

# ICS12, ICS18 and ICS30



## Proximity inductive sensors with E1-type approval



### Description

ICS E1 series is a complete family of high performance inductive sensors which represents Carlo Gavazzi standard solution for outdoor mobile applications.

Since they are installed on vehicles such as trucks or earth-moving equipments, they have to survive harsh environmental conditions, such as very high level of shock and vibrations, low and high temperature, high level radio frequency noise, and frequent washing cycles with liquid cleaners and degreasers to remove grease and oils.

This family is available in M12, M18 and M30 housings, with extended sensing ranges (2x), stainless steel housing and it is characterized by very high durability.

### Benefits

- **A complete family.** Available in M12, M18 and M30 housings with an operating distance from 4 to 22 mm.
- **Less machine downtime.** Lower risk of mechanical damage thanks to the extended range sensors with 2 times the standard operating distance.
- **E1-type approval** by the German Federal Motor Transport Authority, assures the sensor complies with the automotive standards and is allowed to be mounted on vehicles.
- **High EMC standards** with immunity to false actuation when exposed to radiated noise with field strengths of up to 30 V/m and immunity to conducted RF noise of 10 V.
- **Extended power supply range** from 8 to 60 V DC, to allow reliable operation in mobile equipment, where the power source is often only a conventional vehicle battery, requiring a very low voltage in some particular situations.
- **Load-dump protection** protects the electronics against voltage peaks in the onboard power supply. These damaging voltage surges are typically generated when the alternator is charging the battery, supplying charging current, and the battery connection is lost, generally due to corrosion or poor connection.
- **Easy to install.** ICS12 and ICS18 sensors have a milled section for wrench grip. The LED also indicates when there is a short circuit or overload condition. The user can choose between 2 m PUR cable and M12-plug versions.
- **High precision.** The onboard advanced microcontroller ensures better stability with respect to environmental influences, with highly repeatable measurements between -40 and +85°C.
- **Easy customization to specific OEM requests** such as pigtail solutions with special cables and connectors used in mobile equipments are possible on request.
- **Product traceability.** Permanently legible part number and serial number, laser engraved on the plastic cap, guarantee the traceability of every sensor.


### Applications

- Trucks, earth-moving equipments, agriculture machines, mobile cranes, buses.

### Main functions

- Non contact detection of metal objects in general position-sensing and presence-sensing in mobile equipment applications
- Integrated diagnostic function with flashing LED in the event of a short circuit or overload

## References


 **Order code**

 ICS        E1

Enter the code option instead of

Code	Option	Description
I	-	Inductive sensor
C	-	Cylindrical housing
S	-	Stainless steel housing
<input type="checkbox"/>	12	M12 housing
	18	M18 housing
	30	M30 housing
L50	-	Housing with thread length of 50 mm
<input type="checkbox"/>	F	Flush
	N	Non-flush
<input type="checkbox"/>	04	ICS12 flush: 4mm (extended range)
	08	ICS12 non-flush: 8 mm (extended range) ICS18 flush: 8mm (extended range)
	14	ICS18 non-flush: 14mm (extended range)
	15	ICS30 flush: 15mm (extended range)
	22	ICS30 non-flush: 22mm (extended range)
<input type="checkbox"/>	NO	NPN – normally open output
	NC	NPN – normally closed output
	PO	PNP – normally open output
	PC	PNP – normally closed output
<input type="checkbox"/>	B2	2 m PUR cable
	M1	M12 plug
E1	-	E1-type approved for mobile equipment

Additional characters can be used for customized versions.

 Selection guide

## M12 Extended range

Connection	Detection principle	Output type	Ordering no. Normally Open	Ordering no. Normally Closed
Cable	Flush	NPN	ICS12L50F04NOB2E1	ICS12L50F04NCB2E1
		PNP	ICS12L50F04POB2E1	ICS12L50F04PCB2E1
	Non-flush	NPN	ICS12L50N08NOB2E1	ICS12L50N08NCB2E1
		PNP	ICS12L50N08POB2E1	ICS12L50N08PCB2E1
Plug	Flush	NPN	ICS12L50F04NOM1E1	ICS12L50F04NCM1E1
		PNP	ICS12L50F04POM1E1	ICS12L50F04PCM1E1
	Non-flush	NPN	ICS12L50N08NOM1E1	ICS12L50N08NCM1E1
		PNP	ICS12L50N08POM1E1	ICS12L50N08PCM1E1

## M18 Extended range

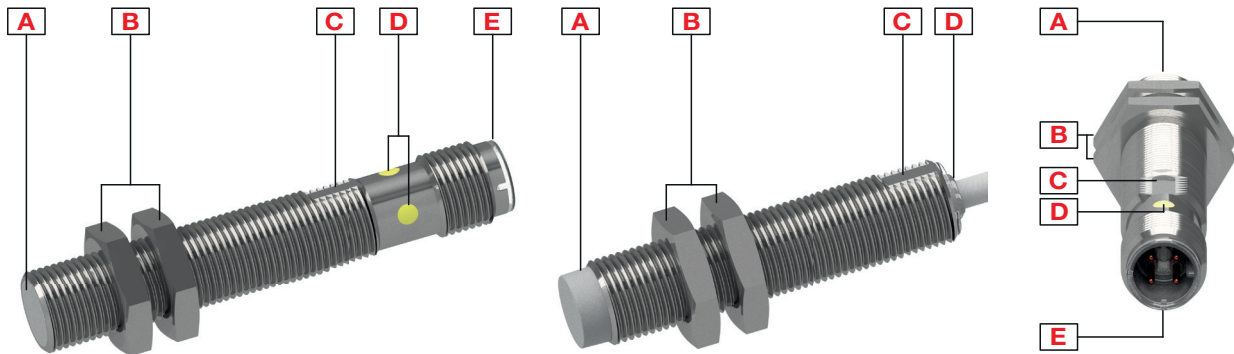
Connection	Detection principle	Output type	Ordering no. Normally Open	Ordering no. Normally Closed
Cable	Flush	NPN	ICS18L50F08NOB2E1	ICS18L50F08NCB2E1
		PNP	ICS18L50F08POB2E1	ICS18L50F08PCB2E1
	Non-flush	NPN	ICS18L50N14NOB2E1	ICS18L50N14NCB2E1
		PNP	ICS18L50N14POB2E1	ICS18L50N14PCB2E1
Plug	Flush	NPN	ICS18L50F08NOM1E1	ICS18L50F08NCM1E1
		PNP	ICS18L50F08POM1E1	ICS18L50F08PCM1E1
	Non-flush	NPN	ICS18L50N14NOM1E1	ICS18L50N14NCM1E1
		PNP	ICS18L50N14POM1E1	ICS18L50N14PCM1E1

## M30 Extended range

Connection	Detection principle	Output type	Ordering no. Normally Open	Ordering no. Normally Closed
Cable	Flush	NPN	ICS30L50F15NOB2E1	ICS30L50F15NCB2E1
		PNP	ICS30L50F15POB2E1	ICS30L50F15PCB2E1
	Non-flush	NPN	ICS30L50N22NOB2E1	ICS30L50N22NCB2E1
		PNP	ICS30L50N22POB2E1	ICS30L50N22PCB2E1
Plug	Flush	NPN	ICS30L50F15NOM1E1	ICS30L50F15NCM1E1
		PNP	ICS30L50F15POM1E1	ICS30L50F15PCM1E1
	Non-flush	NPN	ICS30L50N22NOM1E1	ICS30L50N22NCM1E1
		PNP	ICS30L50N22POM1E1	ICS30L50N22PCM1E1

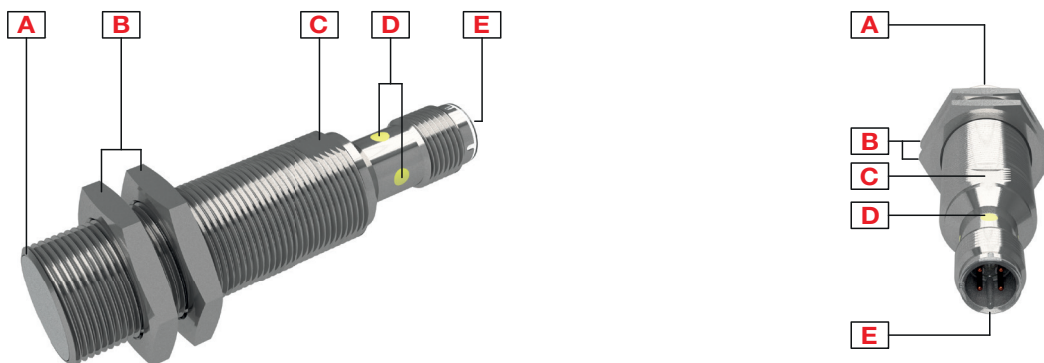
# Structure

## ICS12



Element	Component	Function
A	Sensing face	Flush or non-flush
B	2 nuts	For sensor mounting
C	Milled section	For wrench grip
D	LED	Green and Yellow LED; Output flashing: short circuit, overload or adjustment indicator
E	M12 x 1, 4 pin, male connector	For plug versions only

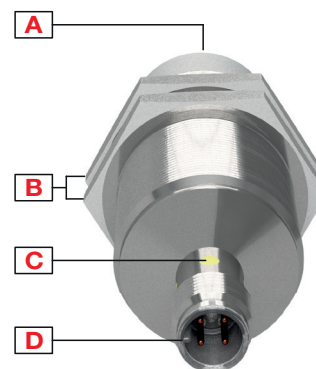
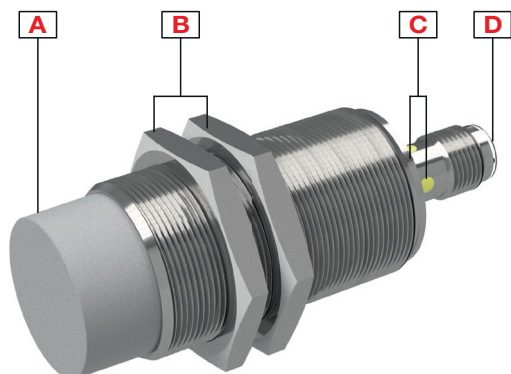
## ICS18



Element	Component	Function
A	Sensing face	Flush or non-flush
B	2 nuts	For sensor mounting
C	Milled section	For wrench grip
D	LED	Green and Yellow LED; Output flashing: short circuit, overload or adjustment indicator
E	M12 x 1, 4 pin, male connector	For plug versions only



## ICS30



Element	Component	Function
A	Sensing face	Flush or non-flush
B	2 nuts	For sensor mounting
C	LED	Green and Yellow LED; Output flashing: short circuit, overload or adjustment indicator
D	M12 x 1, 4 pin, male connector	For plug versions only

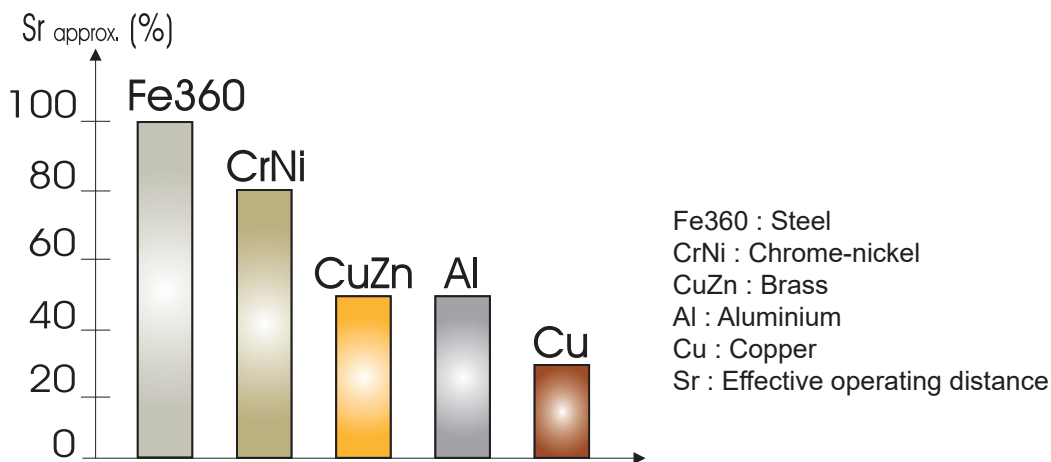
## Sensing

### Detection

<b>Rated operating distance <math>S_n</math></b>	4 to 22 mm: depending on housing diameter and version (flush or non-flush)
<b>Reference target</b>	The operating distance is measured according to IEC 60947-5-2, using a standard target moving axially. This target is square shape 1 mm thickness, made of steel e.g. type Fe 360 as defined in ISO 630 and it shall be of the rolled finish. The length of the side of the square is equal to – the diameter of the circle inscribed on the active surface of the sensing face, or – three times the rated operating distance $S_n$ whichever is greater
<b>Assured operating sensing distance (<math>S_a</math>)</b>	$0 \leq S_a \leq 0.81 \times S_n$ (e.g. with $S_n$ of 15 mm, $S_a$ is 0 ... 12.15 mm)
<b>Effective operating distance (<math>S_r</math>)</b>	$0.9 \times S_n \leq S_r \leq 1.1 \times S_n$
<b>Usable operating distance (<math>S_u</math>)</b>	$0.9 \times S_r \leq S_u \leq 1.1 \times S_r$
<b>Hysteresis (H)</b>	1...20%

### Correction factors

The specific operating distance  $S_n$  refers to defined measuring conditions. The following data have to be considered as general guidelines.



**Fig. 1** The rated operating distance is reduced by the use of metals and alloys other than Fe360. The most important reduction factors for inductive proximity sensors are shown in the figure.

### Accuracy

<b>Repeat accuracy (R)</b>	$\leq 10\%$
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## Features

### Power Supply

Rated operational voltage ( $U_b$ )	8 to 60 VDC (ripple included)
Ripple ( $U_{rpp}$ )	$\leq 10\%$
No load supply current ( $I_o$ )	$\leq 15$ mA
Power ON delay ( $t_o$ )	$\leq 50$ ms

### Outputs

Output functions	NPN or PNP by sensor type open collector
Output configuration	N.O. and N.C. by sensor type
Output current ( $I_o$ )	$\leq 200$ mA
OFF-state current ( $I_o$ )	$< 500$ $\mu$ A
Voltage drop ( $U_d$ )	Max. 2,5 VDC @ 200 mA
Protection	Short-circuit, inductive load, overload, reverse polarity and transients
Voltage transient	1 kV/0.5 J

### Response times

Operating frequency (f)	$\leq xx$ Hz	ICS12
	$\leq xx$ Hz	ICS18
	$\leq xx$ Hz	ICS30

### Indication

Yellow LED	Output	Description
OFF	OFF	N.O. output, target not present N.C. output, target present
ON	ON	N.O. output, target present N.C. output, target not present
Blinking	f: 2Hz	Short-circuit or overload




Green LED	Output	Description
OFF	-	Sensor is not operational
ON	-	Sensor is operational


**Environmental**

<b>Ambient temperature</b>	Operating: -40° to +85°C	
	Storage: -40° to +85°C	
<b>Rapid temperature changes -40.. +85 °C</b>	TA = -40 °C; TB = 85 °C; t1 = 30 min; t2 = < 10 s; 50 cycles	EN 60068-2-14 Na
<b>Vibration</b>	20 g (10...3000 Hz) / -20...50 °C 50 sweep cycles per frequency; 1 octave per minute in 3 axes	EN 60068-2-6 Fc
<b>Shock resistance</b>	100 g 11 ms half-sine; 3 shocks each in every direction of the 3 coordinate axes / -20...50 °C	EN 60068-2-27 Ea
<b>Continuous shock resistance</b>	40 g 6 ms; 4000 shocks each in every direction of the 3 coordinate axes / -20...50 °C	IEC 60068-2-29 Eb
<b>Degree of protection</b>	IP67, IP68 (2m submersion for 24h), IP69K	IEC 60529; EN 60947-1
<b>Chemical resistance</b>	Automotive and hydraulic oil, fuel/diesel, trans- mission fluid, break fluid, battery acid, road salt, and sour gas	




## Compatibility and conformity

EMC protection	<b>ISO 11452-2 Radiated noise</b> Sensor immunity to false actuation when exposed to field strengths generated by radio transmitters	30 V/m 20 MHz to 2 GHz
	<b>IEC 61000-4-2 Electrostatic discharge (ESD)</b> Sensor resistance against electrostatic disruptions. - CD Contact Discharge test, where a high voltage potential of 8 kV is applied directly to the sensor housing - AD Air Discharge test, the high voltage potential of 15 kV is applied to a plate at a specific distance from the sensor	CD: 8 kV / AD: 15 kV Severity level IV / IV
	<b>IEC 61000-4-3 Radiated radiofrequency</b>	30 V/m (80...2500 MHz)
	<b>IEC 61000-4-4 Burst immunity</b> Protection against very high voltage bursts, generated by interruption of circuits containing inductive loads	2 kV Severity level III
	<b>IEC 61000-4-5 Surge</b> Protection against high energy surge signals that are capable of damaging electronic circuitry. Typically associated with power main switching and lightning strikes. They can be also generated upon ignition/start up in mobile equipment circuitry	0,5 kV mains line to line
	<b>IEC 61000-4-6 HF Conducted radiofrequency.</b> Sensors are immune to both damage and spurious output signals when subject to conducted RF limits of 10V	10 V (0.01...80 MHz) Severity level III
	<b>IEC 61000-4-8 Power frequency magnetic fields</b>	30 A/m
Load dump protection	Full protection in case of battery disconnection from alternator	DIN ISO 7637-2/SAE J1113-11 (load dump) degree of severity 4
MTTF <sub>d</sub>	M12: xx years @50°C (122°F) M18: xx years @50°C (122°F) M30: xx years @50°C (122°F)	
Approvals	  	


**Mechanical data**

<b>Weight (including 2 nuts) max.</b>	<b>M12</b>	Cable version: xxxg; Plug version: xxxg.
	<b>M18</b>	Cable version: xxxg; Plug version: xxxg.
	<b>M30</b>	Cable version: xxxg; Plug version: xxxg.
<b>Mounting</b>	Flush mountable or non-flush mountable	
<b>Material</b>	Housing: stainless steel AISI 304 Front cap: Grey thermoplastic polyester	
<b>Max tightening torque</b>	ICS12: 17.5 Nm ICS18: 27.5 Nm ICS30: 50 Nm	


**Electrical connection**

<b>Cable</b>	ICS12: 2m, 3 x 0.34 mm <sup>2</sup> , Ø4 mm, PUR, grey, oil proof
	ICS18: 2m, 3 x 0.34 mm <sup>2</sup> , Ø5.2 mm, PUR, grey, oil proof
	ICS30: 2m, 3 x 0.34 mm <sup>2</sup> , Ø5.2 mm, PUR, grey, oil proof
<b>Plug</b>	M12 x 1, 4 pin, male connector

## Connection Diagrams

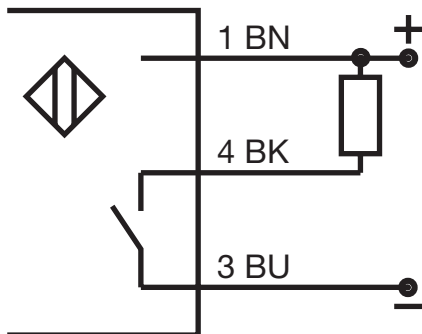


Fig. 2 NPN - Normally open

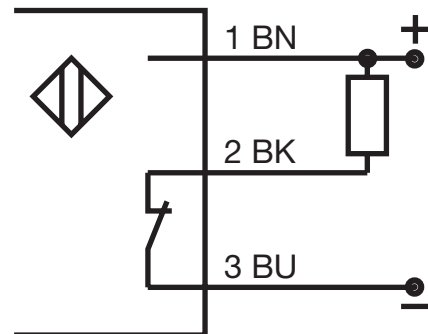


Fig. 3 NPN - Normally closed

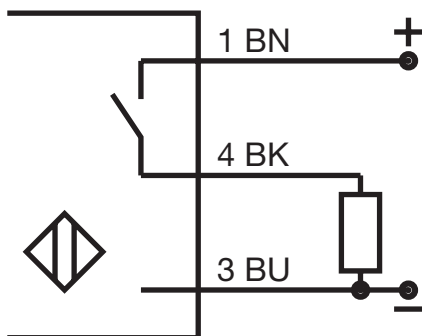


Fig. 4 PNP - Normally open

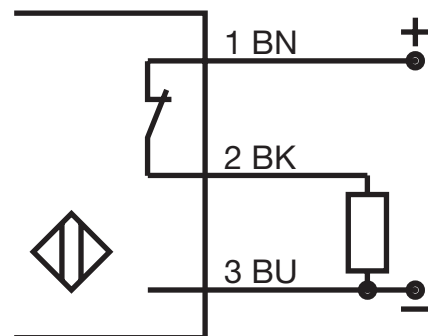


Fig. 5 PNP - Normally closed

Colour code		
BN: brown	BK: black	BU: blue

Wire colors in accordance with EN 60947-5-2

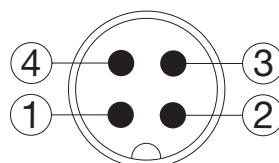


Fig. 6 Plug

## Dimensions

### ICS12 [mm]

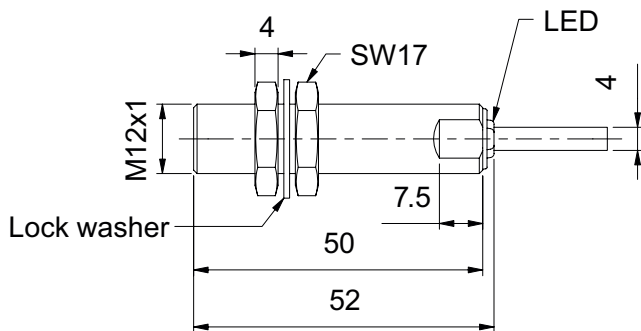


Fig. 7 Long body, flush version, cable

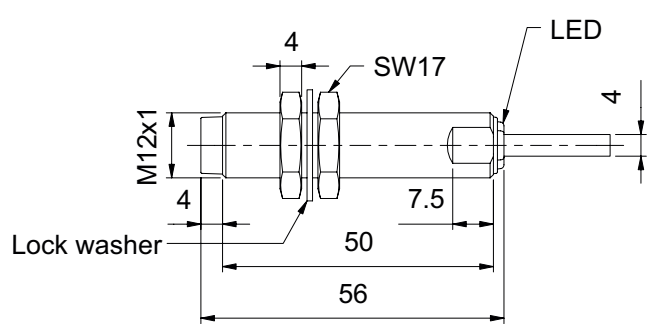


Fig. 8 Long body, non-flush version, cable

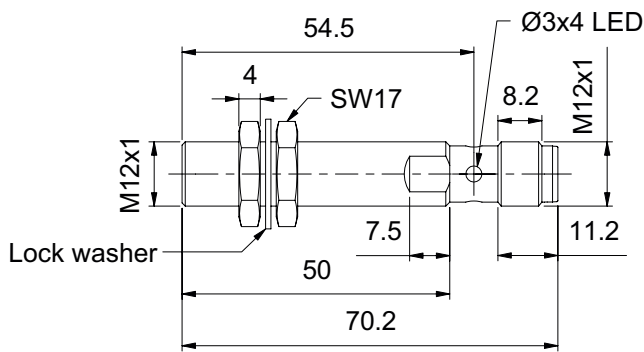


Fig. 9 Long body, flush version, plug

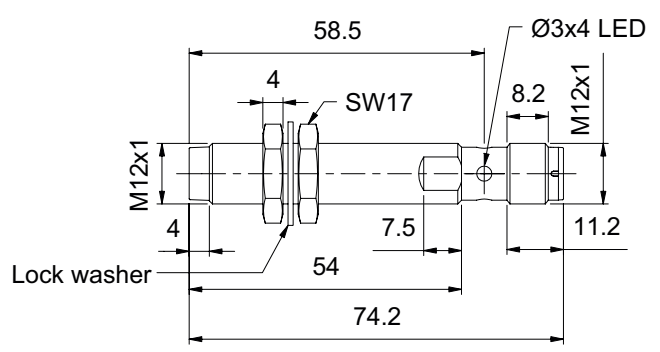


Fig. 10 Long body, non-flush version, plug

### ICS18 [mm]

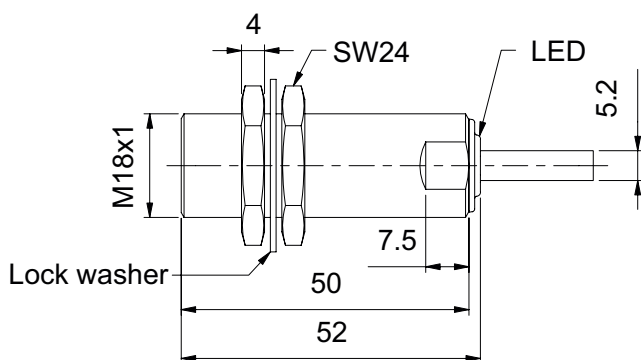


Fig. 11 Long body, flush version, cable

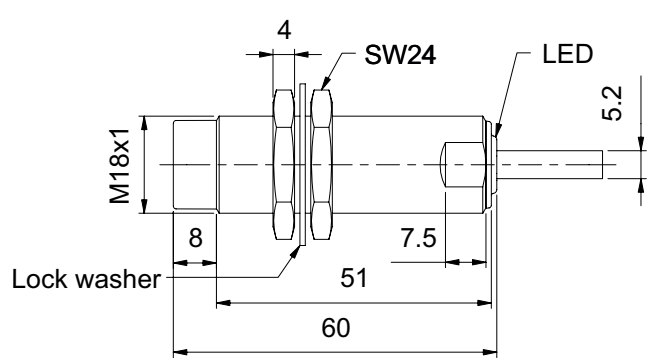


Fig. 12 Long body, non-flush version, cable

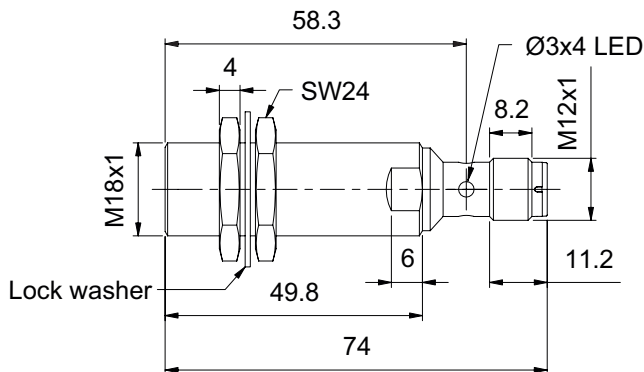


Fig. 13 Long body, flush version, plug

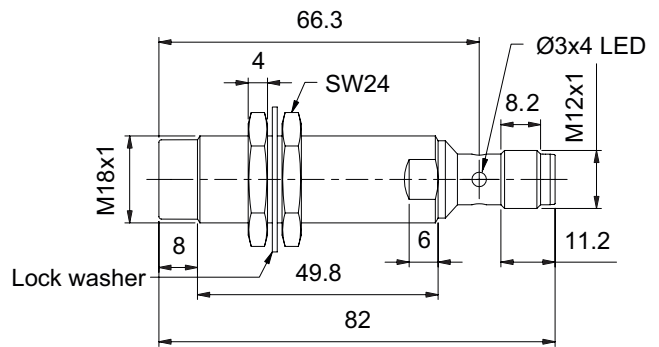


Fig. 14 Long body, non-flush version, plug

ICS30 [mm]

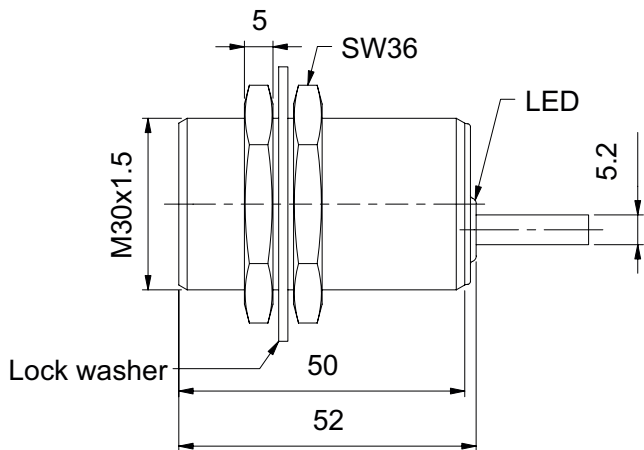


Fig. 15 Long body, flush version, cable

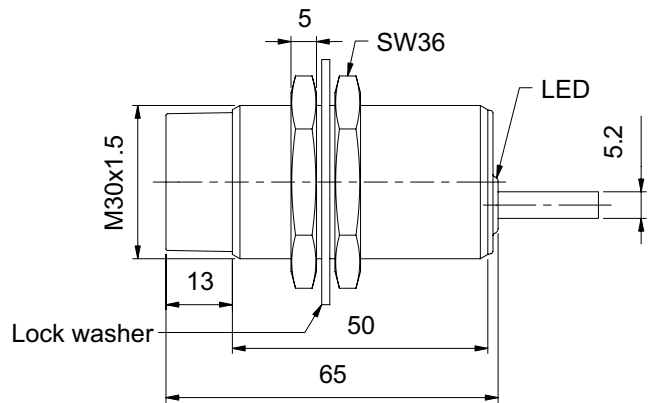


Fig. 16 Long body, non-flush version, cable

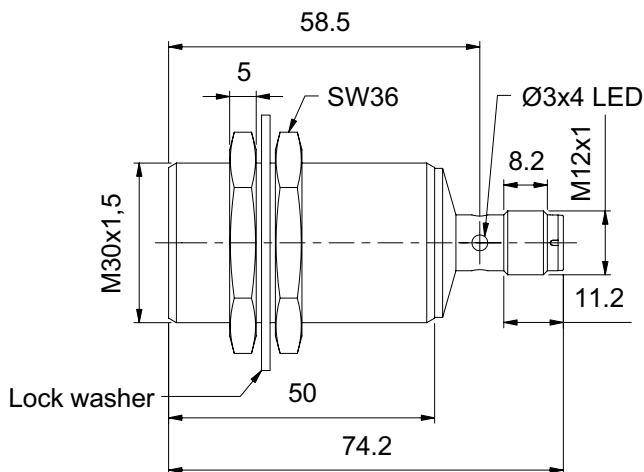


Fig. 17 Long body, flush version, plug

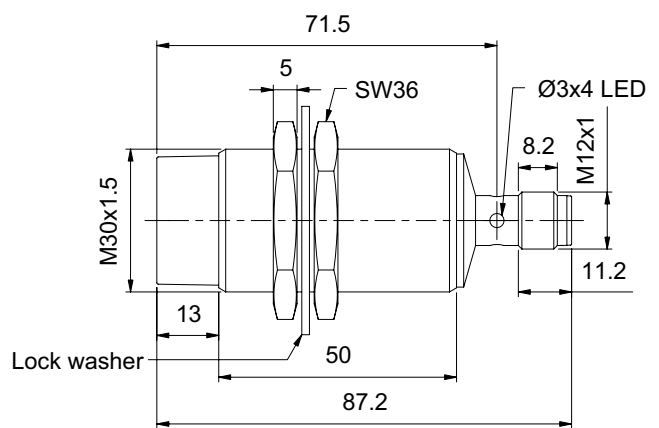
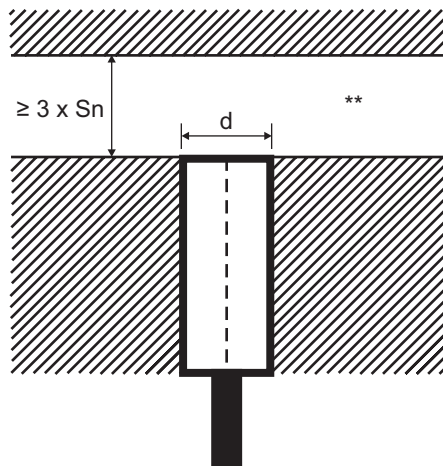


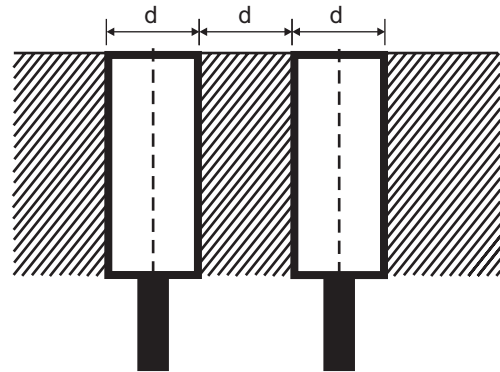
Fig. 18 Long body, non-flush version, plug

# Installation

## M12, M18 and M30 flush

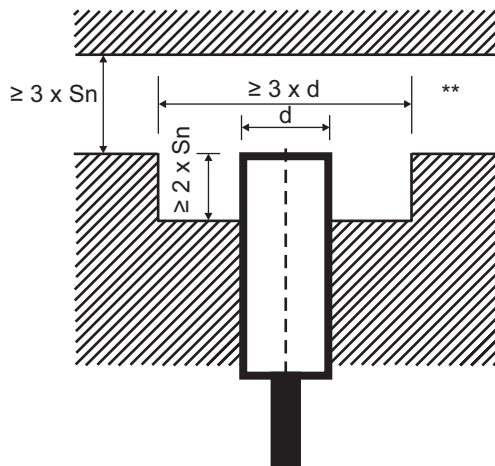


**Fig. 19** Flush sensor, when installed in damping material

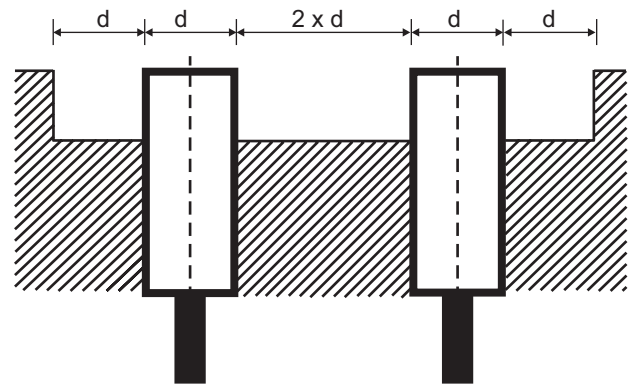


**Fig. 20** Flush sensors, when installed together in damping material

## M12, M18 and M30 non-flush

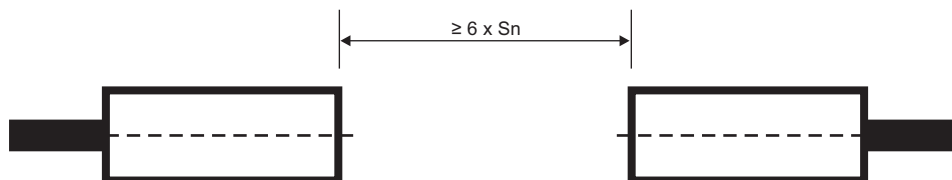


**Fig. 21** Non-flush sensor, when installed in damping material



**Fig. 22** Non-flush sensors, when installed together in damping material

### Sensors installed opposite each other



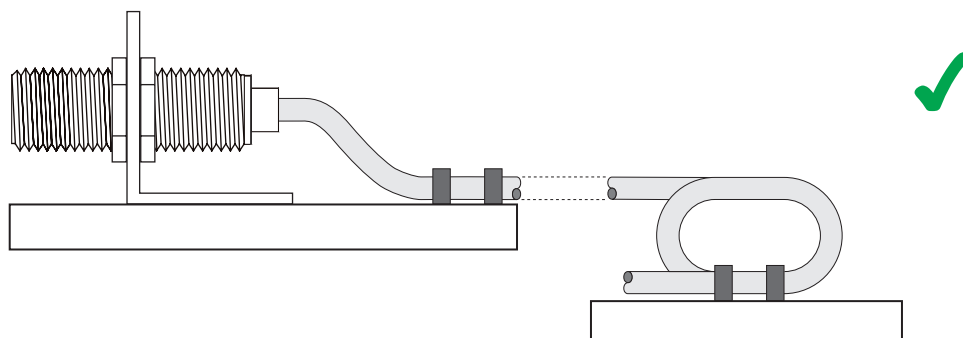
**Fig. 23** For sensors installed opposite each other, a minimum space of  $6 \times S_n$  (the nominal sensing distance) must be observed

\*\* Free zone or non-damping material

$S_n$ : nominal sensing distance

$d$ : sensor diameter (12 mm for ICS12, 18 mm for ICS18, 30 mm for ICS30)

### Cable version



## Delivery contents and compatible components



### Delivery contents

- Inductive proximity switch
- 2 fixing nuts
- 1 lock washer
- Packaging: plastic bag

### CARLO GAVAZZI compatible components

- Mounting bracket AMB... to be purchased separately
- Connector type: CON... series to be purchased separately

### Further reading

Information	Where to find it	QR
Mounting brackets	<a href="http://www.productselection.net/Pdf/UK/AMB8_30.pdf">http://www.productselection.net/Pdf/UK/AMB8_30.pdf</a>	
Connectors	<a href="http://www.productselection.net/Pdf/UK/CONB14NF.pdf">http://www.productselection.net/Pdf/UK/CONB14NF.pdf</a>	



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