

# **APPENDIX D**

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**CARLO GAVAZZI**  
**CAPACITIVE LIQUID LEVEL SENSORS**



# Proximity Sensors Capacitive Thermoplastic Polyester Housing Types CA, M18, M30, DC, Teach-in

TRIPLESHIELD<sup>®</sup>

CARLO GAVAZZI



- Featuring **TRIPLESHIELD<sup>®</sup>** Sensor Protection
- Sensing distance: 0.5 - 12 mm (M18) and 1.0 - 30 mm (M30)
- Teach-in of sensing distance via push-button or COM-input
- Automatic detection of NPN or PNP load
- Selectable make or break switching by means of Teach-in function
- Protection: Short-circuit, transients and reverse polarity
- Humidity compensation
- Alarm output
- 5 years of warranty
- On request: Delay on output. New line autotune to compensate for heavy dirt build-up

## Product Description

Capacitive proximity switches with a sensing distance of either 8 mm flush mounted in metal or 12 mm non-flush mounted for the M18 version, and either 16 mm flush mounted in metal or 30 mm non-flush mounted for the M30 version. The

switching points can be altered by means of the Teach-in function. 3-wire DC output with selectable make (NO) or break (NC) switching and NPN Alarm. Grey polyester housing with 2 m PVC cable or M12 plug.

## Ordering Key

CA18CLC12BPM1

Capacitive proximity switch	_____
Housing diameter (mm)	_____
Housing material	_____
Housing length	_____
Detection principle	_____
Rated operating dist. (mm)	_____
Output type	_____
Output configuration	_____
Connection type	_____

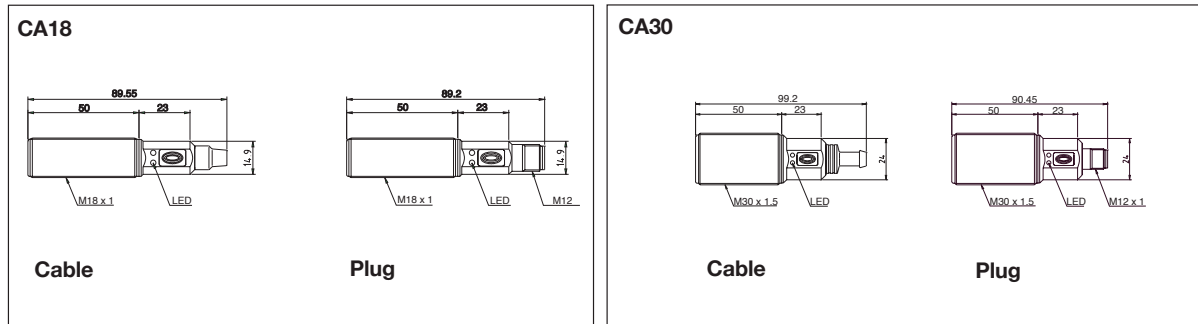
## Type Selection

Housing diameter	Rated operating distance (S <sub>n</sub> )	Ordering no. Cable	Ordering no. Plug
M18	12 mm	CA18CLC12BP	CA18CLC12BPM1
M30	30 mm	CA30CLC30BP	CA30CLC30BPM1

## Specifications

<b>Sensing range (S<sub>d</sub>)</b> CA18CLC12	0.5 - 12 mm factory set at 8 mm	<b>Frequency of operating cycles (f)</b>	15 Hz
CA30CLC30	1.0 - 30 mm factory set at 15 mm	<b>Indication</b> For output ON For safe/unsafe	LED, yellow LED, green
<b>Sensitivity</b>	Adjustable (Teach-in)	<b>Environment</b> Degree of protection Operating temperature Storage temperature	IP 68 -20 to +85 C (-4 to +185 F) -40 to +85 C (-40 to +176 F)
<b>Effective operating dist. (S<sub>r</sub>)</b>	0.9 x S <sub>n</sub> ≤ S <sub>r</sub> ≤ 1.1 x S <sub>n</sub>	<b>Housing material</b> Body Cable end Nuts	Grey, thermoplastic polyester Polyester, softened Black, PA12 Grilamid
<b>Usable operating dist. (S<sub>u</sub>)</b>	0.8 x S <sub>r</sub> ≤ S <sub>u</sub> ≤ 1.2 x S <sub>r</sub>	<b>Connection</b> Cable	Grey, 2 m, 4 x 0.25 mm <sup>2</sup> Oil proof, PVC M12 x 1 CON.1A-series
<b>Repeat accuracy (R)</b>	≤ 5%	Plug (M1) Cable for plug (M1)	
<b>Hysteresis (H)</b>	Depending on Teach-in	<b>Weight</b> Cable version - M18 / M30 Plug version - M18 / M30	110 g/160 g 30 g/70 g
<b>Rated operational volt. (U<sub>B</sub>)</b>	10 to 40 VDC (ripple incl.)	<b>Approvals</b>	UL, CSA
<b>Ripple</b>	≤ 10%	<b>CE-marking</b>	Yes
<b>Rated operational current (I<sub>e</sub>)</b>	≤ 250 mA (continuous)		
<b>No-load supply current (I<sub>o</sub>)</b>	≤ 12 mA		
<b>Voltage drop (U<sub>d</sub>)</b>	≤ 2.5 VDC @ max. load		
<b>Protection</b>	Short-circuit, reverse polarity, transients		
<b>TRIPLESHIELD<sup>™</sup> protection-EMC</b> IEC 1000-4-2/EN 61000-4-2 IEC 1000-4-3/EN 61000-4-3 IEC 1000-4-4/EN 61000-4-4 IEC 1000-4-6/EN 61000-4-6	30 kV > 15 V/m 3 kV > 10 V <sub>rms</sub>		

## Dimensions



## Adjustment Guide

The environments in which capacitive sensors are installed can often be unstable regarding temperature, humidity, object distance and industrial (noise) interference. Because of this, Carlo Gavazzi offers as standard features in all

*TRIPLESHEILDò* capacitive sensors a user-friendly sensitivity adjustment instead of having a fixed sensing range, extended sensing range to accommodate mechanically demanding areas, temperature stability to ensure minimum

need for adjusting sensitivity if temperature varies and high immunity to electromagnetic interference (EMI).

**Note:** Sensors are factory set (default) to nominal sensing range  $S_n$ .

## Installation Hints

Capacitive sensors have the unique ability to detect almost all materials, either in liquid or solid form. Capacitive sensors can detect metallic as well as non-metallic objects, however, their traditional use is for non-metallic materials such as:

• **Plastics Industry**  
Resins, regrinds or moulded products.

• **Chemical Industry**  
Cleansers, fertilisers, liquid soaps, corrosives and petrochemicals.

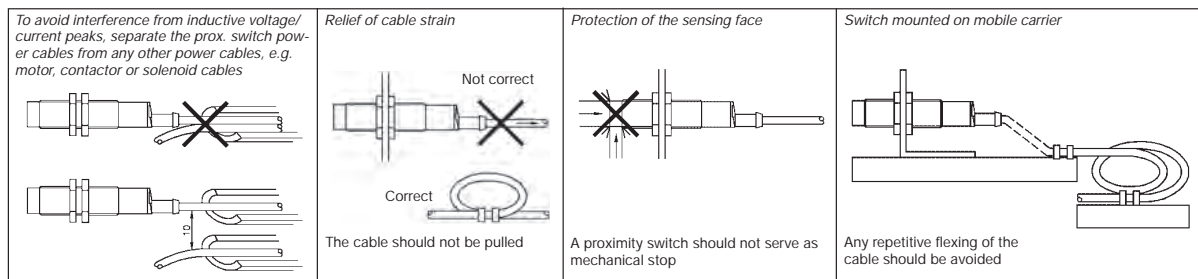
• **Wood Industry**  
Saw dust, paper products, door and window frames.

• **Ceramic & Glass Industry**  
Raw material, clay or finished products, bottles.

• **Packaging Industry**  
Package inspection for level or contents, dry goods, fruits and vegetables, dairy products.

Materials are detected due to their dielectric constant. The bigger the size of an object, the higher the density of material, the better or easier it is to detect the object. Nominal sensing distance for a capaci-

tive sensor is referenced to a grounded metal plate (ST37). For additional information regarding dielectric ratings of materials please refer to Technical Information.



## Delivery Contents

- Capacitive switch: CA..CLC..BP.
- **Packaging:** Cardboard box
- Installation & Adjustment Guide (MAN CAP ENG/GER)

## Accessories

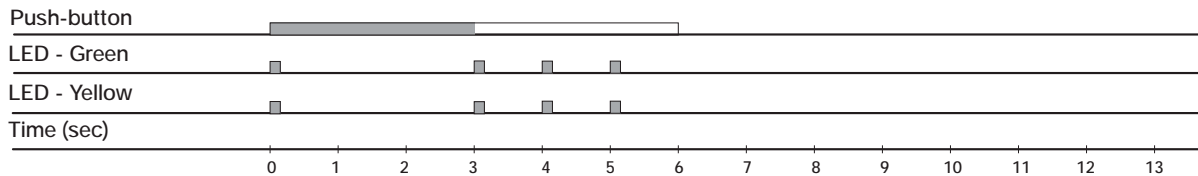
- Plugs CON.1A.. series.

For further information please refer to i Accessories.

## Teach-in Guide

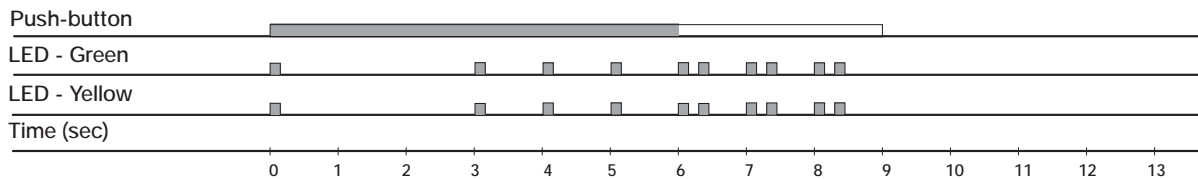
### Adjustment - Background No target present

Press push-button >3 seconds until LED $\times$  are flashing one time per second. The background will be calibrated when the push-button is released during the following 3 seconds



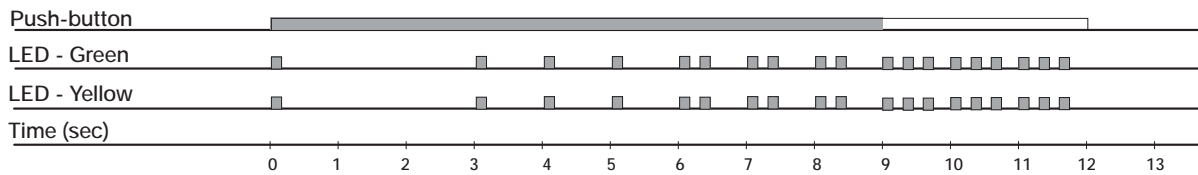
### Adjustment - Object Target present

Press push-button >6 seconds until LED $\times$  are flashing two times per second. The object will be calibrated when the push-button is released during the following 3 seconds



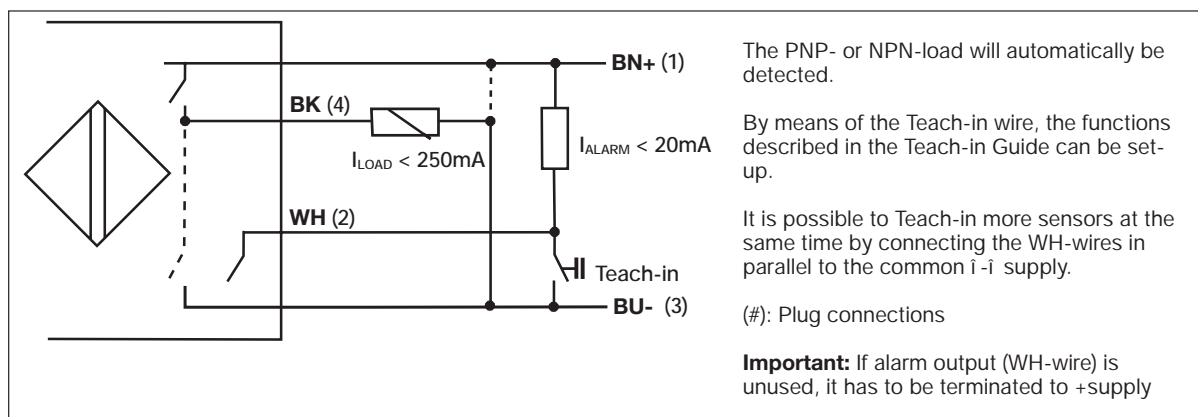
### Adjustment - NO - NC

Press push-button >9 sec. until LED $\times$  are flashing three times per second. The status of NO-NC will toggle when the push-button is released during the following 3 seconds



Releasing the push-button after 12 sec. returns the sensor to factory settings.

## Wiring Diagrams



# Proximity Sensors Capacitive Amplifier, Capacitive, Optical Type SV 190 (Charging/Discharging)



- Level control relay
- Max.-min. control of charging/discharging
- For use with refractive optical sensors or capacitive sensors
- Controls liquid/granulate presence or absence with one sensor, or liquid/granulate level within max./min. limits with two sensors
- Normal or inverted function selectable
- 10 A SPDT output relay
- LED-indication: relay ON
- AC or DC power supply

## Product Description

Level control relay for transparent liquids or granulates which can control one or two levels of charging or discharging. For use with opti-

cal sensors (VP.) or capacitive sensors (DR.. or EC.). Open collector NPN-types only.

## Ordering Key

**SV 190 230**

Type \_\_\_\_\_  
Power supply \_\_\_\_\_

## Type Selection

Plug	Output	Supply: 24 VAC	Supply: 115 VAC	Supply: 230 VAC	Supply: 24 VDC
Circular	SPDT	SV 190 024	SV 190 115	SV 190 230	SV 190 724

## Input Specifications

<b>Sensor supply</b> through pins 7 and 9 (+)	12 VDC, stabilized max. 60 mA
Short-circuit protection	Yes
<b>Sensor input</b> One level	Pin 5
Two levels	Pin 5 and 6
<b>Operating frequency</b>	Max. 5 Hz.
<b>Input resistance</b>	25 kΩ
<b>Cable resistance</b>	Max. 100 Ω

## General Specifications

<b>Time delay before availability</b>	0.5 s
<b>Indication for</b> Output ON	LED, red
<b>Environment</b> Degree of protection	IP 20 B
Pollution degree	3 (IEC 60664)
Operating temperature	-20 to +50°C (-4 to +122°F)
Storage temperature	-50 to +85°C (-58 to +185°F)
<b>Approvals</b>	UL, CSA
<b>CE-marking</b>	Yes

## Supply Specifications

<b>Power supply AC-types</b>	Overvoltage cat. II (IEC 60664)
Rated operational voltage through pin 2 & 10	230 115 024
Rated insulation voltage	230 VAC ± 15%
Rated impulse withstand voltage	115 VAC ± 15%
	24 VAC ± 15%
	≥ 2,0 kVAC (rms)
<b>Power supply DC-types</b>	Installation cat. II (IEC 60664)
Rated operational voltage	724
Rated insulation voltage	24 VDC ±15% (pin 2 pos.)
Rated transient protection volt.	None
	800 V (1.2/50 μs)



## Output Specifications

<b>Output</b>	SPDT relay
Rated insulation voltage	250 VAC (rms) (cont./elec.)
<b>Contact ratings</b> ( Ag-Cd0)	μ (micro gap)
Resistive loads	AC 1 10 A/250 VAC (2500 VA) DC 1 1 A/250 VDC (250 W) or 10 A/25 VDC (250 W)
Small inductive loads	AC 15 2.5 A/230 VAC DC 13 5 A/24 VDC
<b>Mechanical life</b>	≥ 30 x 10 <sup>6</sup> operations
<b>Electrical life</b>	AC 1 ≥ 2.5 x 10 <sup>5</sup> operations (at max. load)
<b>Operating frequency</b>	≤ 7200 operations/h
<b>Insulation voltages</b>	
Rated insulation voltage	≥ 2.0 kVAC (rms) (cont./elec.)
Rated transient protection voltage	4 kV (1.2/50 μs) (cont./elec.) (IEC 60664)

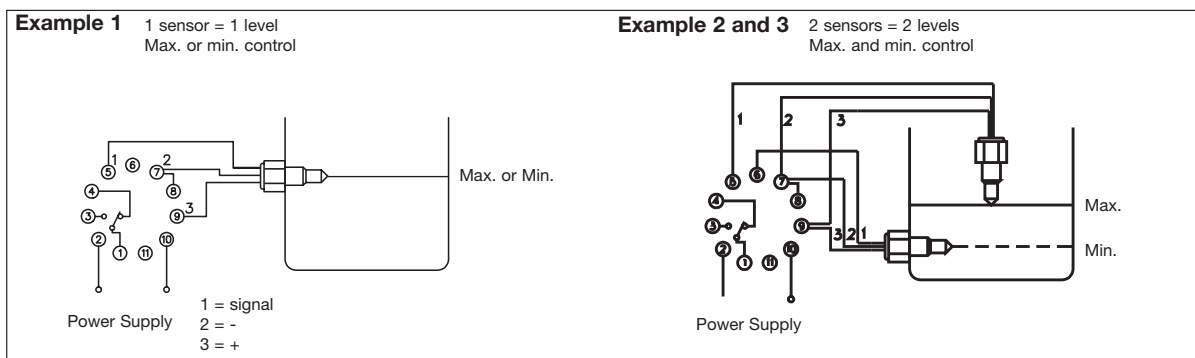
## Accessories

Sensors, open collector NPN-types:

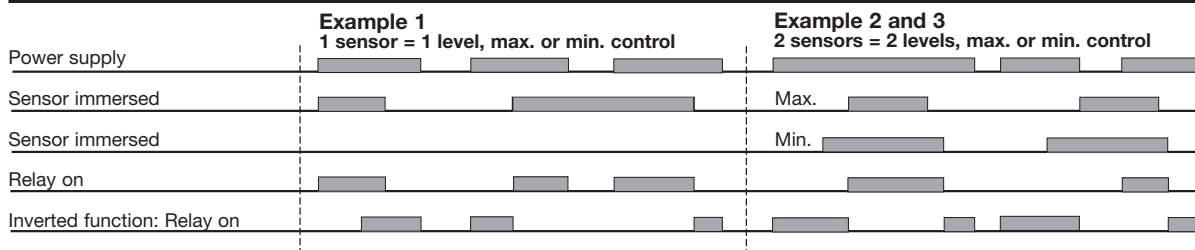
Optical: VP  
Capacitive: DR, EC

Bases  
Hold down spring  
Base covers  
Front mounting bezel

## Wiring Diagrams



## Operation Diagrams



## Mode of Operation

### Example 1

#### One sensor/one level

The relay operates when the sensor is immersed and releases when the sensor is no longer immersed. When pins 7 and 8 are interconnected (dotted line), the relay is inverted.

The relays releases at desired max. level making the pump stop. In case of power supply interruptions, the relay releases and the pump stops, thus overflow is prevented.

#### Sensor characteristics

The optical sensors VP for liquids must not be exposed to more than 100 lux from ambient light sources.

### Example 2: Discharging

#### Two sensors/two levels

The relay operates when the upper sensor (max. level) is immersed and releases when the lower sensor (min. level) is no longer immersed. When pins 7 and 8 are interconnected (dotted line), the relay is inverted.

The capacitive sensors DR and EC are for solid, fluid or granulated substances. The activating distance depends on the physical and electrical characteristics of the object to be detected.

### Example 3: Charging.

#### Two sensors/ two levels

In fill-up applications inverted function (pins 7 and 8 connected) should always be used and the pump always be supplied through pin 3 (relay ON).

Note: Solid or fluid conductors are detected at a greater distance than light or porous insulators.

# General Accessories

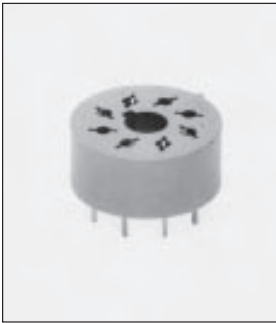
## Sockets

### Types S, D, ZPD, ZVD



**Socket types S 008, S 011**  
For mounting on printed circuits.

**S 008**  
8-pole circular socket.

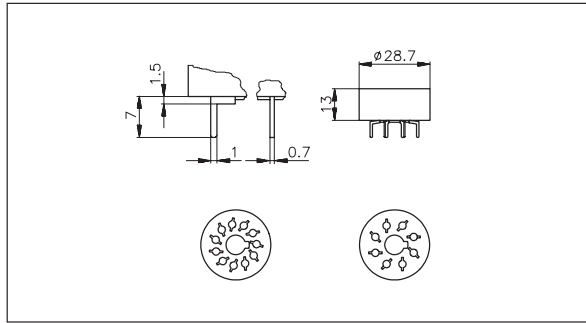


**S 011**  
11-pole circular socket.



**Material**  
**Colour**  
**Material of spring**  
**Printed circuit hole diameter**  
**Approvals**

Glasfilled Noryl SE 1  
Light grey  
Tin-plated brass  
Min. 1.5 mm  
UL, CSA



**Socket types S 108, S 111**  
For mounting on or below a chassis with soldering and plug connections (AMP 187).

**S 108**  
8-pole circular socket.

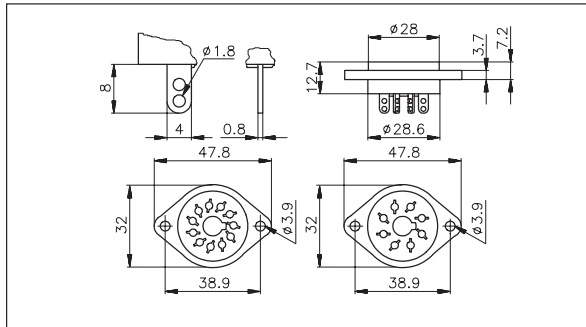


**S 111**  
11-pole circular socket.



**Material**  
**Colour**  
**Material of spring**  
**Approvals**

Glasfilled Noryl SE 1  
Light grey  
Tin-plated brass  
UL, CSA



**Socket types S 108 A, S 111 A**  
For mounting on or below a chassis or printed circuits.

**S 108 A**  
8-pole circular socket.

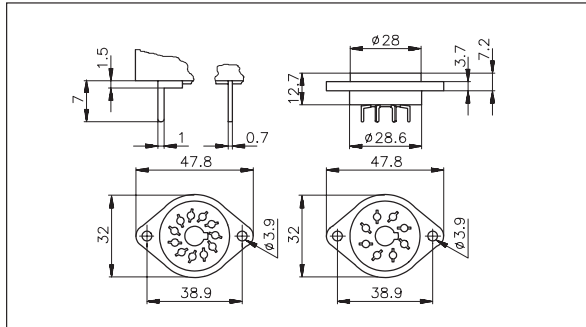


**S 111 A**  
11-pole circular socket.



**Material**  
**Colour**  
**Material of spring**  
**Approvals**

Glasfilled Noryl SE 1  
Light grey  
Tin-plated brass  
UL, CSA



## Sockets (cont.)

### Socket types S 408, S 411

Socket with front screw connections. For mounting by two front screws or for snap-mounting on DIN-rail (DIN EN 50 022). With captive cable clamps and cross-cut terminal screws. For devices with circular plugs.

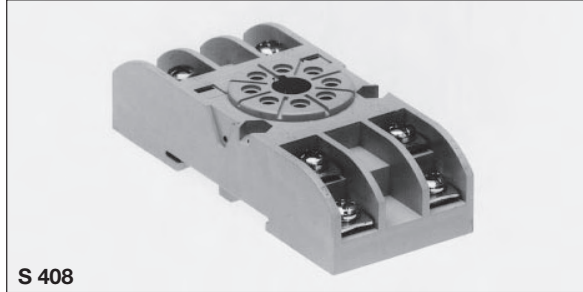
Text markers, type no. tags: e.g. Weidmüller type SG 10

#### S 408

8-pole circular socket.

#### S 411

11-pole circular socket.



S 408

#### Rating

Installation/pollution deg.

Degree of protection

#### Material

Socket

Contact spring

DIN-rail retaining spring

#### Approvals

10 A/250 VAC (IEC 60664)

Cat. III/2

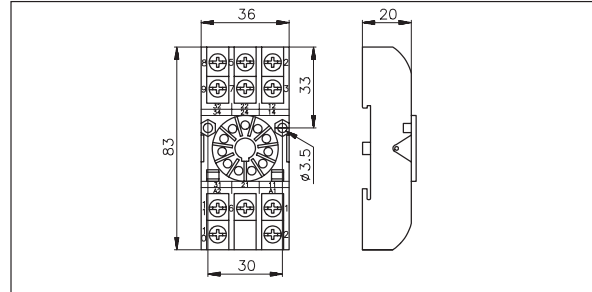
IP 10 (IEC 60529)

Light grey, Noryl SE1

Tin-plated brass

Stainless steel wire

UL, CSA



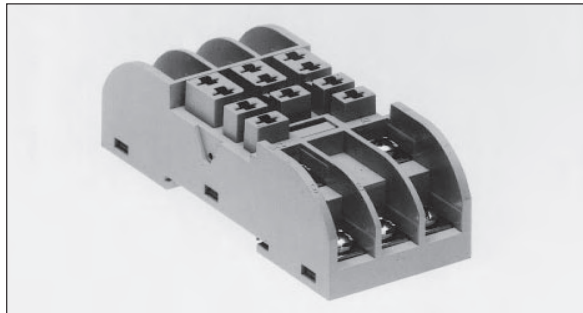
### Socket type D 411 B

Socket with front screw connections. For mounting by two front screws or for snap-mounting on DIN-rail (DIN EN 50 022). With captive cable clamps and cross-cut terminal screws. For devices with spade plugs (4.8 x 0.5 mm).

Text markers, type no. tags: e.g. Weidmüller type SG 10

#### D 411 B

11-pole spade socket.



#### Rating

Installation/pollution deg.

Degree of protection

#### Material

Socket

Contact spring

DIN-rail retaining spring

#### Approvals

10 A/250 VAC (IEC 60664)

Cat. III/3

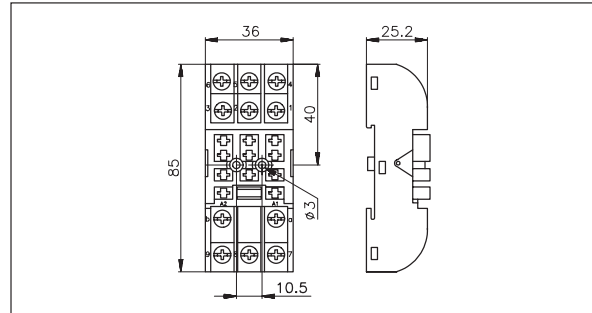
IP 10 (IEC 60529)

Black, Noryl SE1

Tin-plated brass

Stainless steel wire

UL, CSA



### Socket types ZPD 8, ZPD 11,

Socket for mounting on DIN-rail (DIN EN 50 022).

Text markers, type no. tags: e.g. Weidmüller type SG 10

#### ZPD 8

8-pole circular socket.

#### ZPD 11

11-pole circular socket.



ZPD 11

#### Rating

Installation/pollution deg.

Degree of protection

Material: Socket

Contact spring

DIN-rail retaining spring

#### Approvals

10 A/300 VAC (IEC 60664)

Cat. III/2

IP 20 (IEC 60529)

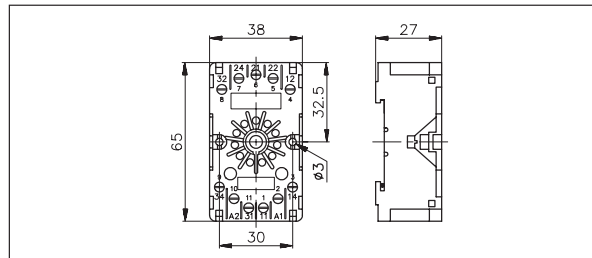
Black, thermoplast. resin

(UL 9040 HB)

Nickel-plated copper alloy

Stainless steel wire

UL, CSA



## Sockets (cont.)

**Socket types ZVD 8, ZVD 11,**  
Socket for mounting on DIN-rail (DIN EN 50 022).

**Rating**  
**Installation/pollution deg.**  
**Degree of protection**  
**Material - Socket**

10 A/300 VAC (IEC 60664)  
Cat. III/2  
IP 10 (IEC 60529)  
Black, thermoplast. resin  
(UL 94 V-1)  
Nickel-plated copper alloy  
Polyester

**ZVD 8**  
**ZVD 11**

8-pole circular socket.  
11-pole circular socket.

Contact spring  
DIN-rail retaining spring

