

# 3RG16 BERO Capacitive Proximity Switches

## Description

### Application

BERO capacitive proximity switches are solid-state position switches, which can be operated without contact. They can detect electrically conductive or non-conductive materials in solid, powder or liquid form, such as glass, ceramics, plastic, wood, oil, water, cardboard and paper. The BERO switch reacts to the material when this is at a definite distance from the sensing face.

Standard applications for BERO capacitive proximity switches are:

- liquid level control with plastic or glass containers
- liquid level monitoring with transparent packing materials
- winding wire breakage signalling
- tape breakage signalling
- bottle counting
- tape loop control, tape tension control
- piece counting of any kind.

The same standards are applicable as for the inductive switches. They are available in DC or AC designs. The DC designs can drive solid-state control devices (SIMATIC) or relays directly. With the AC designs the load (contactor relay, solenoid valve) is connected directly to the AC supply system (preferably 230 V, 50 Hz) in series with the BERO switch.

### Operating frequency

The build-up characteristics specific to other impulse/interval conditions may result in higher switching frequencies.

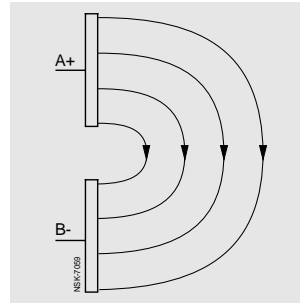
### Operating distance

The stated values are applicable to a target of metal which is earthed and of an area corresponding to the sensing face of the BERO switch. The operating distance for non-conductive targets is dependent on the dielectric constant  $\epsilon$  and the conductivity.

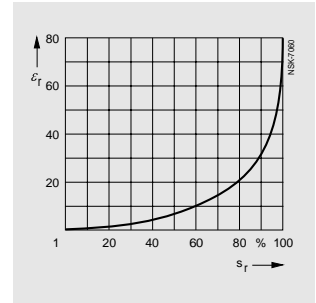
### Dielectric constant of various materials

Material	$\epsilon_r$	Material	$\epsilon_r$
Air, vacuum	1	Polystyrene	3
Alcoholic fluids	25.8	Polyvinyl chloride	2.9
Araldite	3.6	Porcelain	4.4
Bakelite	3.6	Pressboard	4
Cable cast compound	2.5	Quartz glass	3.7
Celluloid	3	Quartz sand	4.5
Glass	5	Silicone rubber	2.8
Laminated paper	4.5	Soft rubber	2.5
Marble	8	Teflon	2
Mica	6	Terpentine oil	2.2
Oil paper	4	Trans-former oil	2.2
Paper	2.3	Vacuum, air	1
Paraffin	2.2	Vulcanized rubber	4
Perspex	3.2	Water	80
Petroleum	2.2	Wood	2-7
Polyamide	5		
Polyethylene	2.3		
Polypropylene	2.3		

Electric field line pattern of the capacitive sensor



The operating distance as a function of the dielectric constant of the target



### Mode of operation

The sensing face of a capacitive sensor is formed by two concentrically allocated metal electrodes. They can be seen as the electrodes of an unwound capacitor. When an object nears the sensing face of the sensor, it enters the electrical field of the electrode areas. Via an evaluation unit this is converted into a switching command.

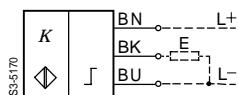
### Technical data

Connecting cable length (max. permissible)	300 m
Degree of protection	IP 67
• Moulded cable	IP 67
• Terminal compartment	IP 67
Ambient temperature	
• in operation	-20 to +70 °C
• when stored	-40 to +85 °C
Shock resistance	30 x g, 11 ms duration
Resistance to vibration	55 Hz, 1 mm amplitude

## Wiring diagrams

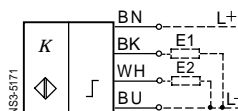
### DC voltage

#### No. 1



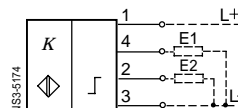
BERO operated  
Load E turned on  
e. g. contactor relays, solenoid valves

#### No. 2



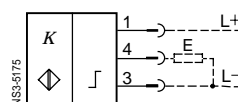
BERO operated  
Load E1 turned on (NO function)  
Load E2 turned off (NC function)  
e. g. contactor relays, solenoid valves

#### No. 3



BERO operated  
Load E1 turned on (NO function)  
Load E2 turned off (NC function)  
e. g. contactor relays, solenoid valves

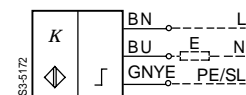
#### No. 4



BERO operated  
Load E turned on (NO function)  
e. g. contactor relays, solenoid valves

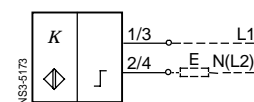
### AC voltage

#### No. 5



BERO operated  
Load E turned on (NO function) or  
Load E turned off (NC function)  
e. g. contactor relays, solenoid valves  
NO or NC function (according to type)

#### No. 6



BERO operated  
Load E turned on (NO function)  
Load E turned off (NC function)  
e. g. contactor relays, solenoid valves  
NO or NC function programmable

# 3RG16 BERO Capacitive Proximity Switches

## AC 20 to 250 V

### Selection and ordering data

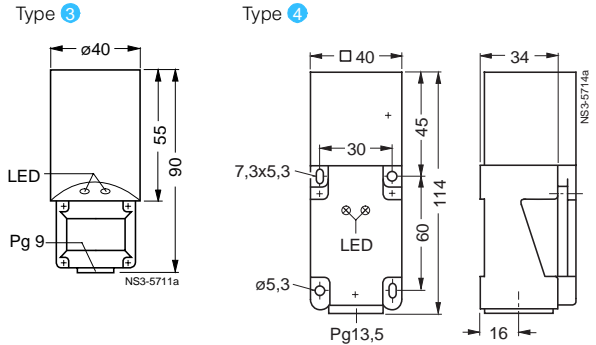
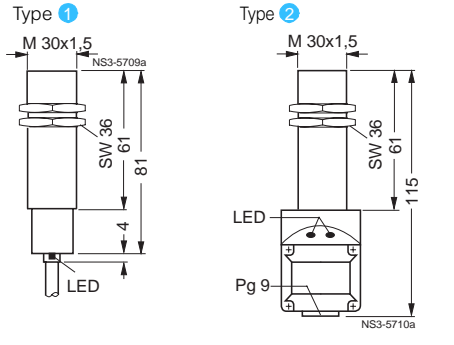
<b>Rated operating distance<sup>1)</sup> <math>s_n</math></b>
<b>Form</b>
<b>Installation</b>

<b>10 mm</b>	<b>10 mm</b>
<b>M 30 x 1.5</b>	<b>M 30 x 1.5</b>
<b>Embeddable</b>	<b>Embeddable</b>

<b>20 mm</b>	<b>20 mm</b>
<b>Ø 40 mm<sup>3)</sup></b>	<b>40 mm x 40 mm block</b>
<b>Embeddable</b>	<b>Embeddable</b>

**Dimensions**

Delivered with  
Pg 9 = Pg 9 thread for moulded-plastic joint  
Pg 13.5 = Pg 13.5 thread for moulded-plastic joint, 3SX6 274 connector plug or 3RX1 566 adapter



<b>Housing material</b>
<b>Effective operating distance<sup>2)</sup> <math>s_r</math></b>
<b>Switching hysteresis</b>
<b>Operational voltage</b> V
<b>Indicators</b>
<b>Output indicator</b>
<b>Operational voltage indicator</b>
<b>Current input/Residual current</b> mA
<b>Operating frequency</b> Hz
<b>Repeat accuracy</b> %

<b>Metal with moulded plastic head</b>	<b>Moulded plastic</b>
Adjustable	Adjustable
0.02 $s_r$ to 0.2 $s_r$	0.02 $s_r$ to 0.2 $s_r$
AC 20 to 250	AC 20 to 250
LED red	LED red
-	LED green
≤ 1.7	≤ 1.7
20	20
≤ 2	≤ 2

<b>Moulded plastic</b>
Adjustable
0.02 $s_r$ to 0.2 $s_r$
AC 20 to 250
LED red
LED green
≤ 1.7
20
≤ 2

<b>Outputs:</b>
<b>Load rating at AC voltage</b>
<b>Siemens contactor</b>
<b>AC 230 V, up to size</b>
• continuous mA
• short time up to 20 ms A
<b>Minimum load current at</b>
• mainly inductive load mA
• mainly resistive load mA
<b>Voltage drop</b>

6	5
500	5
5	10
10	5
5	≤ 7

6	5
500	5
5	10
10	5
5	≤ 7

<b>Connection:</b>
<b>Number of cores</b>

With LiYY cable, 2 m 3 x 0.5 mm <sup>2</sup>	Terminal compartment Screw terminals up to 2.5 mm <sup>2</sup>
3	2

Terminal compartment Screw terminals up to 2.5 mm <sup>2</sup>
2

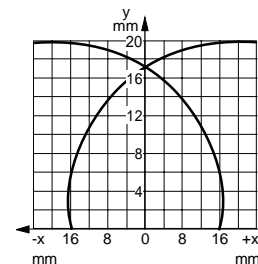
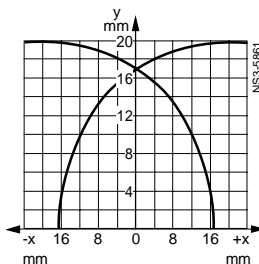
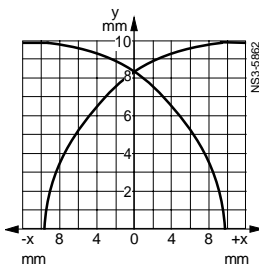
Type	Order No.	Price	Weight approx.	Wiring diagram p. 10/101 No.
1	3RG16 14-0LB00	1 unit	kg	5
1	3RG16 14-0LA00	1 unit	kg	5
2	3RG16 14-6LD00	1 unit	kg	6

Type	Order No.	Price	Weight approx.	Wiring diagram p. 10/101 No.
-	-	1 unit	kg	6
3	3RG16 55-6LD00	1 unit	kg	6
4	3RG16 30-6LD00	1 unit	kg	6

Type	Order No.	Price	Weight approx.	Wiring diagram p. 10/101 No.
-	-	1 unit	kg	6
3	3RG16 55-6LD00	1 unit	kg	6
4	3RG16 30-6LD00	1 unit	kg	6

### Response characteristics

- Delivery**
- Preferred type.
- 1) Actuation by earthed metal.
  - 2) The switching hysteresis can increase distinctly with adjustment  $s_r$  to  $s_n$ .
  - 3) Clamp with 40 mm dia. included in the scope of delivery.



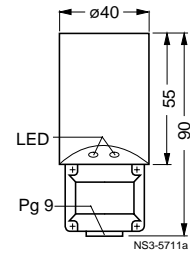
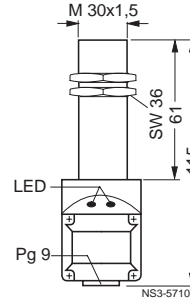
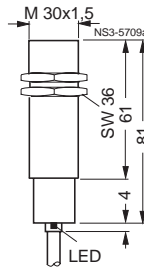
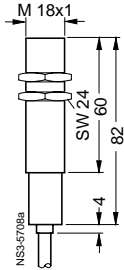
# 3RG16 BERO Capacitive Proximity Switches

## DC 10 to 65 V

### Selection and ordering data

Rated operating distance <sup>1)</sup> $s_n$	5 mm	10 mm	10 mm	20 mm
Form	M 18 x 1	M 30 x 1.5	M 30 x 1.5	Ø 40 mm <sup>3)</sup>
Installation	Embeddable	Embeddable	Embeddable	Embeddable
Dimensions	Type 1	Type 2	Type 3	Type 4
Housing material	Moulded plastic	Metal with moulded plastic head	Moulded plastic	Moulded plastic
Effective operating distance <sup>2)</sup> $s_r$	Adjustable 0.02 $s_r$ to 0.2 $s_r$		Adjustable 0.02 $s_r$ to 0.2 $s_r$	
Switching hysteresis	DC 10 to 65		DC 10 to 65	
Operational voltage	V		V	
Permissible residual ripple	%		%	
Indicators	LED red		LED yellow	
Output indicator	-		LED green	
Operational voltage indicator	-		6 to 12	
Current input/residual current	mA		mA	
Additional protective measures:	Suppressed		Suppressed	
Spurious switching signal	Continuous		Continuous	
Short-circuit protection	Continuous		Continuous	
Overload protection	Incorporated		Incorporated	
Polarity reversal protection of the supply voltage connection	Incorporated		Incorporated	
Inductive interference protection	-		-	
Operating frequency	Hz		Hz	
Repeat accuracy	%		%	
Load rating at DC voltage	mA		mA	
Voltage drop	V		V	

Delivered with Pg 9 = Pg 9 thread for moulded plastic joint



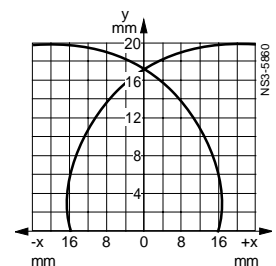
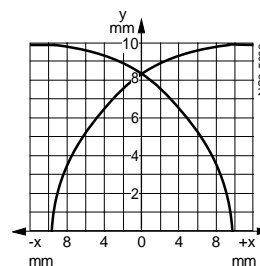
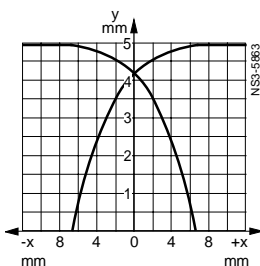
Type	Order No.	Price	Weight approx.	Wiring diagram	Type	Order No.	Price	Weight approx.	Wiring diagram
		1 unit	kg	p. 10/101 No.			1 unit	kg	p. 10/101 No.
1	3RG16 13-0AB00		0.123	1	-				
2	3RG16 14-0AC00		0.250	2	-				
3	3RG16 14-6AC00		0.165	3	3	3RG16 14-6AC00		0.165	3
4	3RG16 55-6AC00		0.223	4	4	3RG16 55-6AC00		0.223	4

### Response characteristics

#### Delivery

► Preferred type.

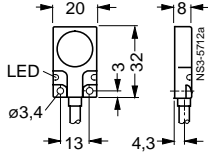
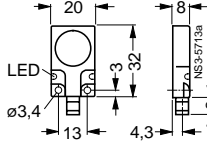
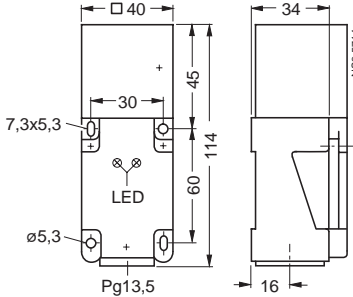
- Actuation by earthed metal.
- The switching hysteresis can increase distinctly with adjustment  $s_r > s_n$ .
- Clamp with 40 mm dia. included in the scope of delivery.



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## DC 10 to 65 V

### Selection and ordering data

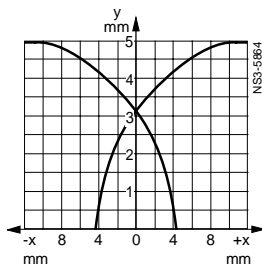
Rated operating distance <sup>1)</sup> $s_n$	5 mm	20 mm																																													
Form	20 mm × 20 mm block	40 mm × 40 mm block																																													
Installation	Embeddable	Embeddable																																													
Dimensions	Type ①  Type ② 	Type ③ 																																													
Delivered with	Pg 13.5 = Pg 13.5 thread for moulded-plastic joint, 3SX6 274 connector plug or 3RX1 566 adapter																																														
Housing material	Metal	Moulded plastic																																													
Effective operating distance <sup>2)</sup> $s_r$	Fix adjustment	Adjustable																																													
Switching hysteresis	0.02 $s_r$ to 0.2 $s_r$	0.02 $s_r$ to 0.2 $s_r$																																													
Operational voltage	DC 10 to 30 V	DC 10 to 65 V																																													
Permissible residual ripple	≤ 10 %	≤ 10 %																																													
Indicators	LED yellow	LED yellow																																													
Output indicator	LED green	LED green																																													
Operational voltage indicator	6 to 12 mA	6 to 12 mA																																													
Current input/residual current																																															
Additional protective measures:																																															
Spurious switching signal	Suppressed	Suppressed																																													
Short-circuit protection	Continuous	Continuous																																													
Overload protection	Continuous	Continuous																																													
Polarity reversal protection of the supply voltage connection	Incorporated	Incorporated																																													
Inductive interference protection	Incorporated	Incorporated																																													
Operating frequency	100 Hz	100 Hz																																													
Repeat accuracy	≤ 2 %	≤ 2 %																																													
Load rating at DC voltage	200 mA	200 mA																																													
Voltage drop	≤ 1.8 V	≤ 1.8 V																																													
	<table border="1"> <thead> <tr> <th>Type</th> <th>Order No.</th> <th>Price</th> <th>Weight approx.</th> <th>Wiring diagram</th> </tr> <tr> <td></td> <td></td> <td>1 unit</td> <td>kg</td> <td>p. 10/101 No.</td> </tr> </thead> <tbody> <tr> <td>①</td> <td><b>3RG16 73-0AG00</b></td> <td></td> <td>0.080</td> <td>1</td> </tr> <tr> <td>②</td> <td><b>3RG16 73-7AG00</b></td> <td></td> <td>0.033</td> <td>4</td> </tr> <tr> <td></td> <td>-</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Type	Order No.	Price	Weight approx.	Wiring diagram			1 unit	kg	p. 10/101 No.	①	<b>3RG16 73-0AG00</b>		0.080	1	②	<b>3RG16 73-7AG00</b>		0.033	4		-				<table border="1"> <thead> <tr> <th>Type</th> <th>Order No.</th> <th>Price</th> <th>Weight approx.</th> <th>Wiring diagram</th> </tr> <tr> <td></td> <td></td> <td>1 unit</td> <td>kg</td> <td>p. 10/101 No.</td> </tr> </thead> <tbody> <tr> <td>-</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>③</td> <td><b>3RG16 30-6AC00</b></td> <td></td> <td>0.240</td> <td>3</td> </tr> </tbody> </table>	Type	Order No.	Price	Weight approx.	Wiring diagram			1 unit	kg	p. 10/101 No.	-					③	<b>3RG16 30-6AC00</b>		0.240	3
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With LiYY cable, 2 m 3 × 0.25 mm <sup>2</sup>	NO function, pnp																																														
With plug 8 mm dia. Type A, C	NO function, pnp																																														
With terminal compartment for cables of up to 2.5 mm <sup>2</sup>	NO and NC function, pnp (non-equivalent)																																														

### Response characteristics

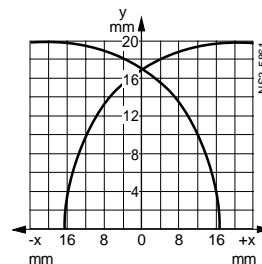
#### Delivery

► Preferred type.

- 1) Actuation by earthed metal.
- 2) The switching hysteresis can increase distinctly with adjustment  $s_r > s_n$ .



Standard target:  
Metal, 20 × 20 × 1 mm or  
conductive water,  
surface area 40 × 40 mm  
with direct contact to earth



Standard target:  
Metal, 60 × 60 × 1 mm or  
conductive water,  
surface area 40 × 40 mm  
with direct contact to earth