



## **Industrial Sensing Guide 2013**

For machines  
that Never Stop!

# Software downloads

2D/3D CAD

Up-to-date datasheets

Manuals

Application examples

[industrial.omron.eu](http://industrial.omron.eu)

Selection tables

FAQ



## Download the latest information

Refer to our website for extended product information with performance charts, dimension drawings, installation and usage instructions, extended specifications, application examples and find information on our complete sensing and accessory portfolio.

## Find information fast!

### Quick Links shortens your search

Quick Links are unique codes assigned to Omron products listed in this guide. Enter Quick Link codes in the search box on [industrial.omron.eu](http://industrial.omron.eu) to access detailed information on products in this guide.





## Content

### Tested Reliability from the world leading manufacturer!

Machine availability is critical to meet the demands expected from today's tough production schedules. With the ever increasing cost pressure on production, even the smallest component failure can cause costly down time. With this in mind, we design and intensively test our sensors to the highest standards, to allow you to achieve the highest production performance and reliability.

- Highest water resistance
- Resistance against temperature change
- Highest mechanical resistance
- Electro-magnetic noise immunity



#### 2 Overview

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## SELECTED INDUSTRY APPLICATIONS



### Material handling

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### Automotive parts

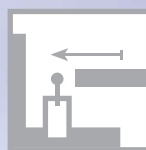
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### Semiconductor, photovoltaic & electronics

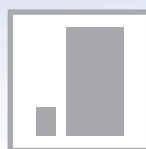
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## SPECIAL OBJECT DETECTION



### Machine parts/end positions

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### Colour and print mark

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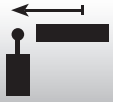





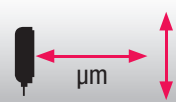





### Objects in harsh environments

page 24



## PRODUCT INFORMATION

Position & presence detection				
Machine part detection 	Object detection 	Area monitoring 	Mark & colour detection 	Position identification 
<b>Inductive sensors</b> Sensing distance (Sn) 40 mm max <b>E2</b>	<b>Lightcurtains</b> h = 2.1 m max <b>F3</b>		<b>Mark detection</b> <b>E3ZM-V, E3X-DAC</b>	<b>Rotary encoders</b> Rotation frequency 10.000 rpm max 6 - 3600 pulses/rotation <b>E6</b>
page 52	page 40		page 38	
<b>Limit switches</b> D4, EE, WL, Z	<b>Photoelectric sensors</b> square: Sn=60 m max cylindrical: Sn=15 m max fork: pitch=25 mm max page 26	<b>Measuring Lightcurtains</b> (cm accuracy) h = 2 m max <b>F3EM2</b> <b>B633</b>	<b>Colour detection</b> <b>E3X CLR</b> <b>FQ CLR</b>	
page 58	<b>Fiber optic sensors</b> Sensing distance 20 m max <b>E32</b> page 46	<b>Area fiber sensors</b> (mm accuracy) h = 70 mm max <b>E32-Area</b> <b>B522</b> µm accuracy	page 38	page 60
			high end colour vision	
Measurement			Inspection & ident systems	
Displacement/distance 	Profile 	Position/diameter/width <b>ZX-GT</b> 	Vision systems 	Ident systems 
For more information refer to QUALITY CONTROL & INSPECTION GUIDE				

## SENSING IN MATERIAL HANDLING & LOGISTICS

### For distribution systems that Never Stop

A smooth and disturbance free operation is key for today's distribution systems.

- Avoid malfunctions due to changing ambient light or reflective backgrounds
- Minimize re-adjustment and maintenance effort during operation



### INSTALLATION AND ADJUSTMENT

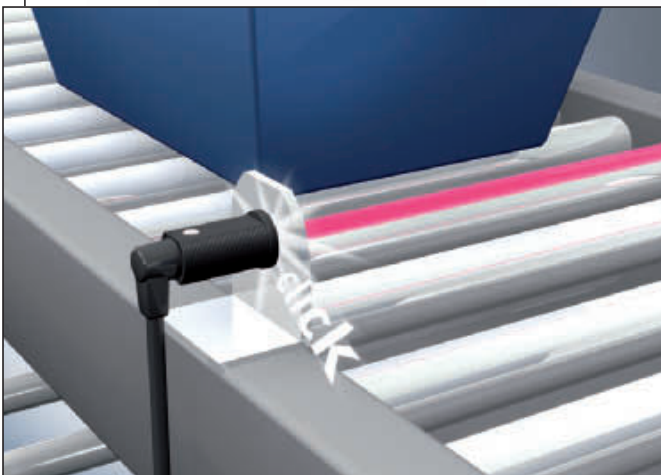
Ensure fast installation and avoid time consuming re-adjustments

- Bright and visible LED spot for most easy installation of E3FA/E3RA sensors
- High accuracy of E3Z/E3FA optical systems for fast and simple alignment

### ENVIRONMENTAL INFLUENCES

Avoid disturbances from artificial light sources and electromagnetic noise e.g. from inverters

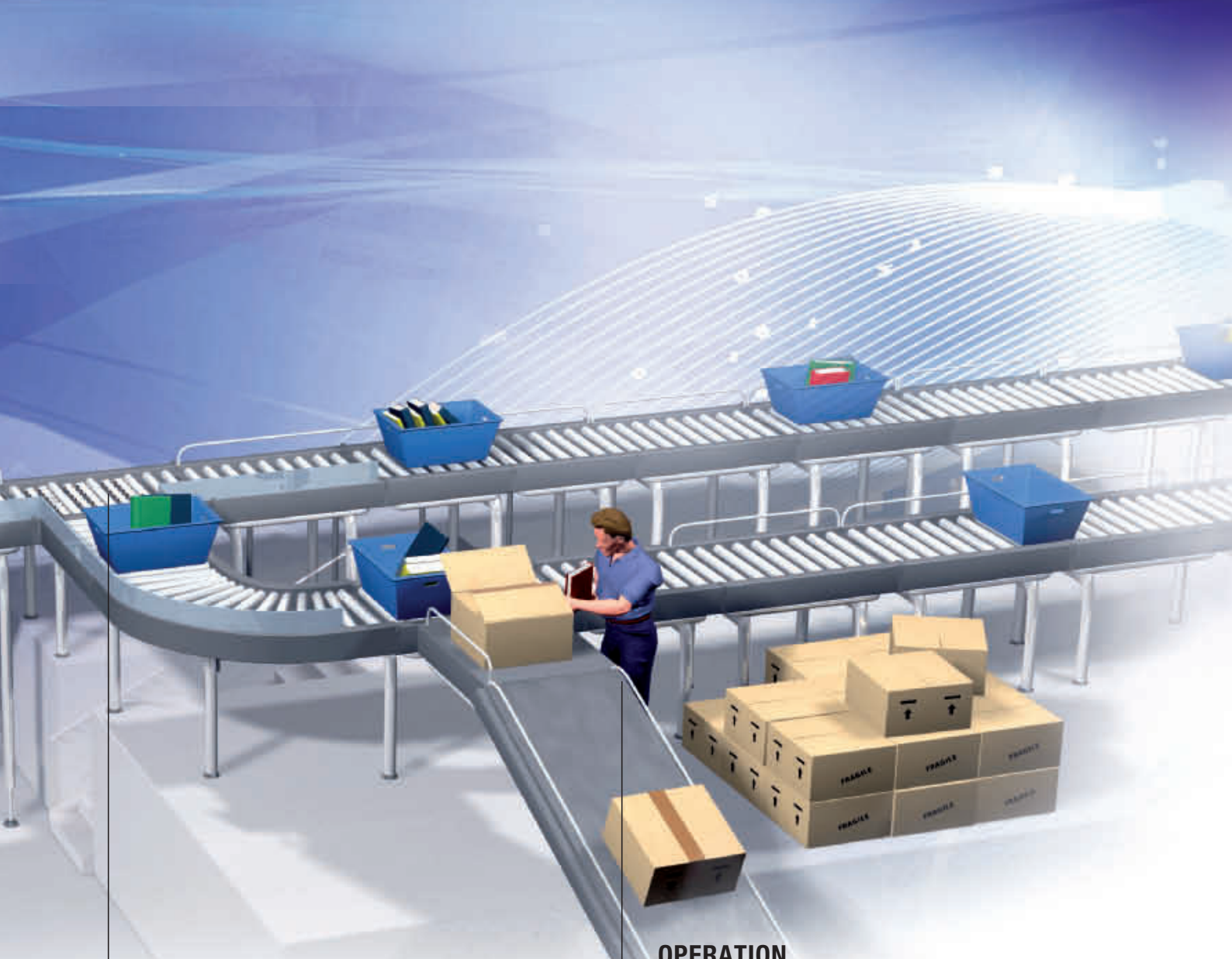
- Pulse synchronisation for ambient light immunity
- Intensive shielding for high EMC



➡ More on photoelectric sensors E3Z, and E3FA page 28

➡ More on resistance to environmental influences page 26



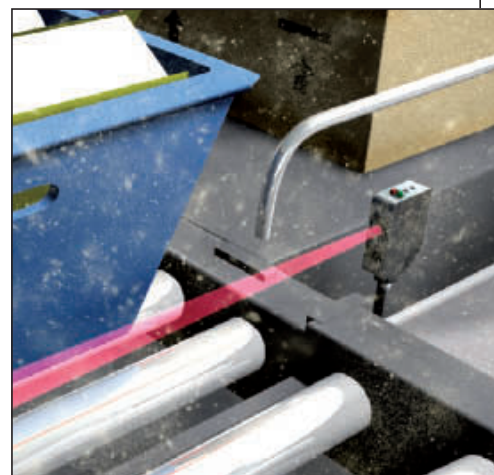
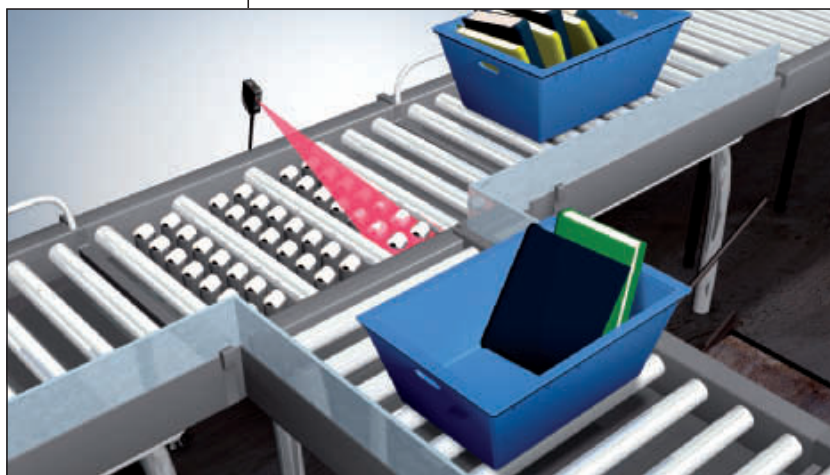


## BACKGROUNDS AND SHINY OBJECTS

- Minimize the influence from shiny objects and backgrounds
- Reliable background suppression on diffuse-reflective models
  - Mirror surface rejection (M.S.R.) on retro-reflective models

## OPERATION

- Ensure continuous operation and avoid costly machine downtime
- High power LED to compensate for dirt and misalignment
  - Rugged housing for protection against mechanical damage



➡ More on background suppression models of E3Z family page 26

➡ More on E3Z and E3FA page 26

## SENSING IN FOOD PACKAGING

### Reliable sensing for flexible machines

Enhanced hygiene and an increasing variety of packaging materials and shapes require easy-to-clean yet flexible packaging machine designs. A high re-usability in design and maximum efficiency during production is key to ensure a competitive food production.

- High detergent resistance for longer lifetime
- Platform concept for enhanced flexibility
- Proven reliability

### PACKAGING MATERIAL VARIETY

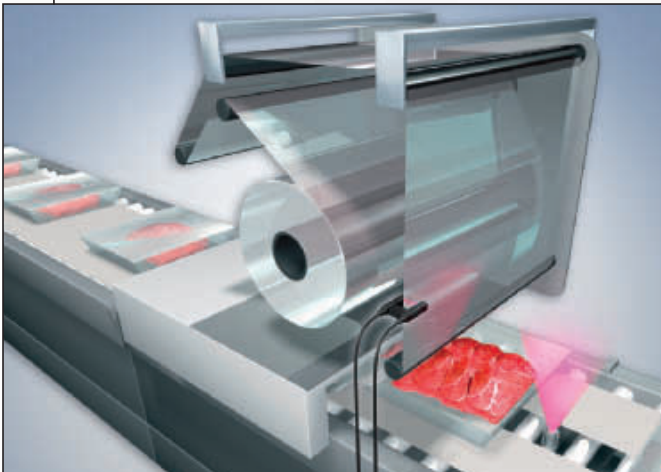
Food products are filled into a large variety of packaging materials. Transparent materials, uneven or shiny surfaces result in the usage of many special sensors in filling and wrapping machines.

- Simplify your machine design: one platform – one usage concept – one mounting
- Choose the performance you need

**E3Z platform** – reliability, simplicity and variety

**E3FA platform** – wide portfolio in simple M18 cylindrical shape

**E3X platform** – for smallest spaces and flexible mounting



More on the detection of different materials page 20 to 23



More on mark and colour sensors page 38

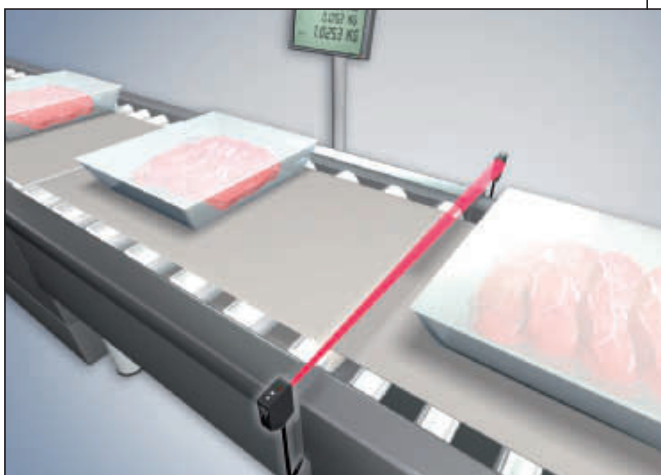




## DETECTING DIFFERENT PACKAGED OBJECTS

Not only the packaging material but also the food comes in different shapes and sizes. Finding the best solution to reliably detect the packaged food is a combination of sensor type, application, mounting and environmental conditions.

- Best practice solutions
- Application solution support

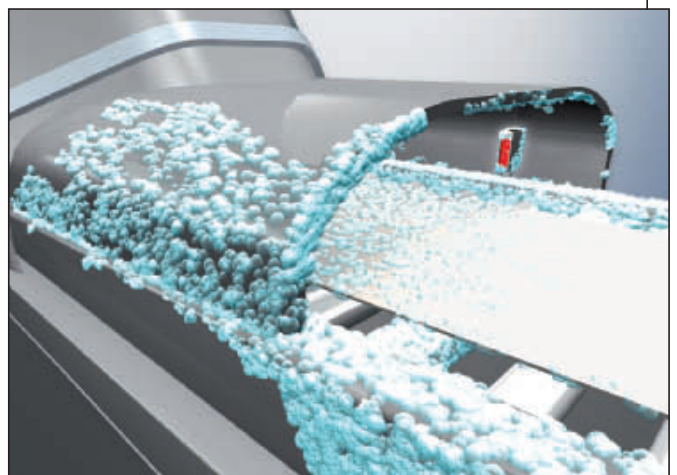


➡ More on the detection of differently shaped objects page 40

## HYGIENE AND FREQUENT CLEANING

Frequent cleaning with harsh detergents and high water pressure significantly reduces the lifetime of machine components. To avoid machine downtime during the processing of fresh food, sensors are frequently replaced resulting in high maintenance cost.

- Enhanced sensor lifetime with stainless steel and fluororesin sensors lasting up to 20 times longer than conventional sensors
- SUS 316L or fluororesin and smooth housing design for enhanced hygiene



➡ More on detergent resistant sensors see page 24  
For stainless steel safety non-contact switches refer to  
MACHINE SAFETY GUIDE

## SENSING IN THE BEVERAGE INDUSTRY

### For flexible and hygienic machines that Never Stop

For beverages and household liquids the shapes and sizes of containers – especially of PET bottles – are very diverse.

In spite of this diversity the common aspects to beverage filling are observing the high hygienic requirements, ensuring that containers are perfectly closed and appealing to customers and that the production can be realised with high cost efficiency.

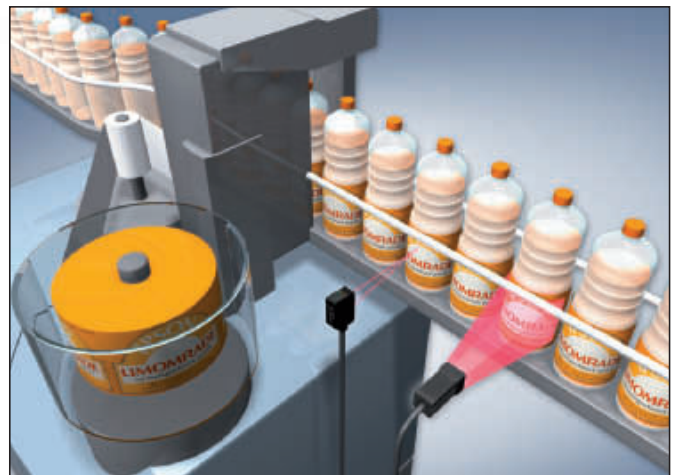


### REDUCED DIVERSITY - FITTING PERFORMANCE

Reduce the variety of housings and usage concepts for the detection of transparent materials, labels, cartons or foils.

- Standardised sensor platforms for common and special operation models in one housing

- E3Z and E3FA platform for highest reliability and accuracy for standard tasks
- E3X platform for enhanced detection, processing and communication functionality
- Vision and Measurement platform for advanced inspection solutions



More on E3Z platform page 26, more on E3X platform page 46, more on E3FA platform page 28  
More on Inspection solutions in QUALITY CONTROL AND INSPECTION GUIDE

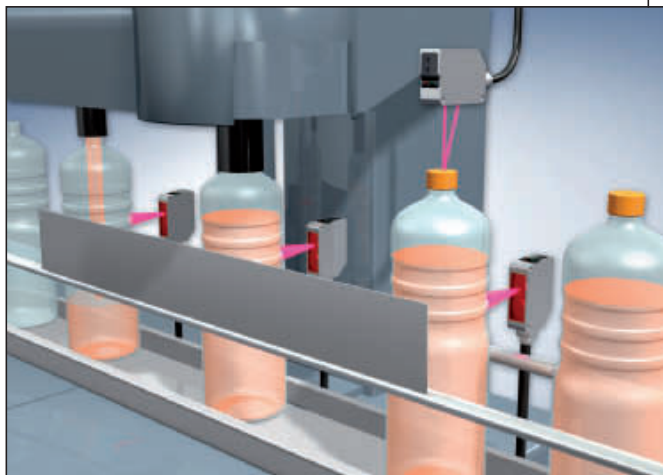




## HYGIENE AND FREQUENT CLEANING

Increased sensor life expectancy in regularly cleaned environments.

- Ecolab certified high detergent resistance for increased lifetime
- New production process for affordable SUS316L housings
- Fluororesin housing for highest detergent resistance and smooth housing

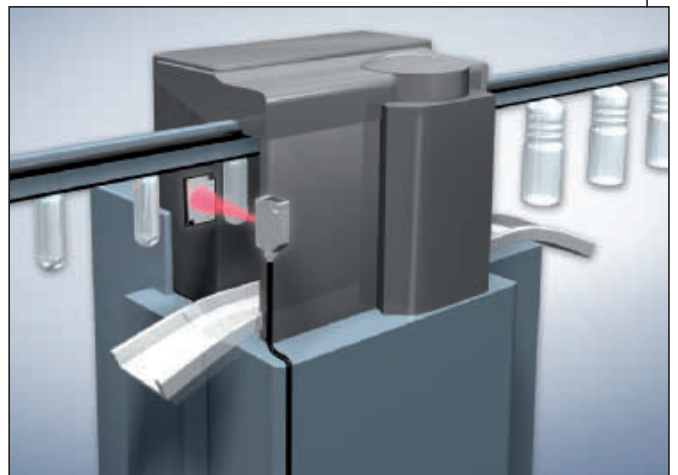


➡ More on sensors for harsh environments page 24

## ENHANCED DETECTION STABILITY

Enhance the stability of the detection of transparent bottles or film compensating for the influence of ambient light, dust, LED aging or temperature.

- Autocompensation functions for enhanced detection stability



➡ More on detection of transparent objects page 20

## SENSING IN THE PHARMACEUTICAL & HEALTHCARE INDUSTRY

### Reliability, precision and ease-of-use in operation and machine design

The high quality consciousness in the pharmaceutical industry results in demanding requirements for sensors in terms of precision, repeatability, performance and durability even in the harshest environments. Documentation requirements and obtaining approvals for machines can be time consuming and proven solutions fulfilling these demanding requirements are preferred.

- Proven solutions with E3Z and E3X photoelectric sensors in a wide range of pharmaceutical filling and packaging machines
- Reliability and precision for long term stability avoiding time consuming re-adjustments
- E3Z and E3X platform concept reducing the effort to adapt machine designs to special customer requests or different industry requirements

### STERILISATION & ASEPTIC FILLING

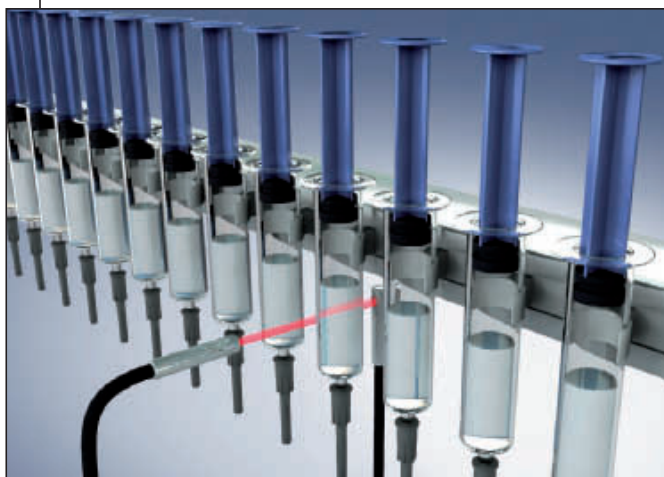
The reduction of organic pyrogens like bacteria, viruses or fungi are key to ensure a sterile production. The use of very high temperatures up to 400°C or aggressive chemicals like H<sub>2</sub>O<sub>2</sub> can significantly reduce the lifetime of sensors in these areas.

- Temperature and chemical resistant fiber heads for long sensor lifetime
- Dual state detection fiber amplifier for the reduction of sensor heads in critical production areas

### QUALITY INSPECTION MADE EASY

In order to realize a failure free production the detection of product deviations is required. Verifying the presence of needles, protective covers or ensuring the correct glass colour of vials requires precise and repeatable sensing performance.

- Easy-to-use and precise twin output fiber solutions simplifying the detection of challenging objects and small deviations (detection of two light levels)
- Easy-to-use vision sensors, vision systems and inspection solutions for multi-inspection tasks

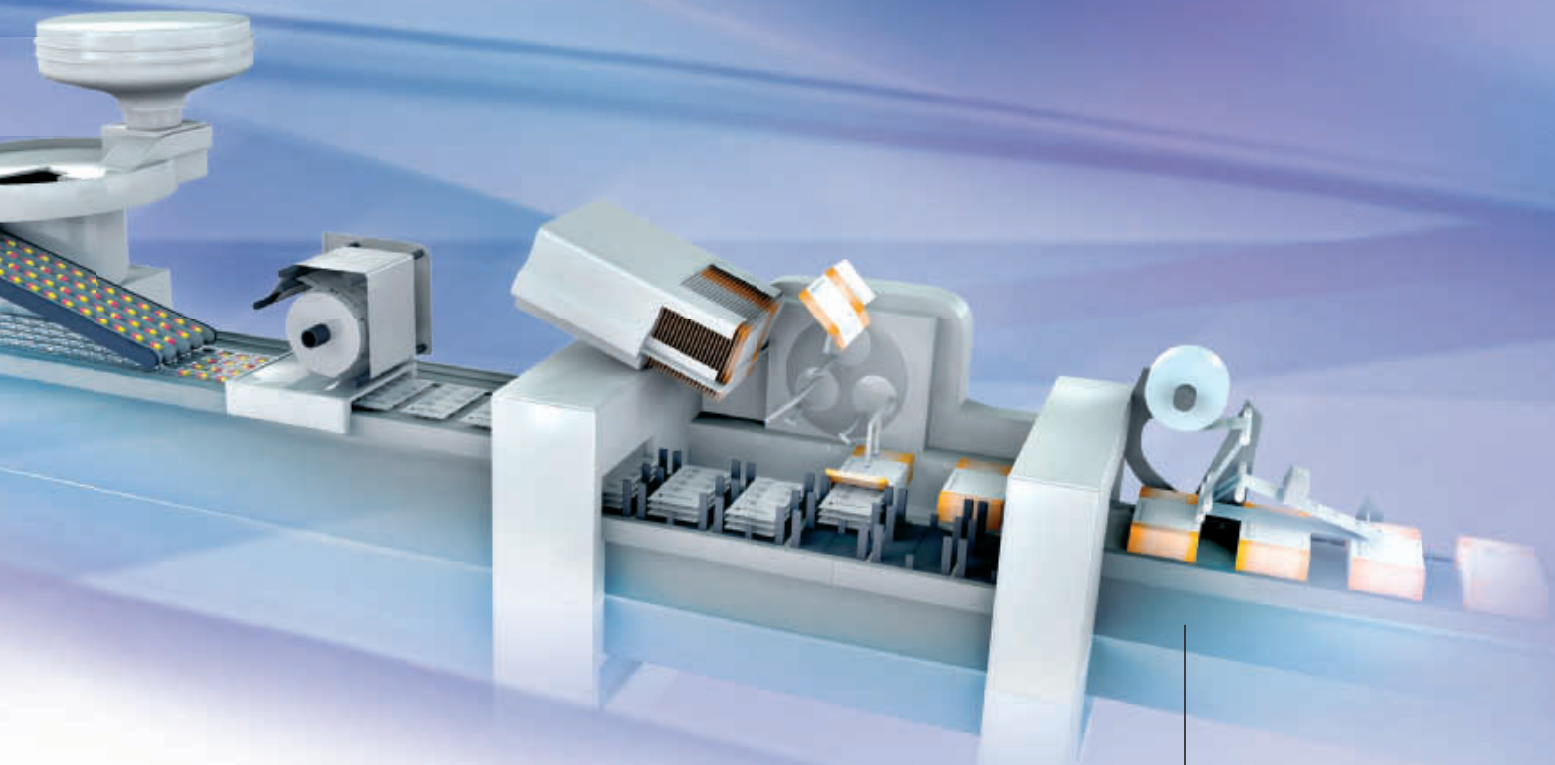


 More on sensors for harsh environments page 24



 More on E3X fiber optic sensors page 46  
More on vision sensors and systems  
in QUALITY CONTROL & INSPECTION GUIDE





## FLEXIBILITY WITH PROVEN SOLUTIONS

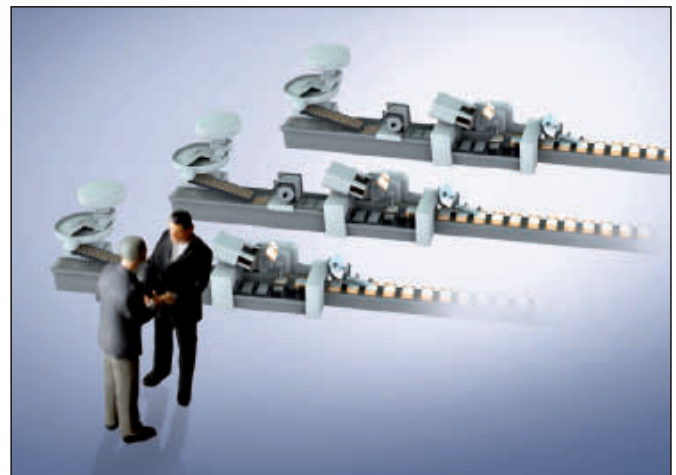
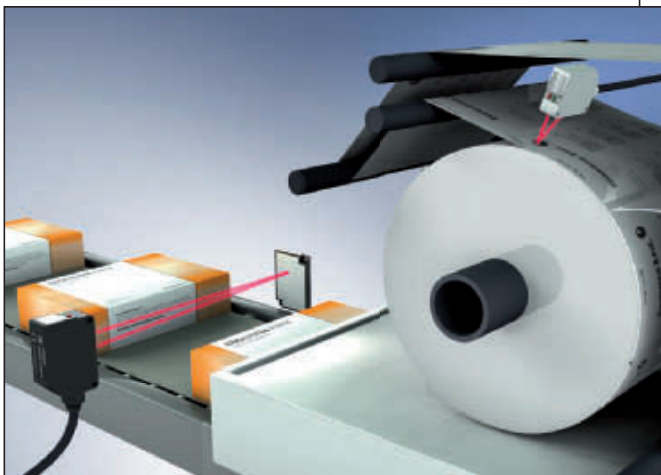
Reducing the effort to adapt machines to special customer or market demands, requires a flexible machine design. A standardized mounting concept simplifies the adaption of the sensor performance to specific application and environmental requirements.

- E3Z platform with a wide range of plastic or stainless steel sensors for standard or special tasks
- E3X fiber platform for high performance sensing, harshest environments and smallest spaces

## CONFORMANCE & BEST PRACTICE SOLUTIONS

Documentation requirements and obtaining approvals for packaging machines in pharmaceutical applications can be time consuming. Re-using proven solutions enhances the acceptance both from legal bodies and pharma producers.

- Close co-operation with leading machine builders and pharma producers to establish best practice solutions



More on E3Z photoelectric sensors page 26  
More on E3X fiber optic sensors page 46

## SENSING IN THE AUTOMOTIVE PARTS INDUSTRY

### Zero defect production

Producing high quality parts to order for the automotive industry requires highest precision and machine availability during production. Error-free identification and inspection assures that all parts are within tolerance requirements.

### MACHINE AVAILABILITY

Avoid malfunctions due to changing ambient light, dust or sensor misalignment.

- Pulse synchronisation for reliable ambient light immunity
- Precision optical alignment and high visibility LEDs compensating for dirt and misalignment

### HARSH ENVIROMENTS

Enhance sensor lifetime and detection reliability in environments with aggressive lubricants or metal chips.

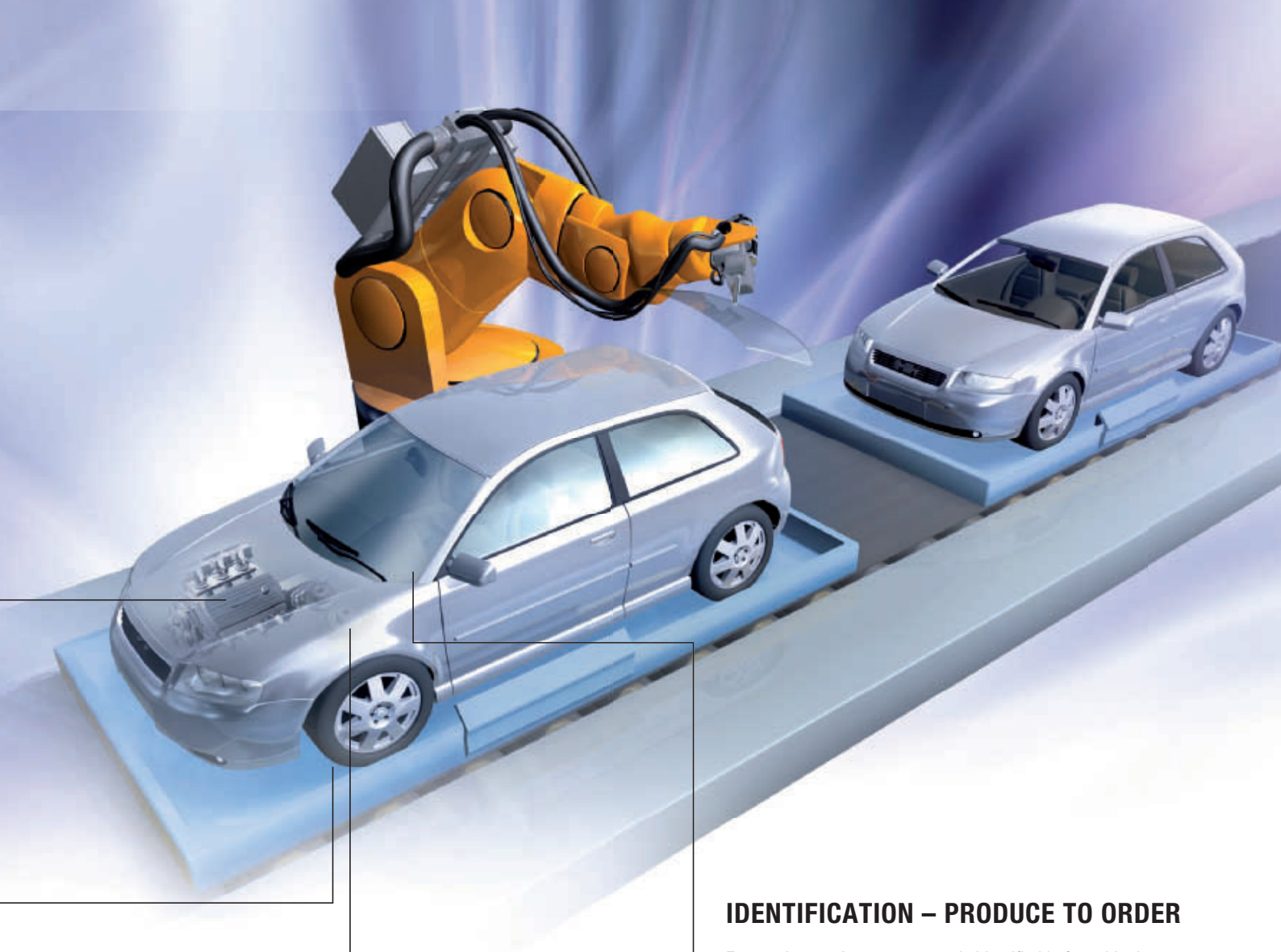
- Tested resistance against oil, welding spatters and mechanical damage



More on E3Z platform page 26, more on E3X platform page 46



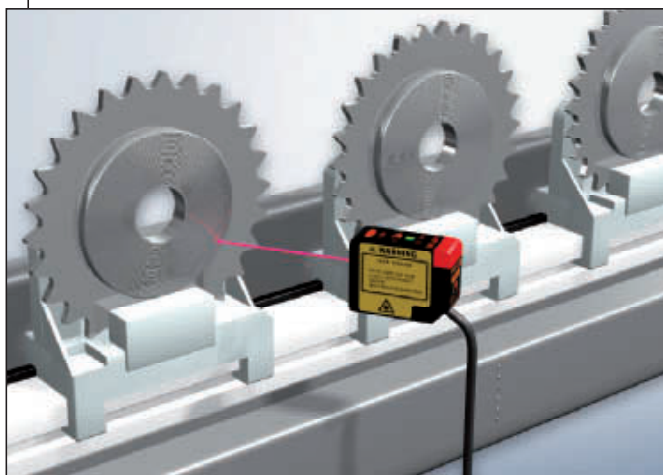
More on sensors for harsh environments page 24



## INSPECTION – QUALITY CONTROL

Verify the presence of product details and ensure that product dimensions are within tolerances.

- High precision laser and inductive sensors for detail presence verification
- High precision measurement systems for dimension tolerance verification



➡ More on E3NC Laser **B289**, **B292**, on E2C-EDA inductive **C433**  
More on measurement systems in **QUALITY CONTROL & INSPECTION GUIDE**

## IDENTIFICATION – PRODUCE TO ORDER

Ensure that products are correctly identified before shipping.

- Colour identification with colour (RGB) ratio comparison sensor
- Advanced colour and shape identification with full colour vision sensors
- Part identification with 2D (datamatrix) code reading



➡ More on colour detection page 38  
More on 2D code readers in **QUALITY CONTROL & INSPECTION GUIDE**



## SENSING IN THE SEMICONDUCTOR, PHOTOVOLTAIC & ELECTRONICS INDUSTRY

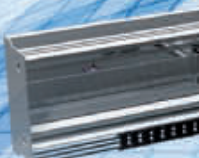
### For small, fast and flexible machines

Continuous miniaturisation and higher performance of electronic components and the ever increasing pressure to increase productivity, result in the demand for small sized, specialised sensors with highest value-performance ratio.

- Wide portfolio of sensors optimized for dedicated applications
- Choose the platform performance you need:

**EE Photomicrosensors** – best value performance ratio and simple mounting for object and machine part detection

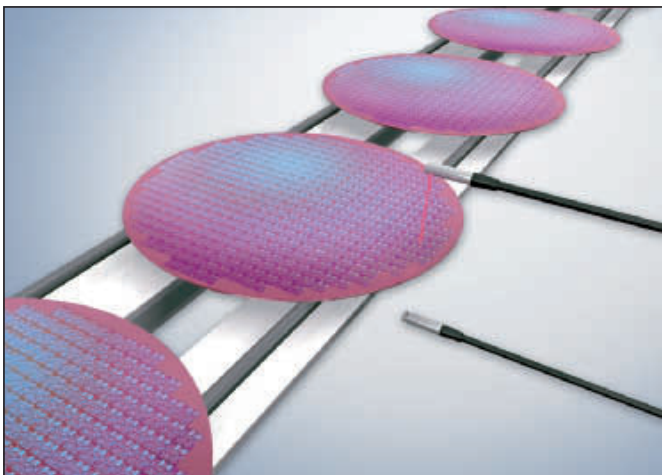
**E32 Fiber Optics** – highest performance in small size for dedicated applications and harsh environments



### HARSH ENVIRONMENTS

The front end processes involve aggressive chemicals and in some cases high temperatures or very low air pressure (vacuum).

- Long sensor lifetime with high chemical, vacuum and temperature resistance

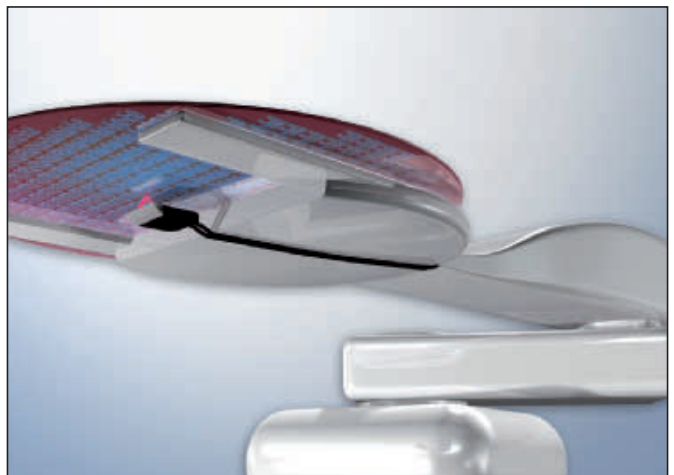


 [More on special environment fibers page 24](#)

### DYNAMIC HANDLING

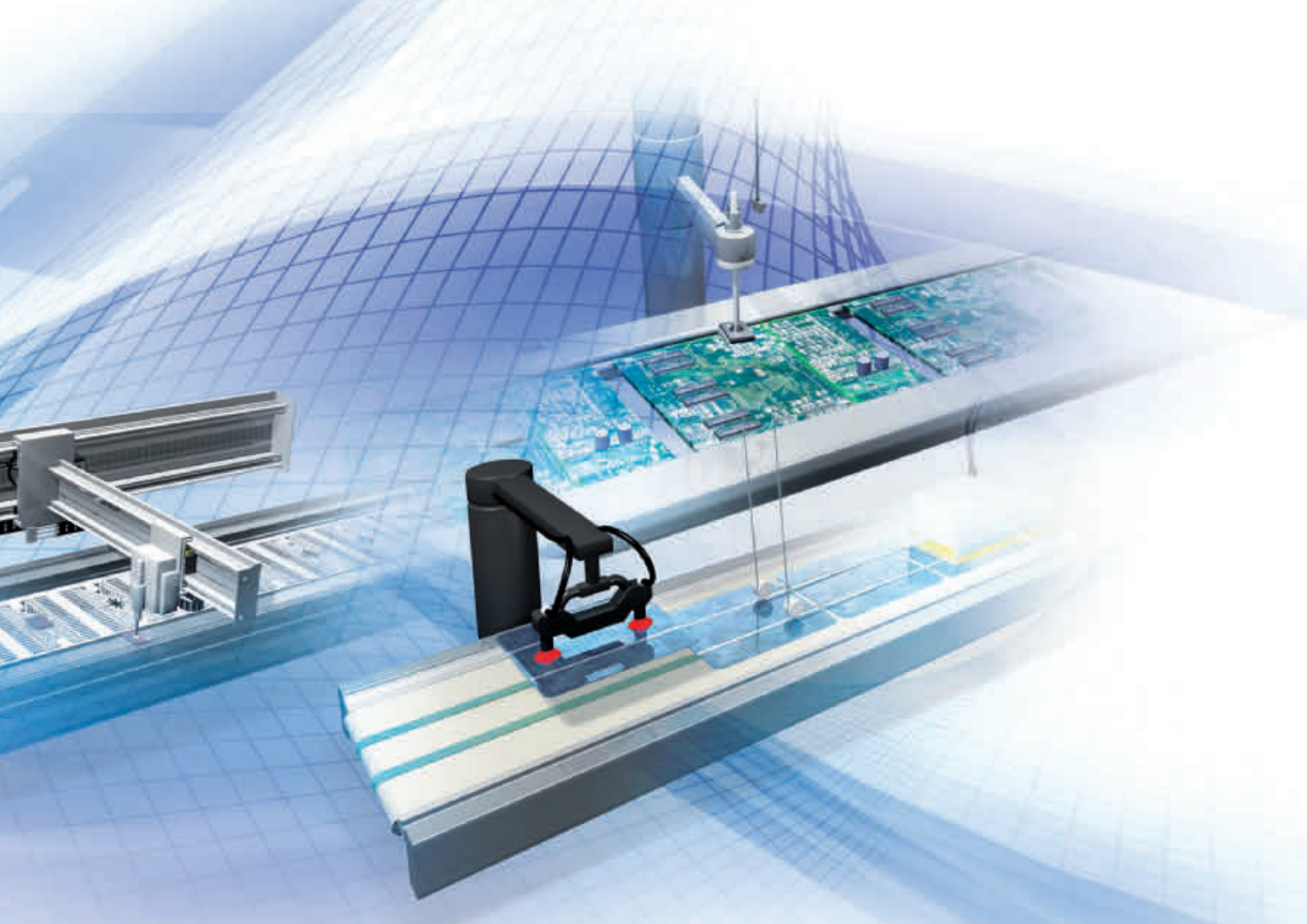
The dynamic handling of wafers with highly reflective surfaces requires small, flexible and accurate sensors.

- High accuracy wafer mapping fibers and limited reflective fibers for stable detection of wafers



 [More on fiber sensors page 46.](#)  
[More on the detection of shiny objects page 22.](#)

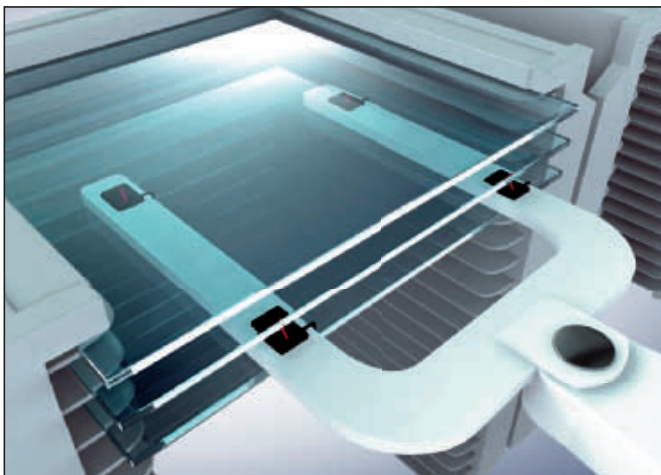




## GLASS POSITIONING AND DETECTION

To handle and stack flat glass plates without breakage requires precise detection and positioning. The transparency of the material, the reflections on the surface and the influence of water drops provide a challenge to standard sensors.

- High precision digital laser sensors for most accurate detection over longer distances
- Special fiber sensors optimised for flat glass detection even in wet processes

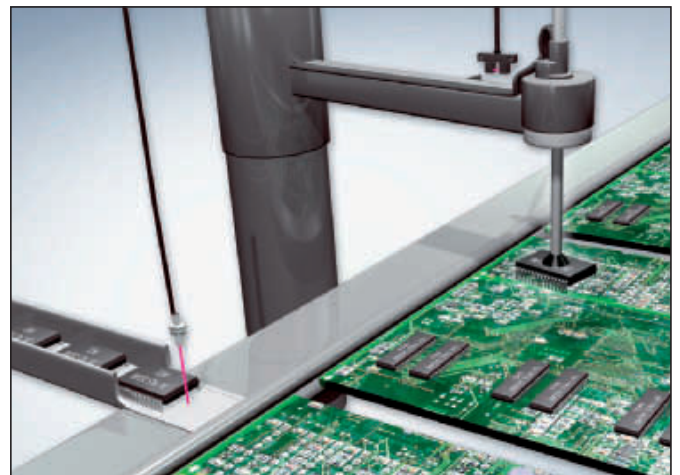


➡ More on glass detection fiber heads page 46  
More on E3C long range laser sensor **C429**

## PRECISION

Chip sizes and assembly machines are continuously becoming smaller.

- Detection of smallest objects (100  $\mu\text{m}$ ) with precision fiber heads
- Easy to mount photomicrosensors for the detection of moving machine parts or linear motors



➡ More on EE photomicrosensors page 26.  
More on E32 precision detection fiber heads **B527**

## DETECTION OF MACHINE PARTS / END POSITIONS

### The reliable and flexible way to stop your machines

For machine part movement detection and for the prevention of machine damage or operator injuries caused by moving machine parts, limit switches are often used.

As a leading global manufacturer for limit switches, Omron provides a large variety of different models fitting varying usage and application requirements.

- Wide range of mechanical actuators or contactless models for varying usage preferences
- Different housing and mounting shapes for regional and usage preferences
- Performance level fitting your application requirements:
  - Best choice in value for money with basic protection for subassemblies
  - High environmental protection and tested long operational lifetime models
  - Best choice for dedicated applications



### MECHANICAL DETECTION

For the detection of machine part end positions, mechanical sensors provide an intuitive and easy to install solution and even high current consumption loads can be switched directly. The high immunity to changing environmental influences ensures a reliable operation in all environments.

- Direct load switching
- Intuitive installation



### CONTACTLESS DETECTION

Mechanical detection can influence the position of smaller objects or damage the surface. For metallic machine parts inductive sensors provide a reliable contactless detection with similar high immunity to most environmental influences. For contactless detection in enclosed machine compartments, the miniature optical photomicrosensors provide very accurate positioning for all materials at best value for money.

- Photomicrosensors for all materials in standard factory environments
- Inductive sensors for metallic machine parts with high environmental resistance

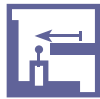


For D4 and WL limit switches see page 58



For EE-SX photomicrosensors see page 26  
For E2 inductive sensors see page 52





limit



size



shape



transparent



shiny



colour



environment



## ENSURING MACHINE SAFETY

To prevent operator injuries from moving machine parts, safety limit switches are often used.

- Mounting compatibility for safe and non-safety applications
- Wide range of safe limit switches, door switches, hinge switches and non-contact switches

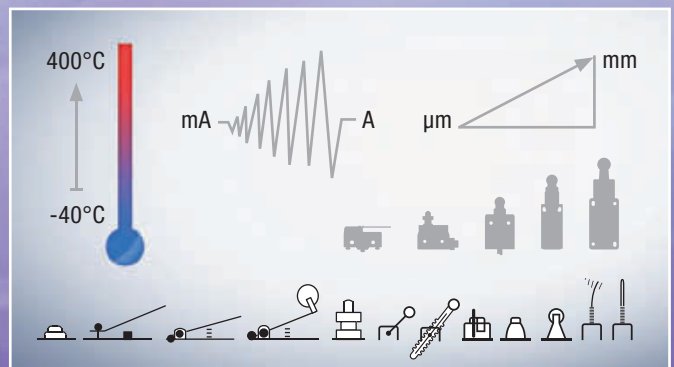


## SPECIAL ENVIRONMENTS OR REQUIREMENTS

For extended temperature ranges, special performance requirements, special mounting shapes (e.g. popular shapes in countries around the world) or a wide range of actuators, Omron provides one of the most comprehensive portfolios.



For safe control systems and safety limit switches see Machine Safety Guide



For an overview of special models see page 58

## DETECTION OF FLAT OBJECTS

### Similar tasks – several solutions

For photoelectric sensors flat objects are often difficult to distinguish from the surface they are lying on. Varying colours of the object or the background can provide a further challenge to standard photoelectric sensors and often require special solutions.

- Simplify your machine design: one platform – one usage concept – one mounting
- Choose the performance you need:

**E3Z platform** – reliability, simplicity and variety

**Remote amplifier platform** – for precise detection when mounting space is limited

### INSTALLATION BETWEEN CONVEYOR SEGMENTS

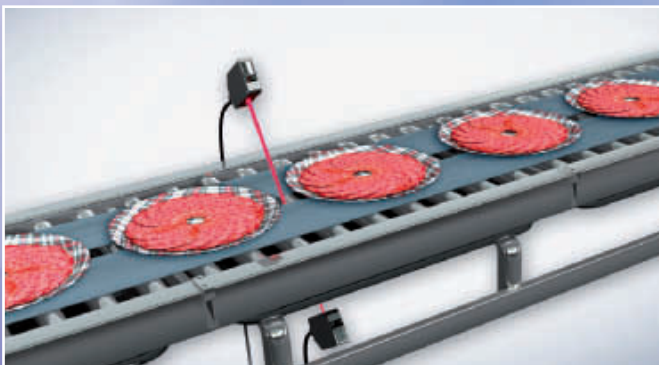
For detecting flat objects on a conveyor system, it is possible to install the sensors to look through the gaps between the conveyor segments. This enables detection of products with a very small profile, although this solution is not always mechanically possible.

- Best value performance ratio with E3Z and E3FA platform
- Flexible mounting in small spaces with E3X platform

### SEVERAL MM THICKNESS

For the detection of flat objects a small and focused beam can be required. To reliably distinguish between the background and the object when detecting from above, the influence of colour and surface finish need to be minimized.

- Focused and thin beam of the E3Z LASER
- Small black / white error of background suppression model E3Z-LL



For E3Z photoelectric sensors page 26  
For E3FA photoelectric sensors page 28  
For E3X remote amplifier platform page 46



For E3Z Laser **B265**





limit



size



shape



transparent



shiny



colour



environment



## DOWN TO 100 µM THICKNESS

For the detection of very small objects or height differences a precise optical and mechanical solution is required. The detection of miniature height differences is often combined with mounting in small spaces.

- Precise triangulation fiber heads for the detection of small height differences (e.g. labels) with limited mounting space
- Coaxial optics of the high performance fiber optic sensor E32-EC41 for the detection of smallest diameters (100 µm)

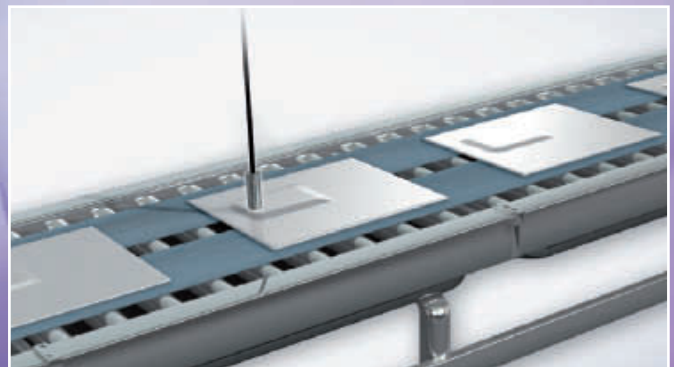
## SMALL HEIGHT DIFFERENCES IN METAL OBJECTS

On shiny metallic surfaces or in dirty environments teachable high precision inductive sensors can be used for the detection of height differences of several 100 µm.

- High repeat accuracy of the E2C high performance inductive sensor heads



For E32 precise detection fiber heads **B527**.  
For even higher precision see measurement platform  
in **QUALITY CONTROL & INSPECTION GUIDE**



For E2C inductive sensor heads see **A233**, for higher  
precision see **ZX-E** in **QUALITY CONTROL & INSPECTION GUIDE**

## TRANSPARENT OBJECTS

### Performance optimised for your application

Transparent objects are usually produced with the goal to provide best visibility of the products they contain. This makes these objects also difficult to detect with optical sensing principles. But photoelectric sensors are still the preferred choice for the detection of transparent objects. Depending on the object characteristics, the variety of the objects that need to be detected and the environmental conditions, different solutions may be required. Omron's platform concept provides flexibility to easily adapt the sensing performance level to the required task.

- Simplify your machine design: one platform – one usage concept – one housing
- Choose the performance you need:
  - ☆ Best choice for standard transparent objects and environments
  - ☆☆ Best choice in reliability, flexibility and stability for standard and challenging environments
  - ☆☆☆ Best performance for dedicated applications

#### STANDARD TRANSPARENT BOTTLE DETECTION

For standard glass or PET bottle detection, retro-reflective solutions with high sensitivity adjustment provide a stable detection as the beam goes through the bottle twice reducing the emitted light. Alternatively a wide beam diffuse-reflective sensor can be used detecting the diffuse reflected light from a large area of the bottle.

- Stable detection for standard objects and environments
- Easy mounting and simple sensitivity adjustment



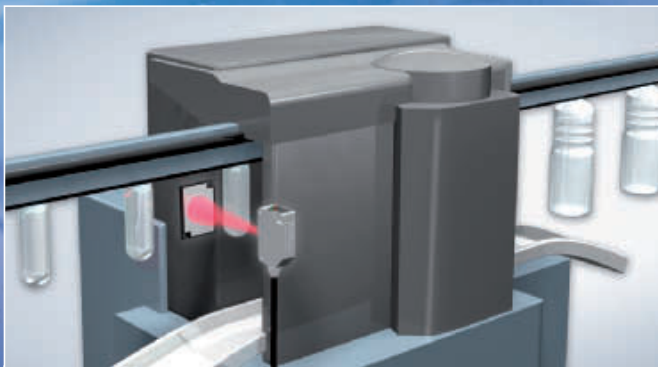
#### ENHANCED DETECTION RELIABILITY FOR PET BOTTLES

Using the polarizing effect of PET bottles, a higher signal margin can be achieved. In combination with compensating for the LED output power to keep the amount of received light stable, the detection stability for PET bottles can be enhanced even in changing conditions.

- P-opaquing function for higher signal margin
- Auto power compensation for enhanced detection stability



➔ More on E3Z-B, E3FA-B, E3ZM-B transparent object sensors page 26



➔ More on E3ZM-B PET optimised models **B266**



limit



size



shape



transparent



shiny



colour



environment



## HIGHEST ACCURACY FOR TRANSPARENT MEDIA

For the precise positioning or detection over longer distances or very challenging objects, full control over the sender beam and signal evaluation is required.

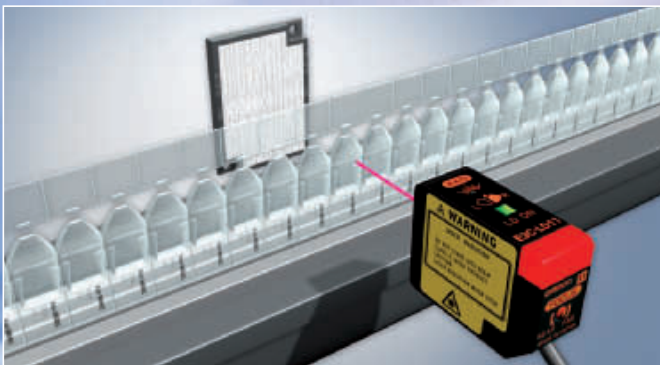
- High precision Laser sensors for accurate and stable detections over longer distances
- Auto-compensation function for long term detection stability



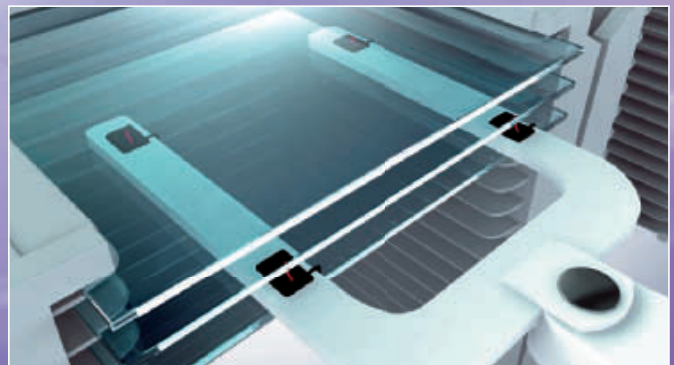
## MOUNTING FLEXIBILITY

The space and mounting conditions for the detection of transparent objects at different points in the production process may vary significantly. With the remote fiber amplifier platform the setting and adjustment of the sensor is always the same while the fiber sensing head is selected according to application and mounting requirements.

- Enhanced design flexibility
- One platform – one usage concept



More on E3C-LDA **C429**  
More on E3NX-FA page 49



More on E32 glass detection fiber sensors see **B529**



## OBJECTS WITH STRUCTURED OR SHINY SURFACES

### Similar tasks – several solutions

Objects with very reflective or structured surfaces can cause unpredictable reflections. This may influence the stable detection of the objects with photoelectric sensors.

In order to realize the stable detection of these objects, several solutions are possible depending on the object and the mounting conditions.

#### THROUGH BEAM SENSORS AND RETRO-REFLECTIVE SOLUTIONS WITH MSR

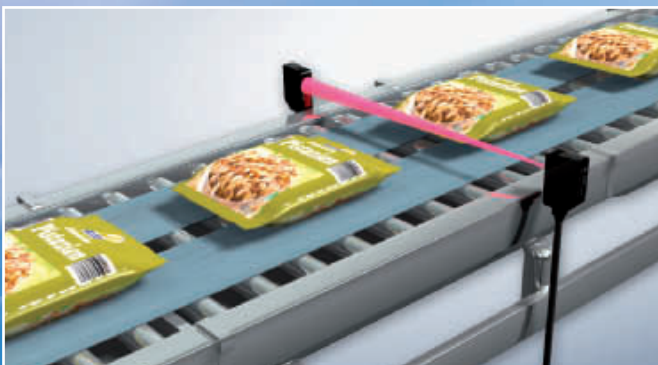
Using a through-beam sensor with a separate sender and receiver is the most reliable solution as the object blocks the emitted light independent of colour or surface.

Retro-reflective sensors work on the same principle but direct reflections from shiny surfaces acting like a reflector need to be compensated for by the mirror surface rejection (M.S.R.) function.

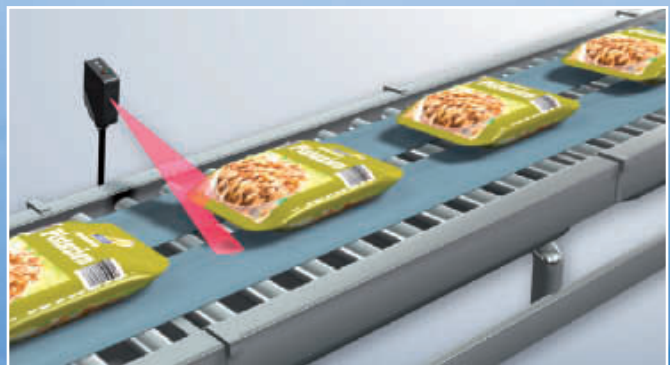
#### DIFFUSE REFLECTIVE WITH BACKGROUND SUPPRESSION

For applications where a separate receiver or a reflector cannot be mounted, different solutions with diffuse reflective sensors with background suppression, wide beams, etc. can be used. Additional constructive measures like mounting at an angle can enhance the detection stability.

- Background suppression sensors with small black /white error for stable detection independent of colour or background
- Wide beam models for stable detection independent of indents and direct reflections



 More information on MSR in technical section page 65



 For application specific solutions please contact your Omron sales representative



limit



size



shape



transparent



shiny



colour



environment



## LIMITED REFLECTIVE

The total reflections on flat objects with very shiny surfaces provide a challenge for standard diffuse reflective models. Limited reflective sensors utilize this effect to provide a stable detection independent of the surface colour.

- Accurate positioning and detection of flat high-reflectivity objects

## ALTERNATIVE TECHNOLOGIES

The effects of shiny and structured objects can be overcome with the usage of alternative technologies like inductive sensors or vision sensors.

- Stable detection of metal objects independent of object surface with inductive sensors
- Stable detection of non-metal objects with tactile/mechanical or capacitive sensors
- Object detection by pattern recognition and inspection at the same time with vision sensors



More on limited reflective fiber sensors **B527**



More on inductive and capacitive sensors page 52  
More on tactile sensors page 58  
More on vision sensors in **QUALITY CONTROL & INSPECTION GUIDE**

## OBJECT DETECTION IN HARSH ENVIRONMENTS

### Enhanced resistance for a longer lifetime

Environmental influences like high temperatures, chemicals, water or electromagnetic noise can reduce the lifetime of sensors or influence the stable operation. For highest reliability and long lifetime, each Omron sensor is designed and tested to withstand conditions exceeding legal requirements and standard industrial environmental conditions.

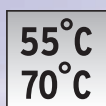
For details about individual tests please contact your Omron representative.

#### HIGH RESISTANCE TESTS FOR STANDARD SENSORS



##### Water, oil and chemical resistance

- Water resistance (details see technical section)
- Salt spray resistance
- Oil resistance



##### Temperature resistance

- High / low continuous temperatures
- Temperature shock (hot/cold air and water)



##### Electromagnetic noise immunity

- Inverter noise
- Mobile communication equipment
- Electrical circuit disturbances
- Electrostatic discharge

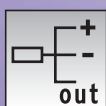


##### Mechanical resistance

- Vibration
- Shock (hammering)



##### Ambient light immunity/mutual interference prevention



##### Protective circuits





limit



size



shape



transparent



shiny



colour



environment

## ENHANCED RESISTANCE SPECIAL TYPES



Enhanced oil resistance

E2E



A222

E2FM



A243

E3ZM-C



B267



Enhanced chemical/  
detergent resistance

E2FQ



A246

E2EH



A244

E3ZM



B223

E3F2-\_-S



B225

E32 Chem.resist.



B523

120°C  
400°C

High temperature

E2EH



A244

E32 Heat resist.



B524

TZ, WL-\_-TH



page 58

e1

Certified higher EMC  
resistance

E2AU



A283



Enhanced mechanical  
resistance

E2FM



A243

10<sup>-10</sup>  
Pa\*m  
s

Vacuum resistance

E32 Vac. resist.



B534

# PHOTOELECTRIC SENSORS

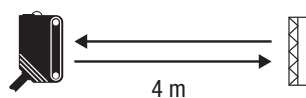
## For machines that Never Stop

Omron's photoelectric sensor range is designed and tested to achieve the maximum levels of reliability and detection performance. Utilising the latest sensor technology, our sensors ensure your machines Never Stop.

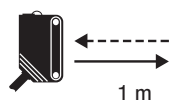
### Through-beam



### Retroreflective (with MSR)



### Diffuse-reflective



### Distance-settable with background suppression



Compact square plastic housing

E3Z

B222



- Highest water resistance



- Highest electromagnetic noise immunity (e.g. from inverters)



- Pulse synchronisation for reliable ambient light immunity

## SPECIAL APPLICATIONS

Precision positioning and detection	Detergent resistant	Oil resistant	Print mark detection	Transparent material detection	Transparent material detection	Transparent material detection
<b>E3Z Laser</b>	<b>E3ZM</b>	<b>E3ZM-C</b>	<b>E3ZM-V</b>	<b>E3ZM-B</b>	<b>E3Z-B</b>	<b>E3F_-B/-V</b>
Small visible light spot	Detergent resistant stainless steel housing	Oil resistant stainless steel housing	Autoteach and white LED	General transparent materials or PET optimised models	General transparent materials optimised optical system	General transparent material optimised optical system
<b>B265</b>	<b>B223</b>	<b>B267</b>	<b>B274</b>	<b>B266</b>	<b>B271</b>	see page 30

miniature housing:

E3T	E3H2 M12, M8	E3T-C M6, M5	E32 fiber optics dia 500 µm to M6
			
<b>B224</b>	<b>B284</b>	<b>B283</b>	see page 46

fork shape:

E3Z-G 25 mm	EE-SPX_03 13 mm	EE-SX 5 mm
		
<b>B268</b>	<b>B428</b>	<b>B423</b>

cylindrical M18 housing:













E3FA/E3FB

see page 28

longer distance:

E3JK	E3G	E3S-CL
		
see page 32	<b>B228</b>	<b>B249</b>

## SPECIAL APPLICATIONS

Detergent resistant	Multi voltage power supply			Structured object detection	High precision detection
					
<b>E3F2-_-S</b>	<b>E3JK</b>	<b>E3JM</b>	<b>E3G-M</b>	<b>E3S-LS3</b>	<b>E3NC-L/E3NC-S</b>
Detergent resistant stainless steel housing 	<ul style="list-style-type: none"> <li>• 24-240 VDC and 24-240 VAC</li> <li>• Relay output</li> </ul> 	models with timer function 	long distance and models with timer function 	Wide beam 	Spot dia min. 0.1 mm 
<b>B225</b>	see page 32	<b>B226</b>	<b>B282</b>	<b>B259</b>	see page 34, 36

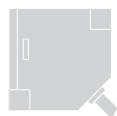




## High performance photoelectric sensor in compact M18 housing

E3FA/E3FB series represents a new generation of OMRON photoelectric sensors with large varieties of reliable and easy-to-use photoelectric sensors. Featuring many standard and special functions this line is addressing many kinds of industries such as packaging, ceramics and material handling.

- Large variety of standard and special types
- High power and visible red LED enabling easy alignment and long sensing distance
- Compact and robust housing for easy integration into machines



Special models



M18 cylindrical



Compact



Miniature



Fork

### Ordering information

#### Straight types

Sensor type	Sensing distance	Connection method				Order code			
						E3FA (plastic housing)		E3FB (metal housing)	
						NPN output	PNP output	NPN output	PNP output
Through-beam 	20 m	—	—	2 m	—	E3FA-TN11 2M	E3FA-TP11 2M	E3FB-TN11 2M	E3FB-TP11 2M
		—	■	—	—	E3FA-TN21	E3FA-TP21	E3FB-TN21	E3FB-TP21
Retro-reflective with MSR <sup>*1</sup> 	0.1 to 4 m (with E39-R1S)	—	—	2 m	—	E3FA-RN11 2M	E3FA-RP11 2M	E3FB-RN11 2M	E3FB-RP11 2M
		—	■	—	—	E3FA-RN21	E3FA-RP21	E3FB-RN21	E3FB-RP21
Coaxial Retro-reflective with MSR <sup>*1</sup> 	0 to 500 mm (with E39-R1S)	—	—	2 m	—	E3FA-RN12 2M	E3FA-RP12 2M	E3FB-RN12 2M	E3FB-RP12 2M
		—	■	—	—	E3FA-RN22	E3FA-RP22	E3FB-RN22	E3FB-RP22
Diffuse-reflective 	100 mm	—	—	2 m	—	E3FA-DN11 2M	E3FA-DP11 2M	E3FB-DN11 2M	E3FB-DP11 2M
		—	■	—	—	E3FA-DN21	E3FA-DP21	E3FB-DN21	E3FB-DP21
	300 mm	—	—	2 m	—	E3FA-DN12 2M	E3FA-DP12 2M	E3FB-DN12 2M	E3FB-DP12 2M
		—	■	—	—	E3FA-DN22	E3FA-DP22	E3FB-DN22	E3FB-DP22
	1 m	—	—	2 m	—	E3FA-DN13 2M	E3FA-DP13 2M	E3FB-DN13 2M	E3FB-DP13 2M
		—	■	—	—	E3FA-DN23	E3FA-DP23	E3FB-DN23	E3FB-DP23
BGS (background suppression) 	100 mm	—	—	2 m	—	E3FA-LN11 2M	E3FA-LP11 2M	E3FB-LN11 2M	E3FB-LP11 2M
		—	■	—	—	E3FA-LN21	E3FA-LP21	E3FB-LN21	E3FB-LP21
	200 mm	—	—	2 m	—	E3FA-LN12 2M	E3FA-LP12 2M	E3FB-LN12 2M	E3FB-LP12 2M
		—	■	—	—	E3FA-LN22	E3FA-LP22	E3FB-LN22	E3FB-LP22

#### Radial types

Sensor type	Sensing distance	Connection method				Order code			
						E3RA (plastic housing)		E3RB (metal housing)	
						NPN output	PNP output	NPN output	PNP output
Through-beam 	15 m	—	—	2 m	—	E3RA-TN11 2M	E3RA-TP11 2M	E3RB-TN11 2M	E3RB-TP11 2M
		—	■	—	—	E3RA-TN21	E3RA-TP21	E3RB-TN21	E3RB-TP21
Retro-reflective with MSR <sup>*1</sup> 	0.1 to 3 m (with E39-R1S)	—	—	2 m	—	E3RA-RN11 2M	E3RA-RP11 2M	E3RB-RN11 2M	E3RB-RP11 2M
		—	■	—	—	E3RA-RN21	E3RA-RP21	E3RB-RN21	E3RB-RP21
Diffuse reflective 	100 mm	—	—	2 m	—	E3RA-DN11 2M	E3RA-DP11 2M	E3RB-DN11 2M	E3RB-DP11 2M
		—	■	—	—	E3RA-DN21	E3RA-DP21	E3RB-DN21	E3RB-DP21
	300 mm	—	—	2 m	—	E3RA-DN12 2M	E3RA-DP12 2M	E3RB-DN12 2M	E3RB-DP12 2M
		—	■	—	—	E3RA-DN22	E3RA-DP22	E3RB-DN22	E3RB-DP22
	700 mm	—	—	2 m	—	E3RA-DN13 2M	E3RA-DP13 2M	E3RB-DN13 2M	E3RB-DP13 2M
		—	■	—	—	E3RA-DN23	E3RA-DP23	E3RB-DN23	E3RB-DP23

<sup>\*1</sup> The Reflector is sold separately. Select the Reflector model most suited to the application.

## Specifications

## Straight type

Model	Sensing method		Through-beam	Retro-reflective	Coaxial Retro-reflective	Diffuse-reflective			BGS (Background suppression)	
	NPN output	Pre-wired	E3F_-TN11 2M	E3F_-RN11 2M	E3F_-RN12 2M	E3F_-DN11 2M	E3F_-DN12 2M	E3F_-DN13 2M	E3F_-LN11 2M	E3F_-LN12 2M
		M12 Connector	E3F_-TN21	E3F_-RN21	E3F_-RN22	E3F_-DN21	E3F_-DN22	E3F_-DN23	E3F_-LN21	E3F_-LN22
	PNP output	Pre-wired	E3F_-TP11 2M	E3F_-RP11 2M	E3F_-RP12 2M	E3F_-DP11 2M	E3F_-DP12 2M	E3F_-DP13 2M	E3F_-LP11 2M	E3F_-LP12 2M
M12 Connector		E3F_-TP21	E3F_-RP21	E3F_-RP22	E3F_-DP21	E3F_-DP22	E3F_-DP23	E3F_-LP21	E3F_-LP22	
Item										
Sensing distance			20 m	0.1 to 4 m	0 to 500 mm	100 mm	300 mm	1 m	100 mm	200 mm
Light source (wavelength)			Red LED (624 nm)							
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)							
Operation mode			Light-ON/Dark-ON selectable by wiring							
Sensitivity adjustment			One-turn adjuster							Fixed
Protection circuits			Reversed power supply polarity protection, Output short-circuit protection and Reversed output polarity protection							
Response time			0.5 ms							
Ambient temperature	Operating		−25 to 55°C							
	Storage		−30 to 70°C (with no icing or condensation)							
Degree of protection			IEC: IP67, DIN 40050-9: IP69K							
Material	Case and Nut		E3FA: ABS, E3FB: Nickel brass							
	Lens and Display		PMMA							
	Adjuster		POM							

## Radial type

Model	Sensing method		Through-beam	Retro-reflective	Diffuse-reflective		
	NPN output	Pre-wired	E3R_-TN11 2M	E3R_-RN11 2M	E3R_-DN11 2M	E3R_-DN12 2M	E3R_-DN13 2M
		M12 Connector	E3R_-TN21	E3R_-RN21	E3R_-DN21	E3R_-DN22	E3R_-DN23
Item	PNP output	Pre-wired	E3R_-TP11 2M	E3R_-RP11 2M	E3R_-DP11 2M	E3R_-DP12 2M	E3R_-DP13 2M
		M12 Connector	E3R_-TP21	E3R_-RP21	E3R_-DP21	E3R_-DP22	E3R_-DP23
Sensing distance			15 m	0.1 to 3 m	100 mm	300 mm	700 mm
Light source (wavelength)			Red LED (624 nm)				
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)				
Operation mode			Light-ON/Dark-ON selectable by wiring				
Sensitivity adjustment			One-turn adjuster				
Protection circuits			Reversed power supply polarity protection, Output short-circuit protection and Reversed output polarity protection				
Response time			0.5 ms				
Ambient temperature	Operating	−25 to 55°C					
	Storage	−30 to 70°C (with no icing or condensation)					
Degree of protection			IEC: IP67, DIN 40050-9: IP69K				
Material	Case and Nut		E3FA: ABS, E3FB: Nickel brass				
	Lens and Display		PMMA				
	Adjuster		POM				



Compact size and shape. Can be installed almost anywhere.



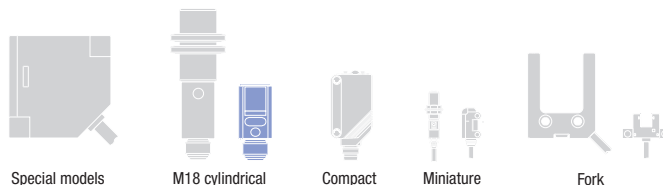
Visible LED light for easy alignment.

## Transparent object detection sensor in compact M18 housing



The E3F\_-B/-V provide enhanced detection stability for the detection of transparent objects. It allows an easy and intuitive adjustment to individual requirements.

- Easy adjustment to individual requirements for all transparent materials
- P-opaquiring technology enables reliable detection of PET bottles also in dusty environments
- Coaxial optics (E3F\_-B\_\_1) for stable, position-independent detection



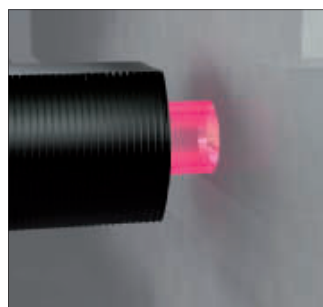
### Ordering Information

Sensor type	Sensing distance	Connection method				Order code			
						E3FA (plastic housing)		E3FB (metal housing)	
						NPN output	PNP output	NPN output	PNP output
Limited distance reflective 	10 to 50 mm	—	—	2 m	—	E3FA-VN11 2M	E3FA-VP11 2M	E3FB-VN11 2M	E3FB-VP11 2M
		—	■	—	—	E3FA-VN21	E3FA-VP21	E3FB-VN21	E3FB-VP21
Coaxial retro-reflective with P-opaquiring function* <sup>1</sup> 	0 to 500 mm (with E39-RP1)	—	—	2 m	—	E3FA-BN11 2M	E3FA-BP11 2M	E3FB-BN11 2M	E3FB-BP11 2M
		—	■	—	—	E3FA-BN21	E3FA-BP21	E3FB-BN21	E3FB-BP21
Retro-reflective with P-opaquiring function* <sup>1</sup> 	0.1 to 2m (with E39-RP1)	—	—	2 m	—	E3FA-BN12 2M	E3FA-BP12 2M	E3FB-BN12 2M	E3FB-BP12 2M
		—	■	—	—	E3FA-BN22	E3FA-BP22	E3FB-BN22	E3FB-BP22

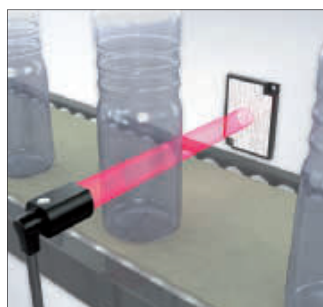
\*<sup>1</sup> The Reflector is sold separately. Select the Reflector model most suited to the application. For PET detection E39-RP1 is recommended for best detection stability.

### Ratings and Specifications

Model	Sensing method		Limited distance reflective	Retro-reflective with P-opaquiring function	
	NPN output	Pre-wired	E3F_-VN11 2M	E3F_-BN11 2M	E3F_-BN12 2M
		M12 Connector	E3F_-VN21	E3F_-BN21	E3F_-BN22
	PNP output	Pre-wired	E3F_-VP11 2M	E3F_-BP11 2M	E3F_-BP12 2M
M12 Connector		E3F_-VP21	E3F_-BP21	E3F_-BP22	
Item					
Sensing distance			10 to 50 mm	0 to 500 mm (coaxial)	0.1 to 2 m
Light source (wavelength)			Red LED (624 nm)		
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)		
Operation mode			Light-ON/Dark-ON selectable by wiring		
Sensitivity adjustment			One-turn adjuster		
Protection circuits			Reversed power supply polarity protection, Output short-circuit protection and Reversed output polarity protection		
Response time			0.5 ms		
Ambient temperature		Operating	-25 to 55°C		
		Storage	-30 to 70°C (with no icing or condensation)		
Degree of protection			IEC: IP67, DIN 40050-9: IP69K		
Material	Case and Nut		E3FA: ABS, E3FB: Nickel brass		
	Lens and Display		PMMA		



Coaxial optics (E3F\_-B) for detection through small holes



Reliable detection of PET bottles by unique p-opaquiring technology



Limited-reflective types suitable for detecting transparent film to shiny, mirror film.



## Standard M18 Photosensor with best price-value ratio

OMRON E3F1 series represents an M18 size Photoelectric sensor with best value at competitive price. It features the same compact housing as E3FA and meets all requirements for standard industrial applications.

- Bright visible red LED enabling easy alignment
- Reliable operation in all industrial environments
- Compact and robust housing for easy integration into machines



Special models



M18 cylindrical



Compact



Miniature



Fork

### Ordering information

Sensor type	Sensing distance	Connection method				Order code	
						NPN output	PNP output
Through-beam 	15 m	—	—	2 m	—	E3F1-TN11 2M <sup>*1</sup>	E3F1-TP11 2M <sup>*1</sup>
		—	■	—	—	E3F1-TN21 <sup>*1</sup>	E3F1-TP21 <sup>*1</sup>
Retro-reflective <sup>*2</sup> 	0.1 to 3 m (with E39-R1S)	—	—	2 m	—	E3F1-RN11 2M	E3F1-RP11 2M
		—	■	—	—	E3F1-RN21	E3F1-RP21
Diffuse-reflective 	100 mm	—	—	2 m	—	E3F1-DN11 2M	E3F1-DP11 2M
		—	■	—	—	E3F1-DN21	E3F1-DP21
	300 mm	—	—	2 m	—	E3F1-DN12 2M	E3F1-DP12 2M
		—	■	—	—	E3F1-DN22	E3F1-DP22

<sup>\*1</sup> Includes the emitter and receiver.

<sup>\*2</sup> The Reflector is sold separately.

### Specifications

Model	Sensing method		Through-beam	Retro-reflective	Diffuse-reflective	
	NPN output	Pre-wired	E3F1-TN11 2M	E3F1-RN11 2M	E3F1-DN11 2M	E3F1-DN12 2M
		M12 Connector	E3F1-TN21	E3F1-RN21	E3F1-DN21	E3F1-DN22
	PNP output	Pre-wired	E3F1-TP11 2M	E3F1-RP11 2M	E3F1-DP11 2M	E3F1-DP12 2M
M12 Connector		E3F1-TP21	E3F1-RP21	E3F1-DP21	E3F1-DP22	
Item						
Sensing distance			15 m	0.1 to 3 m	100 mm	300 mm
Light source (wavelength)			Red LED (624 nm)			
Power supply voltage			10 to 30 VDC (include voltage ripple of 10%(p-p) max.)			
Operation mode			Light-ON/Dark-ON selectable by wiring			
Sensitivity adjustment			One-turn adjuster			
Protection circuits			Reversed power supply polarity protection, Output short-circuit protection and Reversed output polarity protection			
Response time			0.5 ms			
Ambient temperature	Operating	-25 to 55°C				
	Storage	-30 to 70°C (with no icing or condensation)				
Degree of protection			IEC: IP66			
Material	Case	ABS				
	Lens and Display	PMMA				



Compact size and shape. Can be installed almost anywhere.



Visible LED light for easy alignment.



## All voltage photoelectric sensor with long sensing distance

The new generation of square sized E3JK family provides significantly enhanced sensing performance and ease of operation. The family features 24 to 240 VAC power models as well as models with PNP/NPN transistor output.

- High power and visible red LED for all models enabling easy alignment and long sensing distance
- Bright indicator LEDs that are visible even at a large distance
- Best price-value ratio



Special models



M18 cylindrical



Compact



Miniature



Fork

### Ordering information

Sensor type	Sensing distance	Connection method				Order code		
						Relay models (AC/DC)	NPN models	PNP models
Through-beam 	40 m (adjustable)	—	—	2 m	—	E3JK-TR11 2M	E3JK-TN11 2M	E3JK-TP11 2M
Retro-reflective without M.S.R. 	7 m <sup>*1</sup> (adjustable)	—	—	—	—	E3JK-RR11 2M	E3JK-RN11 2M	E3JK-RP11 2M
Retro-reflective with M.S.R. 	6 m <sup>*1</sup> (adjustable)	—	—	—	—	E3JK-RR12 2M	E3JK-RN12 2M	E3JK-RP12 2M
Diffuse-reflective 	2.5 m (adjustable)	—	—	—	—	E3JK-DR11 2M	E3JK-DN11 2M	E3JK-DP11 2M
	300 mm (adjustable)	—	—	—	—	E3JK-DR12 2M	E3JK-DN12 2M	E3JK-DP12 2M

<sup>\*1</sup> Measured with E39-R1S. Please order reflector separately.

### Accessories

Appearance	Description	Order code
	Mounting bracket <sup>*1</sup> (A mounting bracket is not provided with the sensor. Order a mounting bracket separately if required.)	E39-L40

<sup>\*1</sup> When using a through-beam sensor, order one mounting bracket for the receiver and one for the emitter.

### Specifications

#### AC models

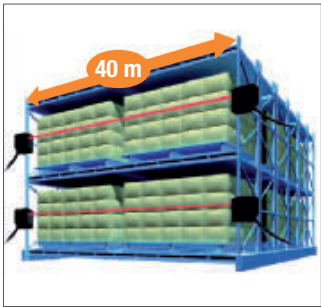
Item	Through-beam	Retro-reflective without M.S.R.	Retro-reflective with M.S.R.	Diffuse-reflective	
	E3JK-TR11	E3JK-RR11	E3JK-RR12	E3JK-DR11	E3JK-DR12
Sensing distance	40 m	7 m	6 m	2.5 m	300 mm
Light source (wave length)	Red LED (624 nm)				
Power supply voltage	24 to 240 VDC $\pm 10\%$ ripple (p-p): 10% max. 24 to 240 VAC $\pm 10\%$ 50/60 Hz				
Control output	Relay output SPDT, 250 VAC, 3 A max. ( $\cos\phi=1$ ), 5 VDC, 10 mA min., Light-ON/Dark-ON selectable				
Response time	20 ms max.				
Sensitivity adjustment	One-turn adjuster				
Ambient temperature	Operating				
	−25 to 55°C				
Storage	Storage				
	−30 to 70°C (with no icing or condensation)				
Degree of protection	IEC60529 IP64				
Material	Case				
	ABS				
Lens	Lens				
	Methacrylics (PMMA)				

DC models

Item	Through-beam		Retro-reflective without M.S.R.	Retro-reflective with M.S.R.	Diffuse-reflective	
	NPN output	E3JK-TN11	E3JK-RN11	E3JK-RN12	E3JK-DN11	E3JK-DN12
	PNP output	E3JK-TP11	E3JK-RP11	E3JK-RP12	E3JK-DP11	E3JK-DP12
Sensing distance		40 m	7 m	6 m	2.5 m	300 mm
Light source (wave length)		Red LED (624 nm)				
Power supply voltage		10 to 30 VDC, including ripple (p-p): 10%				
Control output		Open collector output (NPN/PNP), Load current: 100 mA max., Light-ON/Dark-ON selectable				
Response time		1 ms max.				
Sensitivity adjustment		One-turn adjuster				
Ambient temperature	Operating	−25 to 55°C				
	Storage	−30 to 70°C (with no icing or condensation)				
Degree of protection		IEC60529 IP64				
Material	Case	ABS				
	Lens	Methacrylics (PMMA)				



AC power-supply fits for building installations like industrial doors, elevators or car parks



Long sensing distance up to 40 m

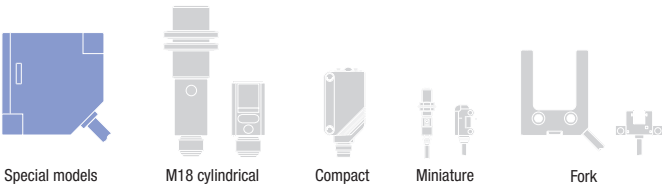




High precision laser sensor with separate amplifier


The separate amplifier laser sensors feature sensing heads with variable spot for highest precision positioning and detection applications.

- Easy installation due to adjustable focus point and smart tuning functions
- Sensor heads up to 1.2m sensing distance covering a wide area of applications
- High speed network connectivity to field busses like EtherCAT



Ordering information

Sensor heads

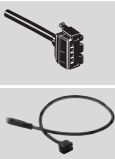
Sensor type	Sensing distance	Remarks	Order code
	1,200 mm	Variable spot (diffuse reflective)	E3NC-LH02 2M
	70±15 mm	Fixed spot (limited reflective)	E3NC-LH01 2M

Amplifier units



Item	Order code			
	pre-wired		with connector <sup>*1</sup>	
	NPN output	PNP output	NPN output	PNP output
2 outputs + 1 input models	E3NC-LA21 2M	E3NC-LA51 2M	—	
1 output + 1 input models	—		E3NC-LA7	E3NC-LA9
Networking model <sup>*2</sup>	E3NC-LA0			

<sup>\*1</sup> order connector (E3X-CN21\_) separately from accessories  
<sup>\*2</sup> for network connection please order networking unit E3NW

Amplifier connectors

Shape	Type	Comment	Order code
	Amplifier connector	2 m PVC cable	E3X-CN21
		30 cm PVC cable with M12 plug connector (4 pin)	E3X-CN21-M1J 0.3M
		30 cm PVC cable with M8 plug connector (4 pin)	E3X-CN21-M3J-2 0.3M

Communication units

Shape	Communications method	Applicable Amplifier Units	Order code
	Sensor communication unit for EtherCAT	E3NX-FA0 E3NC-LA0 E3NC-SA0	E3NW-ECT
	Sensor dispersion (slave) unit		E3NW-DS

## Specifications

## Sensor heads

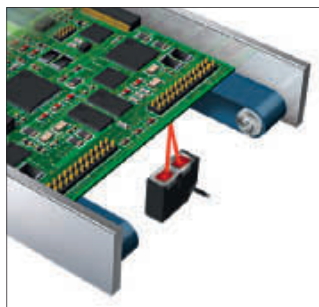
Item	Diffuse-reflective	
	E3NC-LH02	E3NC-LH01
Light source (emission wave length)	Red laser diode (660 nm), 315 µW max. (JIS Class 1, IEC/EN Class 1, and FDA Class 1)	
Sensing distance	Giga-power mode (GIGA): 1,200 mm Standard mode (Std): 750 mm High-speed mode (HS): 250 mm Super-high-speed mode (SHS): 200 mm	70±15 mm
Beam size (typical)	0.8 mm max. (at distances up to 300 mm)	0.1 mm (at 70 mm)
Degree of protection	IEC60529 IP65	

## Amplifier units

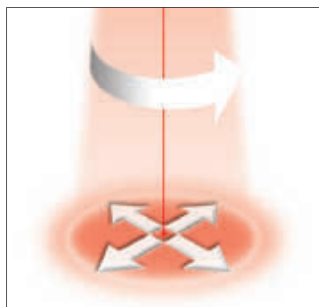
Item		2 output/1 input models		1 output/1 input models	Networking models
		NPN output	E3NC-LA21	E3NC-LA7	E3NC-LA0
		PNP output	E3NC-LA51	E3NC-LA9	
Outputs		2 outputs		1 output	2 outputs
Inputs		1 input			–
Supply voltage		10 to 30 VDC±10%, ripple (p-p) 10% max.			
Response time	Super-high-speed mode	80 μs			
	High-speed mode	250 μs			
	Standard mode	1 ms			
	Giga-power mode	16 ms			
Functions	Smart tuning	2-point tuning, full auto tuning, position tuning, maximum sensitivity tuning, power tuning, or percentage tuning (–99% to 99%)			
	Timer function	Select from timer disabled, OFF-delay, ON-delay, one-shot, or ON-delay + OFF-delay timer: 1 to 9,999 ms			
	Eco mode	Select from OFF (digital displays lit) or ECO (digital displays not lit)			
	Bank switching	Select from banks 1 to 4			
	Dynamic Power Control (DPC)	Provided (automatically controls light intensity and compensates incident level changes)			
Ambient temperature range	Operating	–10 to 55°C			
	Storage	–25 to 70°C (with no icing or condensation)			
Digital display		7-segment displays (sub digital display: green, main digital display: white) Display direction: switchable between normal and reversed			
Degree of protection		IP50 (IEC 60529)			



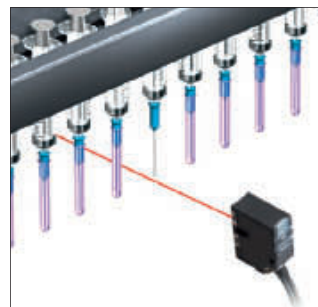
Integration into new N-Smart platform



High precision positioning



Focal point adjustment



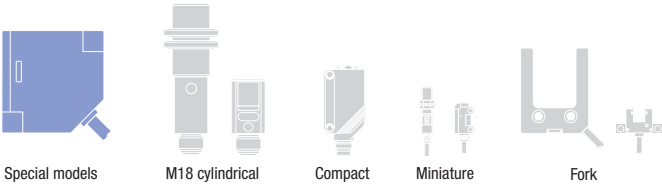
High precision detection over long range



High precision laser CMOS sensor with separate amplifier

The separate amplifier high-precision photoelectric sensors feature advanced CMOS laser sensors for high precision positioning and reliable background suppression.

- High detection stability independent from color or surface structure
- Robust IP67 sensing heads for industrial applications
- Network connectivity to field busses like EtherCAT



Ordering information

Sensor type	Sensing distance	Order code
Diffuse-reflective (distance-settable) 	35–100 mm	E3NC-SH100 2M
	35–250 mm	E3NC-SH250 2M

Amplifier units

Item	Order code			
	pre-wired		with connector <sup>*1</sup>	
	NPN output	PNP output	NPN output	PNP output
2 outputs + 1 input models	E3NC-SA21 2M	E3NC-SA51 2M	—	
1 output + 1 input models	—		E3NC-SA7	E3NC-SA9
Networking model <sup>*2</sup>	E3NC-SA0			

<sup>\*1</sup> order connector (E3X-CN21\_) separately from accessories  
<sup>\*2</sup> for network connection please order networking unit E3NW

Amplifier connectors

Shape	Type	Comment	Order code
	Fiber amplifier connector	2 m PVC cable	E3X-CN21
		30 cm PVC cable with M12 plug connector (4 pin)	E3X-CN21-M1J 0.3M
		30 cm PVC cable with M8 plug connector (4 pin)	E3X-CN21-M3J-2 0.3M

Communication units

Shape	Communications method	Applicable Amplifier Units	Order code
	Sensor communication unit for EtherCAT	E3NX-FA0 E3NC-LA0 E3NC-SA0	E3NW-ECT
	Sensor dispersion (slave) unit		E3NW-DS

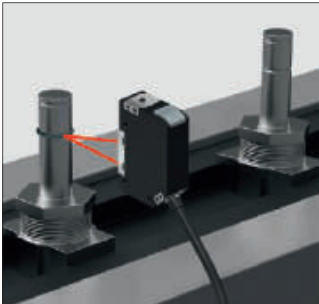


Specifications

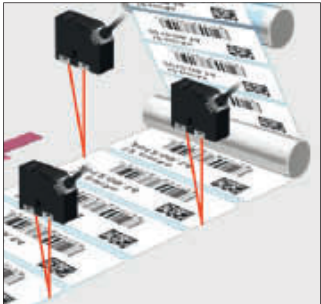
Sensor heads					
Item		Diffuse-reflective (distance-settable)			
		E3NC-SH250		E3NC-SH100	
Light source (emission wave length)		Red laser diode (660 nm), 100 μW max. (JIS Class 1, IEC/EN Class 1, and FDA Class 1)			
Measurement range		35 to 250 mm (display value: 350 to 2,500)		35 to 100 mm (display value: 350 to 1,000)	
Spot diameter		1 mm (at 250 mm)		0.5 mm (at 100 mm)	
Degree of protection		IEC60529 IP67			
Amplifier units					
Item		2 output/1 input models		1 output/1 input models	Networking models
		NPN output	E3NC-SA21	E3NC-SA7	E3NC-SA0
		PNP output	E3NC-SA51	E3NC-SA9	
Outputs		2 outputs		1 output	2 outputs
Inputs		1 input			—
Supply voltage		10 to 30 VDC±10%, ripple (p-p) 10% max.			
Response time	Super-high-speed mode	1.5 ms			
	High-speed mode	5 ms			
	Standard mode	10 ms			
	Giga-power mode	50 ms			
Functions	Smart tuning	2-point tuning, full auto tuning, 1-point tuning, tuning without workpiece, 2-point area tuning, 1-point area tuning, or area tuning without workpiece			
	Timer function	Select from timer disabled, OFF-delay, ON-delay, one-shot, or ON-delay + OFF-delay timer: 1 to 9,999 ms			
	Bank switching	Select from banks 1 to 4			
Ambient temperature range	Operating	−10 to 55°C			
	Storage	−25 to 70°C (with no icing or condensation)			
Digital display		7-segment displays (sub digital display: green, main digital display: white) Display direction: switchable between normal and reversed.			
Degree of protection		IP50 (IEC 60529)			



Integration into new N-Smart platform



Detection of presence of rubber O-Ring



Precise positioning of packaging foil

# MARK SENSORS

## Choose the performance you need

In packaging machines to ensure the correct positioning of packaging material before filling or closing operations, characteristic registration marks or design elements have to be detected. At OMRON we closely work together with leading packaging machine makers to evaluate the requirements for sensors from commonly used packaging material as well as most critical designs or materials. In addition the performance requirements vary according to the overall machine value concept.

- Reliable mark detection even in changing environmental conditions during machine operation
- Fast and easy setup up after packaging material exchange
- Performance levels fitting the machine value concept:

- ☆ Best choice in value for money
- ★★ Best in reliability, flexibility, stability
- ★★★ Best performance for dedicated applications

Standard print mark detection	Challenging designs or colour marks	Complex shape and position detection and synchronized quality inspection.	
			
<p>For print marks most commonly used in the packaging and printing industry, the contrast sensors with white LED have an optimised light intensity and RGB ratio evaluation algorithm ensuring a stable and fast detection.</p> <ul style="list-style-type: none"> <li>• Compact housing concept for high flexibility in machine design</li> <li>• Fast response time of 50 µs</li> </ul>	<p>Objects with complex designs or where the contrast between print mark and background is low, require sensors that allow an easy adaption to the specific requirements of the particular task.</p> <ul style="list-style-type: none"> <li>• Amplifiers with digital value displays and advanced signal evaluation functions for application optimised settings</li> <li>• Wide range of sensing heads fitting the application and distance requirements</li> </ul>	<p>For positioning and machine synchronisation tasks e.g. requiring the recognition of words or symbols, the shape, position detection functionalities of the vision sensors and systems can be set up to provide solutions for the most complex and challenging tasks. The vision systems can also detect the registration mark and perform position and quality inspections at the same time.</p>	
☆	★★	★★★	
			
<b>E3ZM-V</b>	<b>E3X-DAC-S</b>	<b>FQ</b>	<b>Xpectia lite</b>
Autoteach and white LED	White LED, RGB ratio comparison and extended functionality	Simply guided and crystal clear	Performance in touch with simplicity
			
<b>B274</b>	<b>B325</b>	<b>G453</b>	<b>G638</b>

# COLOUR SENSORS

## Choose the performance you need

For the verification of correctly coloured bottle caps or for sorting and classification tasks, the OMRON colour sensors provide a wide performance range from:

- ☆ Easy one or multi colour detection at excellent value for money
- ★★ Colour detection with the flexibility of a vision sensor yet easy to set up and use
- ★★★ Highest colour detection and processing performance with the flexibility and power of a vision system

Application performance level		Output			Tolerance
		Colour detected – digital output	RGB value out (via ethernet)	HSV value out (via ethernet)	
<div>★★★</div> <div></div> <div>Highest performance image processing</div>		<div>Xpectia lite</div> <div></div> <div>G638</div>			Full real colour & image processing flexibility
<div>★★</div> <div></div> <div>Complex colour, shape and position verification (combinations), remotely programmable</div> <div></div> <div>Adjustable inspection area</div>		<div>CLR-V32</div> <div></div> <div>G523</div>	Teachable, auto or manually adjustable tolerance range		
		<div>CLR-V1</div> <div></div> <div>G523</div>			
<div>☆</div> <div></div> <div>Multi Colour Memory</div> <div></div> <div>Single Colour</div>		<div>CLR-X4</div> <div></div> <div>B343</div>	Teachable or auto tolerance range		
		<div>CLR-X1</div> <div></div> <div>B343</div>			



# LIGHTCURTAINS AND AREA SENSORS

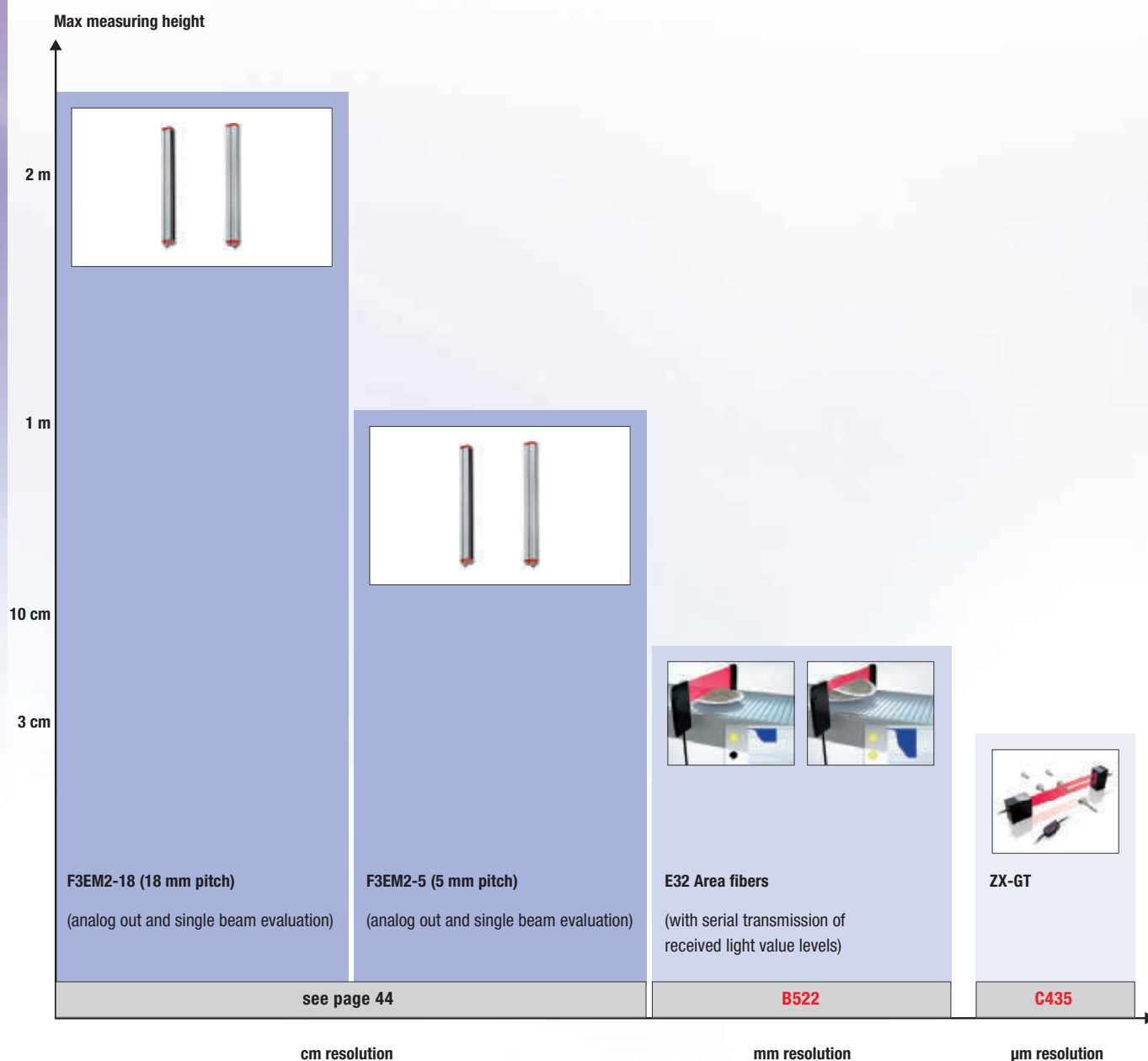
## Choose the accuracy you need

Objects with varying positions or heights or objects with holes can create multiple signals or stay undetected when using single beam sensors. These objects (e.g. parcels, bikes or natural products like ham or fish) are then wrongly classified as multiple smaller items or are not detected correctly.

Detecting these objects over their whole length or acquiring the more detailed object profile can be realized using multiple sensors or light curtains.

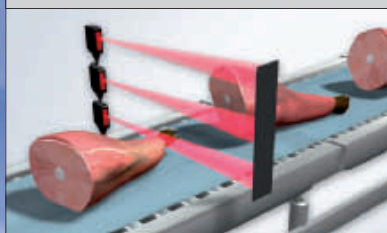
Omron offers a wide range of models with varying max detection heights, different resolutions and with digital, analog or serial outputs to provide the best performance match fitting your application.

## MEASURING LIGHTCURTAINS (ANALOG AND SERIAL I/O)



## LIGHTCURTAINS / AREA MONITORING (DIGITAL I/O)

### Stacking sensors



Mounting two or more sensors next to each other and combining the output signals by an OR-function is a simple way of monitoring an area. To ensure reliable detection mutual interference needs to be prevented.

- Pulse synchronisation function of E3Z platform for mutual interference prevention (R,D and LS types)
- Amplifier timing synchronisation (PLL) of E3X platform (all types)



### Multibeam sensors (lightcurtains)

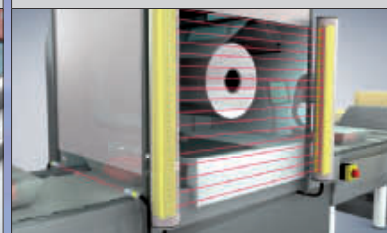


Multibeam sensors consist of several synchronised senders and receivers in one housing for simplified installation and enhanced resolution in the monitored range.

- Wide range of models for different heights from 10 mm up to 2.1 m
- Different pitches from 5 mm to 120 mm
- Slim line or standard housing



### Application specific lightcurtains



The special purpose lightcurtains provide the performance and certifications required for dedicated area monitoring applications like elevators, machine safety, etc.

- Same mounting of safety lightcurtains and F3ET2/F3EM2 for simplified machine design and installation
- Elevator lightcurtain fulfilling EN81-70 in thin F3E housing



						
<b>E3Z</b>	<b>E32-M21</b>	<b>F3ET2</b>	<b>F3E</b>	<b>E32 Area</b>	<b>Safety lightcurtains</b>	<b>Elevator lightcurtains</b>
Mutual interference prevention by frequency modulation	4* M3 heads combined in one fiber 	<ul style="list-style-type: none"> <li>• up to 2.1 m height</li> <li>• 5 to 18 mm pitch</li> </ul>	thin aluminium housing	<ul style="list-style-type: none"> <li>• teachable sensitivity</li> <li>• area beams up to 70 mm height</li> </ul>	type 2, type 4 and dedicated application solutions	Fulfills EN81-70
<b>B222</b>	<b>B522</b>	see page 43	<b>B632</b>	<b>B522</b>	see Machine Safety Guide	<b>B632</b>







## Lightcurtain in robust aluminium housing

The F3ET2 lightcurtains provide a reliable area monitoring in a robust housing. The optical synchronisation between emitter and receiver allow a fast and simple installation without special requirements.

- Optical synchronisation for reliable operation without additional wiring
- Robust aluminium housing
- NPN/PNP and light on/dark on selectable

## Ordering information

Sensor type	Detection area (mm)	Pitch	Sensing distance	Channels	Connection method				Output	Order code <sup>*1</sup>
Through-beam 	150	5 mm	3 m	30	—	5 pin	—	—	PNP/NPN	F3ET2-005-150
		18 mm	15 m	8	—		—	—		F3ET2-018-150
	300	5 mm	3 m	60	—		—	—		F3ET2-005-300
		18 mm	15 m	16	—		—	—		F3ET2-018-300
	450	5 mm	3 m	90	—		—	—		F3ET2-005-450
		18 mm	15 m	24	—		—	—		F3ET2-018-450
	600	5 mm	3 m	120	—		—	—		F3ET2-005-600
		18 mm	15 m	32	—		—	—		F3ET2-018-600
	900	5 mm	3 m	180	—		—	—		F3ET2-005-900
		18 mm	15 m	48	—		—	—		F3ET2-018-900
	1200	5 mm	3 m	240	—		—	—		F3ET2-005-1200
		18 mm	15 m	64	—		—	—		F3ET2-018-1200
	1500	5 mm	3 m	300	—		—	—		F3ET2-005-1500
		18 mm	15 m	80	—		—	—		F3ET2-018-1500
	1800	5 mm	3 m	360	—		—	—		F3ET2-005-1800
		18 mm	15 m	96	—		—	—		F3ET2-018-1800
	2100	18 mm	15 m	112	—		—	—		F3ET2-018-2100

<sup>\*1</sup> Light-ON / Dark-ON selectable

## Connector cables

Type	Features	Material		Order code		
		Nut	Cable	Straight	Angled	
M12	5 wires	CuZn	PVC 2 m	XS2F-M12PVC5S2M	XS2F-M12PVC5A2M	
			PUR 2 m	XS2F-M12PUR5S2M	XS2F-M12PUR5A2M	
			PVC 5 m	XS2F-M12PVC5S5M	XS2F-M12PVC5A5M	
			PUR 5 m	XS2F-M12PUR5S5M	XS2F-M12PUR5A5M	

## Specifications

Item	Through-beam	
	F3ET2-005_	F3ET2-018_
Sensing distance	0 to 3 m	0 to 15 m
Vertical detection area	0 to Max <sub>M</sub> mm; Max <sub>M</sub> : 150, 300, 450, 600, 900, 1200, 1500, 1800 <sup>*1</sup>	0 to Max <sub>M</sub> mm; Max <sub>M</sub> : 150, 300, 450, 600, 900, 1200, 1500, 1800, 2100
Minimum detectable object size	10 mm	30 mm
Pitch	5 mm	18 mm
Response time	4 ms + 80 μs × number of beams	
Light source (wave length)	Infrared LED (880 nm)	
Power supply voltage	24 VDC ±20%	
Operating temperature	−10° to +55°C	
Degree of protection	IEC 60529 IP65	
Material	Case	Aluminium

<sup>\*1</sup> Models with different detection ranges are available in 150 mm intervals. Please contact your OMRON representative.



## Measuring lightcurtain in robust aluminium housing

The F3EM2 provides easy to install and set up height and profile measurement. The analog output provides a simple overall height detection and the serial output models provide single beam evaluation for profile measurements.

- Robust aluminium housing
- Analog output for simple height detections
- Serial output with single beam evaluation for profile measurement
- Various output modes to adapt output data to the given application

### Ordering information

Sensor type	Measurement range (mm)	Pitch <sup>*1</sup>	Sensing distance	Channels	Connection method				Order code	
									RS-232-C Serial/analogue output models <sup>*2</sup>	Analogue output models
Through-beam (measuring) 	150	5 mm	3 m	30	—	M12 8-pin/ M12 5-pin	—	—	F3EM2-005-150	F3EM2-005-150-AV
		18 mm	15 m	8	—		—	—	F3EM2-018-150	F3EM2-018-150-AV
	300	5 mm	3 m	60	—		—	—	F3EM2-005-300	F3EM2-005-300-AV
		18 mm	15 m	16	—		—	—	F3EM2-018-300	F3EM2-018-300-AV
	450	5 mm	3 m	90	—		—	—	F3EM2-005-450	F3EM2-005-450-AV
		18 mm	15 m	24	—		—	—	F3EM2-018-450	F3EM2-018-450-AV
	600	5 mm	3 m	120	—		—	—	F3EM2-005-600	F3EM2-005-600-AV
		18 mm	15 m	32	—		—	—	F3EM2-018-600	F3EM2-018-600-AV
	900	5 mm	3 m	180	—		—	—	F3EM2-005-900	F3EM2-005-900-AV
		18 mm	15 m	48	—		—	—	F3EM2-018-900	F3EM2-018-900-AV
	1200	5 mm	3 m	240	—		—	—	F3EM2-005-1200	F3EM2-005-1200-AV
		18 mm	15 m	64	—		—	—	F3EM2-018-1200	F3EM2-018-1200-AV
	1500	5 mm	3 m	300	—		—	—	F3EM2-005-1500	F3EM2-005-1500-AV
		18 mm	15 m	80	—		—	—	F3EM2-018-1500	F3EM2-018-1500-AV
	1800	5 mm	3 m	360	—		—	—	F3EM2-005-1800	F3EM2-005-1800-AV
		18 mm	15 m	96	—		—	—	F3EM2-018-1800	F3EM2-018-1800-AV
	2100	18 mm	15 m	112	—		—	—	F3EM2-018-2100	F3EM2-018-2100-AV

<sup>\*1</sup> Models with 7.5 mm pitch are available. Contact your OMRON representative.

<sup>\*2</sup> Models with RS-485 serial output are available. Contact your OMRON representative.

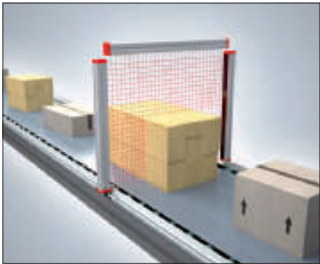
### Connector cables

Type	Features	Material		Order code	
		Nut	Cable	Straight	Angled
M12	8 wires	CuZn	PUR 2 m	Y92E-M12PURSH8S2M-L	
			PUR 5 m	Y92E-M12PURSH8S5M-L	
	5 wires	CuZn	PVC 2 m	XS2F-M12PVC5S2M	XS2F-M12PVC5A2M
			PUR 2 m	XS2F-M12PUR5S2M	XS2F-M12PUR5A2M
			PVC 5 m	XS2F-M12PVC5S5M	XS2F-M12PVC5A5M
			PUR 5 m	XS2F-M12PUR5S5M	XS2F-M12PUR5A5M

Specifications

Item	Through-beam	
	F3EM2-005_	F3EM2-018_
Sensing distance	0 to 3 m	0 to 15 m
Vertical measurement range	0 to Max <sub>M</sub> mm; Max <sub>M</sub> : 150, 300, 450, 600, 900, 1200, 1500, 1800 <sup>*1</sup>	0 to Max <sub>M</sub> mm; Max <sub>M</sub> : 150, 300, 450, 600, 900, 1200, 1500, 1800 <sup>*1</sup>
Minimum detectable object size	10 mm	30 mm
Pitch	5 mm	18 mm
Response time	4 ms + 80 µs × number of beams (+ transmitting time for serial operation)	
Light source (wave length)	Infrared LED (880 nm)	
Power supply voltage	24 VDC ±20%	
Ambient temperature	-10° to +55°C	
Degree of protection	IEC 60529 IP65	
Material	Case	Aluminium

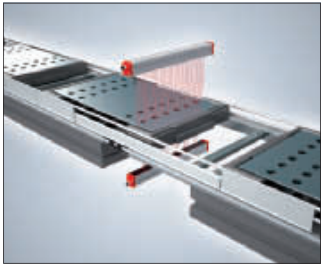
<sup>\*1</sup> Models with different measurement ranges are available in 150 mm intervals. Please contact your OMRON representative.



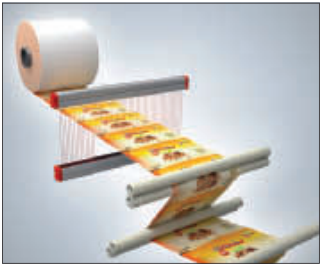
Volume measurement



Profile scan



Hole detection



Position control

# FIBER OPTIC AMPLIFIERS AND SENSORS

## The simplicity of high performance in challenging areas

With the easy one-nut mounting standard fiber sensor heads and the 1-button teaching amplifiers, you can realize reliable and precise detection in seconds in even the smallest spaces.

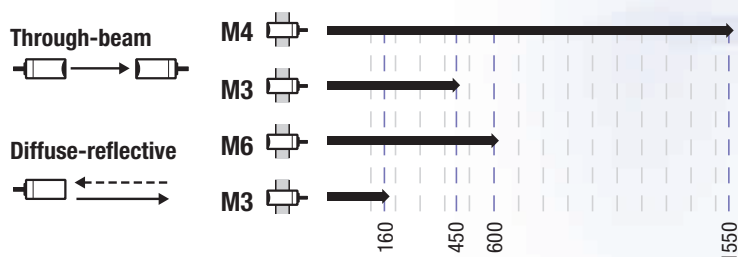
The high resistance to frequent bending, heat, chemicals and/or vacuum of the robotic and environmental resistant fiber sensor heads, provide longest operational lifetime in even the most challenging environments. And for applications requiring a special or the little extra performance or functionality, our extended range of over 500 fiber sensor heads and the high or special functionality amplifiers can provide the best matching solution for your special application.



Standard cylindrical fiber heads

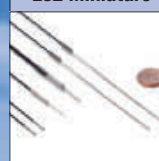
Standard cylindrical	B533
----------------------	------

- Easy installation and long sensor lifetime for all general applications
- High flex fibers and 90° models for fiber breakage prevention



smaller size:

E32 Miniature



B526

square housing:

E32 Square



B532

longer distance:

E32 Longer distance



B525

## SPECIAL APPLICATIONS

Heat, chemical, vacuum resistant	Robotic applications	Area monitoring	Precision detection	Special application
<b>E32 Environm. resistance</b>	<b>E32 Robot</b>	<b>E32 Area monitoring</b>	<b>E32 Precision</b>	<b>E32 Special</b>
Heat resistant up to 400° C	Robot fiber with >1 Mio bending cycles	Area monitoring up to 70 mm width	Coaxial or limited reflective models, up to 100 µm resolution, variable focal lenses or fine beam	Special solutions for the detection of flat glass, wafers, liquid levels, labels, etc.
B523, B524, B534	B528	B522	B527	B529





Easy-teach amplifier with dual or single display

easy potentiometer adjustment:

<b>E3X-HD/E3X-SD</b>	<b>B342/B334</b>
----------------------	------------------

- Easy 1-button teaching
- Auto-teaching during operation
- Auto power control for long term stability

high functionality:



**E3X-NA**

**B328**



**E3NX-FA**

see page 49

#### SPECIAL APPLICATIONS

2 in 1  
double amplifier



**E3X-MDA**

AND or OR signal  
comparison of 2 input  
signals

**B326**

Fast response



**E3X-NA-F**

Short turn on time  
of 20  $\mu$ s

**B339**

Infrared LED



**E3X-DAH-S Infrared**

Infrared LED

**B338**





High-performance digital fiber amplifier

The E3NX-FA amplifier is best choice for most challenging fiber applications in terms of long sensing distance, minute object detection or high speed processes.

- Easy teaching by Smart tuning within a few seconds
- New N-Smart technology provides significant improvement for sensing distance, minimum object detection and speed
- Easy and transparent information about sensor status by Solution Viewer and Change Finder function
- EtherCAT Communication unit for high-speed field bus connectivity

Ordering information

Item	Connection	Inputs/Outputs	Order code	
			NPN output	PNP output
Standard models	Pre-wired	1 output	E3NX-FA11 2M	E3NX-FA41 2M
	Fiber amplifier connector		E3NX-FA6	E3NX-FA8
Advanced models	Pre-wired	2 outputs + 1 input	E3NX-FA21 2M	E3NX-FA51 2M
	Fiber amplifier connector	1 output + 1 input	E3NX-FA7	E3NX-FA9
		2 outputs	E3NX-FA7TW	E3NX-FA9TW
Networking model <sup>*1</sup>	Connector for communication unit	via com. protocol	E3NX-FA0	

<sup>\*1</sup> For field bus connection please chose communication unit E3NW-ECT for EtherCAT.

Fiber amplifier connectors

Shape	Type	Comment	Order code
	Fiber amplifier connector	2 m PVC cable (4 pin)	E3X-CN21
		30 cm PVC cable with M12 plug connector (4 pin)	E3X-CN21-M1J 0.3M
		30 cm PVC cable with M8 plug connector (4 pin)	E3X-CN21-M3J-2 0.3M

Communication units

Shape	Communications method	Applicable Amplifier Units	Order code
	Sensor communication unit for EtherCAT	E3NX-FA0 E3NC-LA0 E3NC-SA0	E3NW-ECT
	Sensor dispersion (slave) unit		E3NW-DS

## Specifications

Item	Type	Standard models		Advanced models			Model for sensor communications unit
	NPN output	E3NX-FA11	E3NX-FA6	E3NX-FA21	E3NX-FA7	E3NX-FA7TW	E3NX-FA0
	PNP output	E3NX-FA41	E3NX-FA8	E3NX-FA51	E3NX-FA9	E3NX-FA9TW	
	Connection method	Pre-wired	Wire-saving connector	Pre-wired	Wire-saving connector		Connector for sensor communications unit
Inputs/outputs	Outputs	1 output		2 outputs	1 output	2 outputs	via com. protocol
	External inputs	—		1 input	1 input	—	
Light source (wavelength)		Red, 4-element LED (625 nm)					
Power supply voltage		10 to 30 VDC, including 10% ripple (p-p)					
Power consumption		At power supply voltage of 24 VDC Standard model or model for sensor communications unit: Normal mode: 960 mW max. (current consumption: 40 mA max.), Power saving eco mode: 840 mW max. (current consumption: 35 mA max.) Advanced model: Normal mode: 1,080 mW max. (current consumption: 45 mA max.), Power saving eco mode: 930 mW max. (current consumption: 40 mA max.)					
Control output		Load power supply voltage: 30 VDC max., open-collector output Load current: groups of 1 to 3 amplifiers: 100 mA max., groups of 4 to 30 amplifiers: 20 mA max. Residual voltage:   at load current of less than 10 mA: 1 V max. at load current of 10 to 100 mA: 2 V max. OFF current: 0.1 mA max.					—
Response time	Super-high-speed Mode (SHS) <sup>*1</sup>	Operate or reset for model with 1 output: 30 μs, with 2 outputs: 32 μs					
	High-speed Mode (HS)	Operate or reset: 250 μs					
	Standard Mode (Std)	Operate or reset: 1 ms					
	Giga-power Mode (GiGA)	Operate or reset: 16 ms					
No. of units for mutual interference prevention	Super-high-speed Mode (SHS) <sup>*1</sup>	0					
	High-speed Mode (HS)	10					
	Standard Mode (Std)	10					
	Giga-power Mode (GiGA)	10					
Functions		Auto power control (APC), dynamic power control (DPC), timer, zero reset, resetting settings, eco mode, bank switching, power tuning, and hysteresis width					
Maximum connectable units		30					

<sup>\*1</sup> The mutual interference prevention function is disabled if the detection mode is set to super-high-speed mode.



## Easy One-Button-Teaching/Smart Tuning



## Automatic setting of optimum values

Threshold + Incident level

5000 9999

Set to the intermediate value between the incident levels with and without a workpiece.

Incident level adjustment with and without a workpiece

Dynamic range increased by a factor of 40,000

Easy setting of optimum power and threshold by pushing tune button twice.

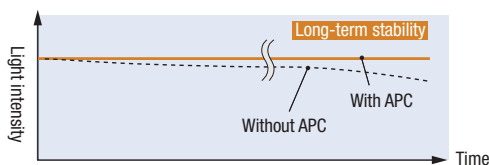
## Smart power control

Smart Power Control

## APC

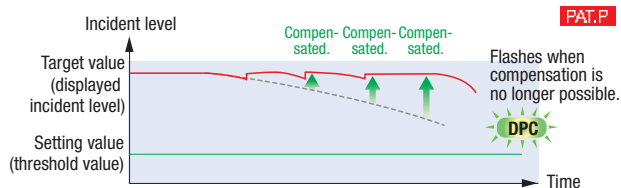
Always ON

(AUTO POWER CONTROL)  
Automatically compensate light intensity



## DPC

(DYNAMIC POWER CONTROL)  
Automatically compensate incident level



Enhanced signal stability control for compensating power reductions caused by temperature drift, dust or aging of LED. Alarm output added for predictive maintenance.

## N-Smart platform

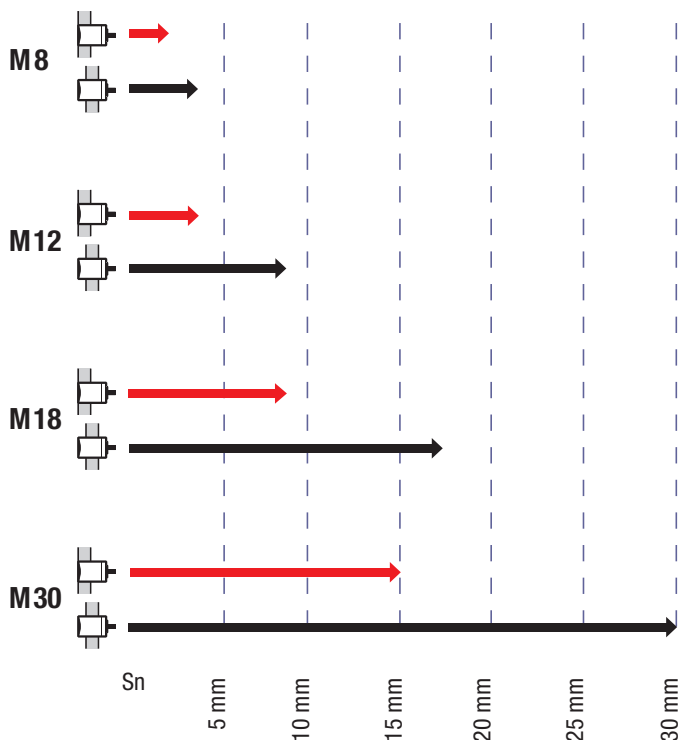


The N-Smart platform provides wide portfolio of advanced sensors – all with the same intuitive operation concept and field bus connectivity.

# INDUCTIVE SENSORS

## For machines that Never Stop

Our inductive sensors are designed and tested to ensure a long service life and achieve maximum machine availability even in the harshest environments.



Cylindrical brass housing, DC 3-wire

E2A	A272
-----	------



• Highest water resistance



• Highest electromagnetic noise immunity (e.g. from inverters)

• Wide temperature range -40°C to 70°C



• 200mA max load current

• Wide connection range

### SPECIAL APPLICATIONS

DC 2-wire / DC 4-wire	Stainless steel housing	Detergent resistant	Chemical resistant	e1 certified
<b>E2A DC 2 wire</b>	<b>E2A-S</b>	<b>E2EH</b>	<b>E2FQ</b>	<b>E2AU</b>
<ul style="list-style-type: none"> <li>Cable breakage detection</li> <li>Stock reduction for spare parts</li> </ul>	Stainless steel housing (SUS 303)	High grade stainless steel housing (SUS 316L)	Fluoro plastic (PTFE) housing	30 V/m electromagnetic noise immunity certified
<b>A282</b>	<b>A278</b>	<b>A244</b>	<b>A246</b>	<b>A283</b>

Lite series:

E2B



see page 55

miniature housing:

E2EC



A226

μPROX E2E



see page 57

E2S



A234

compact square housing:

TL-W



A227

longer distance:

E2Q5



A229

E2A3



A274

#### SPECIAL APPLICATIONS

Enhanced  
oil resistance



E2E-\_U

Tested oil resistance  
on commonly used  
lubricants



A285

Full metal housing



E2FM

- Metal sensing face
- Compensates for  
metal chip deposits



A243

Precision  
Positioning



E2C-EDA

Typically several  
hundred μm  
detection precision

C433

All material  
detection



E2K-C

Capacitive detection  
up to 25 mm  
distance

A324







## The ideal solution for standard industrial conditions

Thanks to the simple construction and Omron's innovative "hot melt" production process, the E2B sensors embody two characteristics: value-for-money and high reliability.

- All-round-visible indicator
- The laser printed part number
- Vibration shock resistance: IEC 60947-5-2 (10 to 55 Hz)
- Operating temperature: -25°C to 70°C
- Water resistance: IP67

## Ordering information

### Pre-wired

Size			Sensing distance	Output configuration	Order code (for pre-wired types with 2 m PVC cable)	
					Operation mode NO	Operation mode NC
M8	■	—	2.0 mm	PNP <sup>*1</sup>	E2B-S08KS02-WP-B1 2M <sup>*2</sup>	E2B-S08KS02-WP-B2 2M <sup>*2</sup>
	—	■	4.0 mm	PNP <sup>*1</sup>	E2B-S08KN04-WP-B1 2M <sup>*2</sup>	E2B-S08KN04-WP-B2 2M <sup>*2</sup>
M12	■	—	4.0 mm	PNP <sup>*1</sup>	E2B-M12KS04-WP-B1 2M	E2B-M12KS04-WP-B2 2M
	—	■	8.0 mm	PNP <sup>*1</sup>	E2B-M12KN08-WP-B1 2M	E2B-M12KN08-WP-B2 2M
M18	■	—	8.0 mm	PNP <sup>*1</sup>	E2B-M18KS08-WP-B1 2M	E2B-M18KS08-WP-B2 2M
	—	■	16.0 mm	PNP <sup>*1</sup>	E2B-M18KN16-WP-B1 2M	E2B-M18KN16-WP-B2 2M
M30	■	—	15.0 mm	PNP <sup>*1</sup>	E2B-M30KS15-WP-B1 2M	E2B-M30KS15-WP-B2 2M
	—	■	30.0 mm	PNP <sup>*1</sup>	E2B-M30LN30-WP-B1 2M	E2B-M30LN30-WP-B2 2M

### Connector types

Size			Sensing distance	Output configuration	Order code	
					Operation mode NO	Operation mode NC
M8	■	—	2.0 mm	PNP <sup>*1</sup>	E2B-S08KS02-MC-B1 <sup>*2</sup>	E2B-S08KS02-MC-B2 <sup>*2</sup>
	—	■	4.0 mm	PNP <sup>*1</sup>	E2B-S08KN04-MC-B1 <sup>*2</sup>	E2B-S08KN04-MC-B2 <sup>*2</sup>
M12	■	—	4.0 mm	PNP <sup>*1</sup>	E2B-M12KS04-M1-B1	E2B-M12KS04-M1-B2
	—	■	8.0 mm	PNP <sup>*1</sup>	E2B-M12KN08-M1-B1	E2B-M12KN08-M1-B2
M18	■	—	8.0 mm	PNP <sup>*1</sup>	E2B-M18KS08-M1-B1	E2B-M18KS08-M1-B2
	—	■	16.0 mm	PNP <sup>*1</sup>	E2B-M18KN16-M1-B1	E2B-M18KN16-M1-B2
M30	■	—	15.0 mm	PNP <sup>*1</sup>	E2B-M30KS15-M1-B1	E2B-M30KS15-M1-B2
	—	■	30.0 mm	PNP <sup>*1</sup>	E2A-M30LN30-M1-B1	E2B-M30LN30-M1-B2

<sup>\*1</sup> NPN models are available. For ordering replace '-B1' or '-B2' by '-C1' or '-C2'.

<sup>\*2</sup> M8 sized housings are only available in stainless steel (SUS 303).

### Optional features

Refer to complete datasheet or contact your OMRON representative for the below optional features

#### Sensing module and body

- single sensing distance (ideal for compatibility with previous machine generations)
- Long body (ideal for mounting through thicker constructions)

#### Connection

- M8 3-pin -MC e.g. E2B-S08KS02-MC-B1

#### Output

- 200 mA max. load current

Specifications

(Exemplary for shielded versions.)

Item		M8	M12	M18	M30
		E2B-S08KS	E2B-M12KS	E2B-M18KS	E2B-M30KS
Sensing distance		2 mm ±10%	4 mm ±10%	8 mm±10%	15 mm±10%
Response frequency		1,500 Hz	1,000 Hz	500 Hz	250 Hz
Power supply voltage (operating voltage)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)			
Protective circuits		Output reverse polarity protection, Power source circuit reverse polarity protection			
Ambient temperature	Operating and storage	-25°C to 70°C			
Degree of protection		IP67 after IEC 60529			
Material	Case	Stainless steel	Brass-nickel plated		
	Sensing surface	PBT			



High-visibility ring LED indicator



Laser printing part number

















## Small diameter proximity sensors for high precision detection

Omron's latest inductive technology has now been applied to a new range of small diameter inductive sensors. The new μPROX E2E provides precision detection and allows installation in even the most confined spaces. The portfolio has been extended to include non-shielded types and versions with pig-tail connector leads.

- Miniature size: 3, 4, 6.5 mm and M4, M5 diameters
- High frequency of 5 kHz: suitable for high-speed counting
- All sizes are also available as non-shielded types
- IP67 water ingress protection
- Highly visible indicators for easy operation confirmation

### Ordering information

Size			Sensing distance	Connection	Output configuration	Order code	
						Operation mode NO	Operation mode NC
dia 3 mm			0.8 mm	PW	PNP	E2E-C03SR8-WC-B1 2M OMS	E2E-C03SR8-WC-B2 2M OMS
			2 mm	PW	NPN	E2E-C03SR8-WC-C1 2M OMS	E2E-C03SR8-WC-C2 2M OMS
						E2E-C03N02-WC-B1 2M OMS	E2E-C03N02-WC-B2 2M OMS
M4			0.8 mm	PW	PNP	E2E-S04SR8-WC-B1 2M OMS	E2E-S04SR8-WC-B2 2M OMS
			2 mm	PW	NPN	E2E-S04SR8-WC-C1 2M OMS	E2E-S04SR8-WC-C2 2M OMS
						E2E-S04N02-WC-B1 2M OMS	E2E-S04N02-WC-B2 2M OMS
dia 4 mm			1.2 mm	PW	PNP	E2E-C04S12-WC-B1 2M OMS	E2E-C04S12-WC-B2 2M OMS
			3 mm	PW	NPN	E2E-C04S12-WC-C1 2M OMS	E2E-C04S12-WC-C2 2M OMS
						E2E-C04N03-WC-B1 2M OMS	E2E-C04N03-WC-B2 2M OMS
M5			1.2 mm	PW	PNP	E2E-S05S12-WC-B1 2M OMS	E2E-S05S12-WC-B2 2M OMS
			3 mm	PW	NPN	E2E-S05S12-WC-C1 2M OMS	E2E-S05S12-WC-C2 2M OMS
						E2E-S05N03-WC-B1 2M OMS	E2E-S05N03-WC-B2 2M OMS
dia 6.5 mm			2 mm	PW	PNP	E2E-C06S02-WC-B1 2M OMS	E2E-C06S02-WC-B2 2M OMS
					NPN	E2E-C06S02-WC-C1 2M OMS	E2E-C06S02-WC-C2 2M OMS
				M8(3P)	PNP	E2E-C06S02-MC-B1 OMS	E2E-C06S02-MC-B2 OMS
			4 mm		NPN	E2E-C06S02-MC-C1 OMS	E2E-C06S02-MC-C2 OMS
				PW	PNP	E2E-C06N04-WC-B1 2M OMS	E2E-C06N04-WC-B2 2M OMS
				M8(3P)	NPN	E2E-C06N04-WC-C1 2M OMS	E2E-C06N04-WC-C2 2M OMS
						E2E-C06N04-MC-B1 OMS	E2E-C06N04-MC-B2 OMS
						E2E-C06N04-MC-C1 OMS	E2E-C06N04-MC-C2 OMS

### Specifications

Item	Φ3/M4		Φ4/M5		Φ6.5	
	E2E-C03S/-S04S	E2E-C03N/-S04N	E2E-C04S/-S05S	E2E-C04N/-S05N	E2E-C06S	E2E-C06N
Sensing distance	0.8 mm ±10%	2.0 mm ±10%	1.2 mm ±10%	3.0 mm ±10%	2.0 mm ±10%	4 mm ±10.%
Setting distance	0~0.56mm	0~1.4mm	0~0.84mm	0~2.1mm	0~1.4mm	0~2.8mm
Response frequency	5 kHz	3 kHz	4 kHz	2 kHz	3 kHz	4 kHz
Supply voltage	10~30 VDC					
Current consumption	≤10 mA					
Max. control output	≤50 mA		≤100 mA		≤200 mA	
Residual output voltage	≤2 V					
Ambient temperature range	-25°C~70°C					
Ambient temperature fluctuation	≤15%					
Degree of protection	IEC 60529 IP67					
Material	Case	Stainless steel (SUS303)				
	Sensing surface	Heat-resistant ABS				

# LIMIT SWITCHES / MECHANICAL SENSORS

## The reliable and flexible way to stop your machines

For the detection of machine part movement especially for the detection of end positions, the mechanical and optical limit switches provide accurate and reliable operation with a large variety of actuation possibilities optimized for a widest range of application and usage requirements. The easy positioning and intuitive installation, the high immunity to changing environmental influences (electromagnetic fields, sunlight, temperatures, etc.) as well as the possibility to directly switch loads with up to 15 A make these sensors ideal for a wide range of conveying and handling applications.





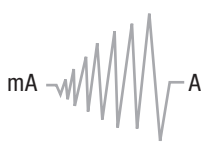



D4N Limit switch

S238

- Wide range of actuators (plunger, lever)
- One family suitable for standard and safety applications (direct opening mechanism and TÜV approved)
- M12 connector or terminal block with M20 conduit
- Up to 10 A switching capacity
- Plastic housing
- IP67
- -30° to 70°C operating temperature range

### SPECIAL MODELS

Extended temperature range	Ultra long mechanical life	High precision multi direction detection	Highest precision tactile measurement	Electrical load variations	Extended safety limit switch range
					
<b>WL-_-T, TZ, D4B</b>	<b>D4B-_1, WLM</b>	<b>D5B</b>	<b>ZX-T</b>	<b>X, D4E, ZC, D4C, Z</b>	<b>D4 Safety</b>
Models from -40° up to 400°C	up to 30 Mio mechanical operations guaranteed	<ul style="list-style-type: none"> <li>• X, Y, Z action</li> <li>• Several µm switching accuracy</li> <li>• M5, M8, M10 sizes</li> </ul>	Measurement resolution up to 0.1 µm	<ul style="list-style-type: none"> <li>• Microloads (1 mA - 100 mA)</li> <li>• High current at high voltage switching (10 A at 125 VDC)</li> <li>• Double circuit switching</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanical form lock</li> <li>• Manual reset</li> <li>• Door hinge switches</li> </ul>
<b>L855</b>	<b>L852</b>	<b>L833</b>	<b>C428</b>	<b>L856</b>	<b>see Machine Safety Guide</b>



Cost efficient basic housing for subassemblies:

Z



L862

Compact metal housing:

D4C



L824

ZC



L834

Metal housing:

D4B



L833

#### SPECIAL MODELS

Mounting shape and pitch variations



WL, HL, D4MC, etc.

- mounting shapes and pitches popular in different countries in the world
- mounting pitch variations (base mounting, diagonal pitches,...)
- alternative actuator positions

L853

Connection and wiring variations



D4E, SHL, WL

- Screw conduit variations (PG13.5, G1/2, 1/2"14NPT)
- Cable exit variations (pigtailed, rubber snap on covers, screw on covers, with or without cable breakage protection for different cable diameters)

L854

# ROTARY ENCODERS

## For machines that Never Stop

The accurate coordination of object and machine part movement is mandatory for the production of high quality products. The high signal repeat accuracy of our incremental and absolute encoders ensures reliable detection of machine part movement.



Incremental encoder in compact housing

**E6C2-C, E6C3-C**

**F527**

- Dia 50 mm housing
- 5000 rpm max rotation frequency
- Resolution range from 10 to 3600 pulses / rotation

smaller size:

enhanced mechanical resistance:

higher rotation frequency:

**E6A2-C**



**F525**

**E6B2-C**



**F526**

**E6F-C**



**F529**

**E6H-C**



**M429**



Absolute encoder in compact housing

E6C3-A	F522
<ul style="list-style-type: none"> <li>• Dia 50 mm housing</li> <li>• 5000 rpm max rotation frequency</li> <li>• Resolution range from 6 to 1024 pulses / rotation</li> </ul>	

enhanced mechanical resistance:

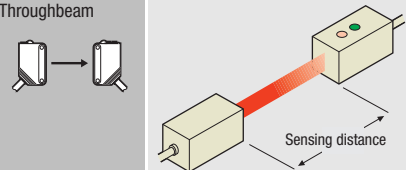
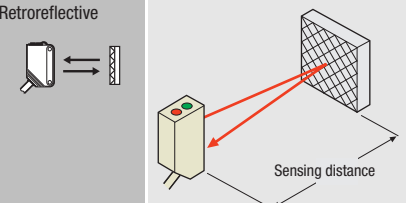
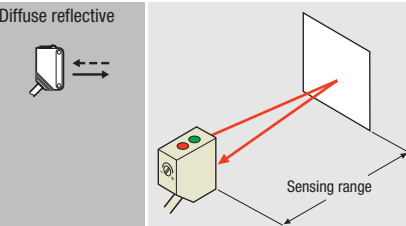
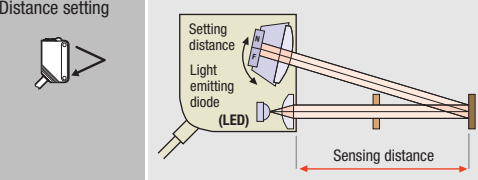
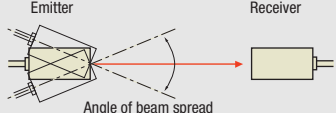
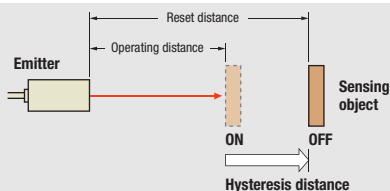
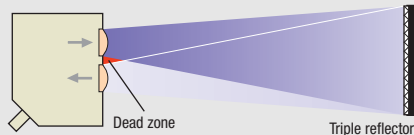
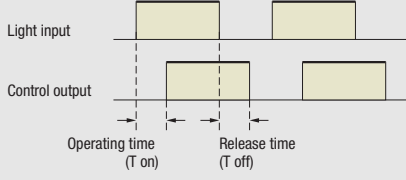


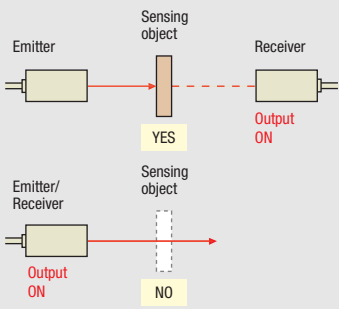
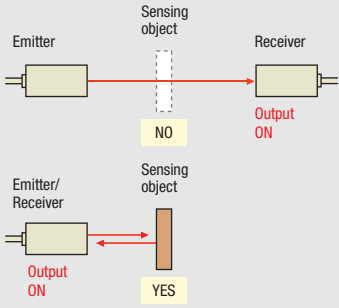
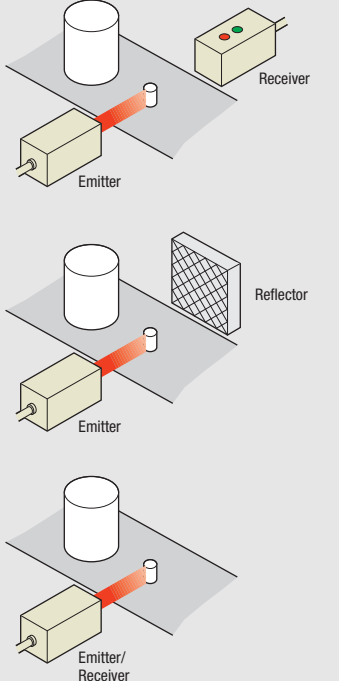
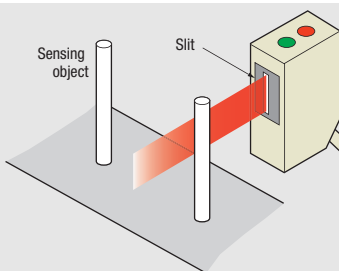
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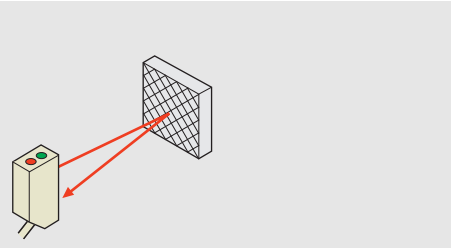
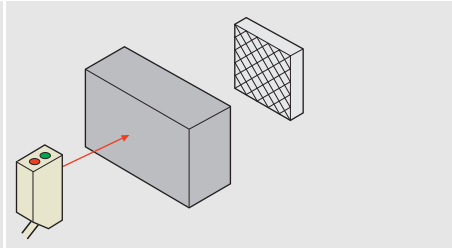
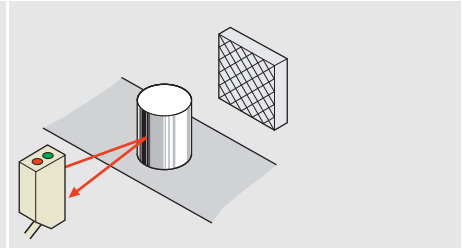
## Explanation of terms

Item	Explanatory diagram	Meaning
Sensing distance	Throughbeam 	This is the maximum detection distance that can be set with stability for through-beam and retroreflective models, taking into account product deviations and temperature fluctuations. Actual distances in standard conditions will be longer than the rated detection distances for both models.
	Retroreflective 	
	Diffuse reflective 	
Detection range/ Set range	Distance setting 	In contrast to non distance-setting photoelectric sensors, which detect the presense (or not) of an object by means of the amount of light reflected back and thus have difficulty detecting objects with low reflectance, the distance-setting type detects the presense of the object based on the position, not the amount, of the reflected light. Suffering little from the effects of background objects and color, this type enables stable detection. A PSD (Position Detection Device) is used in the detector. Detection range: The range where detection is possible. Set range: A range where the distance to the detected object can be set.
Directional angle		Through-beam models, retroreflective models The range of angles where operation as a photoelectric sensor is possible.
Differential distance		Diffuse-reflective model The difference between the operating distance and the reset distance. Generally expressed in catalogs as a percentage of the detection distance.
Dead zone		The "Dead zone" is the non-operational area outside of the emission and detection areas near the lens surface in mark sensors, the distancsetting type, the limited reflective model, the diffuse-reflective model, and the retroreflective model. Detection is not possible in this area.
Response time		The "response time" is the lag time from the on/off of the light input to activation or reset of the control output. In general, for photoelectric sensors, activation time (Ton) ≈ release time (Toff).

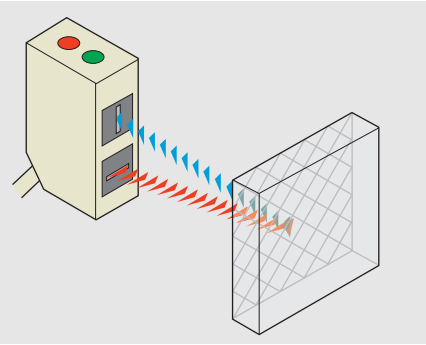
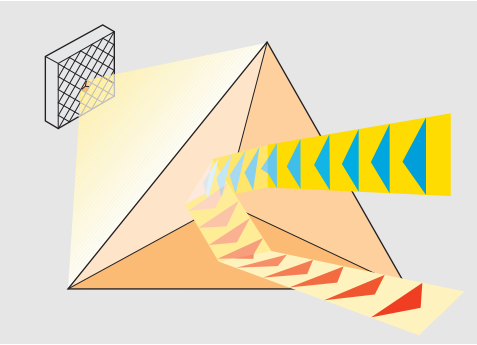
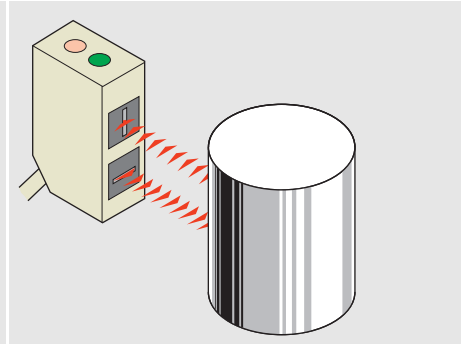
Item	Explanatory diagram	Meaning
Dark-on operation		“Dark on” is a model that outputs when the light entering the detector is shielded or decreases. The output method is expressed as DARK ON. “Light on” is a model that outputs when the light entering the detector increases. The output method is expressed as LIGHT ON.
Light-on operation		
Minimum detection object		Typical examples are given of the smallest objects that can be detected using Through-beam and retroreflective models with the sensitivity correctly adjusted to the light-on activation level at the rated detection distance. For the reflection model, typical examples are given of the smallest objects that can be detected with the sensitivity set to the highest level.
Smallest detection object with slit attached		Typical examples are given of the smallest objects that can be detected using Through-beam and retroreflective models with a slit attached. The sensitivity is correctly adjusted to the light-on activation level at the rated detection distance, and the slit is moved along its length and parallel to the object.

M.S.R. function


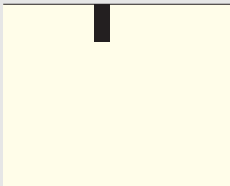
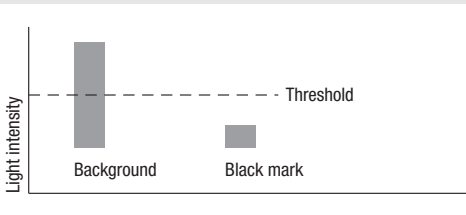

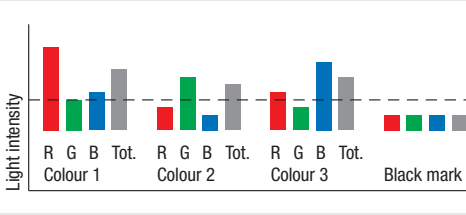

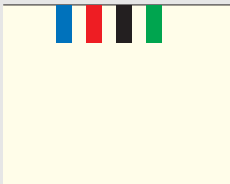
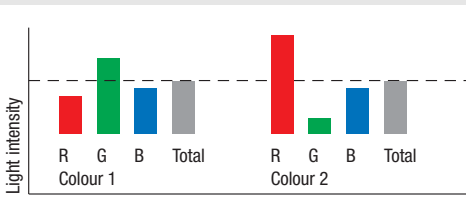
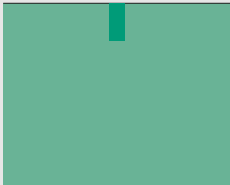
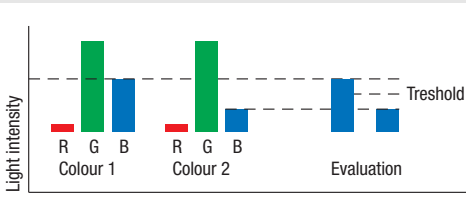
The Mirror Surface Rejection (MSR) is a function using the effect that light can be polarized and filtered according to the polarization direction. This effect can be used to avoid wrong detection of objects with smooth glossy surfaces like aluminium cans.

No object	Non-glossy object	Object with a smooth, glossy surface
The light from the emitter hits the reflective plate and returns to the detector.	Light from the emitter is obstructed by the object, does not reach the reflective plate, and does not return to the detector.	(Example: battery, can, etc.) Light from the emitter is reflected by the object and returns to the detector.
		

A direct reflection to the receiver from the surface of the object can be avoided by mounting the sensor at an angle. But for higher detection reliability the M.S.R. (Mirror Surface Rejection) function provides a solution for this type of application.

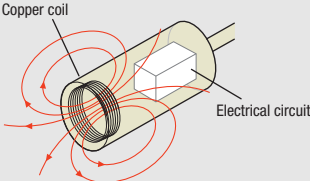
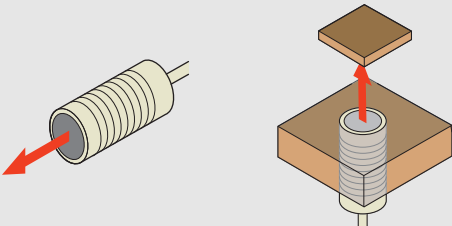
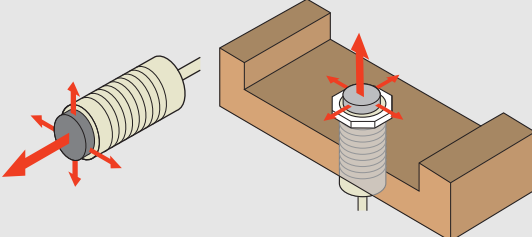
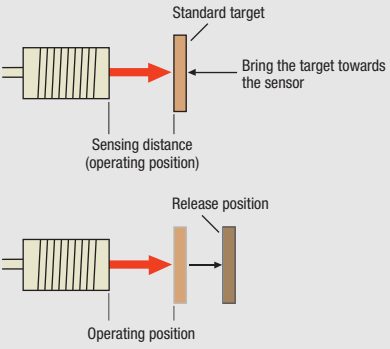
The light from the emitter is now polarized. The polarization plane is turned 90° by a reflector consisting of many small mirrors aligned so the light is reflected three times (triple reflector).		If an object with a smooth, glossy surface passes the emitted polarized light is returned to the receiver. As the polarization plane is not turned 90° the light does not pass the polarization filter in front of the receiver and the objects can be detected independent of their surface.
		

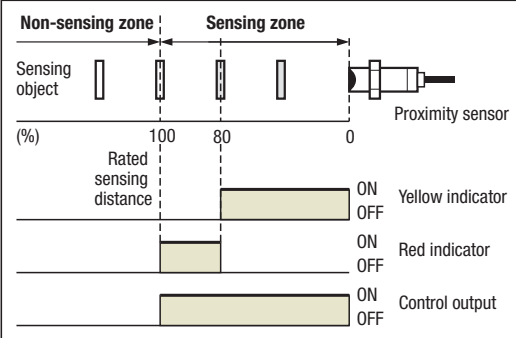
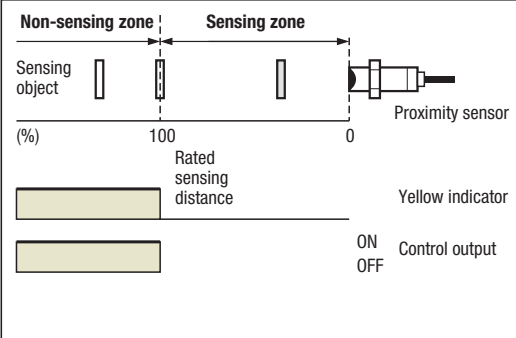
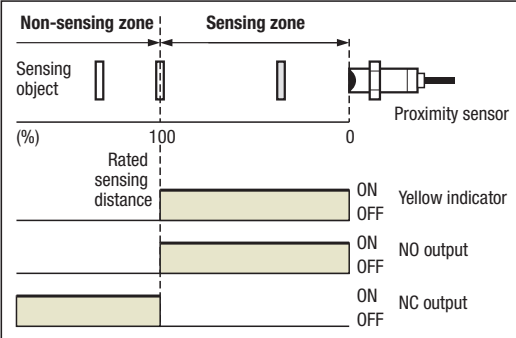
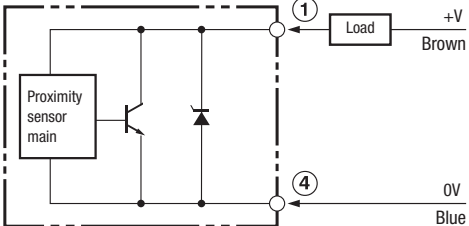

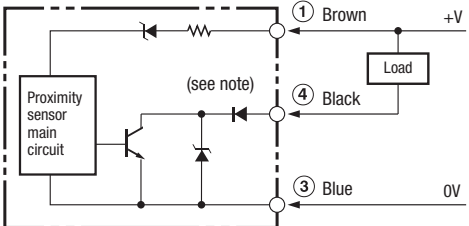
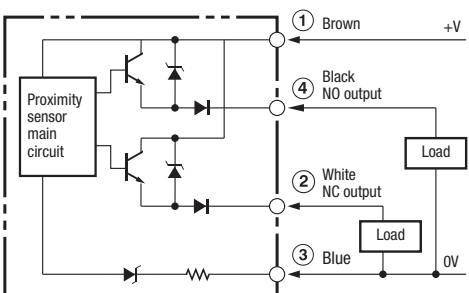

## Contrast and colour sensing

Item		Explanatory diagram	Meaning
<b>Contrast sensing</b> 	Black marks on monochrome backgrounds	 	Contrast/mark sensors evaluate the intensity/amount of the returned light and are able to distinguish between two levels e.g. a black print mark and the background by setting the threshold in the middle between the two intensity levels.
	Black marks with multi-coloured backgrounds (Register mark mode)	 	For a stable detection of black marks on multi-coloured backgrounds, a higher detection stability can be achieved when the threshold is set closer to the black mark light intensity.
<b>Colour/colour mark detection</b> 	RGB ratio comparison (C-mode)	 	Colours with similar black/white contrast values may be difficult to differentiate by standard contrast sensors. Sensors evaluating the difference in the colour spectrum by comparing RGB (red, green, blue) ratios, allow a differentiation of colours (full colour sensors).
	Colour intensity comparison (I-mode)	 	For colours with similar RGB values, evaluating not the full RGB ratio but only the colour with the highest value difference, provides a higher detection stability.

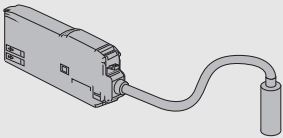
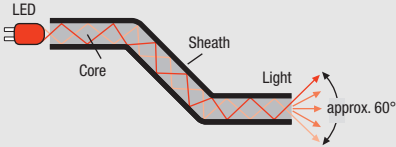
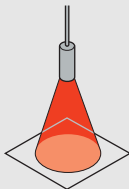
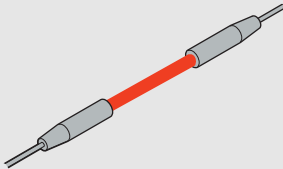
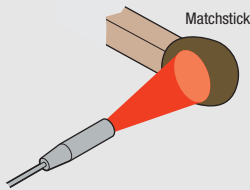
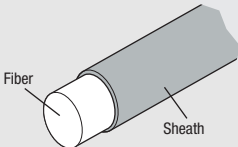
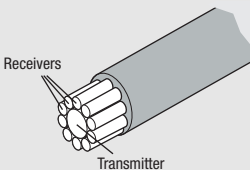
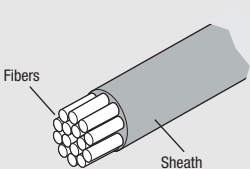


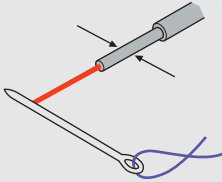
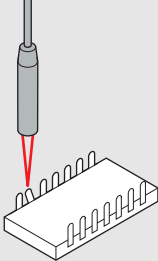
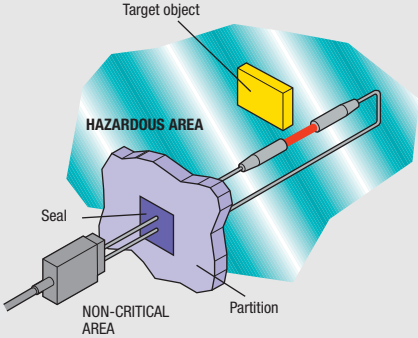
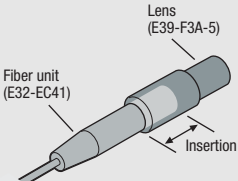
Inductive proximity switch

Item		
Principle of operation		<p>An inductive proximity sensor consists of a coil wound around a ferrite core at the sensing head. A high frequency is applied to this, generating an oscillating electromagnetic field around it. This is monitored by internal circuitry.</p> <p>When a metallic object travels toward the field, electric currents are created in the object (eddy currents). As the target approaches the sensing face these increase in size.</p> <p>These currents cause a transformer like effect, as a result the energy in the detecting coil lessens and the oscillations reduce. As the object moves in closer the oscillation finally stops.</p> <p>The monitoring circuitry detects the stopping of the oscillations and then switches the output on. The object has now been detected.</p> <p>Because the operating principle uses an electromagnetic field, proximity sensors excel over the likes of photoelectric sensors in environmental resistance. The likes of water, oil or dirt generally have no influence on the operation of the sensor making the use on machine tools etc. common place.</p>
Shielded sensors (flush mounting)		<p>Shielded sensors are made with a shielding plate around the ferrite core. This has the effect of limiting the electromagnetic field to the front of the head. The sensor can be mounted flush in metal surfaces. This gives the advantage of mechanical protection, along with sensing directly adjacent to the sensing face. This limits the sensing range, but the sensor can be mounted with ease with surrounding metals taking no effect.</p>
Unshielded sensors (non-flush mounting)		<p>Unlike the shielded sensor there is no shielding around the ferrite core. This gives a greater sensing range than the equivalent diameter shielded proximity sensor. For the same diameter the range is generally doubled.</p> <p>As the field extends to the side of the proximity switch it can be influenced by metals in this area. Thus it cannot be flush mounted and requires more distance to other proximity sensors or metal parts.</p>
Sensing distance		<p>The sensing distances quoted in the specifications for the proximity sensors are based on a standard target. This target (known as a standard object) is a square plate of mild steel 1 mm thick, a primarily ferrous object.</p> <p>When the target reaches the point where the sensor operates, this is the sensing distance.</p> <p>The sensor will release (i.e. turn off) at a point lightly further from the sensing face (hysteresis).</p>

<div>Item</div> <div>Output and Connection</div> <div>For the output mode NO (normally open) the control output is OFF if no object is present.</div> <div>For the output mode NC (normally closed) the control output is ON if no object is present.</div> <div>For the output mode NO+NC (antivalent) the NO output is OFF and the NC output is ON if no object is present.</div>	<div>DC 2-wire</div> <div>Timing chart for NO (normally open)</div> <div></div> <div>DC 3-wire</div> <div>Timing chart for NC (normally closed)</div> <div></div> <div>DC 4-wire</div> <div>Timing chart for NO+NC (antivalent)</div> <div></div>	<div>Output circuit</div> <div></div> <div>M12 Connector Pin Arrangement</div> <div></div> <div>Output circuit (example for NPN)</div> <div></div> <div>Note: With M8 connector models, there is no output reverse polarity protection diode.</div> <div>M12 Connector (see note)</div> <div>M8 Connector (3 Pin)</div> <div>M8 Connector (4 Pin)</div> <div>Note: Terminal 2 of the M12 connector is not used.</div> <div>Output circuit (example for PNP)</div> <div></div> <div>M12 Connector Pin Arrangement</div> <div></div>
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Fiber optics

Item		
Principle of operation		Fiber optic photoelectric sensors comprise two parts, the amplifier and the sensing head. The amplifier contains the emitter (the light source) and receiver (detector) along with their associated electronics. The fiber optic cable is the means used to transfer the light to the sensing head.
		The light source (an LED) transmits the light beam down the fiber optic cable by repeatedly reflecting the light off the boundary between the fiber core and its sheath. When it reaches the end of the fiber the light is dispersed at the end.
		When the light is dispersed it spreads out and forms a beam much like that of other sensors, but on a smaller scale. With smaller light sources and lens areas the sensing ranges are on the whole much shorter.
Types of fiber		Fiber optic heads mainly split into two types, through-beam and diffuse (although there are a few retro-reflective types). The principle of operation of both types is exactly that of standard photoelectric sensors.
		
Construction		Standard fiber: Most fiber optic sensing heads use this configuration of fiber (i.e. a single fiber covered by a protective sheath). The fibers are usually plastic, 0.5 to 1 mm in diameter and covered in a plastic protective sheath.
		Coaxial fiber: This gives greater accuracy. The core is used as the transmitter and the surrounding fibers are bundled together to form the receiver. This gives better accuracy, the target can enter the detecting area from any direction.
		Multicore: These consist of large numbers of small fibers. This results in a more flexible cable (E32-R types) which can literally be tied in a knot. Robotic: In robotic fibers the multicore fibers are manufactured without fixation. This allows them to move freely reducing mechanical stress when the fiber is bent.

Item		
Using fiber optic sensors		<p>The main advantage of fiber optics is that they are small. This means that they can be mounted in places where other sensors couldn't fit.</p>
		<p>As the sensor heads are extremely compact, they are ideal for the stable detection of small objects. As a result of the less light that is emitted they generally do have smaller ranges than conventional photoelectric sensors.</p>
		<p>Fiber optic sensor heads can be used in areas that standard sensors are unable to go, for instance hazardous areas. This is because no electric current flows through them. This also means they are totally unaffected by electrical noise (provided the amplifier is suitably positioned). By using glass fibers instead of plastic they can be used in areas of up to 350°C.</p>
		<p>Extremely small objects can be detected with a diffuse coaxial sensor and additional focal lens. Using these, objects as small as 100 µm can be detected.</p>

## Protective Structure

Note: IP-XX is based on the following testing method. Please verify sealing in the actual environment and conditions of use before using.

### IEC (International Electrotechnical Commission) Standards (IEC60529:2001)

**IP-■■**  
Protective characteristic symbol (International Protection)  
Symbol 1: Level of protection against solid objects

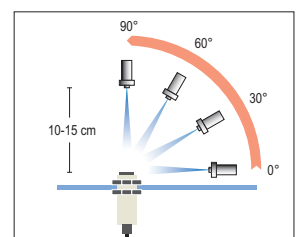
Level		Amount of protection
0		No protection
1		Solid objects 50 mm or larger in diameter (hand, etc.) do not penetrate.
2		Solid objects 12.5 mm or larger in diameter do not penetrate.
3		Wires or other solid objects 2.5 mm or larger in diameter do not penetrate.
4		Wires or other solid objects 1 mm or larger in diameter do not penetrate.
5		An amount of dust sufficient to interfere with normal operation of the device or create a safety problem does not enter.
6		Dust does not enter.

### Symbol 2: Level of protection against water penetration

Level		Amount of protection	Summary of test method (test uses fresh water)	
0	No special protection	No protection against water penetration.	No test	
1		Suffers no damaging effects from vertically dripping water.	Placed under vertically dripping water from a dripping tester for 10 minutes.	
2		Suffers no damaging effects from water dripping no more than 15° out of plumb.	Placed at an inclination of 15° under dripping water from a dripping tester for 10 minutes (2.5 minutes in each direction).	
3		Suffers no damaging effects from water sprayed from an angle up to 60° from plumb.	Using the tester at right, the device is sprayed from each side up to an angle of 60° from plumb for 10 minutes).	
4		Suffers no damaging effects from water sprayed from all directions.	Using the tester at right, the device is sprayed from all directions for 10 minutes.	
5		Suffers no damaging effects from direct jet spray from all directions.	Using the tester at right, each square meter of the case is sprayed from all directions for 1 minute, for a total of at least 3 minutes.	
6		Suffers no damaging effects from strong and direct jet spray from all directions.	Using the tester at right, each square meter of the case is sprayed from all directions for 1 minute, for a total of at least 3 minutes.	
7		Water does not penetrate when the device is submerged for a specified amount of time at a specified pressure.	The device is submerged for 10 minutes at depth of 1 m in water (if the height of the device is less than 850 mm)	
8		The device can be used on a regular basis under water.	Decided by the manufacturer and the user of the device.	

### IP69k according to DIN40 050/9

The IP69k test according to DIN 40 050 part 9 is intended to simulate high pressure / steam cleaning. During the test 14-16 l/min water at 80°C is sprayed onto the sensor from different angles with 8000-10000 kPa. The sensor may not suffer any damaging effects from high pressure water in appearance and functionality.



### JEM (Japan Electrical Manufacturers Association) Standards (JEM1030:1991)

**IP-■■■**  
Symbols 1 and 2 of IEC60529  
Level of protection against oil penetration

Level		Amount of protection
f	Oil resistant	Suffers no damaging effects from oil drop or oil spray incident from any direction
g	Oil proof	Oil drops or oil spray incident from any direction does not penetrate.

Note: Other levels (h, c, d and e) also exist.

### NEMA (National Electrical Manufacturers Association)

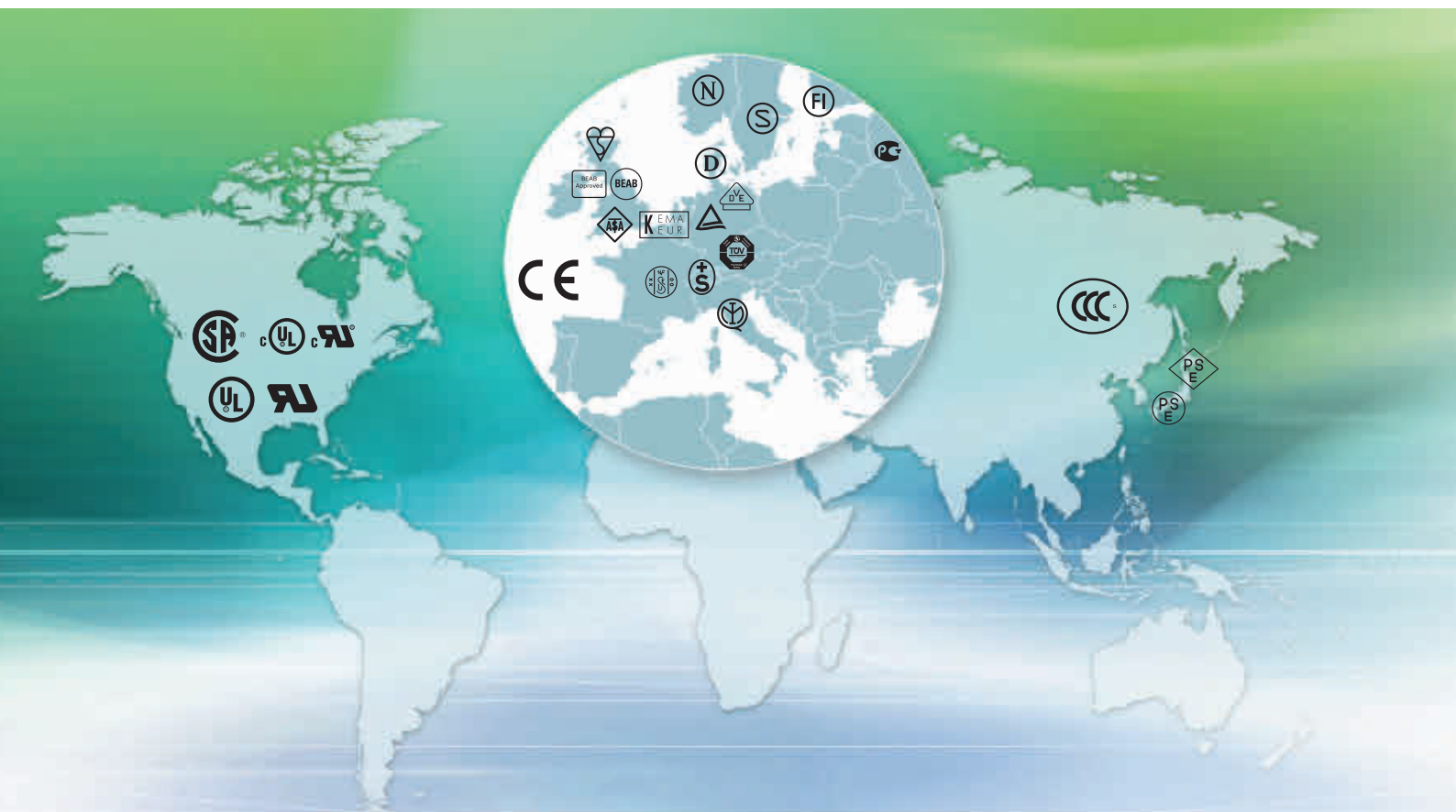
Table for converting NEMA enclosures to IEC60529  
(conversion from IEC60529 to NEMA is not possible)

Nema 250	IEC 60529	Nema 250	IEC 60529
1	IP10	4, 4X	IP56
2	IP11	5	IP52
3	IP54	6, 6P	IP67
3R	IP14	12, 12K	IP52
3S	IP54	13	IP54

Note: From Appendix A of NEMA standard 250. NEMA enclosure levels and IEC60529 differ in the areas of corrosion resistance, rust resistance, and icing characteristics.



# Outline of Major Standards



Type of product	Product family <sup>*1</sup>	Marks on product or label	CE			UL	Other countries	Special, industry specific	Additional OMRON specific <sup>*2</sup>
			EMC directive 2004/108/EC Applicable if product contains parts emitting potentially disturbing electromagnetic noise	Low voltage directive 2006/95/EC Applicable if rated supply voltage >50 VAC or >75 VDC	Machine directive 2006/42/EC Applicable if product category is listed as falling under the machine directive (e.g. safety components)	UL 508 (UL 60947 in preparation) Applicable if rated voltage is >30 VAC or >30 VDC	e.g. CCC, Gost etc CCC: applicable if product category is listed as falling under CCC and rated voltage is >36 VAC or >36 VDC Other countries: see note <sup>*3</sup>	Voluntary or mandatory application specific certification (refer to product information for details)	Extended lifetime and operational reliability tests (applicable for all OMRON prime standard products – refer to product information for details)
Standard products with rated voltage ≤30 VDC and 30 VAC	E2B	CE	■	n.a.	n.a.	n.a.	n.a.	—	■
	E2C								
	E2EC								
	μPROX E2E								
	E2S								
	E3F1								
	E3G-__								
	E3H2								
	E3S								
	E3T								
	E3X/E3NX								
	E6								
	EE-SX								
	F3EM2								
	F3ET2								
	TL-W								
	D4CC-__	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	■
	D5B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	■
	TZ								
	E3C/E3NC								
	E3Z Laser	CE	■	n.a. <sup>*4</sup>	n.a.	n.a. <sup>*4</sup>	n.a.	n.a. <sup>*5</sup>	■

Type of product	Product family <sup>*1</sup>	Marks on product or label	CE			UL	Other countries	Special, industry specific	Additional OMRON specific <sup>*2</sup>
			EMC directive	Low voltage directive	Machine directive				
			2004/108/EC	2006/95/EC	2006/42/EC	UL 508 (UL 60947 in preparation)	e.g. CCC, Gost etc		
			Applicable if product contains parts emitting potentially disturbing electromagnetic noise	Applicable if rated supply voltage >50 VAC or >75 VDC	Applicable if product category is listed as falling under the machine directive (e.g. safety components)	Applicable if rated voltage is >30 VAC or >30 VDC	CCC: applicable if product category is listed as falling under CCC and rated voltage is >36 VAC or >36 VDC Other countries: see note <sup>*3</sup>	Voluntary or mandatory application specific certification (refer to product information for details)	Extended lifetime and operational reliability tests (applicable for all OMRON prime standard products – refer to product information for details)
Standard products with rated voltage >30 VDC and 30 VAC	E3JK	CE, UL	■	■	n.a.	—	■	—	■
	X								
	Z								
	E3G-M_	CE	■	■	n.a.	— <sup>*6</sup>	■	—	■
	E3JM								
	XS2F/XS3F	UL	n.a.	n.a.	n.a.	■	n.a.	—	■
Standard and application specific products with rated voltage ≤30 VDC and 30 VAC and additional certification <sup>*7</sup>	E2E	CE	■	n.a.	n.a.	n.a.	n.a.	■	■
	E2FM								
	E2Q5								
	E3FA/E3FB								
	E3Z								
	E3ZM								
	E2A	CE	■	n.a.	n.a.	— <sup>*7</sup>	n.a.	■	■
	E2A3								
	E2EH								
	E2FQ	CE	■	n.a.	n.a.	<sup>*8</sup>	n.a.	—	■
	E2AU	CE	■	n.a.	n.a.	<sup>*9</sup>	<sup>*9</sup>	■	■
	D4B	CE, UL, TÜV, others	n.a.	■	■	■	■	■	■
	D4N								
	D4C-__	CE, UL, TÜV	n.a.	■	n.a.	■	■	■	■
	WL								
	ZC								
Non OMRON brand products	F3E	CE	■	n.a.	n.a.	<sup>*9</sup>	n.a.	■	—
	Y92E-S08	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—
	Y92E-S12	UL	n.a.	n.a.	n.a.	■	n.a.	—	—
Products without rated supply voltage	E32	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	E39								

<sup>\*1</sup> This table provides an overview for models listed in this guide. Other special models may exist with different specifications, ratings and certifications.

<sup>\*2</sup> OMRON voluntarily provides RoHS certification after the RoHS directive. A RoHS mark is applied on the package label for applicable products. Contact your OMRON representative for more details.

<sup>\*3</sup> Please contact your OMRON representative for details on other certificates and standards.

<sup>\*4</sup> Voluntary Laser classification after LASER standard EN60825-1 and LED standard EN62471 listed under Low voltage directive. Additional Laser classification after FDA.

<sup>\*5</sup> E3Z Laser has additional IP69k specification after DIN 40050 part 9.

<sup>\*6</sup> Special UL listed models are available.

<sup>\*7</sup> E2A, E2A3 and E2EH are rated up to 32VDC. For usage in USA and Canada use class II circuit only.

<sup>\*8</sup> Applicable for DC 2-wire types only.

<sup>\*9</sup> Can be sold as general product. For application specific usage (e.g. elevators, mobile machines, etc) confirm with local legislation and requirements first.















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## ➡ Refer to the other guides and the DVD



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