

# FORK SENSORS

## PHOTOELECTRIC SENSORS

ROBUST SPACE-SAVING DESIGN OFFERS VERSATILITY AND SIMPLICITY



### APPLICATION

**Photoelectric fork sensor checks presence of plastic cap and eliminates downtime**

During continuous production of fast-moving consumer goods, line stoppages are both costly and time consuming. After filling, sealing and capping, bottles of table sauces proceed for labelling and packaging; at this stage, the undetected absence of a plastic cap from an individual bottle requires manual intervention and potentially the rejection of an entire batch of production. A highly versatile photoelectric fork sensor, positioned directly over the conveyor, senses the presence of a cap on each bottle prior to labelling and triggers an alarm if a cap is missing. Contrinex fork light-barrier sensors with industry-standard IO-Link communication are ideal for this application, offering designers four discrete operating modes and switching frequencies up to 14,000 Hz. With a standard resolution of 0.3 mm (down to 0.1 mm in high-resolution mode) and fork openings from 10 mm to 120 mm, these robust, metal-cased sensors are well suited to both the task and the environment.

### INDUSTRIES

Robotics, packaging, materials handling, logistics, food and beverage



Robotics



Beverage filling machines



Conveyor systems



Packaging systems

Contrinex fork light-barrier sensors offer a powerful combination of simplicity, multi-mode operation and compactness, with high-resolution and high-speed sensing as standard. Ideal for general position- and presence-sensing in industrial environments, these versatile, metal-cased devices allow four modes of operation – standard, high-resolution, power and high-speed – and the convenience of a push-pull output. Equipped with the industry-standard IO-Link protocol, they provide a choice of manual or remote set-up and adjustment, simplifying installation while saving time and money.

### KEY ADVANTAGES

- ✓ High resolution: Ø 0.1–0.2 mm
- ✓ High frequency up to 14 kHz
- ✓ 4 sensor modes: Standard, High Resolution, Power, Speed
- ✓ **IO-Link v1.1**
- ✓ Sensitivity adjustment allowing detection of transparent objects
- ✓ Compact design accommodates photoelectric emitter and receiver in a single housing
- ✓ Push-pull output keeps inventory costs down while allowing exceptional flexibility
- ✓ Robust space-saving housing ensures precise alignment requiring no on-site adjustment

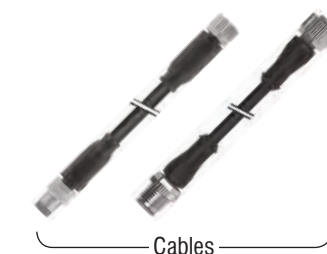


### PRODUCT OVERVIEW

IO-Link								
SERIES	U 10	U 20	U 30	U 40	U 50	U 80	U 100	U 120
Housing size mm	□25×45×10	□40×50×10	□50×60×10	□60×70×10	□70×80×10	□100×80×10	□120×80×10	□144×90×12
Through-beam (s <sub>n</sub> mm)	10	20	30	40	50	80	100	120

### ACCESSORIES

Go to page 298 to see all the accessories



Cables



Sensor tester





## COMMON FEATURES

Supply Voltage range	10 ... 30 VDC
Output	Light-ON/Dark-ON/IO-Link
Ambient temperature	-25 ... +60°C

## OUTPUT

Housing size  
[##] Fork opening in mm

LG[x]-U[xx]MA-[xxx]-[xxx] — see p. 196

Emission type  
[I] Infrared [R] Red — see p. 196

Reference key on page 196

## OPERATING PRINCIPLE

Through-beam

## ACCESSORIES

- A** Group A: M8 3-pin  
Sub-group: Field attachable connectors  
Sub-group: Distribution boxes
- B** Group B: M8 4-pin
- C** Group C: M12 4-pin  
Sub-group: Field attachable connectors  
Sub-group: Distribution boxes
- D** Group D: M12 AC/DC 3-pin
- E** Group E: Universal mounting brackets  
Sub-group: Mechanical stops
- F** Group F: Photoelectric mounting brackets
- G** Group G: Photoelectric reflectors
- H** Group H: Sensor tester

Go to page 298 for details

## CABLES

Cable lengths available:  
2 m, 5 m, 10 m  
other customised lengths possible

# U-SHAPE FORK SENSORS LG SERIES

## KEY ADVANTAGES

- ✓ High resolution: Ø 0.1–0.2 mm
- ✓ High frequency up to 14 kHz
- ✓ 4 sensor modes: Standard, High Resolution, Power, Speed
- ✓ **IO-Link v1.1**
- ✓ Sensitivity adjustment allowing detection of transparent objects
- ✓ Compact design accommodates photoelectric emitter and receiver in a single housing
- ✓ Push-pull output keeps inventory costs down while allowing exceptional flexibility
- ✓ Robust space-saving housing ensures precise alignment requiring no on-site adjustment



FAMILY	OPERATING PRINCIPLE	SENSING RANGE (mm)	FORK OPENING (mm)	LIGHT SOURCE	HOUSING MATERIAL	CABLE	CONNECTOR	IO-Link	SWITCHING FREQUENCY	RESOLUTION (mm)	DEGREE OF PROTECTION	PART REFERENCE	ACCESSORIES (SEE PAGE 194)
U-SHAPE FORK SENSORS – LG SERIES		10	10	LED, infrared 880 nm	Die-cast zinc		M8	IO-Link	10,000	0.2	IP67	LGI-U10MA-PMS-407	A H
		20	20	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U20MA-PMS-407	A H
		30	30	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U30MA-PMS-407	A H
		40	40	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U40MA-PMS-407	A H
		50	50	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U50MA-PMS-407	A H
		80	80	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U80MA-PMS-407	A H
		100	100	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.3	IP67	LGR-U11MA-PMS-407	A H
		120	120	LED, red 660 nm	Die-cast zinc		M8	IO-Link	5,000	0.5	IP67	LGR-U12MA-PMS-407	A H





# ACCESSORIES

## HIGHLIGHTS

- ✓ Comprehensive cable and connector program
- ✓ IP69K and Ecolab-certified cables for the food and beverage industry (on demand)
- ✓ UL-approved cables and connectors
- ✓ Cables with straight or right-angle sockets
- ✓ Distribution boxes
- ✓ Field-attachable connectors
- ✓ T-connectors (on demand)
- ✓ User-friendly standard portfolio
- ✓ Sensor testers for fast field checks
- ✓ Sensor mounting clamps
- ✓ Bases for mounting clamps
- ✓ Mechanical stops
- ✓ Amplifiers for 3-wire and NAMUR sensors (on demand)





## INDUCTIVE & PHOTOELECTRIC CABLES

### Group A

#### M8 3-PIN



open ended wire



connecting cables

CONNECTOR	PINS	CONFIG.	CABLE MATERIAL	CABLE LENGTH	WIRE	CABLE CONNECTION END	PINS	PART REFERENCE
M8	3-pole	straight	PUR	2 m	3		–	S08-3FUG-020
M8	3-pole	straight	PUR	5 m	3		–	S08-3FUG-050
M8	3-pole	straight	PUR	10 m	3		–	S08-3FUG-100
M8	3-pole	right angle	PUR	2 m	3		–	S08-3FUW-020
M8	3-pole	right angle	PUR	5 m	3		–	S08-3FUW-050
M8	3-pole	right angle	PUR	10 m	3		–	S08-3FUW-100
M8	3-pole	straight	PVC	2 m	3		–	S08-3FVG-020
M8	3-pole	straight	PVC	5 m	3		–	S08-3FVG-050
M8	3-pole	straight	PVC	10 m	3		–	S08-3FVG-100
M8	3-pole	right angle	PVC	2 m	3		–	S08-3FVW-020
M8	3-pole	right angle	PVC	5 m	3		–	S08-3FVW-050
M8	3-pole	right angle	PVC	10 m	3		–	S08-3FVW-100
M8	3-pole	straight	PUR	0.6 m	–		3	S08-3FUG-006-08MG
M8	3-pole	straight	PUR	2 m	–		3	S08-3FUG-020-08MG
M8	3-pole	straight	PUR	5 m	–		3	S08-3FUG-050-08MG
M8	3-pole	straight	PVC	0.6 m	–		3	S08-3FVG-006-08MG
M8	3-pole	straight	PVC	2 m	–		3	S08-3FVG-020-08MG
M8	3-pole	straight	PVC	5 m	–		3	S08-3FVG-050-08MG

#### FIELD ATTACHABLES CONNECTORS

CONNECTOR	PINS	CONFIG.	OUTER Ø	WIRE Ø	PART REFERENCE
M8	3-pole	straight	3.0–5.0	0.08–0.38	S08-3FNG-000-NNT1
M8	3-pole	straight	4.0–8.0	0.14–0.50	S08-3FNG-000-NNT2
M8	3-pole	straight	3.0–5.0	0.08–0.38	S08-3MNG-000-NNT1
M8	3-pole	straight	4.0–8.0	0.14–0.50	S08-3MNG-000-NNT2



#### DISTRIBUTION BOXES

CONNECTOR	PINS	NUMBER OF CONNECTIONS	CONNECTION TYPE	PART REFERENCE
M8	3-pole	Universal – Hood	No cable	V08-30PE-000-NNN
M8	3-pole	10 Plug Distribution box	PUR cable 5 m	V08-31PD-050-UYN
M8	3-pole	10 Outputs – Hood	PUR cable 5 m	V08-31PH-050-UNN
M8	3-pole	4 Plug Distribution box	No cable (hood needed)	V08-34PB-000-NYN
M8	3-pole	4 Plug Distribution box	PUR cable 5 m	V08-34PD-050-UYN
M8	3-pole	8 Plug Distribution box	No cable (hood needed)	V08-38PB-000-NYN
M8	3-pole	8 Plug Distribution box	PUR cable 5 m	V08-38PD-050-UYN
M8	3-pole	8 Outputs – Hood	PUR cable 5 m	V08-38PH-050-UNN





## INDUCTIVE & PHOTOELECTRIC CABLES

### Group B

#### M8 4-PIN



open ended wire



connecting cables

CONNECTOR	PINS	CONFIG.	CABLE MATERIAL	CABLE LENGTH	WIRE	CABLE CONNECTION END	PINS	PART REFERENCE
M8	4-pole	straight	PUR	2 m	4		–	S08-4FUG-020
M8	4-pole	straight	PUR	5 m	4		–	S08-4FUG-050
M8	4-pole	straight	PUR	10 m	4		–	S08-4FUG-100
M8	4-pole	right angle	PUR	2 m	4		–	S08-4FUW-020
M8	4-pole	right angle	PUR	5 m	4		–	S08-4FUW-050
M8	4-pole	right angle	PUR	10 m	4		–	S08-4FUW-100
M8	4-pole	straight	PVC	2 m	4		–	S08-4FVG-020
M8	4-pole	straight	PVC	5 m	4		–	S08-4FVG-050
M8	4-pole	straight	PVC	10 m	4		–	S08-4FVG-100
M8	4-pole	right angle	PVC	2 m	4		–	S08-4FVW-020
M8	4-pole	right angle	PVC	5 m	4		–	S08-4FVW-050
M8	4-pole	right angle	PVC	10 m	4		–	S08-4FVW-100
M8	4-pole	straight	PUR	2 m	–		4	S08-4FUG-020-12MG
M8	4-pole	right angle	PUR	2 m	–		4	S08-4FUW-020-08MG
M8	4-pole	straight	PVC	2 m	–		4	S08-4FVG-020-12MG
M8	4-pole	right angle	PVC	2 m	–		4	S08-4FVW-020-08MG

## INDUCTIVE & PHOTOELECTRIC CABLES

### Group C

#### M12 4-PIN



open ended wire



connecting cables

CONNECTOR	PINS	CONFIG.	CABLE MATERIAL	CABLE LENGTH	WIRE	CABLE CONNECTION END	PINS	PART REFERENCE
M12	4-pole	straight	PUR	2 m	4		–	S12-4FUG-020
M12	4-pole	straight	PUR	5 m	4		–	S12-4FUG-050
M12	4-pole	straight	PUR	10 m	4		–	S12-4FUG-100
M12	4-pole	straight	PUR	15 m	4		–	S12-4FUG-150
M12	4-pole	straight	PUR	20 m	4		–	S12-4FUG-200
M12	4-pole	straight	PUR	25 m	4		–	S12-4FUG-250
M12	4-pole	right angle	PUR	2 m	4		–	S12-4FUW-020
M12	4-pole	right angle	PUR	5 m	4		–	S12-4FUW-050
M12	4-pole	right angle	PUR	10 m	4		–	S12-4FUW-100
M12	4-pole	right angle	PUR	15 m	4		–	S12-4FUW-150
M12	4-pole	right angle	PUR	20 m	4		–	S12-4FUW-200
M12	4-pole	right angle	PUR	25 m	4		–	S12-4FUW-250
M12	4-pole	straight	PVC	2 m	4		–	S12-4FVG-020
M12	4-pole	straight	PVC	5 m	4		–	S12-4FVG-050
M12	4-pole	straight	PVC	10 m	4		–	S12-4FVG-100
M12	4-pole	right angle	PVC	2 m	4		–	S12-4FVW-020
M12	4-pole	right angle	PVC	5 m	4		–	S12-4FVW-050
M12	4-pole	right angle	PVC	10 m	4		–	S12-4FVW-100
M12	4-pole	straight	PUR	0.6 m	–		4	S12-4FUG-006-12MG
M12	4-pole	straight	PUR	2 m	–		4	S12-4FUG-020-12MG
M12	4-pole	straight	PUR	5 m	–		4	S12-4FUG-050-12MG
M12	4-pole	straight	PVC	0.6 m	–		4	S12-4FVG-006-12MG
M12	4-pole	straight	PVC	2 m	–		4	S12-4FVG-020-12MG
M12	4-pole	straight	PVC	5 m	–		4	S12-4FVG-050-12MG



## INDUCTIVE & PHOTOELECTRIC CABLES

### Group C

#### FIELD ATTACHABLES CONNECTORS

CONNECTOR	PINS	CONFIG.	OUTER Ø	WIRE Ø	PART REFERENCE
M12	3-pole	straight	3.0–5.0	0.08–0.38	S12-3FNG-000-NNT1
M12	3-pole	straight	3.0–5.0	0.08–0.38	S12-3MNG-000-NNT1
M12	4-pole	straight	3.0–5.0	0.08–0.38	S12-4FNG-000-NNT1
M12	4-pole	straight	4.0–8.0	0.14–0.50	S12-4FNG-000-NNT2
M12	4-pole	straight	5.5–8.0	0.50–1.00	S12-4FNG-000-NNT3
M12	4-pole	right angle	3.0–5.0	0.08–0.38	S12-4FNW-000-NNT1
M12	4-pole	straight	3.0–5.0	0.08–0.38	S12-4MNG-000-NNT1
M12	4-pole	straight	4.0–8.0	0.14–0.50	S12-4MNG-000-NNT2
M12	4-pole	straight	5.5–8.0	0.50–1.00	S12-4MNG-000-NNT3
M12	4-pole	right angle	3.0–5.0	0.08–0.38	S12-4MNW-000-NNT1



#### DISTRIBUTION BOXES

CONNECTOR	PINS	NUMBER OF CONNECTIONS	CONNECTION TYPE	PART REFERENCE
M12	5-pole	Universal – Hood	No cable	V12-50PE-000-NNN
M12	5-pole	4 Plug Distribution box	Connector M23	V12-54MG-023-NYN
M12	5-pole	4 Plug Distribution box	No cable (hood needed)	V12-54PB-000-NYN
M12	5-pole	4 Plug Distribution box	PUR cable 2 m	V12-54PD-020-UYN
M12	5-pole	4 Plug Distribution box	PUR cable 5 m	V12-54PD-050-UYN
M12	5-pole	4 Plug Distribution box	PUR cable 10 m	V12-54PD-100-UYN
M12	5-pole	4 Plug Distribution box + Hood	PUR cable 5 m	V12-54PY-050-UYN
M12	5-pole	8 Plug Metal Distribution box	PUR cable 5 m	V12-58MD-050-UYN
M12	5-pole	8 Plug Metal Distribution box	PUR cable 10 m	V12-58MD-100-UYN
M12	5-pole	8 Plug Metal Distribution box	Connector M23	V12-58MG-023-NYN
M12	5-pole	8 Plug Distribution box	No cable (hood needed)	V12-58PB-000-NYN
M12	5-pole	8 Plug Distribution box	PUR cable 2 m	V12-58PD-020-UYN
M12	5-pole	8 Plug Distribution box	PUR cable 5 m	V12-58PD-050-UYN
M12	5-pole	8 Plug Distribution box	PUR cable 10 m	V12-58PD-100-UYN
M12	5-pole	8 Plug Distribution box + Hood	PUR cable 2 m	V12-58PY-020-UYN
M12	5-pole	8 Plug Distribution box + Hood	PUR cable 5 m	V12-58PY-050-UYN





## INDUCTIVE & PHOTOELECTRIC CABLES

### Group D

#### M12 AC/DC 3-PIN



CONNECTOR	PINS	CONFIG.	CABLE MATERIAL	CABLE LENGTH	WIRE	CABLE CONNECTION END	PINS	PART REFERENCE
UNF 1/2"	3	straight	PUR	2 m	3	OPEN CABLE	–	S13-3FUG-020
UNF 1/2"	3	straight	PUR	5 m	3	OPEN CABLE	–	S13-3FUG-050
UNF 1/2"	3	right angle	PUR	2 m	3	OPEN CABLE	–	S13-3FUW-020
UNF 1/2"	3	right angle	PUR	5 m	3	OPEN CABLE	–	S13-3FUW-050

## UNIVERSAL MOUNTING BRACKETS

### Group E

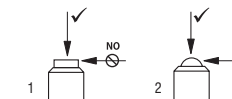
#### UNIVERSAL MOUNTING BRACKETS

	HOUSING SIZE COMPATIBILITY	TYPE	PART REFERENCE
	Ø 3	without limit stop	ASU-0001-030
	Ø 4	without limit stop	ASU-0001-040
	Ø 5	without limit stop	ASU-0001-050
	Ø 6.8	without limit stop	ASU-0001-065
	Ø 8	without limit stop	ASU-0001-080
	Ø 8	with limit stop	ASU-0002-080
	Ø 12 mm	without limit stop	ASU-0001-120
	Ø 12 mm	with limit stop	ASU-0002-120
	Ø 18 mm	without limit stop	ASU-0001-180
	Ø 18 mm	with limit stop	ASU-0002-180

#### MECHANICAL STOPS

	INNER Ø	OUTER Ø	PLUNGER TYPE	MAX. FORCE ON HOUSING	MAX. FORCE ON PLUNGER	PART REFERENCE
	M5 × 0.5	M8 × 1	Flat <sup>1</sup>	8,000 N	2,000 N	AMS-0001-M08
	M5 × 0.5	M8 × 1	Spherical <sup>2</sup>	8,000 N	2,000 N	AMS-0002-M08
	M8 × 1	M12 × 1	Flat <sup>1</sup>	15,000 N	2,000 N	AMS-0001-M12
	M8 × 1	M12 × 1	Spherical <sup>2</sup>	15,000 N	2,000 N	AMS-0002-M12

**Material:** Steel XC 48, black  
**Max. tightening torque:** 30 Nm (M8), 50 Nm (M12)





## PHOTOELECTRIC MOUNTING BRACKETS

### Group F

	HOUSING SIZE COMPATIBILITY	BRACKET MATERIAL	PART REFERENCE
	C23PA series	Stainless steel V2A	LXW-C23PA-000
	C23PA series	Stainless steel V2A	LXW-C23PA-001
	C23PA series	Stainless steel V2A	LXW-C23PA-002
	C23PA series	Stainless steel V2A	LXW-C23PA-003
	DGI series MGI series	Stainless steel V2A	LXW-DGMGA-000

	HOUSING SIZE COMPATIBILITY	BRACKET MATERIAL	PART REFERENCE
	M18PA series	ABS/PMMA	LHW-M18PA-000
	M18PA series	ABS/PMMA	LLW-M18PA-000
	M18PA series	ABS/PMMA	LTW-M18PA-000
	M18PA series	ABS	LXW-M18PA-000
	M18PA series	Polyamid	LXW-M18PA-001





PHOTOELECTRIC REFLECTORS

Group G

REFLECTORS

	∅	PART REFERENCE
	26 mm	LXR-0000-025
	46 mm	LXR-0000-046
	82 mm	LXR-0000-084
	32 × 20 mm	LXR-0001-032
	60 × 20 mm	LXR-0001-062
	26 mm	LXU-0000-025
	82 mm	LXU-0000-084
	32 × 20 mm	LXU-0001-032
	60 × 41 mm	LXU-0001-064

SENSOR TESTER


Group H

	PART REFERENCE
	ATE-0000-010







# PHOTOELECTRIC SENSORS

## HIGHLIGHTS

- ✓ Complete C23 series with first-class sensing ranges
- ✓ Excellent background suppression sensors
- ✓ Smallest self-contained miniature sensors on the market
- ✓ Wide range of fiber-optic amplifiers, including  IO-Link
- ✓ Excellent color and contrast recognition sensors

## NEW

- ✓ C23 sensors with patented UV technology for transparent object detection, including  IO-Link
- ✓ M18 series with short plastic housing and  IO-Link
- ✓ Distance measurement sensors in C23 and C55 size with  IO-Link
- ✓ Detection and measurement light grids
- ✓ Fork sensors with  IO-Link



# PHOTOELECTRIC SENSORS PROGRAM OVERVIEW

VIEW PHOTOELECTRIC DATASHEETS

[www.contrinex.com/product-range/photoelectric-sensors](http://www.contrinex.com/product-range/photoelectric-sensors)



PROGRAM OVERVIEW

FAMILY	SERIES		D04	M05	M12M	1120	M18P	M18M	1180		0507	C12	C23	3030	3060	4050	C55	DGI	MGI	LG	
	HOUSING SIZE IN MM		∅ 4	M5	M12	M12	M18	M18	M18		5×7×40	13×21×7 13×27×7	20×30×10 20×34×12	30×30×15	31×60×10	40×50×15	50×50×23	40×20×H	40×20×H	60×10×GAP	
	OPERATING PRINCIPLE	SENSING RANGE	CYLINDRICAL							CUBIC										U-SHAPE	
STANDARD	Diffuse	0 ... 1,500 mm			p. 126	p. 128	p. 130	p. 132	p. 134				p. 138	p. 142		p. 144					
	Background suppression	2 ... 5,000 mm					p. 130	p. 132	p. 134				p. 138	p. 142		p. 144	p. 146				
	Reflex	0 ... 8,000 mm			p. 126	p. 128	p. 130	p. 132	p. 134				p. 140	p. 142		p. 144					
	Through-beam	0 ... 50,000 mm			p. 126	p. 128	p. 130	p. 132	p. 136				p. 140	p. 142		p. 144					
MINIATURE	Diffuse	0 ... 90 mm	p. 150	p. 150							p. 154										
	Background suppression	2 ... 120 mm										p. 156									
	Reflex	0 ... 3,000 mm										p. 156									
	Through-beam	0 ... 2,000 mm	p. 150	p. 152								p. 156									
TRANSPARENT OBJECT	Reflex, UV light	0 ... 1,200 mm											p. 160								
	Reflex, red light	10 ... 5,000 mm											p. 160								
FIBER OPTIC SENSORS AND FIBERS	Amplifier	0 ... 200 mm												p. 164	p. 166						
	Plastic fiber	0 ... 1,100 mm												p. 168	p. 166						
	Glass fiber	0 ... 500 mm												p. 170							
DISTANCE	Short range	20 ... 200 mm											p. 178								
	Medium range	0 ... 5,000 mm															p. 180				
COLOR AND CONTRAST	Color	30 ... 40 mm														p. 184					
	Contrast	12 mm														p. 184					
LIGHT GRIDS	Detection	80 ... 8,000 mm																	p. 188		
	Measurement	300 ... 4,000 mm																		p. 190	
FORK	Through-beam	0 ... 120 mm																			p. 194

# PHOTOELECTRIC SENSORS

## OPERATING PRINCIPLE

The light-emitting diode (LED) emits a beam of modulated light towards the target. This beam is interrupted by the target, causing partial reflection. A part of the reflected light reaches the sensing face of the receiver. Depending on the operating principle, either the interrupted beam or the reflected light is used for further processing.

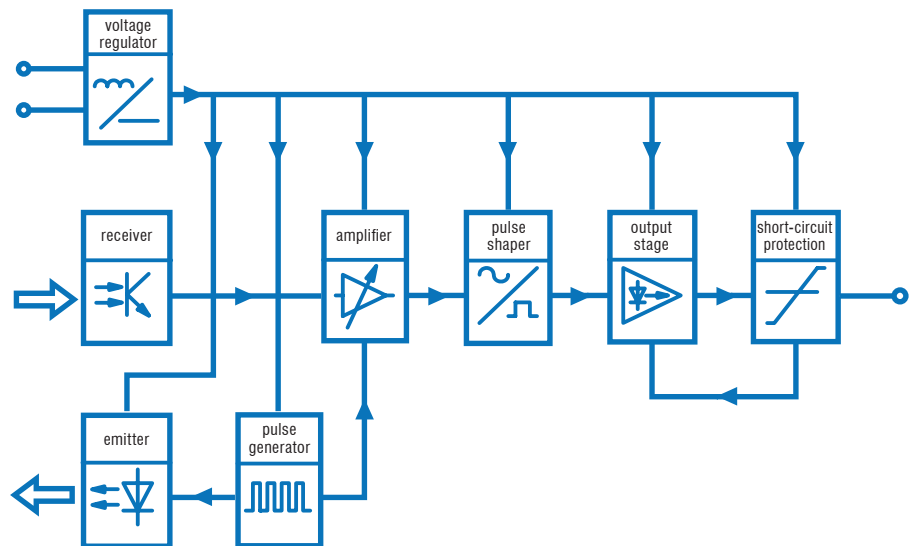
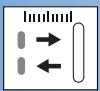


Fig. 7: Functional blocks of a photoelectric sensor

## TECHNOLOGY FAMILIES

### DIFFUSE



#### Versatile and cost-effective

A diffuse-mode, or energetic-diffuse, photoelectric sensor is a reflective sensor, containing a transmitter and a receiver in a single housing. The sensor emits a light beam toward a distant target that acts as a reflector, returning part of the transmitted light to the sensor. The receiver detects the amount of light reflected by the target, triggering the sensor when the light intensity reaches a threshold value.

Diffuse-mode sensors are cost-effective as they do not require separate reflectors or receivers, and detect reflective targets with ease. Sensing range depends on the target's size, shape, color

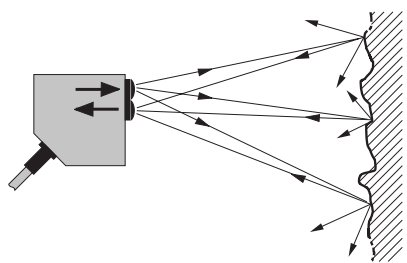
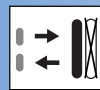


Fig. 8: Diffuse sensing

and surface finish, although sensor sensitivity is adjustable during installation to compensate for targets with poor reflective qualities.

### BACKGROUND SUPPRESSION

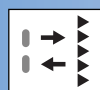


#### Excellent suppression of light-colored backgrounds

Diffuse-mode photoelectric sensors with background suppression emit a focused light beam toward a distant target. Part of the beam is reflected from the target and returns to the sensor, striking a position-sensitive receiver. The receiver distinguishes between reflections from the target and reflections from background objects, only triggering the sensor when the signal reaches a value that relates to the preset target distance.

The sensing range is practically insensitive to the target's size, color, shape and surface finish, and background-suppression sensors provide highly reliable detection of "difficult" targets, even against a light background. Stable, accurate detection of small, fast-moving parts on conveyors or automated machinery is possible over the entire sensing range, eliminating false triggering by objects in the background.

### REFLEX



#### Long sensing range in a single-housing device

A reflex, or reflective, photoelectric sensor contains a transmitter and a receiver in a single housing, and emits a pulsed, focused light beam toward a distant reflector. Reflected light returns to the sensor, arriving at the receiver. When a target object interrupts the light beam, the receiver detects the reduced light intensity and triggers the sensor.

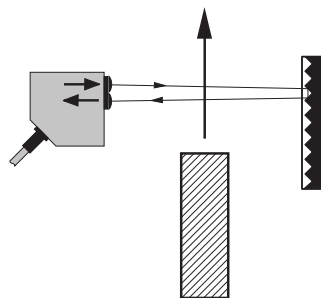
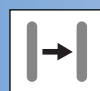


Fig. 9: Reflex sensing

The relatively high level of reflected light allows reflex sensors to achieve sensing distances up to eight meters.

### THROUGH-BEAM



#### Emitter and receiver in separate housings for sensing ranges from 0 to 50 m

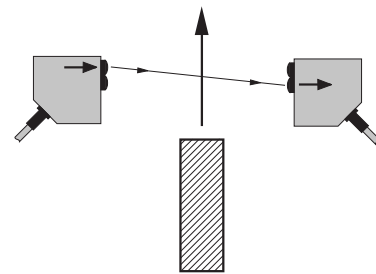


Fig. 10: Through-beam sensing

A through-beam photoelectric sensor comprises an emitter and receiver, each mounted in a separate housing. The emitter is aligned so that the greatest possible amount of pulsed light from its emitting diode reaches the receiver (Fig. 12). The receiver, which is mounted beyond the target area, processes incoming light in such a way that it is clearly separated from ambient and other light sources. Any interruption of the light beam by a target triggers the sensor, causing its output signal to switch.

Contrinex through-beam photoelectric sensors are ideal for industrial applications where sensing components must be mounted some distance from the target area. Through-beam sensors utilize infrared,

visible and laser light sources to detect opaque and semi-transparent targets, reliably and repeatably, at extended distances.

### ANALOG OUTPUT

#### Precise distance control

Photoelectric sensors with analog outputs are ideal for measuring absolute values of distance. Using background suppression-mode technology, analog photoelectric sensors produce an output signal that is accurately calibrated and approximately proportional to the distance of the target from the sensor. Users have a choice of current or voltage outputs that are compatible with all modern control systems.

## PRODUCT RANGES



### STANDARD

#### First-class performance for general use



include infrared, laser and pinpoint LED.



### MINIATURE

#### Smallest on the market



The Contrinex **Miniature** range packs exceptional position- and presence-sensing performance into the smallest self-contained photoelectric sensors on the market. Designers have the choice of through-beam or diffuse sensors in **Ø4** and **M5** cylindrical metal housings that offer multiple mounting methods and beam orientation. For fully embedded applications, sensors with spherical sapphire-glass lenses produce focused, cylindrical light beams.



### TRANSPARENT OBJECT

#### Outstanding reliability and ease of adjustment environments



The Contrinex **TRU-C23** photoelectric sensor is ideally suited for the presence control of transparent objects. Its patented technology uses **UV light**. Since transparent materials like plastic or glass absorb large amounts of polarized UV light, it is very easy to set the threshold at which the sensor switches. The shape or thickness of the target has no influence on detection. In addition, sensor performance is unaffected by dirt, water drops or aging.



### FIBER-OPTIC SENSORS AND FIBERS

#### Reliable short and long-range sensing



The highly versatile **Fiber-Optic** range includes the self-contained **3030** series and the DIN-rail mounted **3060** series, suitable for multiple-sensor applications. **Synthetic fibers** are available for general use and **glass fibers** for high temperatures and aggressive environments.



### DISTANCE

#### High precision and direct digital transmission



**100 mm**. Applications include small-part detection, position or height checking and monitoring material thickness on winding rolls.



### COLOR AND CONTRAST

#### Excellent resolution for smallest variations



**Color** photoelectric sensors utilize energetic-diffuse sensing technology to detect variations in target color, allowing color sorting or color control. A "teach-in" function is used to program up to three separate outputs. Contrinex color photoelectric sensors also feature five selectable tolerance levels for each output.

**Contrast** sensors are ideal for detecting print marks in printing, labelling and packaging processes. Using a narrowly focused light beam and RGB emission technology, contrast sensors automatically select the best emission color (red, green or blue) during the teach-in procedure.

Using a narrowly focused light beam and RGB emission technology, contrast sensors automatically select the best emission color (red, green or blue) during the teach-in procedure.



### LIGHT GRIDS

#### Fast detection, counting and measurement



The use of infrared light grids for non-contact measurement offers many advantages, including fast response times, reliable detection of the most varied objects and immunity to interference from ambient light. Typical applications can be found in logistics, automated packaging systems, warehouses and the wood industry.



### FORK

#### Fast detection and counting in one housing



Fork sensors come either with an infrared or red LED with a detection frequency up to 14 kHz. They operate like a through beam sensor with the advantage of having the sensing and receiving element included in the same housing, thus reducing efforts on alignment and cable assembly. Fork sensors are particularly useful in packaging application to detect and count high speed objects or check the presence of a cap, hood or cover.





# GLOSSARY



## INDUCTIVE SENSORS

## PHOTOELECTRIC SENSORS

### A

#### AUTOCOLLIMATION

Photoelectric sensors using the autocollimation principle are characterized by the fact that the optical axes of the emitting and receiving channels are identical. This is possible with light from one of the channels being deflected by means of a semi-transparent mirror (Fig. 11). This principle completely eliminates the interfering blind zone often found in the proximity of the sensor, which is of special advantage when using reflex sensors.

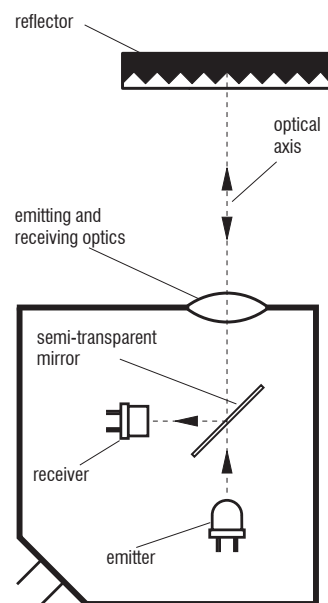


Fig. 11

### B

#### BACKGROUND SUPPRESSION

The light pulse from the emitting diode leaves the optical system as a focused, almost parallel, light beam. On meeting an object in its path, part of the beam is diffusely reflected, and in turn, part of this reflected light falls on the PSD (Position-Sensitive Device) housed in the same sensor (Fig. 12).

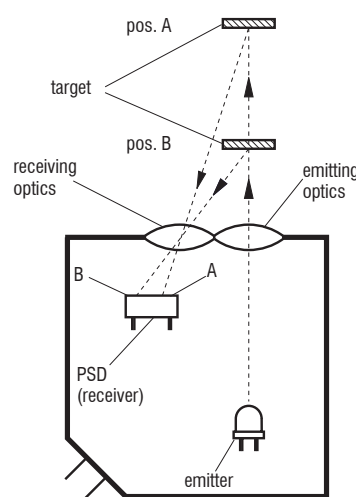


Fig. 12

Depending on the distance of the target from the device, the light falls on a particular spot of the PSD, and a corresponding reception signal is emitted, indicating that an object is present at a certain distance from the device. The analyzing circuit compares the signal received with the preset operating distance (adjusted by means of the built-in potentiometer), and, if the distance of the object is less than, or equal to, the preset operating distance, the output is switched. Contrary to an energetic diffuse sensor, the operating distance depends only to a very small extent on the target's size or color, or on the nature of its surface. The object can therefore be easily discerned, even against a light background.

### C

#### CLASSICS FAMILY

The **Classics** family (series 600) is one of three inductive sensing technologies offered by Contrinex. **Classics** family sensors rely on conventional inductive oscillator and coil technology (see page 30). Sensors are sized from Ø3 up to M30 and C44 (40 × 40 mm). PNP, NPN and 2-wire AC/DC output configurations are available, combined with sensing distances between 0.6 mm and 40 mm. The **Classics** technology family includes devices from the following ranges: **Basic, Miniature, 2-Wire, Extra Pressure, Extra Temperature, High Temperature** and **Washdown**.

### E

#### EXCESS-GAIN INDICATION (SYSTEM RESERVE INDICATION)

The excess-gain indication circuit detects the excess radiation power which falls on the light incidence surface and is processed by the light receiver. The excess gain can decrease in time due to dirt, a change in the target's reflection factor, and aging of the emitter diode, so that reliable operation can no longer be guaranteed. Some devices are therefore equipped with a second LED (green), which lights up when less than approximately 80% of the available operating distance is used. Models with an excess-gain output make the excess-gain signal available to the user for further processing. Thus, operating conditions which are no longer reliable can be recognized in time.

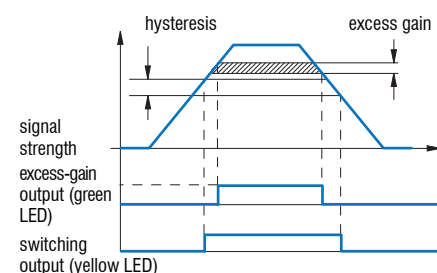


Fig. 13

### F

#### EXTRA DISTANCE FAMILY

The **Extra Distance** family (series 500/520) is one of three inductive sensing technologies offered by Contrinex. **Extra Distance** family sensors rely on conventional inductive oscillator and coil technology, but with a completely different signal evaluation circuit for better stability and therefore long operating distances. The most important contribution to this comes from the Contrinex Condist® oscillator (see page 30). Sensors are sized from Ø4 to M30, with long operating distances up to 40 mm. The **Extra Distance** technology family includes devices from the **Basic, Miniature, Extra Pressure, High Pressure** and **Analog Output** ranges.

### F

#### FULL INOX FAMILY

The **Full Inox** family (series 700) is one of three inductive sensing technologies offered by Contrinex. **Full Inox** family sensors rely on Contrinex's Condet® technology (see page 31).

**Full Inox** sensors have a one-piece, stainless steel housing and are exceptionally robust and chemically resistant. They are not only the most durable inductive sensors on the market, but also offer long operating distances on any conductive metal. Sensors are sized from Ø4 to M30 and cuboid variant of 20 × 32 × 8 mm, with long operating distances up to 40 mm and protection class IP67 and IP69K.

The **Full Inox** technology family includes devices from the **Basic, Miniature, Extreme, High Pressure, Washdown, Weld-Immune, Chip-Immune, Double-Sheet** and **Maritime** ranges.

### H

#### HYSTERESIS

Hysteresis (differential travel) causes a defined switching behavior of the device (Fig. 14). The sensing range always refers to the switch-on point. Distance hysteresis is only useful for the diffuse sensor model and its related fiber version.

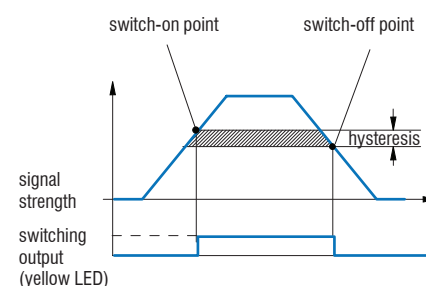


Fig. 14

### F

Hysteresis (differential travel) causes a defined switching behavior of the device (Fig. 15). The operating distance always refers to the switch-on point. Namur devices and those with analog output have continuous transmission behavior, i.e. there is no hysteresis.

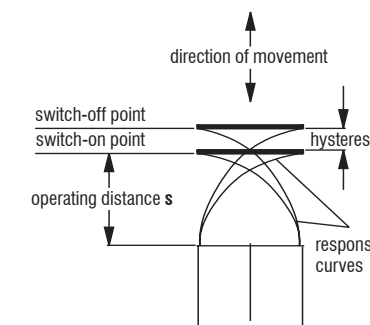


Fig. 15

### I

#### IO-LINK

IO-Link is an industry-standard (IEC 61131-9) point-to-point communication protocol for digital sensors and actuators. Using simple three- or four-wire cables, IO-Link enables these devices to communicate via an IO-Link master to any industrial-fieldbus network, or directly using a standard IO signal. IO-Link is highly flexible, allowing user-defined sensor configuration of many functions.

### M

#### MOUNTING

##### EMBEDDABLE SENSORS

Embeddable sensors may be flush mounted in all metals. For trouble-free operation, a free zone according to Fig. 16 should be observed.

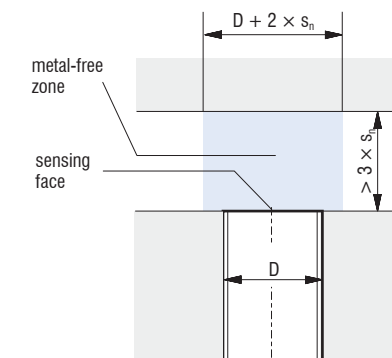


Fig. 16

##### QUASI-EMBEDDABLE SENSORS

When installing quasi-embeddable Extra Distance sensors (500 and 520 series) in conductive materials (metals), the devices must **protrude** by a distance **X**, according to Fig. 17. Further, a free zone of  $3 \times s_n$  must be observed. Flush mounting in non-conducting materials is permitted.

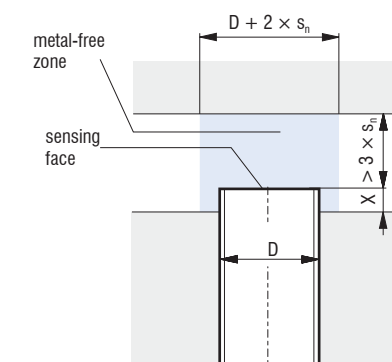


Fig. 17

##### NON-EMBEDDABLE SENSORS

When mounting non-embeddable sensors in conducting materials (metals), minimum distances to the conducting material must be maintained according to Fig. 18. Flush mounting in non-conducting materials is permitted.

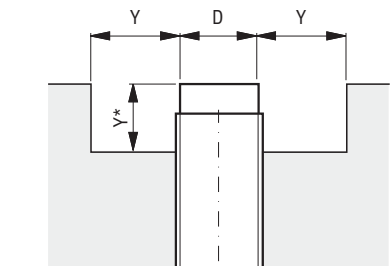


Fig. 18



## O

### OPERATING DISTANCE

The operating distance of inductive sensors is the distance at which a target approaching the sensing face triggers a signal change. The operating distance is measured according to IEC 60947-5-2/EN 60947-5-2, using a **standard square target** moving **axially** (Fig. 19).

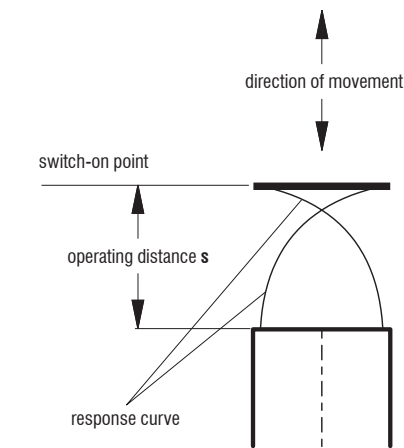


Fig. 19

This target is made of steel, e.g. type FE 360 in accordance with ISO 630, with a smooth surface, square shape, and thickness of 1 mm (Fig. 20). The sides equal the **diameter** of the inscribed circle of the sensing face or **three times the rated operating distance  $s_n$**  of the sensor, whichever is the greater.

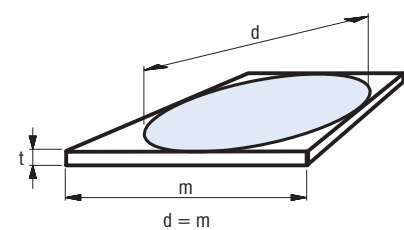


Fig. 20

#### Rated operating distance $s_n$

This is the operating distance for which the sensor is designed. It can be found under "technical data".

#### Effective operating distance $s_e$

The measured operating distance for a given switch according to IEC 60947-5-2/EN 60947-5-2.

$$0.9 s_n \leq s_e \leq 1.1 s_n$$

This means that the manufacturing tolerance must not exceed  $\pm 10\%$ .

#### Usable operating distance $s_u$

This distance takes into account expected additional deviations caused by temperature and supply voltage fluctuations within the specified range.

$$0.9 s_e \leq s_u \leq 1.1 s_e$$

The temperature and supply voltage ranges can be found under "technical data".

#### Assured operating distance $s_a$

$$0 \leq s_a \leq 0.81 s_n$$

This operating distance is guaranteed by the manufacturer for all specified operating conditions. It is the **basis for a safe design**.

## P

### PARALLEL CONNECTION

Connecting sensors in parallel, in order to perform logic functions, is possible without any problem (Figs. 21 and 22).

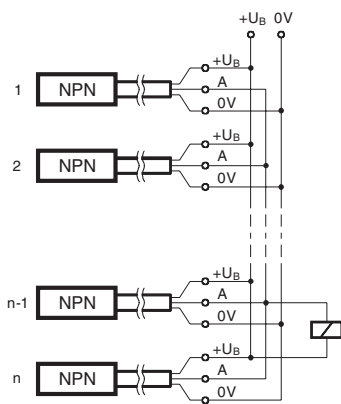


Fig. 21

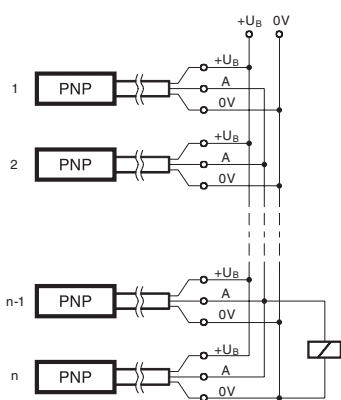


Fig. 22

Please note:

- The no-load supply current increases.
- Leakage currents add up, so that, even when closed, an inadmissible voltage drop can occur at the output.

## S

### SENSING RANGE

The specified sensing range of photoelectric sensors is the maximum usable distance between the device and the standard target (diffuse sensors); between the device and the reference reflector (reflex sensors), and between the emitter and the receiver (through-beam sensors). The potentiometer must be set for maximum sensitivity, or for diffuse sensors with background suppression, for maximum sensing range. Moreover, the specified reflector (reflex sensors) or standard target (diffuse sensors) must be used.

### SERIES CONNECTION

The connection of sensors in series in order to achieve logic functions is possible, but not recommended. The same effect can be achieved by the **parallel connection** of sensors with **NC function** (instead of the series connection of models with NO function), or vice versa. However, please note that, as a result, the output signal is inverted.

### SMART SENSORS

SMART Sensors are digital devices that offer the advantages of the industry-standard IO-Link SSP 3.3 profile plus the extreme flexibility of leading-edge multi-mode sensing capabilities, including distance, temperature and cycle counting. Depending on the user-defined mode of operation, measurements may be output as either routine process data or stand alone IO event data.

### STANDARDS

The sensors in this catalog comply, either completely or to a great extent, with the following standards:

- IEC 60947-5-1, **IEC 60947-5-2**, EN 60947-5-1, **EN 60947-5-2**
- IEC 61000-4-1, 61000-4-2, 61000-4-3, 61000-4-4, DIN EN 55011, DIN EN 55081-2, DIN EN 50140
- IEC 60529 / DIN 40050
- IEC 60947-1 / EN 60947-1 / DIN VDE 0660, part 100, part 100 A3, part 200, part 208
- DIN EN 50008, 50010, 50025, 50026, 50032, 50036, 50037, 50038, 50040, 50044

### SWITCHING FREQUENCY

The maximum switching frequency of inductive sensors indicates the highest permissible number of pulses per second for a constant pulse/pause ratio of 1:2 at **half the rated operating distance  $s_n$** . Measurement is according to IEC 60947-5-2/EN 60947-5-2 (Fig. 23).

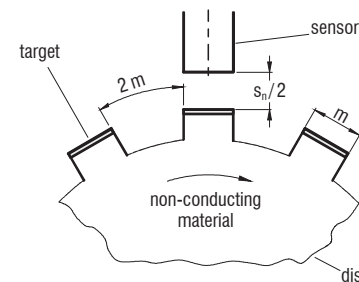


Fig. 23

### IN THE CASE OF PHOTOELECTRIC SENSORS, THE FREQUENCY OF OPERATING CYCLES (f) IS DETERMINED FROM THE FORMULA:

$$f = \frac{1}{t_{on} + t_{off}}$$

where:  $t_{on}$  is the turn on time  
 $t_{off}$  is the turn off time

$t_{on}$  and  $t_{off}$  are measured in accordance with IEC 60947-5-2 2007 paragraph 8.5.3.

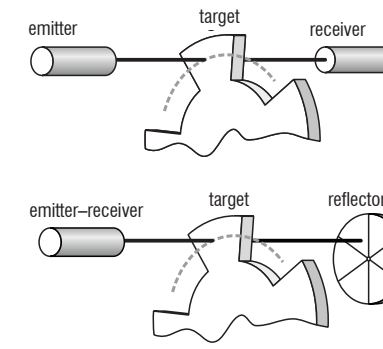


Fig. 24: Through-beam and reflex modes: the light beam must be fully broken by the target.

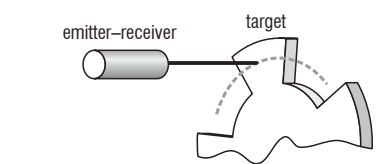


Fig. 25: Diffuse mode: the target must be of the same material as the standard target.

## T

### TIGHTENING TORQUE

Over-tightening of the nuts can mechanically damage cylindrical sensors. The specified maximum permissible tightening torques must therefore not be exceeded.

### CLASSICS / EXTRA DISTANCE (SERIES 500\*, 520\*, 600, 620)

Housing size D	M (Nm)
M4	0.8
M5	1.5
C5	0.2
M8	8 / 4*
C8	1
M12	10**
M18	25
M30	70
C44	2.5

\*\*6 Nm for the first 10 mm

## FULL INOX (SERIES 700)

Housing size D	M (Nm)
M8	8
M12	20
M18	50
M30	150

## SERIES D04 / M5, 1120, 1180, 1180W

Housing size D	M (Nm)
M5	1.5
M12	10
M18 / M18W	20

## W

### WIRING

Sensor cables must not be laid in parallel in the same cable runs as cables connected to **inductive loads** (i.e. protection solenoids, magnetic rectifiers, motors, etc.), or which conduct currents from **electronic motor drives**. Leads should be kept as short as possible; however, with suitable wiring (low coupling capacitance, small interference voltages), they can be up to 300 m long.

To reduce electromagnetic interference, apply the following measures:

- Maintain the distance to interfering cables > 100 mm
- Use shields
- Install inductances (contactors, magnetic rectifiers, relays) with RC networks or varistors



ALL OVER THE WORLD

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