Opto-BERO

4

Summary of ranges

Overview

Function		Design	Sensing range
Diffuse sensors		D 4, M5	5 cm
		M12	30 cm
		M18P	30 cm
		K 20	50 cm
		M18S	60 cm
		K 21, K 21 R	60 cm
		K 31	60 cm
		C40	70 cm
		K 30	1.2 m
		K 40	2 m
		K 80	2 m
Diffuse sensors with background suppression		K 20	10 cm
		M18P	10 cm
		M 18	12 cm
		K 31	15 cm
		C 40	25 cm
		K 80	1 m
	Laser	L 50	15 cm
Sensors with fiber-optic conductors		K 31	200 mm
		KL 40	280 mm
		K 30	400 mm
Diffuse sensor with analog output		**Laser** L 50	45 ... 85 mm

50 mm 120 mm 150 mm 50 cm 60 cm 1 m 1.2 m 2 m 2.5 m 4 m 6 m 12 m 15 m 50 m 70 m

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Operating voltage range		Output					Connection					Features					Design	Page
DC	UC	pnp	npn	Relays	AS-Interface	Analog output	M 8 connector	M 12 connector	Cable	Terminals	AS-Interface with FK block	Timing function	Anti-interference function	Test input	Molded plastic	Metal enclosure		
10 ... 30 V		■	■				■		■							■	D 4, M5	4/15
10 ... 36 V		■	■					■	■							■	M12	4/17
10 ... 30 V		■	■					■	■						■		M18P	4/22
10 ... 30 V		■	■				■		■				■		■		K 20	4/25
10 ... 36 V		■	■					■	■							■	M18S	4/19
10 ... 30 V		■	■				■		■						■		K 21, K 21 R	4/26
10 ... 36 V		■	■				■		■						■		K 31	4/28
10 ... 30 V		■	■					■					■		■		C40	4/35
10 ... 36 V		■	■				■		■						■		K 30	4/30
10 ... 36 V		■	■				■	■	■						■		K 40	4/33
10 ... 36 V	20 ... 320 V	■	■	■	■			■		■	■	■		■	■		K 80	4/37
10 ... 30 V		■	■				■		■				■		■		K 20	4/25
10 ... 30 V		■	■					■	■						■		M18P	4/22
10 ... 36 V		■	■					■	■							■	M 18	4/21
10 ... 36 V		■	■				■		■						■		K 31	4/28
10 ... 30 V		■	■					■					■		■		C 40	4/35
10 ... 36 V	20 ... 320 V	■	■	■	■			■		■	■	■		■	■		K 80	4/37
10 ... 30 V		■	■					■	■						■		L 50	3/57
10 ... 30 V		■	■				■		■						■		K 31	4/28
10 ... 36 V		■	■				■		■			■			■		KL 40	4/40
10 ... 36 V		■	■				■		■						■		K 30	4/30
18 ... 28 V						■			■						■		L 50	4/45

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Summary of ranges

Function		Design	Sensing range
Retroreflective sensor		M12	1.5 m
		M18S	2 m
		M18P	2 m
		K 31	2 m
		K 21, K 21 R	3 m
		K 30	4 m
		K 40	6 m
		C 40	6 m
		K 80	6 m
	Laser	L 50	12 m
		Light array	1.4 m
Thru-beam sensor		D 4, M5	25 cm
		M12	4 m
		M18S	6 m
		K 31	6 m
		M18P	12 m
		K 30	12 m
		K 40	15 m
		K 80	50 m
	Laser	L 18	50 m
Color sensors		CL 40	15 mm
Color mark sensors BERO		C 80	18 mm

50 mm · 120 mm · 150 mm · 50 cm · 60 cm · 1 m · 1.2 m · 2 m · 2.5 m · 4 m · 6 m · 12 m · 15 m · 25 m · 50 m

Operating voltage range		Output				Connection					Features					Design	Page
DC	UC	pnp	npn	Relays	AS-Interface	M 8 connector	M 12 connector	Cable	Terminals	AS-Interface with FK block	Timer function	Anti-interference function	Test input	Molded plastic	Metal enclosure		
10 ... 30 V		■	■				■	■							■	M12	4/17
10 ... 36 V		■	■				■	■							■	M18S	4/19
10 ... 30 V		■	■				■	■						■		M18P	4/22
10 ... 36 V		■	■			■		■						■		K 31	4/28
10 ... 30 V		■	■			■		■				■		■		K 21, K 21 R	4/26
10 ... 36 V		■	■			■		■						■		K 30	4/30
10 ... 36 V		■	■			■	■	■						■		K 40	4/33
10 ... 30 V		■	■				■					■		■		C 40	4/35
10 ... 36 V	20 ... 320 V	■	■	■	■		■		■	■	■		■			K 80	4/37
10 ... 36 V		■	■				■	■						■		L 50	4/45
12 ... 36 V		■				■								■		Light array	4/47
10 ... 30 V		■	■			■		■					■		■	D 4, M5	4/15
10 ... 36 V		■	■				■	■					■		■	M12	4/17
10 ... 36 V		■	■				■	■					■		■	M18S	4/20
10 ... 36 V		■	■			■		■					■	■		K 31	4/28
10 ... 30 V		■	■			■		■							■	M18P	4/22
10 ... 36 V		■	■			■		■					■	■		K 30	4/30
10 ... 36 V		■	■			■	■	■					■	■		K 40	4/33
10 ... 36 V	20 ... 320 V	■	■	■	■		■		■	■	■		■	■		K 80	4/37
10 ... 30 V		■					■	■							■	L 18	4/43
10 ... 30 V		■	■			■		■			■			■		CL 40	4/41
10 ... 30 V		■				■		■			■				■	C 80	4/42

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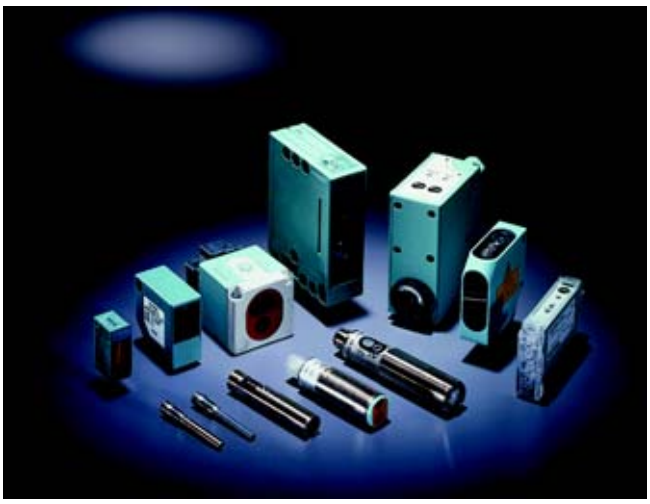
Introduction

Overview



The Opto-BERO photoelectric proximity switches react to changes in the received quantity of light. The light beam emitted from the emitter diode is interrupted or reflected by the object to be detected.

Depending on the type of BERO, the interruption or reflection of the light beam is evaluated. The following exist:

- Diffuse sensor or type D
- Retroreflective sensor or type R
- Thru-beam sensor or type T.

The devices can be provided with background suppression as an option, or also as fiber-optic devices.

The comprehensive range of Opto-BERO operates using infrared, red or laser light and covers sensing ranges between 3 cm and 50 m. Due to the different physical principles of these systems, thru-beam sensors have wider sensing ranges than retroreflective sensors. Diffuse sensors can also react to diffuse-reflecting materials. Thus the sensing range is smaller than with retroreflective sensors.

The Opto-BEROs can be set quickly and easily by means of a Teach-In or potentiometer. A large selection of cubic, cylindrical and miniature designs will satisfy every wish.

Area of application

The various versions of the Opto-BEROs are preferably used in the following sectors:

- In conveyor systems
- In packaging machines
- In mechanical engineering
- In paper, textile and plastics processing
- In printing machines
- For access control.

These photoelectric sensors detect all objects regardless of their composition, whether metal, wood or plastic. Special versions of the K 20 form in miniature enclosure and the C 40 are available for detecting transparent objects.

Special devices such as the color sensor or color mark reader can be used to detect differences in color or contrast. The analog laser supports extremely precise distance measurements and position monitoring.

Safety-related applications

The use of the sensors is not permissible for applications in which the safety of persons is dependent on the function of the BERO.

Design

The devices can be mounted in any position. They should be installed in such a manner as to prevent dirt deposits as far as possible. The available accessories enable the devices to be mounted easily and correctly.

Alignment

Diffuse sensors

The sensor must be aligned with the object to be sensed to ensure reliable switching. In devices that have a surplus light function, the relevant LED must be active.

Retroreflective sensors

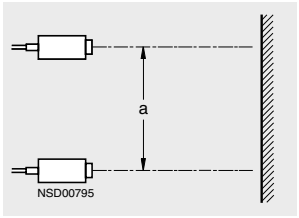
- Place the reflector at the required location and secure it firmly.
- Cover the reflector with adhesive tape so that only the center (approximately 25 % of the surface) remains free.
- Install the retroreflective sensor so that it switches reliably.
- Finally remove the adhesive tape from the reflector.

Thru-beam sensors

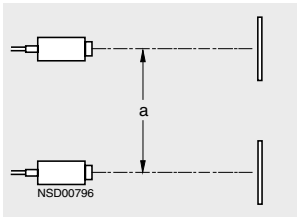
- Place the receiver in the required position and secure it firmly.
- Align the emitter with the receiver as accurately as possible.

Minimum clearance

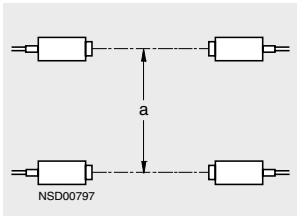
The proximity switches must not interfere with each other. Therefore a minimum distance **a** must be observed between two sensors. The following distances are recommended values only. The values given are for maximum sensitivity.



Diffuse sensor



Retroreflective sensor



Thru-beam sensor

Opto-BERO	Distance **a**
D 4/M5	50 mm
M12	250 mm
M18	250 mm
K 31	250 mm
K 30	500 mm
K 40	750 mm
K 80	500 mm
L 18 (laser retroreflective sensor)	150 mm [1])
L 50 (laser diffuse sensor)	30 mm
L 50 (laser retroreflective sensor)	80 mm

1) Focusing at 50 m.

Setting the operating distance

The sensitivity is adjusted via the built-in multi-turn potentiometer. Turning it clockwise increases the sensitivity. The potentiometer cannot be overwound (no stops).

Diffuse sensors

The sensitivity and the distance should be set such that the object is reliably detected; if required, the surplus light LED should be activated. The object must then be removed. If the output remains On, the sensitivity must be reduced slightly.

Retroreflective sensors and thru-beam sensors

The potentiometer is normally set to maximum sensitivity (clockwise rotation). This results in maximum surplus light. It may be necessary to reduce the sensitivity in the case of transparent objects.

Cable length

Long cables between the devices result in:
- Additional capacitive loading (short-circuit protection)
- Increased injection of interference.

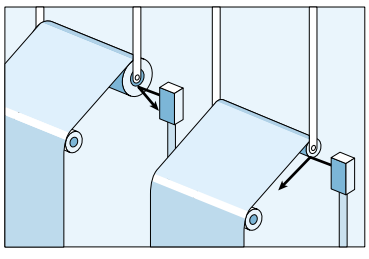
For this reason the specified maximum cable length must not be exceeded.

Functions

Diffuse sensors (energetic sensors)

The light from the emitter falls on an object and is reflected in a diffuse pattern. Part of this reflected light reaches the receiver located in the same device. If the intensity of the received light is sufficient, the output is switched.

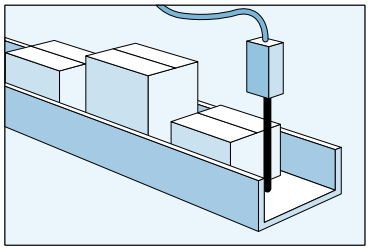
The sensing range depends on the size and color of the object involved as well as its surface texture. The sensing range can be varied within a wide range by means of the built-in potentiometer. The energetic sensor can therefore also be used to detect different colors.



Introduction

Diffuse sensor with background suppression

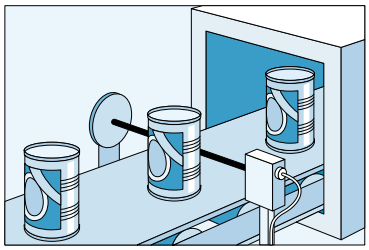
Diffuse sensors with background suppression can detect objects up to a specific sensing range. All objects beyond this range are suppressed. The focus level can be adjusted. The background is suppressed due to the geometric constellation between the emitter and the receiver.



Retroreflective sensors

The light from the emitter diode is focused through a lens and directed via a polarization filter to a reflector (principle of a 3-way mirror). Part of the reflected light passes through another polarization filter and reaches the receiver. The filters are selected and aligned in such a way that only the light reflected from the reflector reaches the receiver and not the light reflected from other objects within the beam range.

An object that interrupts the light beam from the emitter through the reflector to the receiver causes the output to switch.



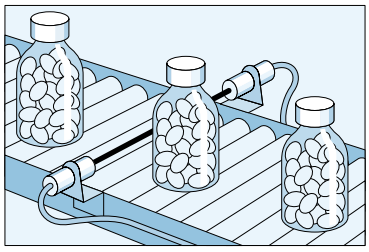
Light array (7-beam retroreflective sensor)

The light from all seven emitters of this special Opto-BERO is directed to one reflector and reflected to the seven receivers of the BERO. The switching output switches as soon as one of the beams is interrupted. A line of 42 mm can be completely covered. Typical applications are found, e.g. in conveyor systems.

Thru-beam sensors

Thru-beam sensors comprise an emitter and a receiver. The emitter is aligned in such a way that the greatest possible amount of pulsed light from the emitter diode reaches the receiver. The receiver evaluates the incoming light to clearly separate it from the ambient light and other light sources.

Any interruption of the light beam between emitter and receiver causes the output to switch.

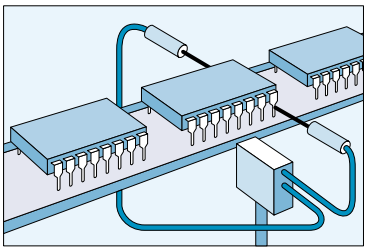


Introduction

Devices for fiber-optic conductors

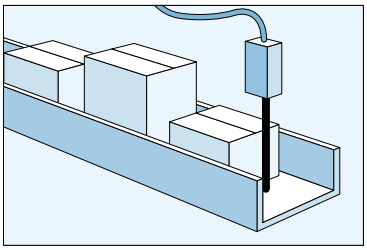
The basic operation is the same for optical fibers made of glass or plastic. Optical fibers are fitted in front of the emitter and receiver. They represent the "extended eye" of the Opto-BERO.

As optical fibers are very small and flexible, they provide a practical solution to the problem of sensing at points that are not easily accessible. Furthermore no electrical potential is transferred.



Laser diffuse sensor with analog output

The analog laser BERO can measure the exact distance of an object within its sensing range. Due to the use of visible laser light, the measurement is highly accurate and the output is extremely linear. All laser BEROs belong to safety class 2, i.e. they are harmless and can be used without any risk to health (e.g. to the eyes).



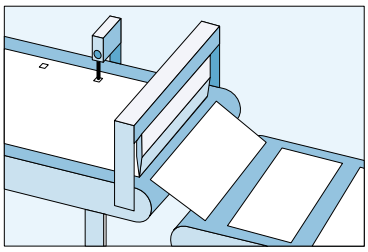
Color sensors

The color sensor uses three LEDs with the colors red, green and blue. The light is emitted to the object.

When the BERO is set, the color of the object is measured and assigned to an output state. During the learning phase, the BERO saves the detected color in a non-volatile EEPROM. This ensures that the setting procedure will not have to be repeated whenever the supply for the BERO is switched on. One color or a color range can be set.

Color mark sensor

The color mark sensor uses green or red emitted light. The color is selected automatically depending on the contrast. The mark color and the background color can be set separately by means of two keys.



Technical specifications

This table lists data which are independent of the design.

Type		Solid-state output	Relay output (K 80)	Devices with laser (L 18, L 50)
Voltage drop at 200 mA	V	Max. 2.0	–	Max. 2.4
Operating capacity	mA	Max. 200	2000	Max. 200
Reverse current of outputs	mA	Max. 0.1	–	Max. 0.1
Power-up delay	ms	Max. 20	Max. 300	Max. 300
Differential travel (typical) for diffuse sensors		10%	10%	5%
Repeat accuracy for diffuse sensors		5 % of operating distance		
Ambient light limit				
• Sunlight	Lux	10.000		
• Halogen light	Lux	3.000		
Protective measures				
• Overload protection		•	–	•
• Overvoltage protection		•	–	•
• Short-circuit protection		•	Backup fuse required	•
Max. cable length	m	Max. 250	Max. 250	Max. 100

For further technical specifications, see the respective form.

Options

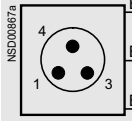
Cable length

The designs with cable are normally supplied with a cable of 2 or 3 m in length (see selection data).

Longer cables can be ordered as necessary. In this case, the Order No. must be supplemented by **"–Z"** and the required length specified in plain text.

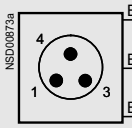
Circuit diagrams

Fig. 1



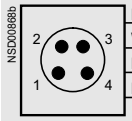
BN (1)	+ U_b	M 8 connector, type A, C, D
BK (4)	Output light-ON/dark-ON	Cable
BU (3)	0 V	

Fig. 2



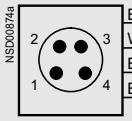
BN (1)	+ U_b	M 8 connector, type A, C, D
BK (4)	Enable input	Cable
BU (3)	0 V	

Fig. 3



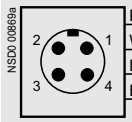
BN (1)	+ U_b	M 8 connector, type B
WH (2)	Output dark-ON	Cable
BK (4)	Output light-ON	
BU (3)	0 V	

Fig. 4



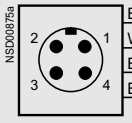
BN (1)	+ U_b	M 8 connector, type B, 4-pole
WH (2)	Output surplus light	Cable
BK (4)	Output light-ON	
BU (3)	0 V	

Fig. 5



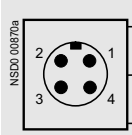
BN (1)	+ U_b	M12 connector, type F, K, L
WH (2)	Output dark-ON	Cable
BK (4)	Output light-ON	
BU (3)	0 V	

Fig. 6



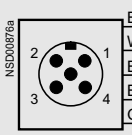
BN (1)	+ U_b	M12 connector, type F, K, L
WH (2)	Output surplus light	Cable
BK (4)	Output light-ON/dark-ON	
BU (3)	0 V	

Fig. 7



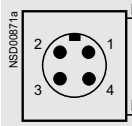
BN (1)	+ U_b	M12 connector, type E, F, H, J, K, L
BK (4)	Enable input	Cable
BU (3)	0 V	

Fig. 8



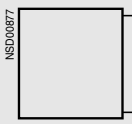
BN (1)	+ U_b	M12 connector, type G, M
WH (2)	Output surplus light	
BK (4)	Output light-ON/dark-ON	
BU (3)	0 V	
GR (5)	Enable input	

Fig. 9



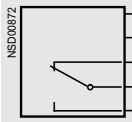
BN (1)	+ U_b	M12 connector, type E, F, H, J, K, L, M
BU (3)	0 V	Cable

Fig. 10



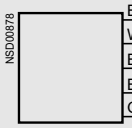
(1)	AS-Interface	AS-Interface, FK block
(3)	AS-Interface	

Fig. 11



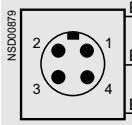
(1)	+ U_b	Screw terminals
(2)	0 V	
(3)	NC (relay)	
(4)	Common (relay)	
(5)	NO (relay)	

Fig. 12



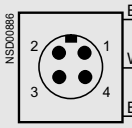
BN (1)	+ U_b	Screw terminals
WH (2)	Output surplus light	
BK (4)	Output light-ON/dark-ON	
BU (3)	0 V	
GR (5)	Enable input	

Fig. 13



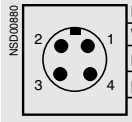
BN (1)	+ U_b	M12 connector, type E, F, H, J, K, L, N
BK (4)	Output light-ON/dark-ON	Cable
BU (3)	0 V	

Fig. 14



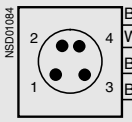
BN (1)	+ U_b	M12 connector, type E, F, H, J, K, L, N
WH (2)	Output light-ON/dark-ON	Cable
BU (3)	0 V	

Fig. 15



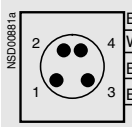
BN (1)	+ U_b 10 ... 30 V DC	M12 connector, type E, F, H, J, K, L, N
WH (2)	Output dark-ON	
BU (3)	0 V	
BK (4)	Output light-ON	

Fig. 16



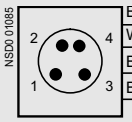
BN (1)	+ U_b DC 10 ... 30 V	M 8 connector, type B, 4-pole
WH (2)	Programming	
BU (3)	0 V	
BK (4)	Switching output light-ON/dark-ON	

Fig. 17



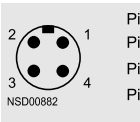
BN (1)	+ U_b 10 ... 30 V DC	M 8 connector, type B, 4-pole
WH (2)	Changeover light-ON/dark-ON	
BU (3)	0 V	
BK (4)	Switching output	

Fig. 18



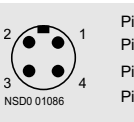
BN (1)	+ U_b 10 ... 30 V DC	M 8 connector, type B, 4-pole
WH (2)	Test input +	
BU (3)	0 V	
BK (4)	Test input –	

Fig. 19



	Pin 1: AS-Interface +	M12 connector, type E, F, H, J, K, L, N
	Pin 2:	
	Pin 3: AS-Interface –	
	Pin 4:	

Fig. 20



	Pin 1: + U_b 10 ... 30 V DC	M12 connector, type E, F, H, J, K, L, N
	Pin 2: Changeover light-ON/dark-ON	
	Pin 3: 0 V	
	Pin 4: Switching output pnp	

BK = Black BU = Blue YE = Yellow
BN = Brown GR = Gray WH = White

4

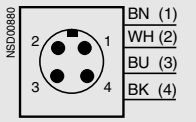
Introduction

Fig. 21

Pin 1: + U_b 10 ... 30 V DC
Pin 2: Test input +
Pin 3: 0 V
Pin 4: Test input –

M12 connector, type E, F, H, J, K, L, N

Fig. 22



BN (1) + U_b 10 ... 30 V DC
WH (2) Output dark-ON
BU (3) 0 V
BK (4) Output light-ON

M12 connector, type E, F, H, J, K, L, N

Fig. 23

Pin 1: + U_b 10 ... 30 V DC
Pin 2: Programming
Pin 3: 0 V
Pin 4: Switching output

M 8 connector, type B, 4-pole

Fig. 24

Pin 1: + U_b 10 ... 30 V DC
Pin 2: Switching output npn
Pin 3: 0 V
Pin 4: Switching output pnp

M 8 connector, type B, 4-pole

Fig. 25

Pin 1: + U_b 10 ... 30 V DC
Pin 2: Time function
Pin 3: 0 V
Pin 4: Switching output

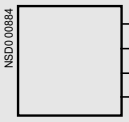
M 8 connector, type B, 4-pole

Fig. 26

Pin 1: + U_b 10 ... 30 V DC
Pin 2: Analog output
Pin 3: 0 V
Pin 4: Switching output npn/pnp

M12 connector, type E, F, H, J, K, L, N

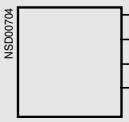
Fig. 27



BN + U_b 10 ... 30 V DC
WH Test input +
BK Test input –
BU 0 V

Cable

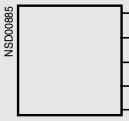
Fig. 28



BN + U_b 10 ... 30 V DC
WH
BK Switching output pnp
BU 0 V
RD Changeover light: U_b

Cable

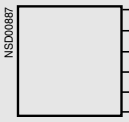
Fig. 29



BN + U_b 10 ... 30 V DC
WH Switching output npn
BK
BU 0 V
RD Changeover light-ON : U_b

Cable

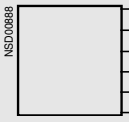
Fig. 30



BN + U_b 10 ... 30 V DC
WH
BK Switching output pnp
BU 0 V
RD Changeover light: U_b; dark: 0 V
Alarm output

Cable

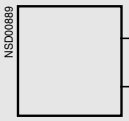
Fig. 31



BN + U_b 10 ... 30 V DC
WH Switching output npn
BK
BU 0 V
RD Changeover light: U_b; dark: 0 V
Alarm output

Cable

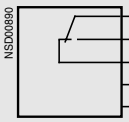
Fig. 32



BK
BU UC 15 ... 264 V

Cable

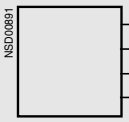
Fig. 33



WH
BN Switching output relay
RD
BK
BU 15 ... 264 V AC/DC

Cable

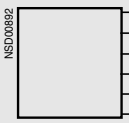
Fig. 34



BN + U_b 10 ... 30 V DC
WH Switching output
BU 0 V
OR Programming

Cable

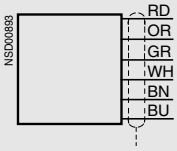
Fig. 35



BN + U_b 10 ... 30 V DC
BK Switching output
GR Time function
BU 0 V
WH Programming
RD Alarm output

Cable

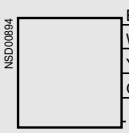
Fig. 36



RD Control input A
OR Control input B
GR Analog output
WH Switching output npn/pnp
BN + U_b 10 ... 30 V DC
BU 0 V

Cable

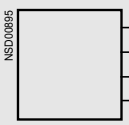
Fig. 37



BN + U_b
WH + U_a
YE – U_a
GN 0 V
Shielding

Cable

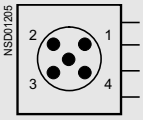
Fig. 38



BN + U_b 10 ... 30 V DC
WH Switching output (npn), Progr. (pnp)
BK Progr. (npn), Switching output (pnp)
BU 0 V

M12 connector, type E, F, H, J, K, L, N
Cable

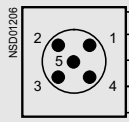
Fig. 39



PIN 1: + U_b
PIN 2: Programming
PIN 3: 0 V
PIN 4: Switching output light-ON/dark-ON

M12 connector, type G, M

Fig. 40



PIN 1: + U_b
PIN 2: Programming
PIN 3: 0 V
PIN 4: Switching output light-ON/dark-ON
PIN 5: Output surplus light

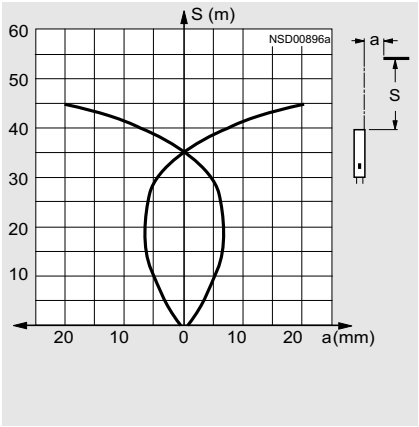
M12 connector, type G, M

BK = Black BU = Blue OR = Orange WH = White
BN = Brown GR = Gray RD = Red YE = Yellow

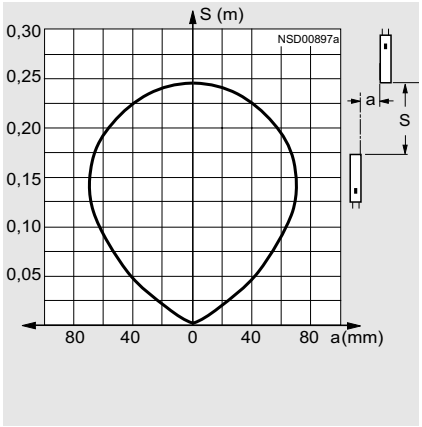
Characteristics

D 4 and M5 forms

Diffuse sensor

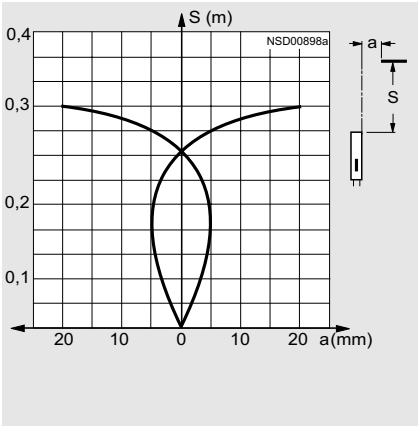


Thru-beam sensor

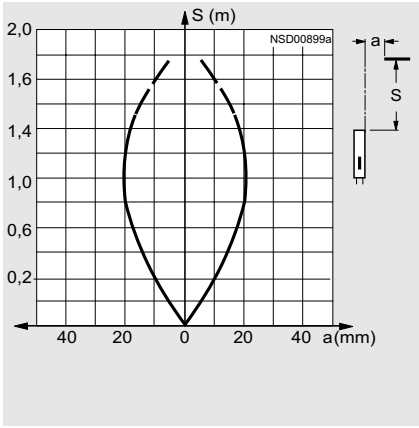


M12 form

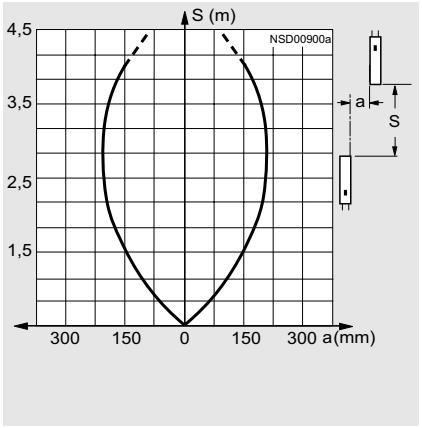
Diffuse sensor



Retroreflective sensor

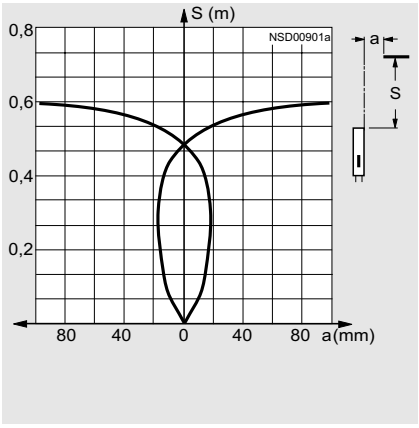


Thru-beam sensor

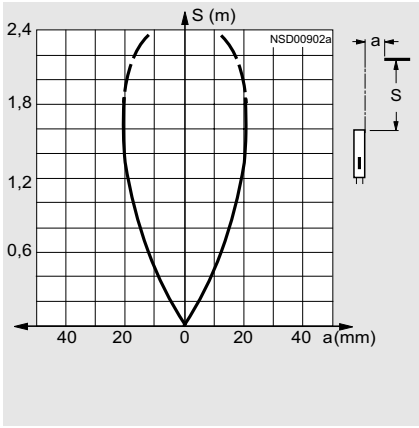


M18 form

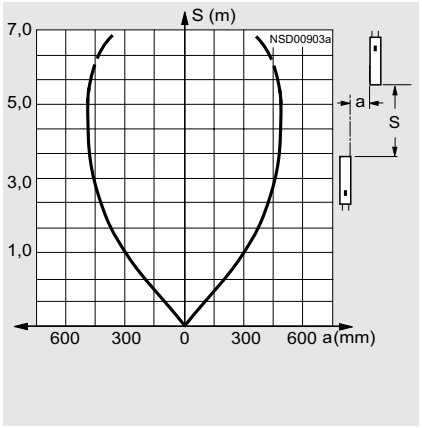
Diffuse sensor



Retroreflective sensor



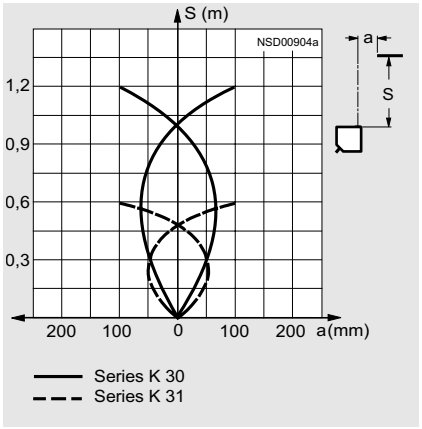
Thru-beam sensor



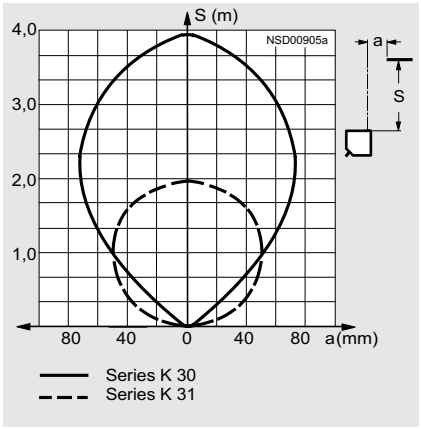
Introduction

K 30 and K 31 forms

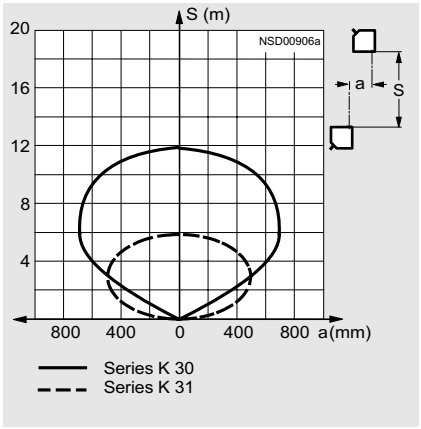
Diffuse sensor



Retroreflective sensor

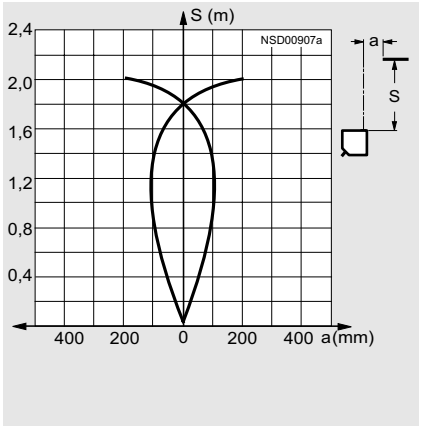


Thru-beam sensor

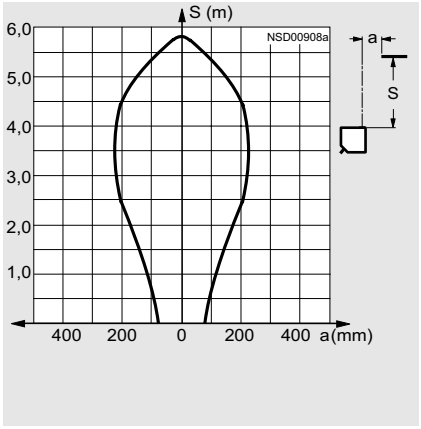


K 40 form

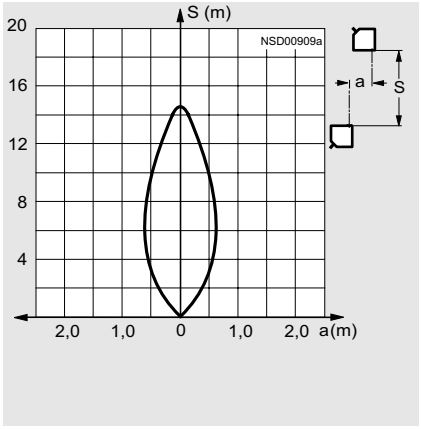
Diffuse sensor



Retroreflective sensor

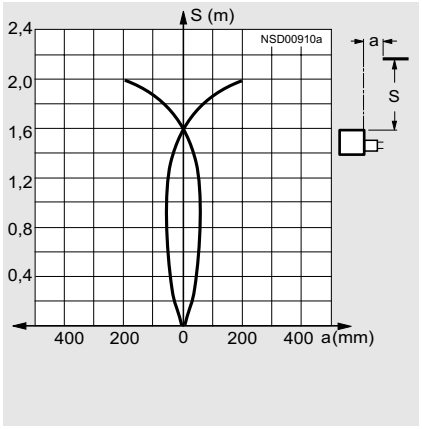


Thru-beam sensor

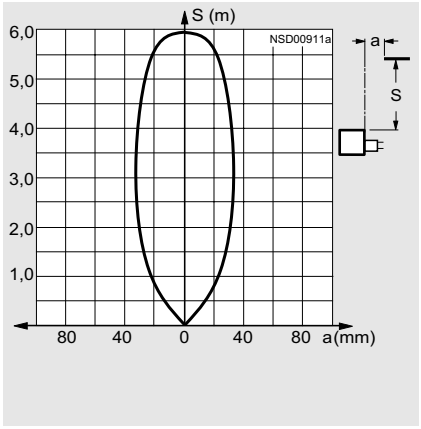


K 80 form

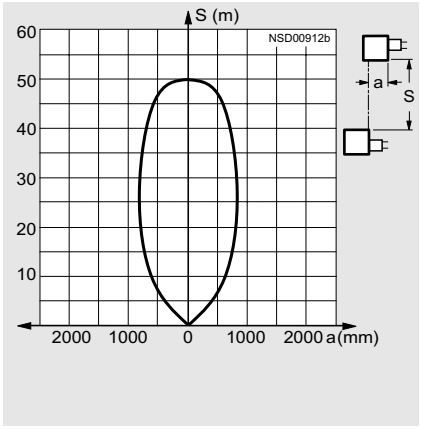
Diffuse sensor



Retroreflective sensor



Thru-beam sensor



4

Further information

Opto-BERO lexicon

Terms associated with the technology of photoelectric proximity switches are explained below. Some of the terms are defined in IEC 60947-5-2.

Connection to AS-Interface

Assignment of data bits

Data bits	Meaning
D0	Switching signal
D1	Surplus light
D2	–
D3	Test input • 0 : emitter on • 1 : emitter out

Assignment of parameter bits

Parameter bits	Meaning
P0	–
P1	Inversion of D0 • 0 : inverted • 1 : not inverted
P2	–
P3	–

Anti-interference function

This function prevents mutual interference between Opto-BEROs. The specified clearances between the devices does not have to be observed for devices with an anti-interference function. It is therefore possible to align, e. g. two retroreflective sensors with a common reflector.

Function of the outputs

Dark-ON

The "Dark-ON" function means that this output is conducting (current-carrying) when **no** light reaches the receiver.

Light-ON

The "light-ON" function means that this output is conducting (current-carrying) when light reaches the receiver.

Antivalent

The devices with antivalent output have 2 outputs. One output is **dark-ON**, and the other is **light-ON**.

Surplus light

Alternatively some of the devices are available with a different configuration of the outputs: one output is light-ON and the other is for signaling the surplus light.

Output current

The devices are designed for a maximum output current (rated operating current, see Technical specifications). If this current is exceeded, even briefly, the built-in overload and short-circuit protection will be activated. Destruction of the device is effectively prevented.

Incandescent lamps, capacitors and other strongly capacitive loads (e.g. long leads) have a similar effect to an overload.

A minimum load current (smallest operating current) is not required. A built-in pull-up resistor ensures that an output signal is always available.

Autocollimation

With these devices, the optical axes of the emitter and receiver are identical. The device only has one optical axis. This means that there is no close range in front of the BERO and the accuracy of the switching point is higher.

Spurious signal suppression

The devices feature spurious signal suppression. It prevents the occurrence of spurious signals from the moment of application of the operating voltage until the moment when the device is ready for operation (approximately 5 ms).

Sensing range

The sensing range is the range within which the operating distance can be set. This term replaces any other previously used terms.

Correction factors

The specified sensing ranges of diffuse sensors are achieved with the specified surfaces by using matte-white standard paper. The following correction factors (approximate values) apply to other surfaces:

Test card	100 %
White paper	80 %
Light-colored wood	73 %
White plastic	70 %
Cork	65 %
Printed newspaper	60 %
Gray PVC	57 %
Black plastic	22 %
Black neoprene	20 %
Automobile tires	15 %
Sheet aluminum	
• Raw	200 %
• Black anodized	150 %
• Matte (brushed)	120 %
Stainless steel, polished	230 %

Enabling input

Opto-BEROs with a test input allow the emitter to be selectively switched on or off. The output signal can be evaluated to check that the sensor is functioning correctly (thru-beam sensors: no obstruction of light beam / diffuse sensors: reflecting object exists).

To disable the BERO, the enabling input must be connected to 0 V. For operation of the BERO, the enabling input does not have to be used.

Ambient light limit

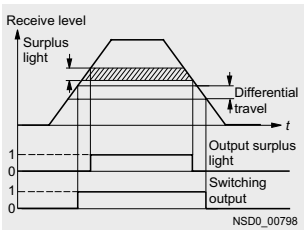
Ambient light is the light produced by external light sources. The luminescence level is measured on the light incidence surface. Thanks to the use of modulated light, the devices are insensitive to ambient light.

There is, however, an upper limit for the intensity of any external light which is referred to as the ambient light limit. It is specified for sunlight (unmodulated light) and halogen light (light modulated at twice the frequency of the electricity supply). Reliable operation is not possible above the respective ambient light limit.

Introduction

Surplus light

The surplus light is the excess radiant power that falls on the light incidence surface and that is evaluated by the light receiver. The surplus light can decrease in the course of time due to pollution, changing of the reflection factor of the object and aging of the emitter diode, so that reliable operation is no longer guaranteed.



All devices are therefore equipped with a surplus light LED. Devices are also available in which this signal is connected to one of the outputs. This can be used to recognize states that are not operationally safe any longer.

Semiconductor lasers, laser diodes

These are characterized by an extremely high-density beam and emit extremely tightly bundled light rays in visible red.

The lasers used correspond to protection class 2!

Differential travel

The differential travel causes a defined switching response for the devices. The ranges are always specified with regard to the pick-up point on approach.

IR light

IR is the abbreviation for "infrared". It refers to electromagnetic radiation with a wavelength between 780 and 1500 nm which is longer than that of visible light (wavelength between 380 and 780 nm).

Fiber-optic conductors

Fiber-optic conductors consist of plastic or glass fibers in which the light can also be directed around bends. Fiber-optic conductors support applications in which space is at a premium and under critical environmental conditions.

Light-emitting diodes, LEDs

In the Opto-BEROs, LEDs are used as light beam sources. They have a narrow emission spectrum, can be easily modulated and have a long service life. In the Opto-BEROs, they also serve to signal the switching status or the surplus light emission.

Parallel connection

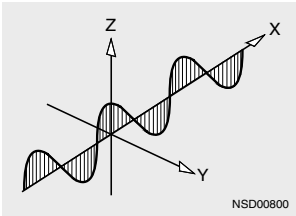
Devices can be connected in parallel for logic gating of the outputs. Different logic operations can be achieved by mixed use of dark-ON and light-ON outputs.

Note:

The power consumption increases. Leakage currents add up so that even in the off state, the load may be energized. Diodes in the output leads serve to decouple the pull-up resistors. They can be omitted when a small number of devices are connected in parallel.

Polarized light

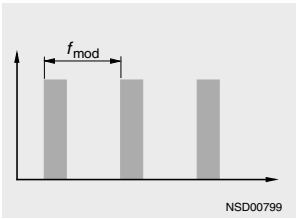
Natural light (including the light from the emitter diodes or laser diodes) is unpolarized. When the light has passed through a polarization filter, only that part of the light remains which oscillates in the polarization direction of the filter.



Retroreflective sensors use this polarized light to minimize the influence of unwanted reflections. With polarization filters in front of the emitter and receiver, the retroreflective sensor only reacts to light that is reflected by a special reflector, the so-called 3-way mirror. Other reflections do not cause a reaction.

Modulated light

Opto-BEROs operate with modulated light, i.e. the emitter is only active for a short time. Depending on the type, the modulation frequency f_{mod} of the modulated light is between 5 and 30 kHz.



If an Opto-BERO is operated in close proximity of another Opto-BERO with the same modulation frequency, this may cause interference (see minimum distance).

Operation with modulated light offers the following advantages:
- High degree of insensitivity to ambient light
- Larger sensing ranges
- Minimal temperature rise and therefore longer service life of the emitter diodes.

Overview

Cylindrical metal enclosure, IP67,
connection using cable or M 8 connector

Diffuse sensor (energetic sensor)
• Sensing range 5 cm (not adjustable)

Thru-beam sensor
• Sensing range 25 cm (not adjustable)

Rated operating voltage DC 24 V

Electronics output pnp or npn

Technical specifications

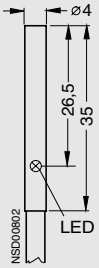
Operating mode		**Diffuse sensor** 	**Thru-beam sensor** 
Sensing range Standard target	cm mm	5 (not adjustable) 100 × 100 (white)	25 (not adjustable) –
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 30 (max. 20 % residual ripple) 10	5 / 5 (emitter / receiver)
Rated operational current I_e	mA	100	
Switching frequency Switching time	Hz ms	250 2.5	250 2.5
Wavelength (type of light)	nm	880 (IR)	880 (IR)
Displays • Reliable detection • Surplus light fallen below		Yellow LED Yellow LED flashing	
Enclosure material Degree of protection		D 4: stainless steel; M5: brass, nickel-plated IP67	
Ambient temperature Temperature coefficient	°C %/K	0 ... +55 0.3	
Type		3RG70 40–...00	3RG70 42–...00

Selection and ordering data

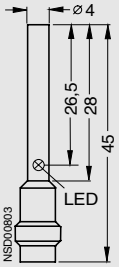
	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
	Diffuse sensor	5	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	X	**3RG70 40–0AB00**	1 unit	0.039
					npn, light-ON	1	X	**3RG70 40–0GB00**	1 unit	0.040
				M 8 connector, 3-pole, type A	pnp, light-ON	1	D	**3RG70 40–7AB00**	1 unit	0.015
					npn, light-ON	1	X	**3RG70 40–7GB00**	1 unit	0.016
	Thru-beam sensor	25	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	X	**3RG70 42–0AB00**	1 unit	0.039
					npn, light-ON	1	X	**3RG70 42–0GB00**	1 unit	0.041
					Emitter	2	X	**3RG70 42–0BG00**	1 unit	0.040
				M 8 connector, 3-pole, type A	pnp, light-ON	1	D	**3RG70 42–7AB00**	1 unit	0.011
					npn, light-ON	1	X	**3RG70 42–7GB00**	1 unit	0.011
					Emitter	2	D	**3RG70 42–7BG00**	1 unit	0.012

Dimension drawings

3RG70 4.–0..00



3RG70 4.–3..00



M5 form

Overview

Cylindrical metal enclosure, IP67,
connection using cable or M 8 connector

Diffuse sensor (energetic sensor)
• Sensing range 5 cm (not adjustable)

Thru-beam sensor
• Sensing range 25 cm (not adjustable)

Rated operating voltage DC 24 V

Electronics output pnp or npn

Technical specifications

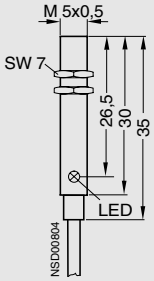
Operating mode		**Diffuse sensor** 	**Thru-beam sensor** 
Sensing range Standard target	cm mm	5 (not adjustable) 100 × 100 (white)	25 (not adjustable) –
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 30 (max. 20 % residual ripple) 10	 5 / 5 (emitter / receiver)
Rated operational current I_e	mA	100	
Switching frequency Switching time	Hz ms	250 2.5	250 2.5
Wavelength (type of light)	nm	880 (IR)	880 (IR)
Displays • Reliable detection • Surplus light fallen below		 Yellow LED Yellow LED flashing	
Enclosure material Degree of protection		D 4: stainless steel; M5: brass, nickel-plated IP67	
Ambient temperature Temperature coefficient	°C %/K	0 ... +55 0.3	
Type		3RG70 30–...00	3RG70 32–...00

Selection and ordering data

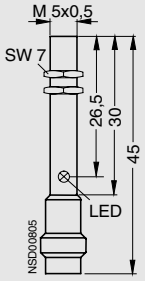
	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
	Diffuse sensor	5	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	A	**3RG70 30–0AB00**	1 unit	0.041
					npn, light-ON	1	X	**3RG70 30–0GB00**	1 unit	0.044
				M 8 connector, 3-pole, type A	pnp, light-ON	1	A	**3RG70 30–7AB00**	1 unit	0.015
					npn, light-ON	1	X	**3RG70 30–7GB00**	1 unit	0.019
	Thru-beam sensor	25	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	D	**3RG70 32–0AB00**	1 unit	0.041
					npn, light-ON	1	A	**3RG70 32–0GB00**	1 unit	0.038
					Emitter	2	D	**3RG70 32–0BG00**	1 unit	0.040
				M 8 connector, 3-pole, type A	pnp, light-ON	1	D	**3RG70 32–7AB00**	1 unit	0.016
					npn, light-ON	1	A	**3RG70 32–7GB00**	1 unit	0.012
					Emitter	2	D	**3RG70 32–7BG00**	1 unit	0.015

Dimension drawings

3RG70 3.–0..00



3RG70 3.–3..00



Wherever you find the abbreviation SW in dimension drawings please note that SW means "spanner width" and Sg means "connecting thread".

Overview

Cylindrical metal enclosure, IP67,
connection using cable or M 12 connector

Diffuse sensor (energetic sensor)
- Sensing range 30 cm (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 1.5 m (adjustable using potentiometer)
- Supplied without reflector

Thru-beam sensor
- Sensing range 4 m (adjustable using potentiometer)
- Enabling input for test purposes

Rated operating voltage DC 24 V

Electronics output pnp or npn

Technical specifications

Operating mode		**Diffuse sensor** 	**Retroreflective sensor with polarization filter** 	**Thru-beam sensor** 
Sensing range Standard target/reflector	cm mm	30 (adjustable) 200 × 200 (white)	150 (adjustable) Reflector type D 84	400 (adjustable) –
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	15	15 / 15 (emitter / receiver)
Rated operational current I_e	mA	200		
Switching frequency Switching time	Hz ms	1000 0.5	1000 0.5	1000 0.5
Wavelength (type of light)	nm	660 (red)	660 (red, polarized)	660 (red)
Displays • Switching status • Surplus light		 Yellow LED Green LED		
Enclosure material Degree of protection		Brass, nickel-plated IP67		
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3		
Type		3RG71 20–...00	3RG71 21–...00	3RG71 22–...00

4

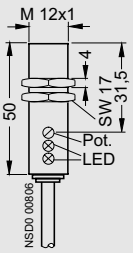
M12 form

Selection and ordering data

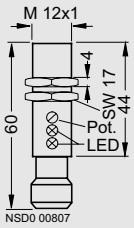
Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	cm	nm							kg
Diffuse sensor	30 (adjustable via potentiometer)	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	►	**3RG71 20–0AB00**	1 unit	0.102
				pnp, dark-ON	14	A	**3RG71 20–0AA00**	1 unit	0.104
				npn, light-ON	13	X	**3RG71 20–0GB00**	1 unit	0.104
				npn, dark-ON	14	X	**3RG71 20–0GA00**	1 unit	0.104
			M12 connector 4-pole, type F	pnp, light-ON	13	►	**3RG71 20–3AB00**	1 unit	0.046
				pnp, dark-ON	14	A	**3RG71 20–3AA00**	1 unit	0.042
				npn, light-ON	13	X	**3RG71 20–3GB00**	1 unit	0.042
				npn, dark-ON	14	X	**3RG71 20–3GA00**	1 unit	0.038
Retroreflective sensor	150 (adjustable via potentiometer)	660 (red, polarized)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	14	A	**3RG71 21–0AB00**	1 unit	0.098
				pnp, dark-ON	13	A	**3RG71 21–0AA00**	1 unit	0.098
				npn, light-ON	14	A	**3RG71 21–0GB00**	1 unit	0.105
				npn, dark-ON	13	X	**3RG71 21–0GA00**	1 unit	0.104
			M12 connector 4-pole, type F	pnp, light-ON	14	A	**3RG71 21–3AB00**	1 unit	0.038
				pnp, dark-ON	13	A	**3RG71 21–3AA00**	1 unit	0.039
				npn, light-ON	14	X	**3RG71 21–3GB00**	1 unit	0.034
				npn, dark-ON	13	X	**3RG71 21–3GA00**	1 unit	0.036
Thru-beam sensor	400 (adjustable via potentiometer)	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	14	A	**3RG71 22–0AB00**	1 unit	0.098
				pnp, dark-ON	13	X	**3RG71 22–0AA00**	1 unit	0.100
				npn, light-ON	14	X	**3RG71 22–0GB00**	1 unit	0.101
				npn, dark-ON	13	X	**3RG71 22–0GA00**	1 unit	0.101
				Emitter	7	►	**3RG71 22–0BG00**	1 unit	0.098
			M12 connector 4-pole, type F	pnp, light-ON	14	A	**3RG71 22–3AB00**	1 unit	0.038
				pnp, dark-ON	13	A	**3RG71 22–3AA00**	1 unit	0.038
				npn, light-ON	14	X	**3RG71 22–3GB00**	1 unit	0.037
				npn, dark-ON	13	X	**3RG71 22–3GA00**	1 unit	0.037
				Emitter	7	►	**3RG71 22–3BG00**	1 unit	0.039

Dimension drawings

3RG71 2.–0..00



3RG71 2.–3..00



Overview

Cylindrical metal enclosure, IP67,
connection using cable or M 12 connector

Diffuse sensor (energetic sensor)
- Sensing range 80 cm (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 3 m
- Supplied without reflector

Thru-beam sensor
- Sensing range 6 m

Rated operating voltage DC 24 V

Electronics output pnp

Technical specifications

Operating mode		**Diffuse sensor** 	**Retroreflective sensor with polarization filter** 	**Thru-beam sensor** 
Sensing range Standard target/reflector	cm mm	80 (adjustable) 200 × 200 (white)	300 Reflector type D 84	600 –
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 30 (max. 20 % residual ripple)		
Rated operational current I_e	mA	150		
Switching frequency Switching time	Hz ms			
Wavelength (type of light)	nm	660 (red)	660 (red, polarized)	660 (red)
Displays • Switching status • Surplus light		Yellow LED Green LED		
Enclosure material Degree of protection		Brass, nickel-plated IP67		
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3		
Type		3RG76 40–...00, 3RG76 50–...00	3RG76 41–...00, 3RG76 51–...00	3RG76 42–...00, 3RG76 52–...00

Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
Straight sensor										
	Diffuse sensor	80 (adjustable via potentiometer)	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 40–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 40–0AA00**	1 unit	0.115
				4 × 0.34 mm²	pnp, light-ON and dark-ON	5	A	**3RG76 40–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 40–0CD00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 40–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 40–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 40–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 40–3CD00**	1 unit	0.040
	Retroreflective sensor	300	660 (red, polarized)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 41–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 41–0AA00**	1 unit	0.115
				4 × 0.34 mm	pnp, light-ON and dark-ON	5	A	**3RG76 41–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 41–0CD00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 41–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 41–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 41–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 41–3CD00**	1 unit	0.040

Start of delivery: beginning of 2004.

M18 S form

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
Straight sensor										
	Thru-beam sensor	600	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 42–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 42–0AA00**	1 unit	0.115
				4 × 0.34 mm²	pnp, light-ON and dark-ON	5	A	**3RG76 42–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 42–0CD00**	1 unit	0.115
				2 × 0.34 mm²	Emitter	9	A	**3RG76 42–0BG00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 42–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 42–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 42–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 42–3CD00**	1 unit	0.040
					Emitter	9	A	**3RG76 42–3BG00**	1 unit	0.040
Angled sensor										
	Diffuse sensor	80 (adjustable via potenti-ometer)	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 50–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 50–0AA00**	1 unit	0.115
				4 × 0.34 mm²	pnp, light-ON and dark-ON	5	A	**3RG76 50–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 50–0CD00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 50–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 50–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 50–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 50–3CD00**	1 unit	0.040
	Retroreflective sensor	300	660 (red, polar-ized)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 51–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 51–0AA00**	1 unit	0.115
				4 × 0.34 mm	pnp, light-ON and dark-ON	5	A	**3RG76 51–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 51–0CD00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 51–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 51–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 51–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 51–3CD00**	1 unit	0.040
	Thru-beam sensor	600	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG76 52–0AB00**	1 unit	0.115
					pnp, dark-ON	13	A	**3RG76 52–0AA00**	1 unit	0.115
				4 × 0.34 mm	pnp, light-ON and dark-ON	5	A	**3RG76 52–0CC00**	1 unit	0.115
					pnp, light-ON and surplus light function	6	D	**3RG76 52–0CD00**	1 unit	0.115
				2 × 0.34 mm²	Emitter	9	A	**3RG76 52–0BG00**	1 unit	0.115
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG76 52–3AB00**	1 unit	0.040
					pnp, dark-ON	14	A	**3RG76 52–3AA00**	1 unit	0.040
					pnp, light-ON and dark-ON	5	A	**3RG76 52–3CC00**	1 unit	0.040
					pnp, light-ON and surplus light function	6	D	**3RG76 52–3CD00**	1 unit	0.040
					Emitter	9	A	**3RG76 52–3BG00**	1 unit	0.040

Start of delivery: beginning of 2004.

For dimension drawings, see M 18.

Overview

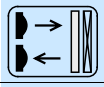
Cylindrical metal enclosure, IP67,
connection using cable or M 12 connector

Diffuse sensor with background suppression
- Sensing range 1 ... 12 cm (adjustable using potentiometer)

Rated operating voltage DC 24 V

Electronics output pnp or npn

Technical specification

Operating mode		**Diffuse sensor with background suppression** 
Sensing range Standard target	cm mm	1 ... 12 (adjustable) 50 × 50 (white)
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 25
Rated operational current I_e	mA	200
Switching frequency Switching time	Hz ms	500 1
Wavelength (type of light)	nm	660 (red)
Displays • Switching status • Surplus light		 Yellow LED Green LED
Enclosure material Degree of protection		Brass, nickel-plated IP67
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3
Type		3RG76 54–...00

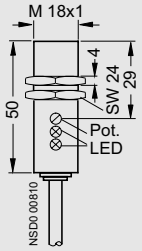
Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
	Diffuse sensor with background suppression	1 ... 12 (adjustable via potentiometer)	660 (red)	2 m cable, PUR, 3 × 0.34 mm²	pnp, light-ON	13	A	**3RG71 34–0AB00**	1 unit	0.125
					pnp, dark-ON	14	X	**3RG71 34–0AA00**	1 unit	0.127
					npn, light-ON	13	X	**3RG71 34–0GB00**	1 unit	0.125
					npn, dark-ON	14	X	**3RG71 34–0GA00**	1 unit	0.130
				M12 connector 4-pole, type F	pnp, light-ON	13	A	**3RG71 34–3AB00**	1 unit	0.066
					pnp, dark-ON	14	A	**3RG71 34–3AA00**	1 unit	0.067
					npn, light-ON	13	X	**3RG71 34–3GB00**	1 unit	0.066
					npn, dark-ON	14	X	**3RG71 34–3GA00**	1 unit	0.066

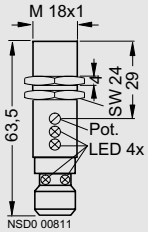
Dimension drawings

M18 form

3RG71 3.–0..00

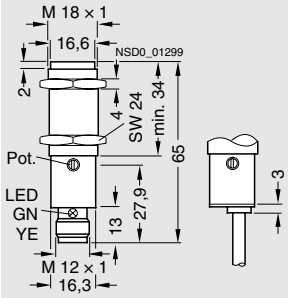


3RG71 3.–3..00

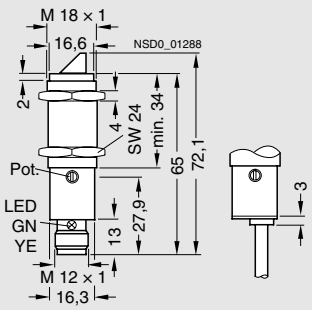


M18S form

3RG76 4.--...00



3RG76 5.-...00



M18 P form

Overview

Cylindrical molded-plastic enclosure, IP67,
connection using cable or M 12 connector

Diffuse sensor (energetic sensor)
- Sensing range 30 cm (adjustable using potentiometer)
- Sensing range 10 cm (not adjustable)

Diffuse sensor with background suppression
- Sensing range 2 ... 10 cm (not adjustable)
- Special design with straight or angular optic system

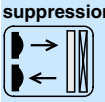
Retroreflective sensor
- Sensing range 1.5 m (adjustable using potentiometer)
- Sensing range 2 m (not adjustable)
- Supplied without reflector

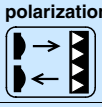
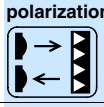
Thru-beam sensor
- Sensing range 12 m (not adjustable)

Rated operating voltage DC 24 V

Electronics output pnp and npn,
programmable as light-ON or dark-ON.
Exception with background suppression:
Electronics output pnp or npn

Technical specification

Operating mode		**Diffuse sensor** 	**Diffuse sensor** 	**Diffuse sensor with background suppression** 
Sensing range Standard target	cm mm	30 (adjustable) 100 × 100 (white)	10 (not adjustable) 100 × 100 (white)	2 ... 10 (not adjustable) 100 × 100 (gray, 18 %)
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 30		
Rated operational current I_e	mA	150		100
Switching frequency Switching time	Hz ms	500 1		200 2.5
Wavelength (type of light)	nm	880 (IR)		660 (red)
Display • Switching status • Surplus light		 Yellow LED –		 Yellow LED Green LED
Enclosure material Degree of protection		Molded plastic (ABS) IP67		
Ambient temperature Temperature coefficient	°C %/K	–15 ... +55		
Type		3RG76 20–...00	3RG76 20–...60	3RG76 24–...00, 3RG76 34–...00

Operating mode		**Retroreflective sensor with polarization filter** 	**Retroreflective sensor without polarization filter** 	**Thru-beam sensor** 
Sensing range Reflector	cm mm	150 (adjustable) Reflector type S 48	200 (not adjustable) Reflector type S 48	1200 (not adjustable) –
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 30		
Rated operational current I_e	mA	150		
Switching frequency Switching time	Hz ms	500 1		250 2
Wavelength (type of light)	nm	660 (red, polarized)	880 (IR)	880 (IR)
Display • Switching status • Surplus light		 Yellow LED –		
Enclosure material Degree of protection		Molded plastic (ABS) IP67		
Ambient temperature Temperature coefficient	°C %/K	–15 ... +55		
Type		3RG76 21–...00	3RG76 21–...51	3RG76 22–...00

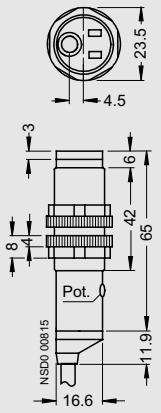
Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm								kg
	Diffuse sensor	30 (adjustable via potentiometer)	880 (IR)	2 m cable, PVC, 4 × 0.25 mm²	pnp/npn, light-ON or dark-ON		38	►	**3RG76 20–1RH00**	1 unit	0.113
				M12 connector 4-pole, type F	pnp/npn, light-ON or dark-ON			A	**3RG76 20–3RH00**	1 unit	0.037
		10	880 (IR)	2 m cable, PVC, 4 × 0.25 mm²	pnp/npn, light-ON or dark-ON		38	A	**3RG76 20–1RH60**	1 unit	0.119
				M12 connector 4-pole, type F	pnp/npn, light-ON or dark-ON			X	**3RG76 20–3RH60**	1 unit	0.033
	Retroreflective sensor with polarization filter	150 (adjustable via potentiometer)	660 (red)	2 m cable, PVC, 4 × 0.25 mm²	pnp/npn, light-ON or dark-ON		38	A	**3RG76 21–1RH00**	1 unit	0.112
				M12 connector 4-pole, type F	pnp/npn, light-ON or dark-ON			A	**3RG76 21–3RH00**	1 unit	0.043
	Retroreflective sensor	200	880 (IR)	2 m cable, PVC, 4 × 0.25 mm²	pnp/npn, light-ON or dark-ON		38	A	**3RG76 21–1RH51**	1 unit	0.108
				M12 connector 4-pole, type F	pnp/npn, light-ON or dark-ON			X	**3RG76 21–3RH51**	1 unit	0.034
	Thru-beam sensor	1200	880 (IR)	2 m cable, PVC, 4 × 0.25 mm²	pnp/npn, light-ON or dark-ON		38	A	**3RG76 22–1RH00**	1 unit	0.111
					Emitter		21	A	**3RG76 22–1BG00**	1 unit	0.108
				M12 connector 4-pole, type F	pnp/npn, light-ON or dark-ON			A	**3RG76 22–3RH00**	1 unit	0.035
					Emitter			A	**3RG76 22–3BG00**	1 unit	0.038
	Diffuse sensor with background suppression, straight optics	2 ... 10	660 (red)	2 m cable, PVC, 4 × 0.25 mm²	Light-ON, dark-ON (compatible)	pnp	15	X	**3RG76 24–1CC00**	1 unit	0.123
						npn	15	X	**3RG76 24–1HC00**	1 unit	0.123
				M12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	15	X	**3RG76 24–3CC00**	1 unit	0.057
						npn	15	X	**3RG76 24–3HC00**	1 unit	0.057
	Diffuse sensor with background suppression, angled optics	2 ... 10	660 (red)	2 m cable, PVC, 4 × 0.25 mm²	Light-ON, dark-ON (compatible)	pnp	15	X	**3RG76 34–1CC00**	1 unit	0.125
						npn	15	X	**3RG76 34–1HC00**	1 unit	0.124
				M12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	15	X	**3RG76 34–3CC00**	1 unit	0.059
						npn	15	X	**3RG76 34–3HC00**	1 unit	0.059

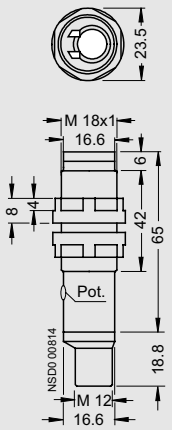
M18 P form

Dimension drawings

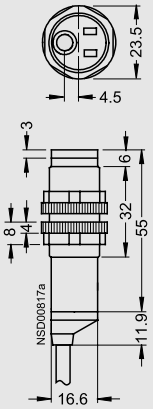
3RG76 20–1..00



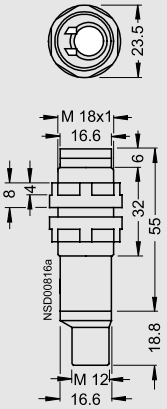
3RG76 20–3..00



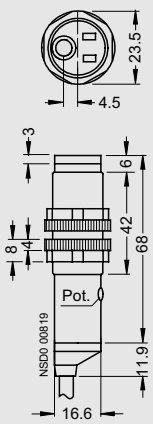
3RG76 20–1..60,
3RG76 21–1..51,
3RG76 22–1..00



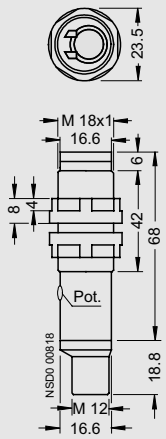
3RG76 20–3..60,
3RG76 21–3..51,
3RG76 22–3..00



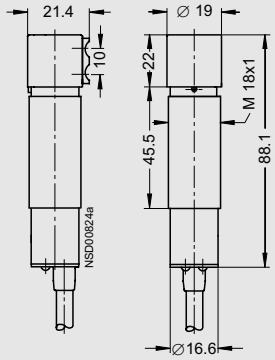
3RG76 21–1..00



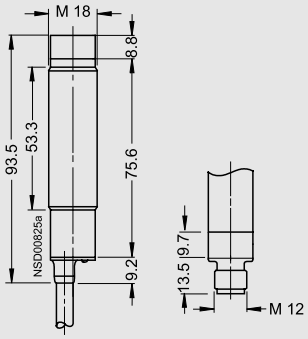
3RG76 21–3..00



3RG76 34–1..00
(angular optic system)



3RG76 24–1..00 3RG76 24–3..00
(straight optic system)



Overview

Cubic molded-plastic enclosure, IP67,
connection using cable or M 8 connector

Diffuse sensor with background suppression
- Sensing range 2 ... 10 cm (adjustable via teach-in)

Retroreflective sensor for transparent objects
(adjustable via teach-in)
- Sensing range 50 cm

Rated operating voltage DC 24 V

Anti-interference function

Electronics output pnp or npn

Supplied without fixing accessories and without reflector

Technical specification

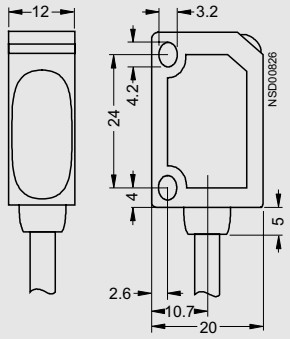
Operating mode		**Diffuse sensor with background suppression** 	**Retroreflective sensor for transparent objects** 
Sensing range Standard target/reflector	cm mm	2 ... 10 (adjustable) 100 × 100 (gray 18 %)	50 (adjustable) Reflector type R 60
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 35	
Rated operational current I_e	mA	100	
Switching frequency Switching time	Hz ms	1000 0.5	
Wavelength (type of light)	nm	660 (red)	
Displays • Switching status • Surplus light		 Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (ABS) IP67	
Ambient temperature Temperature coefficient	°C %/K	–20 ... +60 0.3	
Type		3RG74 04–...00	3RG74 01–...52

Selection and ordering data

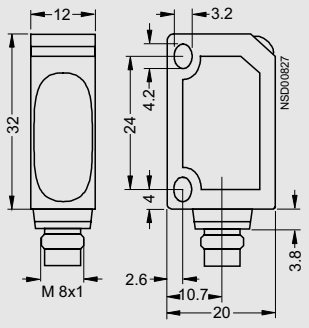
	Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm								kg
	Diffuse sensor with background suppression	2 ... 10 (adjustable via "teach-in")	660 (red)	2 m cable, PUR, 4 × 0.14 mm²	Light-ON or dark-ON	pnp	16	A	**3RG74 04–0CH00**	1 unit	0.044
						npn	16	C	**3RG74 04–0HH00**	1 unit	0.049
				M 8 connector, 4-pole, type B	Light-ON or dark-ON	pnp	16	▶	**3RG74 04–7CH00**	1 unit	0.013
						npn	16	X	**3RG74 04–7HH00**	1 unit	0.016
	Retroreflective sensor for transparent objects	50 (adjustable via "teach-in")	660 (red)	2 m cable, PUR, 4 × 0.14 mm²	Light-ON or dark-ON	pnp	16	A	**3RG74 01–0CH52**	1 unit	0.044
						npn	16	C	**3RG74 01–0HH52**	1 unit	0.048
				M 8 connector, 4-pole, type B	Light-ON or dark-ON	pnp	16	A	**3RG74 01–7CH52**	1 unit	0.013
						npn	16	X	**3RG74 01–7HH52**	1 unit	0.014
	Accessories										
	Mounting bracket for K 20							A	**3RX7 308**	1 unit	0.013

Dimension drawings

3RG74 0.–0....



3RG74 0.–7....



K 21, K 21 R forms

Overview

Cubic molded-plastic enclosure, IP68, connection using cable or M 8 connector

Diffuse sensor (energetic sensor)
- Sensing range 60 cm

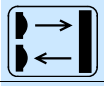
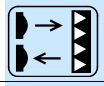
Retroreflective sensor
- Sensing range 3 m

Rated operating voltage DC 24 V

Electronics output pnp or npn

Supplied without mounting material and without reflector

Technical specifications

Operating mode		**Diffuse sensor** 		**Retroreflective sensor** 	
Sensing range Standard target/reflector	cm mm	60 100 × 100 (white 90 %)		300 Reflector type R 60	
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 30 28	33	25	30
Rated operational current I_e	mA	100			
Switching frequency Switching time	Hz ms	700 0.5			
Wavelength (type of light)	nm	660 (red)			
Displays • Switching status • Surplus light		 Yellow LED Green LED			
Enclosure material Degree of protection		Molded plastic (PBTP) IP68			
Ambient temperature Temperature coefficient	°C %/K	–5 ... +55 0.3			
Type		3RG74 00–...00	3RG74 20–...00	3RG74 01–...00	3RG74 21–...00

Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
K 21 form										
	Diffuse sensor	60	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON		A	**3RG74 00–0AB00**	1 unit	0.040
					pnp, dark-ON		A	**3RG74 00–0AA00**	1 unit	0.040
					npn, light-ON		D	**3RG74 00–0GB00**	1 unit	0.044
					npn, dark-ON		D	**3RG74 00–0GA00**	1 unit	0.040
				M 8 connector, 3-pole, type A	pnp, light-ON		A	**3RG74 00–7AB00**	1 unit	0.010
					pnp, dark-ON		A	**3RG74 00–7AA00**	1 unit	0.010
					npn, light-ON		D	**3RG74 00–7GB00**	1 unit	0.013
					npn, dark-ON		D	**3RG74 00–7GA00**	1 unit	0.010
	Retroreflective sensor	300	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON		A	**3RG74 01–0AB00**	1 unit	0.040
					pnp, dark-ON		A	**3RG74 01–0AA00**	1 unit	0.040
					npn, light-ON		D	**3RG74 01–0GB00**	1 unit	0.045
					npn, dark-ON		D	**3RG74 01–0GA00**	1 unit	0.040
				M 8 connector, 3-pole, type A	pnp, light-ON		►	**3RG74 01–7AB00**	1 unit	0.010
					pnp, dark-ON		►	**3RG74 01–7AA00**	1 unit	0.010
					npn, light-ON		D	**3RG74 01–7GB00**	1 unit	0.013
					npn, dark-ON		D	**3RG74 01–7GA00**	1 unit	0.010

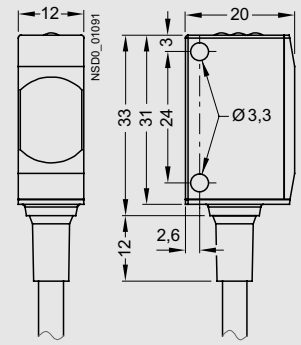
K 21 thru-beam sensor with 6 m sensing range on request.

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
K 21 R form										
	Diffuse sensor	60	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON		A	**3RG74 20–0AB00**	1 unit	0.048
					pnp, dark-ON		A	**3RG74 20–0AA00**	1 unit	0.048
					npn, light-ON		D	**3RG74 20–0GB00**	1 unit	0.048
					npn, dark-ON		D	**3RG74 20–0GA00**	1 unit	0.048
				M 8 connector, 3-pole, type A	pnp, light-ON		A	**3RG74 20–7AB00**	1 unit	0.048
					pnp, dark-ON		A	**3RG74 20–7AA00**	1 unit	0.048
					npn, light-ON		D	**3RG74 20–7GB00**	1 unit	0.048
					npn, dark-ON		D	**3RG74 20–7GA00**	1 unit	0.048
	Retroreflective sensor	300	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON		►	**3RG74 21–0AB00**	1 unit	0.048
					pnp, dark-ON		A	**3RG74 21–0AA00**	1 unit	0.048
					npn, light-ON		D	**3RG74 21–0GB00**	1 unit	0.048
					npn, dark-ON		D	**3RG74 21–0GA00**	1 unit	0.048
				M 8 connector, 3-pole, type A	pnp, light-ON		►	**3RG74 21–7AB00**	1 unit	0.048
					pnp, dark-ON		►	**3RG74 21–7AA00**	1 unit	0.048
					npn, light-ON		D	**3RG74 21–7GB00**	1 unit	0.048
					npn, dark-ON		D	**3RG74 21–7GA00**	1 unit	0.048
	Accessories									
	Mounting bracket for K 21						A	**3RX7 308**	1 unit	0.013

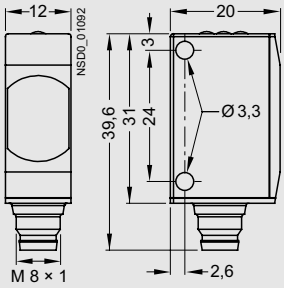
K 21 R thru-beam sensor with 6 m sensing range on request.

Dimension drawings

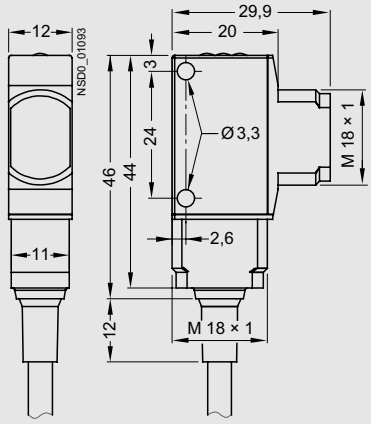
3RG74 0.–0....



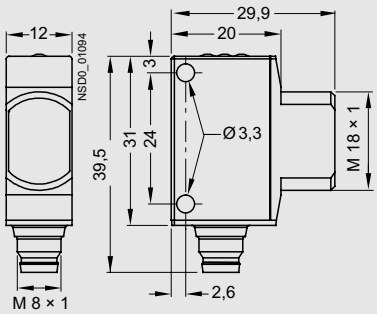
3RG74 0.–7....



3RG74 2.–0....



3RG74 2.–7....



K 31 form

Overview

Cubic molded-plastic enclosure, IP65,
connection using cable or M 8 connector

Diffuse sensor; energetic sensor
- Sensing range 60 cm (adjustable using potentiometer)

Diffuse sensor with background suppression
- Sensing range 3 ... 15 cm (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 2 m (adjustable using potentiometer)
- Supplied without reflector

Thru-beam sensor
- Sensing range 6 m (adjustable using potentiometer)

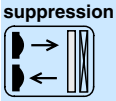
Sensors for plastic optical fibers
- Sensing range depending on type of optical fiber

Rated operating voltage DC 24 V

Electronics output pnp or npn

Supplied without fixing accessories

Technical specifications

Operating mode		**Diffuse sensor** 	**Diffuse sensor with background suppression** 	**Retroreflective sensor with polarization filter** 
Sensing range Standard target/reflector	cm mm	60 (adjustable) 200 × 200 (white)	3 ... 15 (adjustable) 100 × 100 (white)	200 (adjustable) Reflector type D 84
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	25	15
Rated operational current I_e	mA	200		
Switching frequency Switching time	Hz ms	1000 0.5	500 1	1000 0.5
Wavelength (type of light)	nm	880 (IR)	660 (red)	660 (red, polarized)
Displays • Switching status • Surplus light		Yellow LED Green LED		
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP65		
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3		
Type		3RG70 10–...00	3RG70 14–...00	3RG70 11–...00

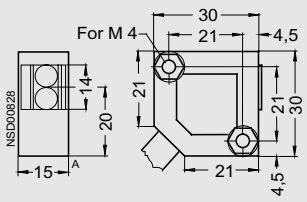
Operating mode		**Thru-beam sensor** 	**Sensor for plastic optical fibers** 
Sensing range Standard target	cm mm	600 (adjustable) –	Depending on type of optical fiber 100 × 100 (white)
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	
Rated operational current I_e	mA	200	
Switching frequency Switching time	Hz ms	1000 0.5	
Wavelength (type of light)	nm	880 (IR)	660 (red)
Display • Switching status • Surplus light		Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP65	
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3	
Type		3RG70 12–...00	3RG70 13–...00

Selection and ordering data

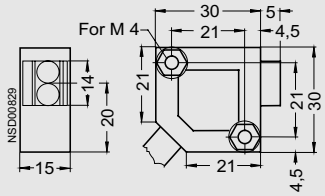
Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	cm	nm							kg
Diffuse sensor	60 (adjustable via potentiometer)	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	▶	**3RG70 10–0AB00**	1 unit	0.052
				pnp, dark-ON	1	C	**3RG70 10–0AA00**	1 unit	0.056
				npn, light-ON	1	X	**3RG70 10–0GB00**	1 unit	0.052
				npn, dark-ON	1	A	**3RG70 10–0GA00**	1 unit	0.054
			M 8 connector, 3-pole, type A	pnp, light-ON	1	▶	**3RG70 10–7AB00**	1 unit	0.027
				pnp, dark-ON	1	C	**3RG70 10–7AA00**	1 unit	0.027
				npn, light-ON	1	X	**3RG70 10–7GB00**	1 unit	0.027
				npn, dark-ON	1	X	**3RG70 10–7GA00**	1 unit	0.029
Diffuse sensor with background suppression	3 ... 15 (adjustable via potentiometer)	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	A	**3RG70 14–0AB00**	1 unit	0.053
				pnp, dark-ON	1	X	**3RG70 14–0AA00**	1 unit	0.054
				npn, light-ON	1	X	**3RG70 14–0GB00**	1 unit	0.050
				npn, dark-ON	1	X	**3RG70 14–0GA00**	1 unit	0.052
			M 8 connector, 3-pole, type A	pnp, light-ON	1	A	**3RG70 14–7AB00**	1 unit	0.028
				pnp, dark-ON	1	A	**3RG70 14–7AA00**	1 unit	0.028
				npn, light-ON	1	X	**3RG70 14–7GB00**	1 unit	0.025
				npn, dark-ON	1	X	**3RG70 14–7GA00**	1 unit	0.024
Retroreflective sensor	200 (adjustable via potentiometer)	660 (red, polarized)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	A	**3RG70 11–0AB00**	1 unit	0.053
				pnp, dark-ON	1	▶	**3RG70 11–0AA00**	1 unit	0.055
				npn, light-ON	1	X	**3RG70 11–0GB00**	1 unit	0.052
				npn, dark-ON	1	X	**3RG70 11–0GA00**	1 unit	0.054
			M 8 connector, 3-pole, type A	pnp, light-ON	1	▶	**3RG70 11–7AB00**	1 unit	0.028
				pnp, dark-ON	1	▶	**3RG70 11–7AA00**	1 unit	0.028
				npn, light-ON	1	X	**3RG70 11–7GB00**	1 unit	0.029
				npn, dark-ON	1	X	**3RG70 11–7GA00**	1 unit	0.029
Thru-beam sensor	600 (adjustable via potentiometer)	880 (IR)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	A	**3RG70 12–0AB00**	1 unit	0.055
				pnp, dark-ON	1	A	**3RG70 12–0AA00**	1 unit	0.051
				npn, light-ON	1	X	**3RG70 12–0GB00**	1 unit	0.053
				npn, dark-ON	1	X	**3RG70 12–0GA00**	1 unit	0.053
				Emitter	2	A	**3RG70 12–0BG00**	1 unit	0.057
			M 8 connector, 3-pole, type A	pnp, light-ON	1	▶	**3RG70 12–7AB00**	1 unit	0.027
				pnp, dark-ON	1	A	**3RG70 12–7AA00**	1 unit	0.025
				npn, light-ON	1	X	**3RG70 12–7GB00**	1 unit	0.027
				npn, dark-ON	1	X	**3RG70 12–7GA00**	1 unit	0.024
				Emitter	2	▶	**3RG70 12–7BG00**	1 unit	0.026
Sensor for plastic optical fibers	Depends on FO conductor	660 (red)	2 m cable, PUR, 3 × 0.14 mm²	pnp, light-ON	1	A	**3RG70 13–0AB00**	1 unit	0.054
				pnp, dark-ON	1	X	**3RG70 13–0AA00**	1 unit	0.053
				npn, light-ON	1	A	**3RG70 13–0GB00**	1 unit	0.054
				npn, dark-ON	1	X	**3RG70 13–0GA00**	1 unit	0.053
			M 8 connector, 3-pole, type A	pnp, light-ON	1	A	**3RG70 13–7AB00**	1 unit	0.029
				pnp, dark-ON	1	A	**3RG70 13–7AA00**	1 unit	0.026
				npn, light-ON	1	D	**3RG70 13–7GB00**	1 unit	0.026
				npn, dark-ON	1	X	**3RG70 13–7GA00**	1 unit	0.025
Accessories									
Mounting bracket for K 30, K 31						A	**3RX7 910**	1 unit	0.028

Dimension drawings

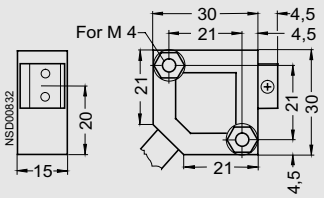
3RG70 10–0..00, 3RG70 12–0..00, 3RG70 14–0..00



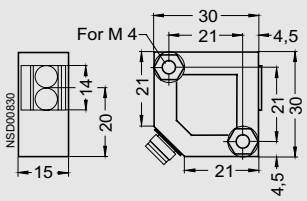
3RG70 11–0..00



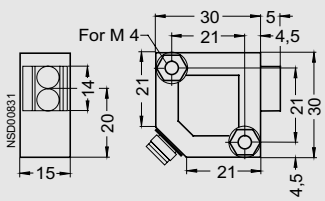
3RG70 13–0..00



3RG70 10–7..00, 3RG70 12–7..00, 3RG70 14–7..00



3RG70 11–7..00



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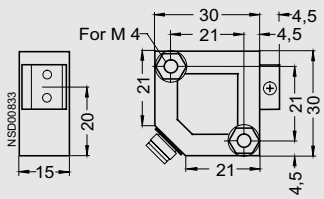


K 30 form

Overview

Cubic molded-plastic enclosure, IP67,
connection using cable or M 8 connector

Diffuse sensor; energetic sensor
- Sensing range 1.2 m (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 4 m (adjustable using potentiometer)
- Supplied without reflector

Thru-beam sensor
- Sensing range 12 m (adjustable using potentiometer)

Sensors for plastic optical fibers
- Sensing range depending on type of optical fiber

Rated operating voltage DC 24 V

Electronics output pnp or npn

Supplied without mounting material

Technical specifications

Operating mode		**Diffuse sensor** 	**Retroreflective sensor with polarization filter** 
Sensing range Standard target/reflector	cm mm	120 (adjustable) 200 × 200 (white)	400 (adjustable) Reflector type D 84
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	 15
Rated operational current I_e	mA	200	
Switching frequency Switching time	Hz ms	1000 0.5	
Wavelength (type of light)	nm	880 (IR)	660 (red, polarized)
Displays • Switching status • Surplus light		 Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP67	
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3	
Type		3RG70 10–...00	3RG70 11–...00

Operating mode		**Thru-beam sensor** 	**Sensor for plastic optical fibers** 
Sensing range Standard target	cm mm	1200 (adjustable) –	Depending on type of optical fiber 100 × 100 (white)
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	
Rated operational current I_e	mA	200	
Switching frequency Switching time	Hz ms	1000 0.5	
Wavelength (type of light)	nm	880 (IR)	660 (red)
Display • Switching status • Surplus light		 Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP67	
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.3	
Type		3RG70 12–...00	3RG70 13–...00

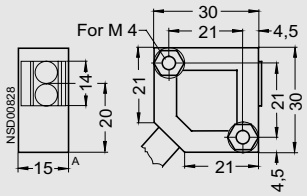
Selection and ordering data

Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	cm	nm								kg
Diffuse sensor	120 (adjustable via potentiometer)	880 (IR)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	▶	**3RG70 10–0CC00**	1 unit	0.100
					npn	3	X	**3RG70 10–0HC00**	1 unit	0.102
				Light-ON and surplus light function	pnp	4	X	**3RG70 10–0CD00**	1 unit	0.096
					npn	4	X	**3RG70 10–0HD00**	1 unit	0.104
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	▶	**3RG70 10–7CC00**	1 unit	0.050
					npn	3	X	**3RG70 10–7HC00**	1 unit	0.048
				Light-ON and surplus light function	pnp	4	A	**3RG70 10–7CD00**	1 unit	0.051
					npn	4	X	**3RG70 10–7HD00**	1 unit	0.048
Retroreflective sensor	400 (adjustable via potentiometer)	660 (red, polarized)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 11–0CC00**	1 unit	0.100
					npn	3	X	**3RG70 11–0HC00**	1 unit	0.100
				Light-ON and surplus light function	pnp	4	X	**3RG70 11–0CD00**	1 unit	0.101
					npn	4	X	**3RG70 11–0HD00**	1 unit	0.094
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	▶	**3RG70 11–7CC00**	1 unit	0.055
					npn	3	X	**3RG70 11–7HC00**	1 unit	0.049
				Light-ON and surplus light function	pnp	4	A	**3RG70 11–7CD00**	1 unit	0.051
					npn	4	X	**3RG70 11–7HD00**	1 unit	0.054
Thru-beam sensor	1200 (adjustable via potentiometer)	880 (IR)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 12–0CC00**	1 unit	0.102
					npn	3	X	**3RG70 12–0HC00**	1 unit	0.102
				Light-ON and surplus light function	pnp	4	X	**3RG70 12–0CD00**	1 unit	0.101
					npn	4	X	**3RG70 12–0HD00**	1 unit	0.102
			3 × 0.14 mm²	Emitter		2	A	**3RG70 12–0BE00**	1 unit	0.094
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	▶	**3RG70 12–7CC00**	1 unit	0.050
					npn	3	X	**3RG70 12–7HC00**	1 unit	0.050
				Light-ON and surplus light function	pnp	4	A	**3RG70 12–7CD00**	1 unit	0.050
					npn	4	X	**3RG70 12–7HD00**	1 unit	0.048
				Emitter		2	▶	**3RG70 12–7BE00**	1 unit	0.046
Sensor for plastic optical fibers	Depends on FO conductor	660 (red)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 13–0CC00**	1 unit	0.101
					npn	3	X	**3RG70 13–0HC00**	1 unit	0.101
				Light-ON and surplus light function	pnp	4	X	**3RG70 13–0CD00**	1 unit	0.105
					npn	4	X	**3RG70 13–0HD00**	1 unit	0.107
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	▶	**3RG70 13–7CC00**	1 unit	0.051
					npn	3	X	**3RG70 13–7HC00**	1 unit	0.049
				Light-ON and surplus light function	pnp	4	X	**3RG70 13–7CD00**	1 unit	0.050
					npn	4	X	**3RG70 13–7HD00**	1 unit	0.049
Accessories										
Mounting bracket for K 30, K31							A	**3RX7 910**	1 unit	0.028

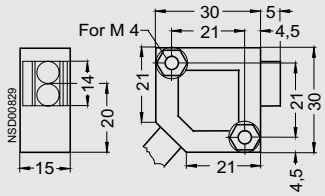
K 30 form

Dimension drawings

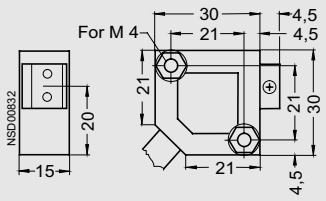
3RG70 10–0..00, 3RG70 12–0..00



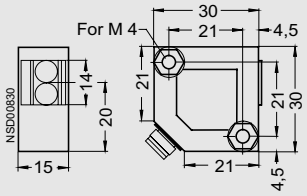
3RG70 11–0..00



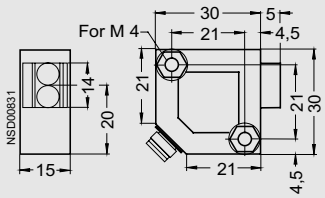
3RG70 13–0..00



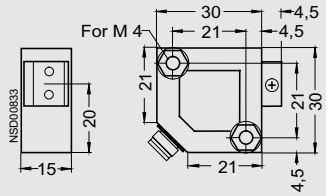
3RG70 10–7..00, 3RG70 12–7..00



3RG70 11–7..00



3RG70 13–7..00



4

Overview

Cubic molded-plastic enclosure, IP67,
connection using cable or M 8 or M 12 connector

Diffuse sensor; energetic sensor
- Sensing range 2 m (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 6 m (adjustable using potentiometer)
- Supplied without reflector

Thru-beam sensor
- Sensing range 15 m (adjustable using potentiometer)

Rated operating voltage DC 24 V

Electronics output pnp or npn

Supplied with fixing accessories

Technical specifications

Operating mode		**Diffuse sensor** 	**Retroreflective sensor with polarization filter** 	**Thru-beam sensor** 
Sensing range Standard target/reflector	cm mm	200 (adjustable) 400 × 400 (white)	600 (adjustable) Reflector type D 84	1500 (adjustable) –
Operating voltage range (DC) No-load supply current I_0 (typ.)	V mA	10 ... 36 (max. 20 % residual ripple) 15	15	10 / 15 (emitter / receiver)
Rated operational current I_e	mA	200		
Switching frequency Switching time	Hz ms	1000 0.5		
Wavelength (type of light)	nm	880 (IR)	660 (red, polarized)	880 (IR)
Displays • Switching status • Surplus light		 Yellow LED Green LED		
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP67		
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.1		
Type		3RG70 20–...00	3RG70 21–...00	3RG70 22–...00

Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm								kg
	Diffuse sensor	200 (adjustable via potenti-ometer)	880 (IR)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 20–0CC00**	1 unit	0.120
						npn	3	X	**3RG70 20–0HC00**	1 unit	0.123
					Light-ON and surplus light function	pnp	4	A	**3RG70 20–0CD00**	1 unit	0.118
						npn	4	X	**3RG70 20–0HD00**	1 unit	0.121
				M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	X	**3RG70 20–7CC00**	1 unit	0.068
						npn	3	X	**3RG70 20–7HC00**	1 unit	0.069
					Light-ON and surplus light function	pnp	4	X	**3RG70 20–7CD00**	1 unit	0.067
						npn	4	X	**3RG70 20–7HD00**	1 unit	0.068
				M12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	3	X	**3RG70 20–3CC00**	1 unit	0.076
						npn	3	X	**3RG70 20–3HC00**	1 unit	0.070
					Light-ON and surplus light function	pnp	4	X	**3RG70 20–3CD00**	1 unit	0.072
						npn	4	X	**3RG70 20–3HD00**	1 unit	0.074

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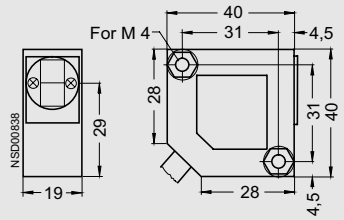
K 40 form

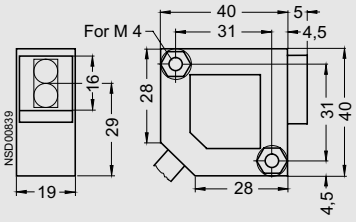
Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	cm	nm								kg
Retroreflective sensor	600 (adjustable via potentiometer)	660 (red, polarized)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	X	**3RG70 21–0CC00**	1 unit	0.121
					npn	3	X	**3RG70 21–0HC00**	1 unit	0.118
				Light-ON and surplus light function	pnp	4	X	**3RG70 21–0CD00**	1 unit	0.120
					npn	4	X	**3RG70 21–0HD00**	1 unit	0.119
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 21–7CC00**	1 unit	0.072
					npn	3	X	**3RG70 21–7HC00**	1 unit	0.070
				Light-ON and surplus light function	pnp	4	X	**3RG70 21–7CD00**	1 unit	0.070
					npn	4	X	**3RG70 21–7HD00**	1 unit	0.069
			M12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 21–3CC00**	1 unit	0.075
					npn	3	X	**3RG70 21–3HC00**	1 unit	0.070
				Light-ON and surplus light function	pnp	4	X	**3RG70 21–3CD00**	1 unit	0.075
					npn	4	X	**3RG70 21–3HD00**	1 unit	0.071
Thru-beam sensor	1500 (adjustable via potentiometer)	660 (red)	3 m cable, PUR, 4 × 0.14 mm²	Light-ON, dark-ON (compatible)	pnp	3	X	**3RG70 22–0CC00**	1 unit	0.119
					npn	3	X	**3RG70 22–0HC00**	1 unit	0.132
				Light-ON and surplus light function	pnp	4	X	**3RG70 22–0CD00**	1 unit	0.124
					npn	4	X	**3RG70 22–0HD00**	1 unit	0.117
			3 × 0.14 mm²	Emitter			X	**3RG70 22–0BE00**	1 unit	0.114
			M 8 connector, 4-pole, type B	Light-ON, dark-ON (compatible)	pnp	3	A	**3RG70 22–7CC00**	1 unit	0.069
					npn	3	X	**3RG70 22–7HC00**	1 unit	0.071
				Light-ON and surplus light function	pnp	4	X	**3RG70 22–7CD00**	1 unit	0.068
					npn	4	X	**3RG70 22–7HD00**	1 unit	0.068
				Emitter			X	**3RG70 22–7BE00**	1 unit	0.062
			M12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	3	X	**3RG70 22–3CC00**	1 unit	0.074
					npn	3	X	**3RG70 22–3HC00**	1 unit	0.070
				Light-ON and surplus light function	pnp	4	X	**3RG70 22–3CD00**	1 unit	0.072
					npn	4	X	**3RG70 22–3HD00**	1 unit	0.071
				Emitter			X	**3RG70 22–3BE00**	1 unit	0.072
Accessories										
Mounting bracket for K 40							A	**3RX7 911**	1 unit	0.030

Dimension drawings

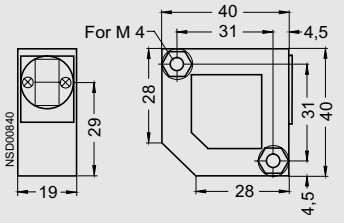
3RG70 20–0..00



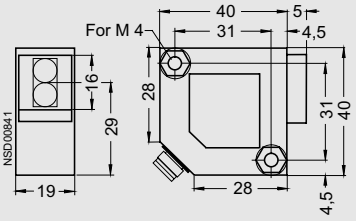
3RG70 21–0..00, 3RG70 22–0..00



3RG70 20–7..00



3RG70 21–7..00, 3RG70 22–7..00



Overview

Cubic molded-plastic enclosure, IP67, connection using M 12 connector

Diffuse sensor; energetic sensor
- Sensing range 70 cm (adjustable via teach-in)

Diffuse sensor with background suppression
- Sensing range 5 ... 25 cm (adjustable via teach-in)

Retroreflective sensor
- Sensing range 6 m (adjustable via teach-in)

Retroreflective sensor for transparent objects
- Sensing range 1 m (adjustable via teach-in)

Rated operating voltage DC 24 V

Electronics output pnp or npn

Supplied with mounting material and without reflector

Technical specifications

Operating mode		**Diffuse sensor** 	**Diffuse sensor with background suppression** 
Sensing range Standard target	cm mm	70 (adjustable) 200 × 200 (white)	5 ... 25 (adjustable) 100 × 100 (gray)
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 35	 25
Rated operational current I_e	mA	200	250
Switching frequency Switching time	Hz ms	1000 0.5	200 2.5
Wavelength (type of light)	nm	660 (red)	
Displays • Switching status • Surplus light		 Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (PBTP) IP67	
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.1	
Type		3RG72 40–...00	3RG72 44–...00

Operating mode		**Retroreflective sensor with polarization filter** 	**Retroreflective sensor for transparent objects** 
Sensing range Reflector	cm mm	600 (adjustable) Reflector type D 84	100 (adjustable) Reflector type D 84
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 35	
Rated operational current I_e	mA	200	
Switching frequency Switching time	Hz ms	1000 0.5	
Wavelength (type of light)	nm	660 (red, polarized)	
Displays • Switching status • Surplus light		 Yellow LED Green LED	
Enclosure material Degree of protection		Molded plastic (ABS) IP67	
Ambient temperature Temperature coefficient	°C %/K	–25 ... +55 0.1	
Type		3RG72 41–...00	3RG72 41–...52

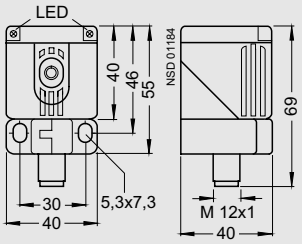
C 40 form

Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
	Diffuse sensor	70 (adjustable via "teach-in")	660 (red)	M12 connector 4-pole, type F	pnp, light-ON or dark-ON	39	A	**3RG72 40–3CH00**	1 unit	0.092
					npn, light-ON or dark-ON	39	D	**3RG72 40–3HH00**	1 unit	0.115
	Diffuse sensor with background suppression	5 ... 25 (adjustable via "teach-in")	660 (red)	M12 connector 4-pole, type F	pnp, light-ON or dark-ON	40	A	**3RG72 44–3CH00**	1 unit	0.086
					npn, light-ON or dark-ON	40	D	**3RG72 44–3HH00**	1 unit	0.085
	Retroreflective sensor with polarization filter	600 (adjustable via "teach-in")	660 (red, polarized)	M12 connector 4-pole, type F	pnp, light-ON or dark-ON	39	A	**3RG72 41–3CH00**	1 unit	0.085
					npn, light-ON or dark-ON	39	D	**3RG72 41–3HH00**	1 unit	0.086
	Retroreflective sensor for transparent objects	100 (adjustable via "teach-in")	660 (red, polarized)	M12 connector 4-pole, type F	pnp, light-ON or dark-ON	40	A	**3RG72 41–3CH52**	1 unit	0.083
					npn, light-ON or dark-ON	40	D	**3RG72 41–3HH52**	1 unit	0.086

Dimension drawings

3RG72 4.–3....



4

Overview

Cubic molded-plastic enclosure, IP67,
connection using M 12 connector or Pg 11 cable gland

Diffuse sensor (energetic sensor)
- Sensing range 2 m (adjustable using potentiometer)

Diffuse sensor with background suppression
- Sensing range 0.2 ... 1 m (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 6 m (adjustable using potentiometer)
- Supplied without reflector

Thru-beam sensor
- Sensing range 50 m (adjustable using potentiometer)

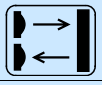
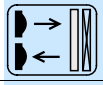
Rated operating voltage DC 24 V or AC/DC 240 V

Inputs and outputs
- Electronics output pnp or npn
  - Programmable as light-ON or dark-ON
  - Light-ON, dark-ON (compatible)
- Relay output AC/DC 20 ... 320 V
- Timing function (delayed pick-up or drop-out, pulse shaping)
- Enabling input for test purposes

Supplied without fixing accessories

Versions with AS-Interface
- I/O configuration 1, ID code 1
- Assembly on FK coupling module
- Current consumption from AS-Interface max. 30 mA
- Switching time max. 5 s

Technical specifications

Operating mode		**Diffuse sensor** 		**Diffuse sensor with background suppression** 
Sensing range Standard target	m mm	2 (adjustable) 400 × 400 (white)		0.2 ... 1 (adjustable) 200 × 200 (white)
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 36 30	– –	10 ... 36 45
Operating voltage range (AC/DC) No-load power, max.	V VA	– –	20 ... 320 2	– –
Rated operational current I_e	mA	200	2000 (at AC 240 V)	200
Switching frequency, max. Switching time, max.	Hz ms	1000 0.5	20 20	250 2
Wavelength (type of light)	nm	880 (IR)		880 (IR)
Display • Switching status • Surplus light		 Yellow LED Green LED		
Enclosure material Degree of protection		Molded plastic (PBTP) IP67		
Ambient temperature Temperature coefficient	°C %/K	–5 ... +55 0.3		
Type		3RG72 00–...00, 3RG72 10–...00	3RG72 10–6MC00	3RG72 04–...00, 3RG72 14–...00

Operating mode		**Retroreflective sensor with polarization filter** 		**Thru-beam sensor** 	
Sensing range Reflector	m mm	6 (adjustable) Reflector type D 84		50 (adjustable) –	
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 36 30	– –	10 ... 36 30	– –
Operating voltage range (AC/DC) No-load power, max.	V VA	– –	20 ... 320 2	– –	20 ... 320 2
Rated operational current I_e	mA	200	2000 (at AC 240 V)	200	2000 (at AC 240 V)
Switching frequency, max. Switching time, max.	Hz ms	1000 0.5	20 20	1000 0.5	20 20
Wavelength (type of light)	nm	660 (red, polarized)		880 (IR)	
Display • Switching status • Surplus light		 Yellow LED Green LED			
Enclosure material Degree of protection		Molded plastic (PBTP) IP67			
Ambient temperature Temperature coefficient	°C %/K	–5 ... +55 0.3			
Type		3RG72 01–...00, 3RG72 11–...00	3RG72 11–6MC00	3RG72 02–...00, 3RG72 12–...00	3RG72 12–6MC00, 3RG72 02–6FG00

K 80 form

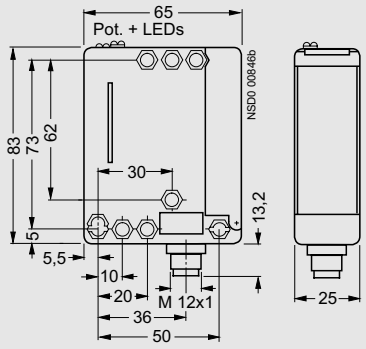
Selection and ordering data

Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	m	nm								kg
Diffuse sensor	2 (adjustable via potentiometer)	880 (IR)	M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	►	**3RG72 00–3CC00**	1 unit	0.123
					npn	5	C	**3RG72 00–3HC00**	1 unit	0.124
			M 12 connector, 5-pole, type G, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	8	D	**3RG72 10–3DK00**	1 unit	0.126
					npn	8	C	**3RG72 10–3EK00**	1 unit	0.127
			Pg 11	Light-ON, dark-ON (compatible)	pnp	12	C	**3RG72 00–6CC00**	1 unit	0.124
					npn	12	C	**3RG72 00–6HC00**	1 unit	0.130
			Pg 11, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	12	►	**3RG72 10–6DK00**	1 unit	0.131
					npn	12	C	**3RG72 10–6EK00**	1 unit	0.131
			Pg 11	Relay, light-ON and dark-ON, with timing function (0.1 ... 10 s)	–	11	►	**3RG72 10–6MC00**	1 unit	0.144
			FK coupling module	AS-Interface, with timing function (0.01 ... 1 s)	–	10	D	**3RG72 10–5WS00**	1 unit	0.125
Diffuse sensor with background suppression	0.2 ... 1 (adjustable via potentiometer)	880 (IR)	M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	A	**3RG72 04–3CC00**	1 unit	0.121
					npn	5	X	**3RG72 04–3HC00**	1 unit	0.120
			M 12 connector, 5-pole, type G, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	8	X	**3RG72 14–3DK00**	1 unit	0.125
					npn	8	X	**3RG72 14–3EK00**	1 unit	0.124
			Pg 11	Light-ON, dark-ON (compatible)	pnp	12	A	**3RG72 04–6CC00**	1 unit	0.130
					npn	12	X	**3RG72 04–6HC00**	1 unit	0.130
			Pg 11, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	12	X	**3RG72 14–6DK00**	1 unit	0.132
					npn	12	X	**3RG72 14–6EK00**	1 unit	0.130
			FK coupling module	AS-Interface, with timing function (0.01 ... 1 s)	–	10	X	**3RG72 14–5WS00**	1 unit	0.131
Retroreflective sensor	6 (adjustable via potentiometer)	660 (red, polarized)	M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	►	**3RG72 01–3CC00**	1 unit	0.115
					npn	5	C	**3RG72 01–3HC00**	1 unit	0.118
			M 12 connector, 5-pole, type G, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	8	►	**3RG72 11–3DK00**	1 unit	0.117
					npn	8	C	**3RG72 11–3EK00**	1 unit	0.121
			Pg 11	Light-ON, dark-ON (compatible)	pnp	12	►	**3RG72 01–6CC00**	1 unit	0.122
					npn	12	D	**3RG72 01–6HC00**	1 unit	0.123
			Pg 11, with enabling input	Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	12	D	**3RG72 11–6DK00**	1 unit	0.125
					npn	12	C	**3RG72 11–6EK00**	1 unit	0.125
			Pg 11	Relay, light-ON and dark-ON, with timing function (0.1 ... 10 s)	–	11	►	**3RG72 11–6MC00**	1 unit	0.137
			FK coupling module	AS-Interface, with timing function (0.01 ... 1 s)	–	10	C	**3RG72 11–5WS00**	1 unit	0.125

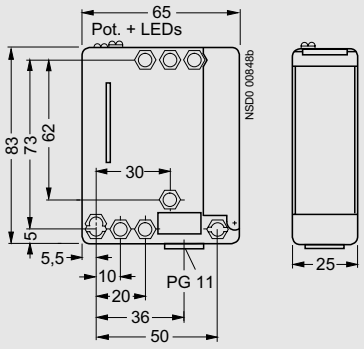
Operating mode	Sensing range	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	m	nm								kg
Thru-beam sensor	50 (adjustable via potentiometer)	880 (IR)	M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	▶	**3RG72 02–3CC00**	1 unit	0.117
					npn	5	C	**3RG72 02–3HC00**	1 unit	0.118
				Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	6	D	**3RG72 12–3DK00**	1 unit	0.120
					npn	6		**3RG72 12–3EK00**		
				Emitter with enabling input	–	7	▶	**3RG72 02–3BG00**	1 unit	0.112
			Pg 11	Light-ON, dark-ON (compatible)	pnp	12	A	**3RG72 02–6CC00**	1 unit	0.118
					npn	12	D	**3RG72 02–6HC00**	1 unit	0.120
				Light-ON or dark-ON, surplus light, with timing function (0.01 ... 1 s)	pnp	12	D	**3RG72 12–6DK00**	1 unit	0.124
					npn	12	C	**3RG72 12–6EK00**	1 unit	0.125
				Emitter with enabling input	–	12	A	**3RG72 02–6BG00**	1 unit	0.117
				Relay, light-ON and dark-ON, with timing function (0.1 ... 10 s)	–	11	▶	**3RG72 12–6MC00**	1 unit	0.136
				Emitter with enabling input	–	12	A	**3RG72 02–6FG00**	1 unit	0.127
			FK coupling module	AS-Interface, with timing function (0.01 ... 1 s)	–	10	D	**3RG72 12–5WS00**	1 unit	0.121
				Emitter	–	10	D	**3RG72 02–5WG00**	1 unit	0.120
Accessories										
Mounting bracket for K 80							A	**3RX7 303**	1 unit	0.247

Dimension drawings

3RG72 ..–3..00



3RG72 ..–6..00



KL 40 form

Overview

Cubic molded-plastic enclosure, IP65, connection using cable or M 8 connector

Sensor for plastic optical fibers
- Sensing range depending on type of optical fiber

Rated operating voltage DC 24 V

Programmable using teach-in

Electronics output pnp or npn

Supplied without fixing accessories

Technical specifications

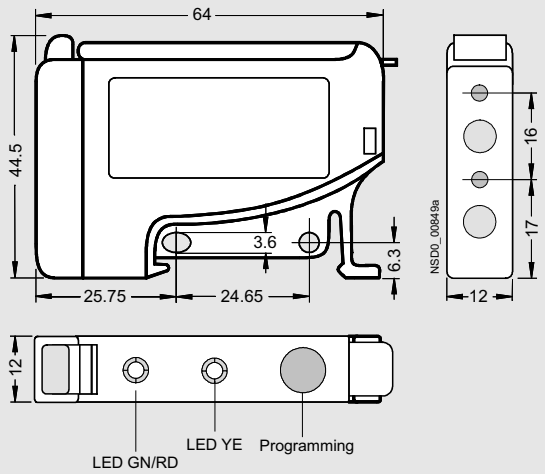
Operating mode		**Sensor for plastic optical fibers** 
Sensing range	mm	Max. 280
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 55
Rated operational current I_e	mA	100
Switching frequency Switching time	Hz ms	1500 0.33
Wavelength (type of light)	nm	660 (red)
Displays • Switching status • Set		 Yellow LED Green/red LED
Enclosure material Degree of protection		Molded plastic (ABS) IP65
Ambient temperature Temperature coefficient	°C %/K	–10 ... +55
Type		3RG74 13–...00

Selection and ordering data

Operating mode	Light type	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	nm								kg
For plastic fiber-optic conductor	660 (red)	2 m cable, PVC, 4 × 0.088 mm²	Light-ON or dark-ON	pnp	34	X	**3RG74 13–1CH00**	1 unit	0.130
				npn	34	X	**3RG74 13–1HH00**	1 unit	0.130
		M 8 connector, 4-pole, type B	Light-ON or dark-ON	pnp	23	▶	**3RG74 13–7CH00**	1 unit	0.056
				npn	23	X	**3RG74 13–7HH00**	1 unit	0.054
Accessories									
Mounting bracket for KL 40						A	**3RX7 313**	1 unit	0.017

Dimension drawing

3RG74 13–...00



Overview

Cubic molded-plastic enclosure, IP65, connection using cable or M 8 connector

Color sensor with plastic optical fibers
• Sensing range 3 ... 15 mm

Rated operating voltage DC 24 V

Programmable using teach-in

Sensors with cable connection additionally with remote teach-in and alarm output

Electronics output pnp or npn

Timing function

Supplied without fixing accessories

Technical specifications

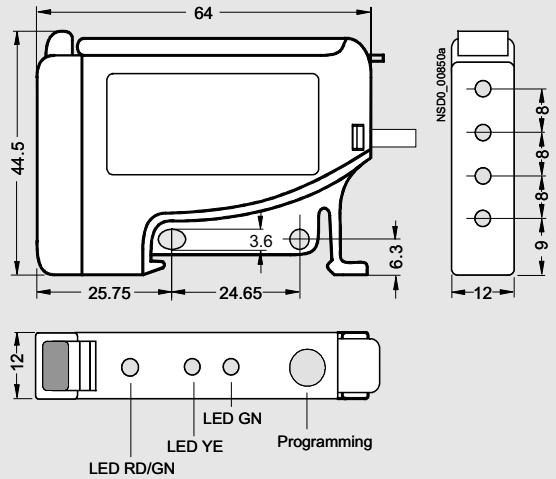
Operating mode		**Color sensor with plastic optical fibers** 
Sensing range	mm	3 ... 15
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 60
Rated operational current I_e	mA	100
Switching frequency Switching time	Hz ms	550 0.1
Wavelength (type of light)	nm	660 (red), 525 (green), 470 (blue)
Displays • Switching status • Programming		 Yellow LED Green/red LED
Enclosure material Degree of protection		Molded plastic (ABS) IP65
Ambient temperature Temperature coefficient	°C %/K	–10 ... +55
Type		3RG75 50–...00

Selection and ordering data

Operating mode	Sensing range	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
	mm								kg
Color sensor with plastic optical fibers	3 ... 15	2 m cable, PVC, 6 × 0.088 mm²	Solid-state + alarm output	pnp	35	A	**3RG75 50–1CA00**	1 unit	0.159
				npn	35	X	**3RG75 50–1HA00**	1 unit	0.158
		M 8 connector, 4-pole, type B	Solid-state	pnp	25	A	**3RG75 50–7CA00**	1 unit	0.100
				npn	25	X	**3RG75 50–7HA00**	1 unit	0.101
Accessories									
Mounting bracket for CL 40						A	**3RX7 313**	1 unit	0.017

Dimension drawing

3RG75 50–...00



C 80 form – color mark sensors

Overview

Cubic metal enclosure, IP67,
connection using cable or M 12 connector

Color sensor with plastic optical fibers
• Sensing range 9 or 18 mm

Rated operating voltage DC 24 V

Programmable using teach-in

Electronics output pnp

Timing function

Supplied without fixing accessories

Technical specifications

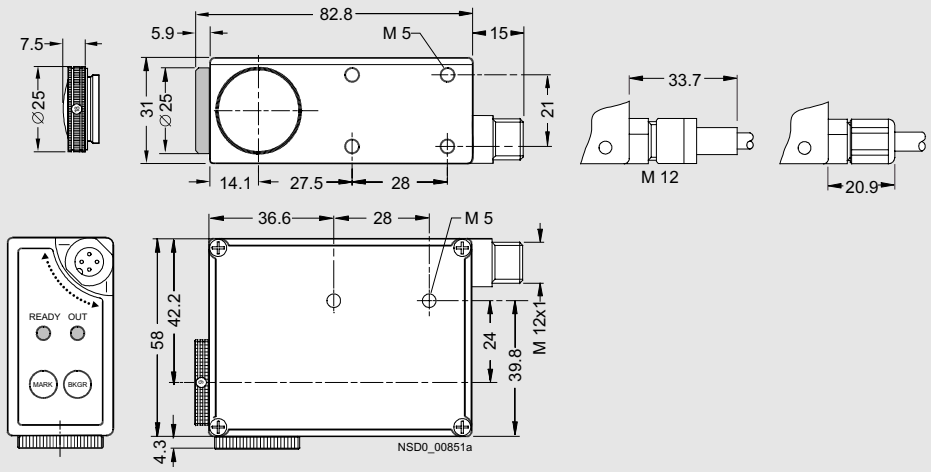
Operating mode		**Color mark sensor BERO** 
Sensing range	mm	9 or 18 mm
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 80
Rated operational current I_e	mA	200
Analog output (R_i = 22 kΩ)	V	0 ... 5.5
Switching frequency Switching time	Hz ms	10 000 0.05
Wavelength (type of light)	nm	660 (red) or 565 (green); automatic selection
Displays • Switching status • Ready		 Yellow LED Green LED
Enclosure material Degree of protection		Die-cast aluminum IP67
Ambient temperature Temperature coefficient	°C %/K	–10 ... +55
Type		3RG75 60–3CH5.

Selection and ordering data

	Operating mode	Sensing range	Connection	Switching output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		m								kg
	Color mark sensor BERO	9	M 12 connector 4-pole, type F	Light-ON or dark-ON	pnp	26	A	**3RG75 60–3CH55**	1 unit	0.354
		18		Light-ON or dark-ON	pnp	26	X	**3RG75 60–3CH54**	1 unit	0.359

Dimension drawing

3RG75 60–3CH5.



Overview

Cylindrical metal enclosure, IP65,
connection using cable or M 12 connector

Visible laser light (red),
laser protection class 3 according to IEC 60825

Thru-beam sensor
- Sensing range 50 m (adjustable using potentiometer)

Rated operating voltage DC 24 V

Electronics output pnp

Supplied with focusing and adjustment aid,
without fixing accessories

Technical specifications

Operating mode		**Laser thru-beam sensor**
Sensing range	m	50 (adjustable)
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 15 (receiver), 10 (emitter)
Rated operational current I_e	mA	200
Switching frequency Switching time	Hz ms	6000 < 0.083
Wavelength (type of light)	nm	660 (red laser light, polarized)
Displays • Switching status • Surplus light • Operating voltage range		 Yellow LED Red LED Green LED
Enclosure material Degree of protection		Brass, nickel-plated IP65
Ambient temperature Temperature coefficient	°C %/K	–10 ... +60 0.1
Type		3RG71 35–...00, 3RG71 75–...00

Selection and ordering data

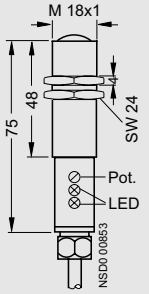
	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		m	nm							kg
Straight sensor										
	Laser thru-beam sensor	50 (adjustable via potentiometer)	660 (red, polarized)	3 m cable, PUR, 4 × 0.25 mm²	pnp, light-ON, dark-ON (compatible)	5	A	**3RG71 35–0CC00**	1 unit	0.203
					pnp, light-ON and surplus light function	6	D	**3RG71 35–0CD00**	1 unit	0.178
					Emitter	9	A	**3RG71 35–0BE00**	1 unit	0.180
				M 12 connector 4-pole, type F	pnp, light-ON, dark-ON (compatible)	5	A	**3RG71 35–3CC00**	1 unit	0.081
					pnp, light-ON and surplus light function	6	D	**3RG71 35–3CD00**	1 unit	0.079
					Emitter	9	A	**3RG71 35–3BE00**	1 unit	0.080
Angled sensor										
	Laser thru-beam sensor	50 (adjustable via potentiometer)	660 (red, polarized)	3 m cable, PUR, 4 × 0.25 mm²	pnp, light-ON, dark-ON (compatible)	5	C	**3RG71 75–0CC00**	1 unit	0.178
					pnp, light-ON and surplus light function	6	D	**3RG71 75–0CD00**	1 unit	0.176
					Emitter	9	C	**3RG71 75–0BE00**	1 unit	0.190
				M 12 connector 4-pole, type F	pnp, light-ON, dark-ON (compatible)	5	A	**3RG71 75–3CC00**	1 unit	0.076
					pnp, light-ON and surplus light function	6	D	**3RG71 75–3CD00**	1 unit	0.075
					Emitter	9	D	**3RG71 75–3BE00**	1 unit	0.082

L 18 form – laser

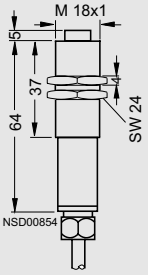
Dimension drawings

Straight sensor

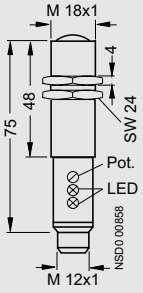
3RG71 35–0C.00



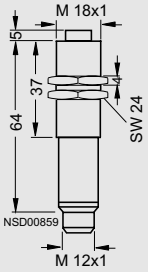
3RG71 35–0BE00



3RG71 35–3C.00

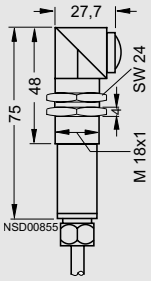


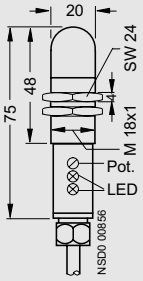
3RG71 35–3BE00



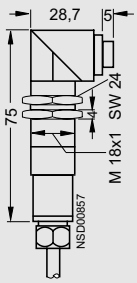
Angled sensor

3RG71 75–0C.00

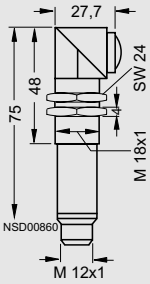


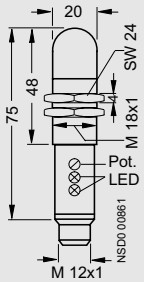


3RG71 75–0BE00

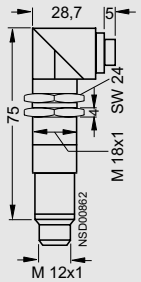


3RG71 75–3C.00





3RG71 75–3BE00



Overview

Cubic molded-plastic enclosure, IP67,
connection using cable or M 12 connector

Visible laser light (red),
laser protection class 3 according to IEC 60825

Diffuse sensor with background suppression
- Sensing range 3 ... 15 cm (adjustable using potentiometer)

Diffuse sensor with analog output
- Sensing range 4.5 ... 8.5 cm (adjustable using potentiometer)

Retroreflective sensor
- Sensing range 12 m (adjustable using potentiometer)
- Supplied without reflector

Rated operating voltage DC 24 V

Electronics output pnp

Analog output

Supplied without fixing accessories

Technical specifications

Operating mode		**Laser diffuse sensor with background suppression** 	**Laser diffuse sensor** 
Sensing range Standard target/reflector	cm mm	3 ... 15 (adjustable) 100 × 100 (white)	1200 (adjustable) Reflector type RL 50
Operating voltage range (DC) No-load supply current I_0, max.	V mA	10 ... 30 (max. 10 % residual ripple) 50	
Rated operational current I_e	mA	200	
Switching frequency Switching time	Hz ms	2500 < 0.2	
Wavelength (type of light)	nm	670 (red laser light)	
Displays • Switching status • Surplus light • Operating voltage range		 Yellow LED Red LED Green LED	
Enclosure material Degree of protection		Molded plastic (ABS) IP67	
Ambient temperature Temperature drift	°C %/K	–20 ... +45 0.1	
Type		3RG70 56–...00	3RG70 57–...00

Operating mode		**Laser diffuse sensor with analog output** 	
Sensing range	mm	45 ... 85 (adjustable)	
Resolution Linearity Target diameter (at distance of 65 mm)	µm ms mm	80 < 1 % of measuring range (40 mm) < 0.8	20
Operating voltage range (DC) No-load supply current I_0, max.	V mA	18 ... 28 (max. 10 % residual ripple) 35	
Analog output Output current, max.	V mA	0 ... 10 3	
Switching frequency Switching time	Hz ms	500 1	50 10
Wavelength (type of light)	nm		
Displays • Surplus light • Operating voltage range		 Red LED Green LED	
Enclosure material Degree of protection		Molded plastic (ABS) IP67	
Ambient temperature Temperature coefficient	°C µm/K	0 ... +45 18	
Type		3RG70 56–.CM00	3RG70 56–.CM03

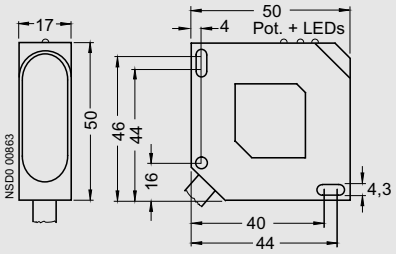
L 50 form – laser

Selection and ordering data

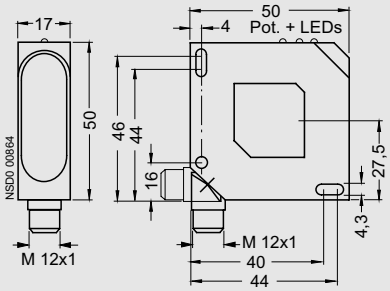
Operating mode	Sensing range/ resolution	Light type	Connection	Switching output/ analog output		Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		nm								kg
Laser diffuse sensor with background suppression	3 ... 15 cm (adjustable via potentiometer)	670 (red laser light)	2 m cable, PUR, 4 × 0.25 mm²	Light-ON, dark-ON (compatible)	pnp	5	D	**3RG70 56–0CC00**	1 unit	0.133
					npn	5	X	**3RG70 56–0HC00**	1 unit	0.130
				Light-ON and surplus light function	pnp	6	C	**3RG70 56–0CD00**	1 unit	0.132
					npn	6	X	**3RG70 56–0HD00**	1 unit	0.129
			M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	▶	**3RG70 56–3CC00**	1 unit	0.040
					npn	5	X	**3RG70 56–3HC00**	1 unit	0.040
				Light-ON and surplus light function	pnp	6	A	**3RG70 56–3CD00**	1 unit	0.040
					npn	6	X	**3RG70 56–3HD00**	1 unit	0.042
Laser diffuse sensor	1200 cm (adjustable via potentiometer)	670 (red laser light)	2 m cable, PUR, 4 × 0.25 mm²	Light-ON, dark-ON (compatible)	pnp	5	C	**3RG70 57–0CC00**	1 unit	0.138
					npn	5	D	**3RG70 57–0HC00**	1 unit	0.135
				Light-ON and surplus light function	pnp	6	X	**3RG70 57–0CD00**	1 unit	0.136
					npn	6	D	**3RG70 57–0HD00**	1 unit	0.100
			M 12 connector 4-pole, type F	Light-ON, dark-ON (compatible)	pnp	5	A	**3RG70 57–3CC00**	1 unit	0.043
					npn	5	X	**3RG70 57–3HC00**	1 unit	0.043
				Light-ON and surplus light function	pnp	6	A	**3RG70 57–3CD00**	1 unit	0.044
					npn	6	D	**3RG70 57–3HD00**	1 unit	0.045
Laser diffuse sensor with analog output	80 µm		6 m cable, PVC, 4 × 0.34 mm², shielded	Analog 0 ... 10 V, rising	–	37	C	**3RG70 56–1CM00**	1 unit	0.258
	20 µm				–	37	C	**3RG70 56–1CM03**	1 unit	0.286
	80 µm		M 12 connector 4-pole, type F	Analog 0 ... 10 V, rising	–	37	A	**3RG70 56–3CM00**	1 unit	0.043
	20 µm				–	37	A	**3RG70 56–3CM03**	1 unit	0.044
Accessories										
Mounting bracket for L 50							A	**3RX7 302**	1 unit	0.034
Cable with connector, shielded, 4 × 0.34 mm²							D	**3RX1 680**	1 unit	0.227
Cable with right-angle connector, shielded, 4 × 0.34 mm²							D	**3RX1 681**	1 unit	0.235

Dimension drawings

3RG70 5.–0..00, 3RG70 56–1..0.

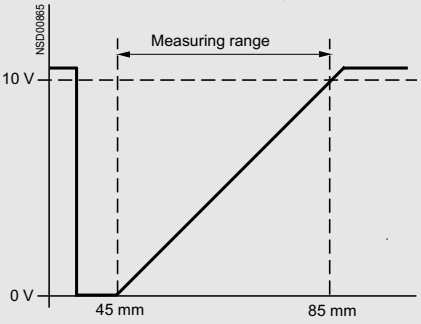


3RG70 5.–3..0.



Characteristics

3RG70 56–.CM0.



Overview

Cubic molded-plastic enclosure, IP54, connection using M 8 connector

7-beam retroreflective sensor
- Sensing range 1.4 m

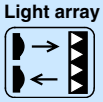
Rated operating voltage DC 24 V

Autocollimation principle

Electronics output pnp, switches on interruption in at least one light beam

Supplied with fixing accessories, without reflector

Technical specifications

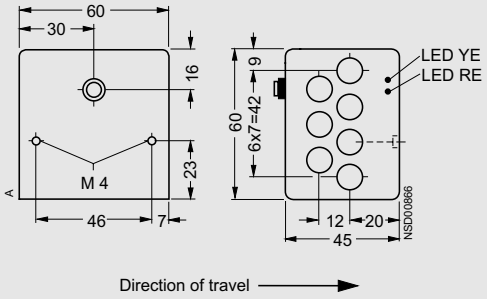
Operating mode		**Light array** 
Sensing range Reflector	cm mm	140 Reflector type R 45
Operating voltage range (DC) No-load supply current I_0, max.	V mA	12 ... 36 30
Rated operational current I_e	mA	200
Switching frequency Switching time	Hz ms	50 10
Wavelength (type of light)	nm	660 (red, polarized)
Displays • Switching status • Contamination monitoring		 Yellow LED Red LED
Enclosure material Degree of protection		Molded plastic (PBTP, Crastin) IP54
Ambient temperature Temperature coefficient	°C %/K	–10 ... +50
Type		3RG70 71–7CD27

Selection and ordering data

	Operating mode	Sensing range	Light type	Connection	Switching output	Circ. diag. No.	DT	Order No.	PS	Approx. weight per PU
		cm	nm							kg
	Light array	140	660 (red, polarized)	M 8 connector, 4-pole, type B	Dark-ON and surplus light function	6	▶	**3RG70 71–7CD27**	1 unit	0.218

Dimension drawings

3RG70 71–7CD27



Plastic optical fibers

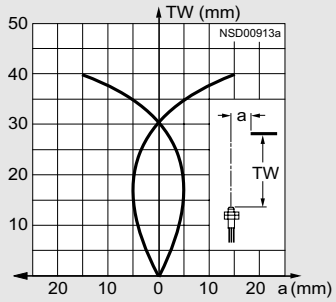
Overview

The plastic fiber-optic conductors are used in conjunction with the Opto-BEROs of K 30, K 31 and KL 40 forms.

The sensing range of the plastic fiber-optic conductors depends on the type of Opto-BERO used.

The main advantages are:

- Extremely small dimensions
- Small bending radii
- For cutting to length
- Visible light
- Wide range of types
- Attractively priced.

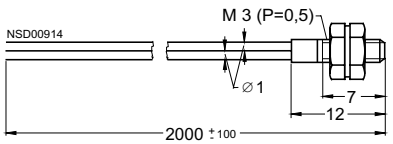
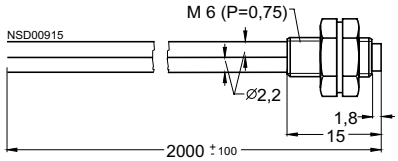
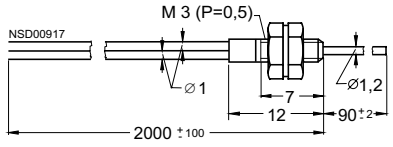
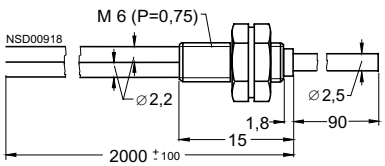


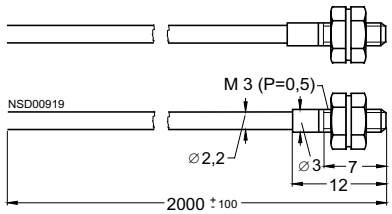
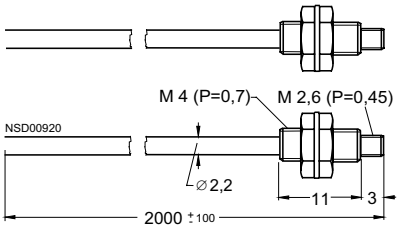
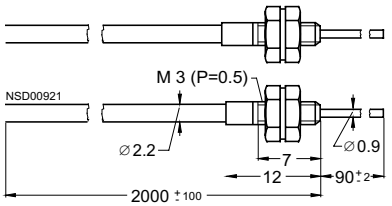
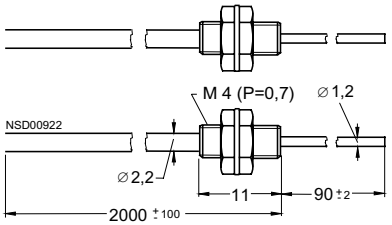
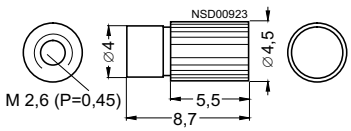
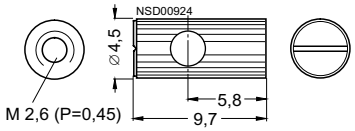
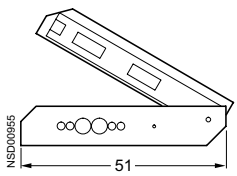
Typical beam diagram (type 3RX7 003)

Technical specifications

Attenuation at 660 nm, max.	dB/m	0.4
Angle of incidence, max.		± 56°
Standard length	m	2 ± 0.1
Bending radius, min.	mm	25
Tensile load, max.	N	30
Sleeve material		Polyethylene
Degree of protection • Sensor head • Sensor		 IP67 IP65
Temperature range	°C	–40 ... +75
Solvent resistance		Not resistant

Selection and ordering data

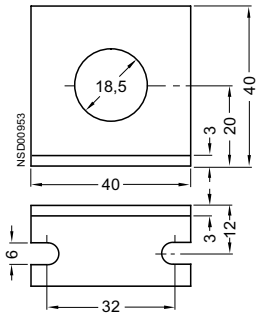
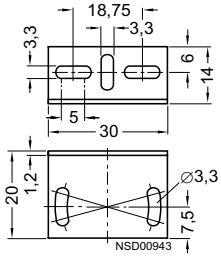
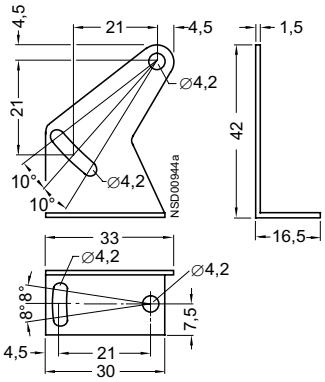
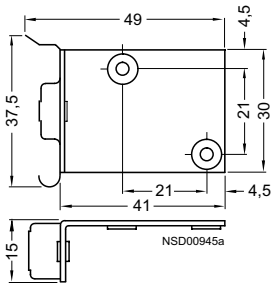
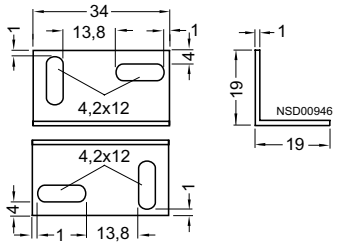
	Design	Sensing range for Opto-BERO	DT	Order No.	PS	Approx. weight per PU
						kg
Plastic fiber-optic conductors for diffuse sensors						
	2 individual fibers Ø 1 mm, can be cut Adapter sleeves for Ø 2.2 mm contained in the scope of supply 20 mm K 31 form 40 mm K 30 form 35 mm KL 40 form		X	**3RX7 001**	1 unit	0.054
	2 individual fibers Ø 2.2 mm, can be cut 60 mm K 31 form 120 mm K 30 form 110 mm KL 40 form		A	**3RX7 002**	1 unit	0.069
	2 individual fibers Ø 1 mm, can be cut Adapter sleeves for Ø 2.2 mm contained in the scope of supply 20 mm K 31 form 40 mm K 30 form 35 mm KL 40 form		X	**3RX7 004**	1 unit	0.053
	2 individual fibers Ø 2.2 mm, can be cut 60 mm K 31 form 120 mm K 30 form 100 mm KL 40 form		A	**3RX7 005**	1 unit	0.066

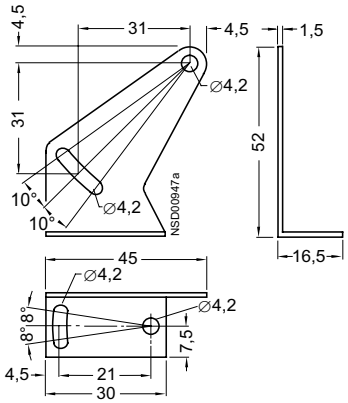
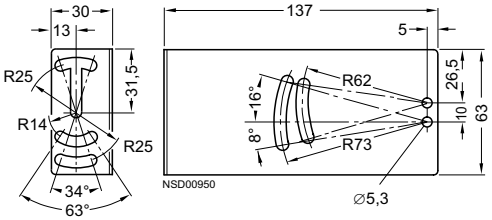
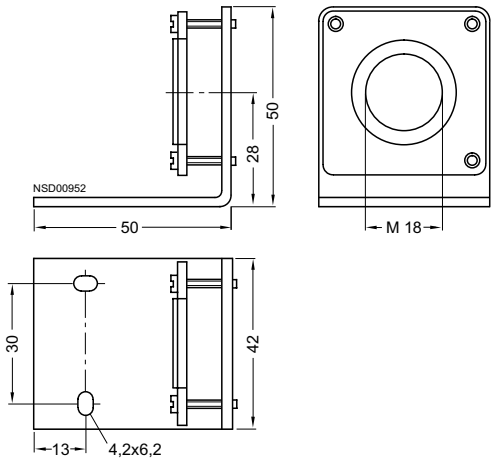
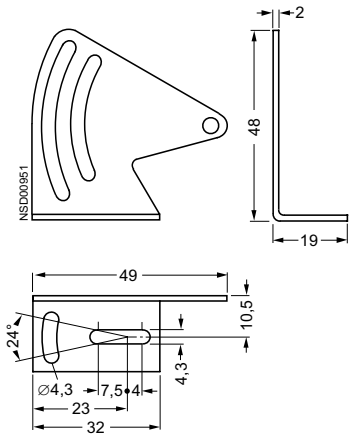
	Design	Sensing range for Opto-BERO	DT	Order No.	PS	Approx. weight per PU
						kg
Plastic fiber-optic conductors for thru-beam sensors						
	2 individual fibers Ø 2.2 mm, can be cut (fine internal fibers)	60 mm K 31 form 120 mm K 30 form 90 mm KL 40 form	A	**3RX7 006**	1 unit	0.068
	2 individual fibers Ø 2.2 mm, can be cut	200 mm K 31 form 400 mm K 30 form 280 mm KL 40 form	X	**3RX7 007**	1 unit	0.069
	2 individual fibers Ø 2.2 mm, can be cut (fine internal fibers)	60 mm K 31 form 120 mm K 30 form 60 mm KL 40 form	A	**3RX7 008**	1 unit	0.071
	2 individual fibers Ø 2.2 mm, can be cut	200 mm K 31 form 400 mm K 30 form 280 mm KL 40 form	A	**3RX7 010**	1 unit	0.070
Front lenses						
	Front lenses (1 pair) for use with 3RX7 007 fiber type	1500 mm K 31 form 3000 mm K 30 form 2000 mm KL 40 form	A	**3RX7 901**	1 unit	0.008
	Front lenses 90° (1 pair) for use with 3RX7 007 fiber type	250 mm K 31 form 500 mm K 30 form 350 mm KL 40 form	D	**3RX7 902**	1 unit	0.007
Cutting tool for fiber-optic conductor						
	**Cutting tool** for plastic fiber-optic conductors		A	**3RX7 918**	1 unit	0.012

4

Mounting brackets

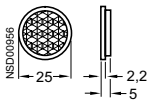
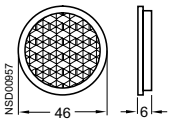
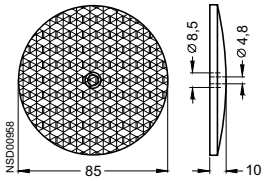
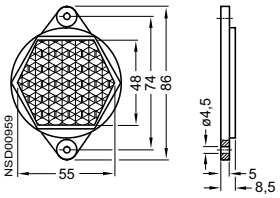
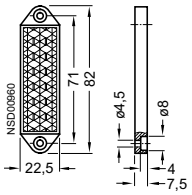
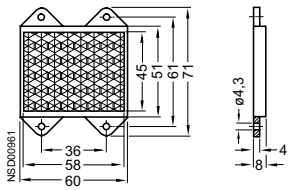
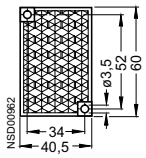
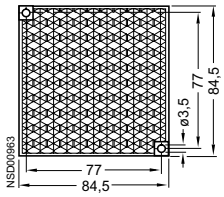
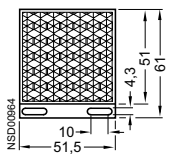
Selection and ordering data

	Design	DT	Order No.	PS	Approx. weight per PU
					kg
	Mounting bracket for Opto-BEROs with cylindrical M 18 enclosure Material: Galvanized steel	A	**3RX7 301**	1 unit	0.019
	Mounting bracket for Opto-BEROs of K 20, K 21 forms	A	**3RX7 308**	1 unit	0.013
	Mounting bracket for Opto-BEROs of K 30, K 31 forms Material: Galvanized steel	A	**3RX7 910**	1 unit	0.028
	Mounting bracket for 35-mm DIN rail for Opto-BEROs of K 30, K 31 forms Material: Galvanized steel	A	**3RX7 304**	1 unit	0.032
	Mounting bracket for Opto-BEROs of KL 40, CL 40 forms	A	**3RX7 313**	1 unit	0.017

	Design	DT	Order No.	PS	Approx. weight per PU
					kg
	Mounting bracket for Opto-BEROs of K 40 form (included in delivery) Material: Galvanized steel	A	**3RX7 911**	1 unit	0.030
	Mounting bracket for Opto-BEROs of K 80 form Material: Galvanized steel	A	**3RX7 303**	1 unit	0.247
	Mounting bracket, can be aligned, for Opto-BEROs with cylindrical enclosure M 18, particularly for laser BEROs of L 18 form Material: Galvanized steel	A	**3RX7 300**	1 unit	0.127
	Mounting bracket for laser BEROs of L 50 form Material: Galvanized steel	A	**3RX7 302**	1 unit	0.034

Reflectors

Selection and ordering data

	Design	Standard for form	DT	Order No.	PS	Approx. weight per PU
						kg
	**D 22** 22 mm diameter Range typically approx. 40 %, referred to type D 84		A	**3RX7 914**	1 unit	0.003
	**D 40** 40 mm diameter Range typically approx. 60 %, referred to type D 84		A	**3RX7 915**	1 unit	0.008
	**D 84** 84 mm diameter	M 12, M 18, K 30, K 31, K 40, C 40, K 80	A	**3RX7 916**	1 unit	0.028
	**S 48** 48 mm diameter Range typically approx. 50 %, referred to type D 84	M 18 P, K 50	A	**3RX7 922–1A**	1 unit	0.019
	**R 70** Range typically approx. 30 %, referred to type D 84		A	**3RX7 920–1A**	1 unit	0.010
	**R 45** Reflector 45 mm × 58 mm Range typically approx. 60 %, referred to type D 84	Light array	A	**3RX7 924**	1 unit	0.021
	**R 60** Reflector 40 mm × 60 mm Range typically approx. 40 to 50 %, referred to type D 84	K 20, K 21	A	**3RX7 305**	1 unit	0.016
	**R 84** Reflector 84 mm × 84 mm high reflection factor for wide ranges		A	**3RX7 306**	1 unit	0.045
	**RL 50** Reflector for laser light, 50 mm × 50 mm	L 50	A	**3RX7 307**	1 unit	0.013
	Reflecting foil 100 mm × 100 mm, range 50 ... 60 %, referred to type D 84		A	**3RX7 917**	1 unit	0.007