vibrating feeders
  - Checking position and parts presence at outlet of the vibrating spiral feeders
  - Buffer zone monitoring
  - Buffer zone belt speed control
  - Separation – position of pneumatic cylinder

- **Factor 1 Sensors:**
  - (same switching distance on all metals)
  - High temperature-proof sensors up to +180 °C
  - Sensors in accordance with ATEX / NAMUR
  - Short design from 22 mm

- **High pressure-proof sensors:**
  - up to 500 bar

- **Weld-resistant and magnetic field resistant sensors:**
  - Up to 2 kHz
  - Cable 2 m
  - Plug M8, 3-pole
  - Plug M12, 3-pole
  - Brass nickel-plated

- **Miniature sensors:**
  - Plug M8, 3-pole
  - Plug M12, 4-pole

- **Stainless steel IP 67 Miniatures:**
  - Cable plug M8, 3-pole

- **Completely integrated electronics:**
  - Plug M8, 3-pole

- **High temperature-proof sensors:**
  - Plug M8, 3-pole
  - Plug M12, 3-pole
  - Plug M12, 4-pole

- **High pressure-proof sensors:**
  - Plug M8, 3-pole
  - Plug M12, 3-pole

- **Weld-resistant and magnetic field resistant sensors:**
  - Plug M8, 3-pole
  - Plug M12, 4-pole

- **Miniature sensors with high pressure-proof sensors:**
  - Plug M8, 3-pole
  - Plug M12, 3-pole
  - Plug M12, 4-pole
<table>
<thead>
<tr>
<th>Sensor principle</th>
<th>Size</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch</td>
<td>IFFM 20</td>
<td>20 × 32 × 10 mm</td>
</tr>
<tr>
<td>Diffuse-reflective sensor</td>
<td>IR06.P02F</td>
<td>6.5 mm × 40 ... 46 mm</td>
</tr>
<tr>
<td>Reflective barrier</td>
<td>IR08.P02F</td>
<td>8 mm × 40 ... 46 mm</td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td>IR12.P04F</td>
<td>12 mm × 40 ... 50 mm</td>
</tr>
<tr>
<td>Reflective light sensor without reflector suppression</td>
<td>IR18.P06F</td>
<td>18 mm × 50 mm</td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>IR18.P08F</td>
<td>18 mm × 60 mm</td>
</tr>
<tr>
<td>Response time</td>
<td>Electric connection / interface points</td>
<td>IO link</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Up to 1 kHz</td>
<td>Plug M8, 3-pole</td>
<td>Brass nickel-plated</td>
</tr>
<tr>
<td>&lt;3 kHz</td>
<td>Plug M8, 3-pole</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>&lt;3 kHz</td>
<td>Plug M8, 3-pole Cable 2 m</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>&lt;2 kHz</td>
<td>Plug M12, 3-pole Cable 2 m</td>
<td>Brass nickel-plated</td>
</tr>
<tr>
<td>&lt;500 kHz</td>
<td>Plug M12, 3-pole Cable 2 m</td>
<td>Brass nickel-plated</td>
</tr>
<tr>
<td>Sensor principle</td>
<td>Size</td>
<td>Nominal operating point / max. operating distance</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Proximity switch</td>
<td>6.2 x 31 x 4.3 mm</td>
<td>4 mT</td>
</tr>
<tr>
<td>Diffuse reflective sensor</td>
<td>6.5 x 21 x 9.4 mm</td>
<td>2 mT (MZTK 06x1012)</td>
</tr>
<tr>
<td>Reflective barrier</td>
<td>6.2 x 31.5 x 4.5 mm</td>
<td></td>
</tr>
<tr>
<td>Through-beam sensor</td>
<td>SmartReflect® light barrier without reflector</td>
<td></td>
</tr>
<tr>
<td>Reflective light sensor with background suppression</td>
<td>Reflective light sensor with background suppression</td>
<td></td>
</tr>
</tbody>
</table>

### Cylinder sensors

<table>
<thead>
<tr>
<th>Sensor Model</th>
<th>Size</th>
<th>Operating Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZTK 06x1011</td>
<td>6.2 x 31 x 4.3 mm</td>
<td>4 mT</td>
</tr>
<tr>
<td>MZTK 06x1012</td>
<td>6.5 x 21 x 9.4 mm</td>
<td>2 mT (MZTK 06x1012)</td>
</tr>
<tr>
<td>MZTK 06x1013</td>
<td>6.2 x 31.5 x 4.5 mm</td>
<td>4 mT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor Model</th>
<th>Size</th>
<th>Operating Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZCK 03x1011</td>
<td>3.7 x 23 x 4.6 mm</td>
<td>4 mT</td>
</tr>
<tr>
<td>MZCK 03x1012</td>
<td>3.7 x 11 x 19.5 mm</td>
<td>4 mT</td>
</tr>
</tbody>
</table>

**Diagram:**
- [Diagram showing sensor and cylinder models]
<table>
<thead>
<tr>
<th>Switch frequency</th>
<th>Electric connection / interface points</th>
<th>IO-Link</th>
<th>Housing material</th>
<th>Protection class</th>
<th>Distinguishing Features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200 kHz</td>
<td>Cable PUR 3 × 0.08, 2.5 m Cable PUR 3-pole, 5 m Cable plug PUR M8, L=300 mm</td>
<td>PA66</td>
<td>IP 67</td>
<td>For T-slot cylinders Detection of piston position Detection of magnets position</td>
<td>Fill level controls in parts hoppers Fill level controls in vibrating spiral feeders Drive control of vibrating feeders Checking position and parts presence at outlet of vibrating spiral feeders Buffer zone belt speed control Separation – parts presence in nest Separation – position of pneumatic cylinder</td>
<td></td>
</tr>
<tr>
<td>&lt; 200 kHz</td>
<td>Cable PUR 3 × 0.08, 2.5 m Cable PUR 3-pole, 5 m Cable plug PUR M8, L=300 mm</td>
<td>PA66</td>
<td>IP 67</td>
<td>For C-slot cylinders Detection of piston position Detection of magnets position</td>
<td>Fill level controls in parts hoppers Fill level controls in vibrating spiral feeders Drive control of vibrating feeders Checking position and parts presence at outlet of vibrating spiral feeders Buffer zone belt speed control Separation – parts presence in nest Separation – position of pneumatic cylinder</td>
<td></td>
</tr>
</tbody>
</table>
### Sensor principle

<table>
<thead>
<tr>
<th>Size</th>
<th>Proximity switch</th>
<th>Diffuse-reflective sensor</th>
<th>Reflective barrier</th>
<th>SmartReflect® light barrier without reflector suppression</th>
<th>Reflective light sensor with background suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inductive distance sensors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR12.D</td>
<td>M12, 12 mm × 40…60 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR18.D</td>
<td>M18, 18 mm × 50…60 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IWRM 18 Outdoor design</td>
<td>M18, 18 mm × 60 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measuring distance

<table>
<thead>
<tr>
<th>IR12.D</th>
<th>0…6 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR18.D</td>
<td>0…10 mm</td>
</tr>
<tr>
<td>IWRM 18 Outdoor design</td>
<td>0…8 mm</td>
</tr>
</tbody>
</table>

### VeriSens® Vision sensors

<table>
<thead>
<tr>
<th>VeriSens® XF series</th>
<th>53 × 99.5 × 38 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>VeriSens® CS series</td>
<td>53 × 99.5 × 38 mm</td>
</tr>
<tr>
<td>VeriSens® XC series</td>
<td>53 × 99.5 × 49.8 mm (without lens / tube)</td>
</tr>
<tr>
<td>Response time / resolution</td>
<td>Electrical connections / interfaces Speed</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>1 ms</td>
<td>Plug M12</td>
</tr>
<tr>
<td>2 ms</td>
<td>Plug M12</td>
</tr>
<tr>
<td>2 ms</td>
<td>Plug M12, 4-pole</td>
</tr>
<tr>
<td>752 x 480 px</td>
<td>Max. 100 Inspections / s</td>
</tr>
<tr>
<td>752 x 480 px</td>
<td>Max. 50 Inspections / s</td>
</tr>
<tr>
<td>640 x 480 px 1280 x 960 px</td>
<td>Max. 118 Inspections / s</td>
</tr>
</tbody>
</table>

**Applications in feeder technology**
- Fill level controls in parts hoppers
- Drive control of vibrating feeders
- Check position and parts presence at outlet of the vibrating spiral feeders
- Buffer zone monitoring
- Buffer zone belt speed control
- Separation – parts presence in nest
- Separation – position of pneumatic cylinder
<table>
<thead>
<tr>
<th>Size</th>
<th>Sensor principle</th>
<th>Detection area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proximity switch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diffuse-reflective sensor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflective barrier</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SmartReflect® light barrier without reflector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflective light sensor with background suppression</td>
<td></td>
</tr>
</tbody>
</table>

**Incremental encoders**

**MA20**
- Size: ø40 mm (Encoder)
- Full wave ø6 mm Flange socket M12, radial/cable
- Measuring wheel encoder consisting of encoder, measuring arm and measuring wheel

**EIL 580P-SC**
- Size: ø58 mm
- Full wave ø10 mm Flange socket M23, radial/axial/cable
- Full wave with clamping flange up to ø10 mm or Servo flange up to ø6 mm
<table>
<thead>
<tr>
<th>Impulses per revolution</th>
<th>Output signals</th>
<th>Output frequency TTL / HTL</th>
<th>Wave type</th>
<th>Connection</th>
<th>Distinguishing Features</th>
<th>Applications in feeder technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 … 25 000</td>
<td>A 90° B</td>
<td>≤ 300 kHz</td>
<td>Full wave ø6 mm</td>
<td>Flange socket M12, radial cable</td>
<td>Measuring wheel encoder consisting of encoder, measuring arm and measuring wheel</td>
<td>Fill level controls in parts hoppers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill level controls in vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Checking position and parts presence at outlet of the vibrating spiral feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buffer zone monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Separation – parts presence in next belt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Separation – position of pneumatic cylinder</td>
</tr>
<tr>
<td>1 … 65 536</td>
<td>A 90° B, R + inverted</td>
<td>≤ 300 kHz (TTL) / ≤ 160 kHz (HTL)</td>
<td>Full wave ø10 mm</td>
<td>Flange socket M23, radial / axial Cable radial / axial / tangential</td>
<td>Full wave with clamping flange up to ø10 mm or Servo flange up to ø6 mm</td>
<td>Fill level controls in parts hoppers</td>
</tr>
</tbody>
</table>

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