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 200 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 (-40 and +185°F).
- **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

I C S ☐ L50 ☐ ☐ ☐ ☐ E1

Enter the code option instead of ☐

Code	Option	Description
I	-	Inductive sensor
C	-	Cylindrical housing
S	-	Stainless steel housing
☐	12	M12 housing
	18	M18 housing
	30	M30 housing
L50	-	Housing with thread length of 50 mm
☐	F	Flush
	N	Non-flush
☐	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)
☐	NO	NPN – normally open output
	NC	NPN – normally closed output
	PO	PNP – normally open output
	PC	PNP – normally closed output
☐	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

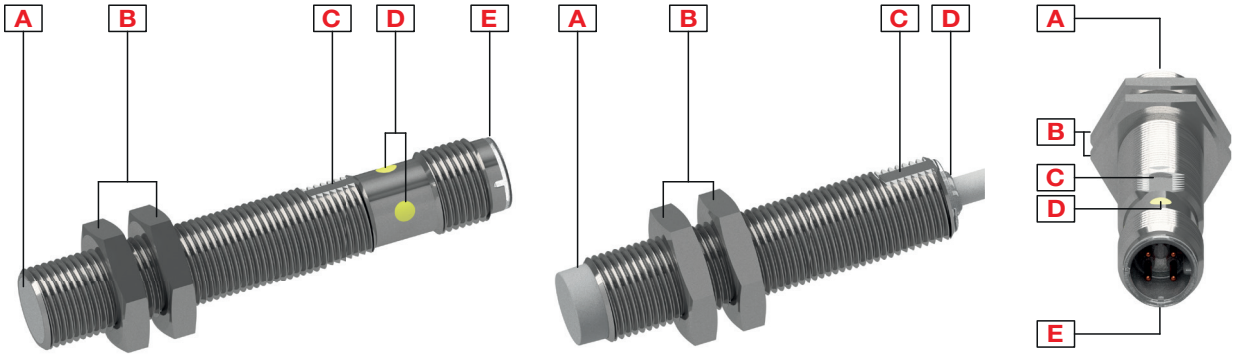
Connection	Detection principle	Output type	Ordering no. Normally Open	Ordering no. Normally Closed
Cable	Flush	NPN	ICS18L50F08NOB2E1	ICS18L50F08NCB2E1
		PNP	ICS18L50F08POB2E1	ICS18L50F08PCB2E1
	Non-flush	NPN	ICS18L50N14NOB2E1	ICS18L50N14NCB2E1
		PNP	ICS18L50N14POB2E1	ICS18L50N14PCB2E1
Plug	Flush	NPN	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

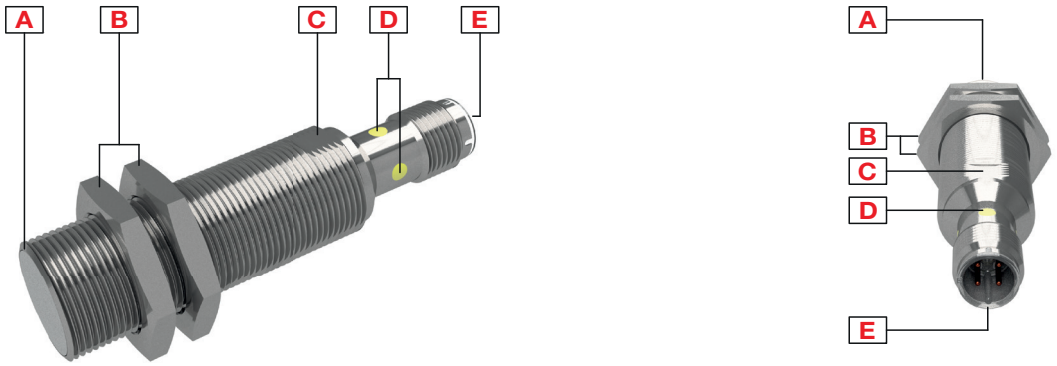
Structure

ICS12



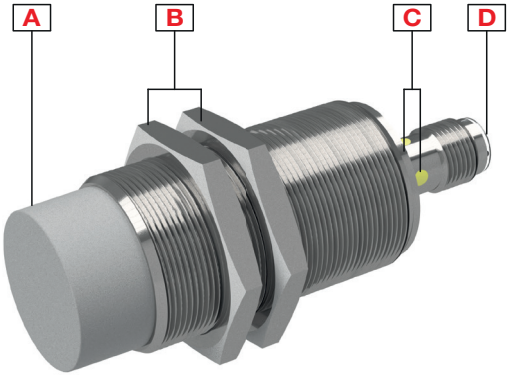
Element	Component	Function
A	Sensing face	Flush or non-flush
B	2 nuts	For sensor mounting
C	Milled section	For wrench grip
D	LED	Green and Yellow LED; Output flashing: short circuit, overload
E	M12 x 1, 4 pin, male connector	For plug versions only

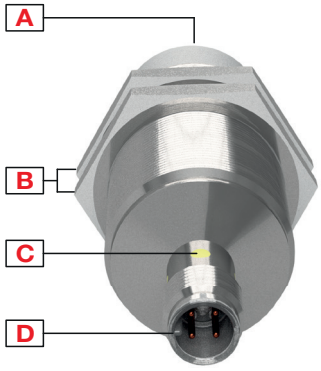
ICS18



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
E	M12 x 1, 4 pin, male connector	For plug versions only

ICS30



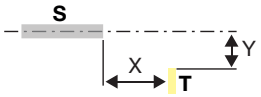


Element	Component	Function
A	Sensing face	Flush or non-flush
B	2 nuts	For sensor mounting
C	LED	Green and Yellow LED; Output flashing: short circuit, overload
D	M12 x 1, 4 pin, male connector	For plug versions only

Sensing

Detection

Rated operating distance S_n	4 to 22 mm: depending on housing diameter and version (flush or non-flush)
Reference target	The operating distance is measured according to EN 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
Assured operating sensing distance (S_a)	$0 \le S_a \le 0.81 \times S_n$ (e.g. with S_n of 15 mm, S_a is 0 ... 12.15 mm)
Effective operating distance (S_r)	$0.9 \times S_n \le S_r \le 1.1 \times S_n$
Usable operating distance (S_u)	$0.9 \times S_r \le S_u \le 1.1 \times S_r$
Hysteresis (H)	1...20%



S: sensor
T: target

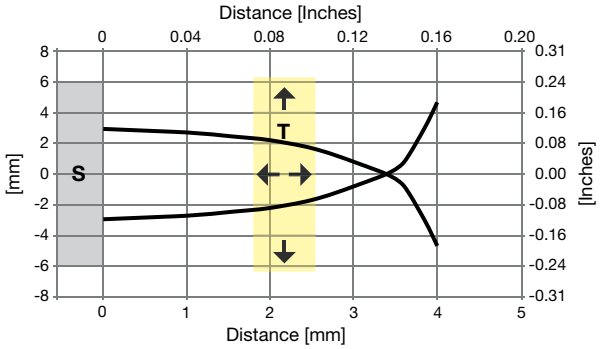


Fig. 1 *M12 Flush*

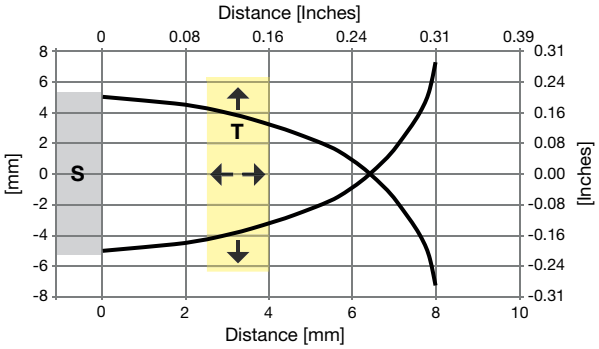


Fig. 2 *M12 Non-flush*

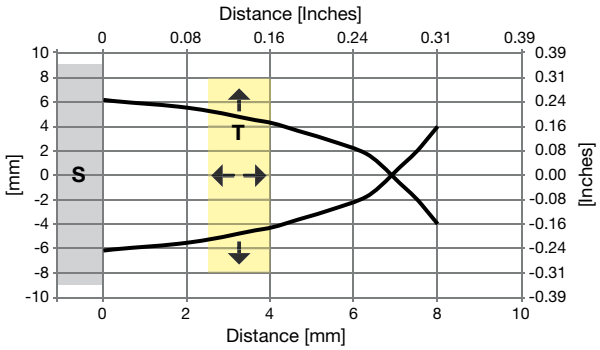


Fig. 3 *M18 Flush*

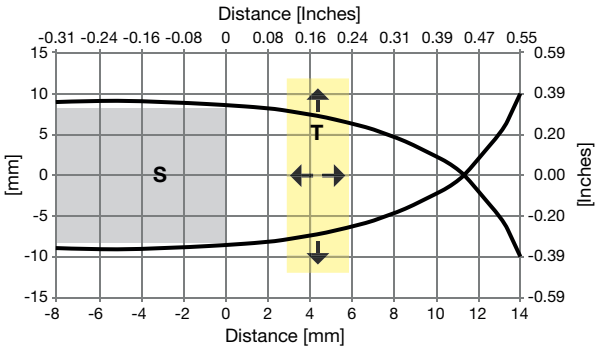


Fig. 4 *M18 Non-flush*

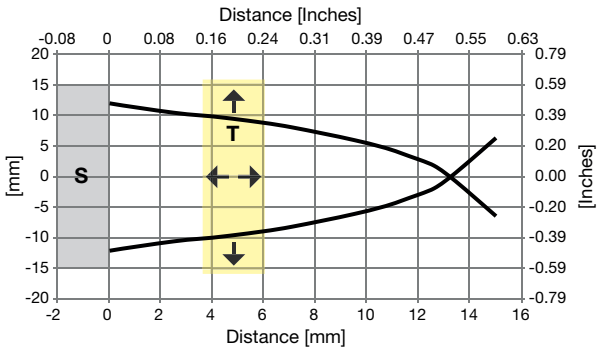


Fig. 5 *M30 Flush*

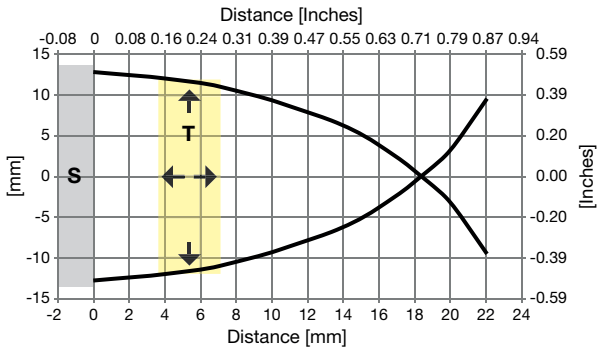
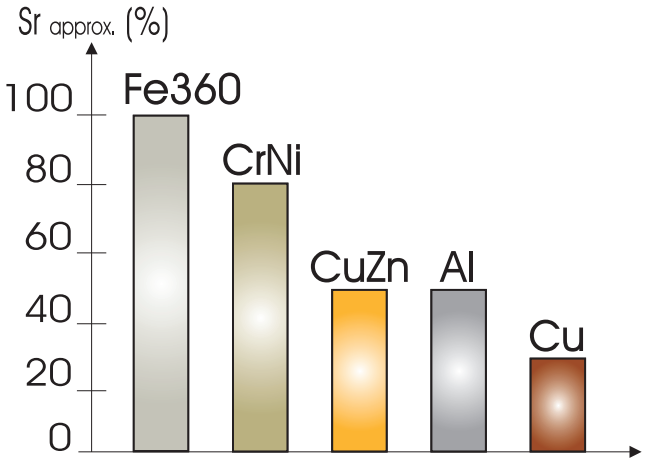


Fig. 6 *M30 Non-flush*

Correction factors

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



Fe360 : Steel
CrNi : Chrome-nickel
CuZn : Brass
Al : Aluminium
Cu : Copper
Sr : Effective operating distance

Fig. 7 *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

Repeat accuracy (R)	≤ 10%

Features

Power Supply

Rated operational voltage (U_B)	8 to 60 VDC (ripple included)
Ripple (U_{pp})	≤ 10%
No load supply current (I_o)	≤ 10 mA
Power ON delay (t_v)	≤ 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_e)	≤ 200 mA
OFF-state current (I_r)	< 500 µA
Voltage drop (U_d)	≤ 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)	≤ 1300 Hz	ICS12 Flush
	≤ 1000 Hz	ICS12 Non-flush
	≤ 900 Hz	ICS18 Flush
		ICS18 Non-flush
	≤ 300 Hz	ICS30 Flush
		ICS30 Non-flush

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

Ambient temperature	Operating: -40° to +85°C (-40° to +185°F)	
	Storage: -40° to +85°C (-40° to +185°F)	
Rapid temperature changes -40.. +85 °C	TA = -40 °C; TB = 85 °C	EN 60068-2-14 Na
Salt spray test	Test method 5 (4 cycles)	EN 60068-2-52 Kb
Ambient humidity	Operating: ≤ 95%	
	Storage: ≤ 95%	
Vibration	20 g (10...3000 Hz) 50 sweep cycles per frequency; 1 octave per minute in 3 axes	EN 60068-2-6 Fc
Shock resistance	100 g 11 ms half-sine; 3 shocks each in every direction of the 3 coordinate axes	EN 60068-2-27 Ea
Continuous shock resistance	40 g 6 ms; 4000 shocks each in every direction of the 3 coordinate axes	EN 60068-2-27 Ea
Degree of protection	IP67, IP68 (2m submersion for 24h), IP69K	IEC 60529; EN 60947-1

Compatibility and conformity

EMC protection	**ISO 11452-2 Radiated noise** Sensor immunity to false actuation when exposed to field strengths generated by radio transmitters	200 V/m 20 MHz to 2 GHz
	EN 61000-4-2 Electrostatic discharge (ESD) 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 8 kV is applied to a plate at a specific distance from the sensor	CD: 8 kV / AD: 8 kV Severity level IV / IV
	EN 61000-4-3 Radiated radiofrequency	30 V/m (80...2500 MHz)
	EN 61000-4-4 Burst immunity Protection against very high voltage bursts, generated by interruption of circuits containing inductive loads	4 kV Severity level III
	EN 61000-4-5 Surge 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
	EN 61000-4-6 HF Conducted radiofrequency. Sensors are immune to both damage and spurious output signals when subject to conducted RF limits of 10 V	10 V (0.01...80 MHz) Severity level III
	EN 61000-4-8 Power frequency magnetic fields	300 A/m
Load dump protection	Full protection in case of battery disconnection from alternator	DIN ISO 7637-2/SAE J1113-11 Pulse 1, 2a, 2b, 3a, 3b, 4, 5a (load dump) degree of level 4
$MTTF_d$	M12 PNP: 1678 years @50°C (122°F); M12 NPN: 1903 years @50°C (122°F) M18 PNP: 1813 years @50°C (122°F); M18 NPN: 1955 years @50°C (122°F) M30 PNP: 1812 years @50°C (122°F); M30 NPN: 1949 years @50°C (122°F)	
Approvals	CE cULus E1 ECE 10R-06	

Mechanical data

Weight (including 2 nuts) max.	**M12**	Cable version: 79g; Plug version: 33g.
	M18	Cable version: flush: 126g; non-flush: 128g; Plug version: flush: 66g; non-flush: 68g.
	M30	Cable version: flush: 201g; non-flush: 203g; Plug version: flush: 144g; non-flush: 146g.
Mounting		Flush mountable or non-flush mountable
Material		Housing: stainless steel AISI 304 Front cap: Grey thermoplastic polyester
Max tightening torque		ICS12: 17.5 Nm ICS18: 27.5 Nm ICS30: 50 Nm

Electrical connection

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

Connection Diagrams

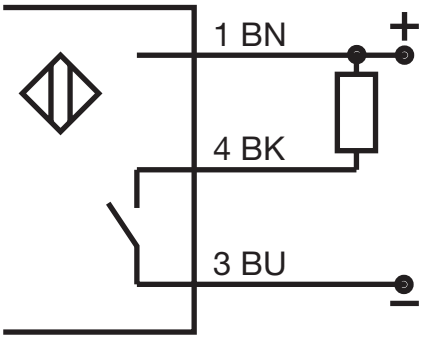


Fig. 8 *NPN - Normally open*

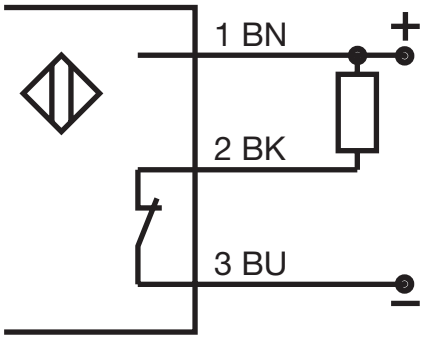


Fig. 9 *NPN - Normally closed*

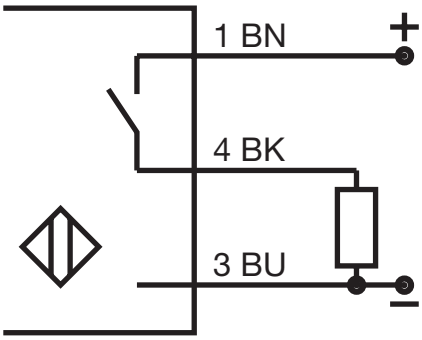


Fig. 10 *PNP - Normally open*

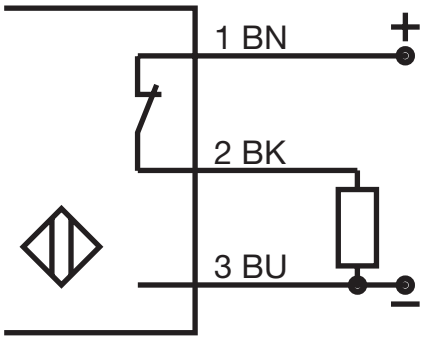


Fig. 11 *PNP - Normally closed*

Colour code		
BN: brown	**BK:** black	**BU:** blue

Wire colors in accordance with EN 60947-5-2

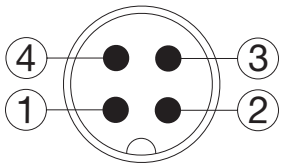


Fig. 12 *Plug*

Dimensions

ICS12 [mm]

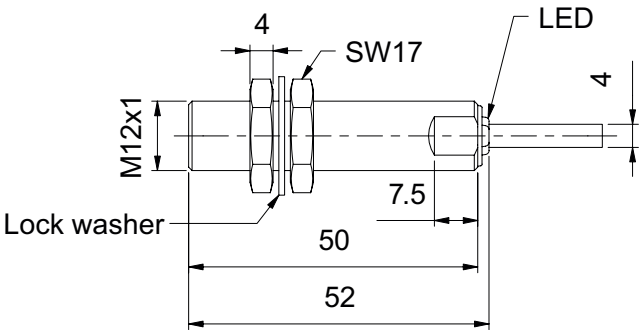


Fig. 13 *Long body, flush version, cable*

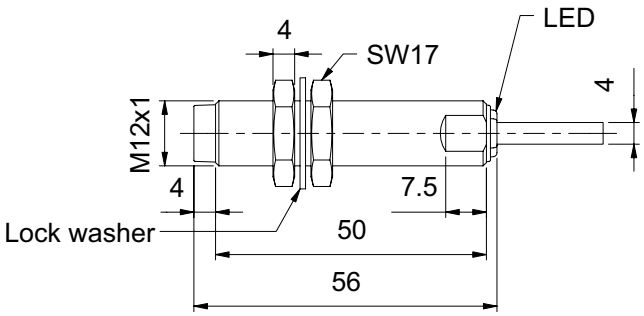


Fig. 14 *Long body, non-flush version, cable*

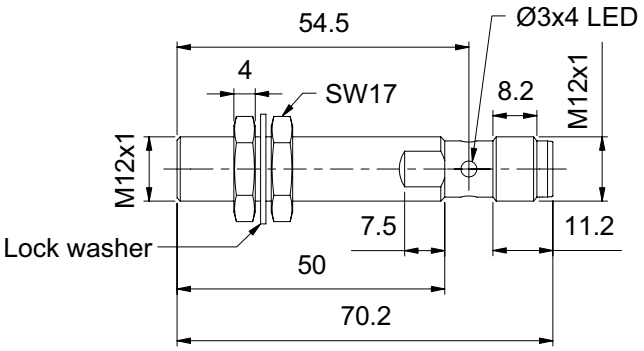


Fig. 15 *Long body, flush version, plug*

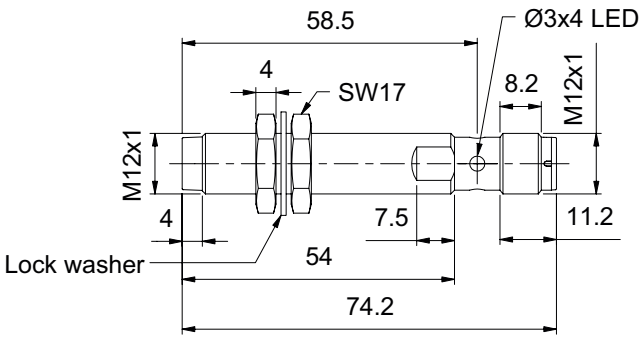


Fig. 16 *Long body, non-flush version, plug*

ICS18 [mm]

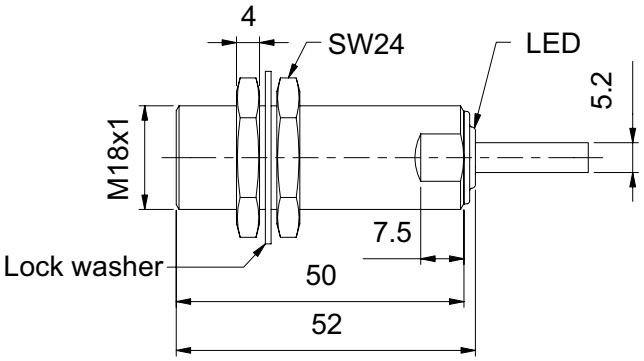


Fig. 17 *Long body, flush version, cable*

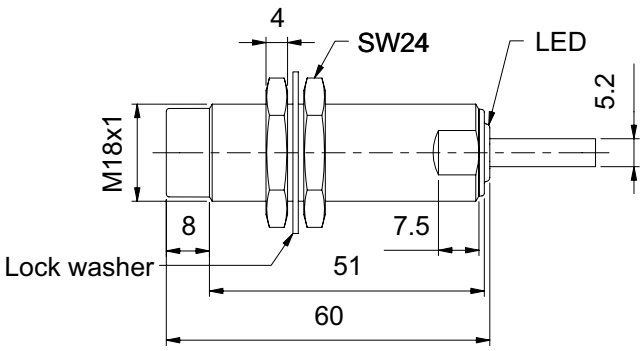


Fig. 18 *Long body, non-flush version, cable*

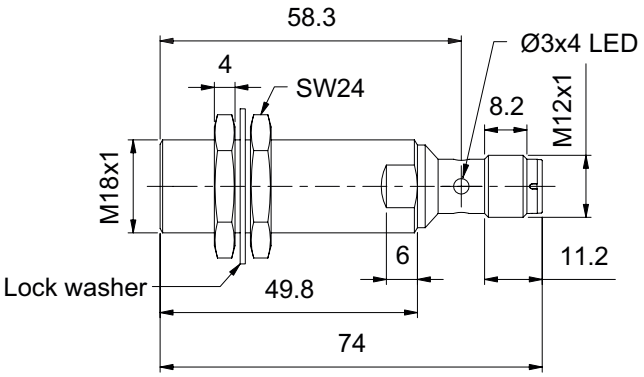


Fig. 19 *Long body, flush version, plug*

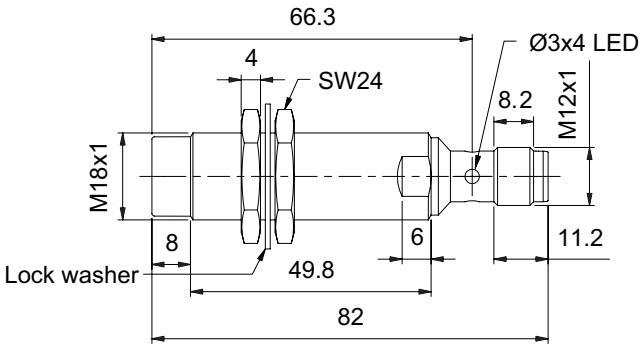


Fig. 20 *Long body, non-flush version, plug*

ICS30 [mm]

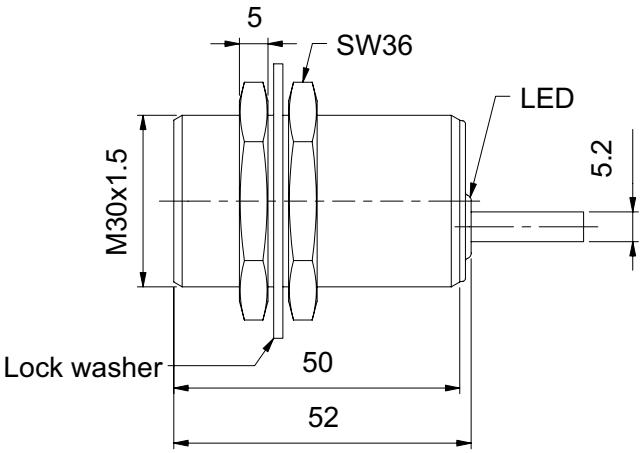


Fig. 21 *Long body, flush version, cable*

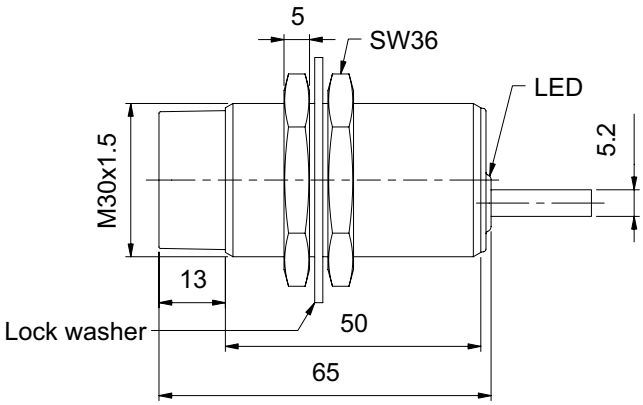


Fig. 22 *Long body, non-flush version, cable*

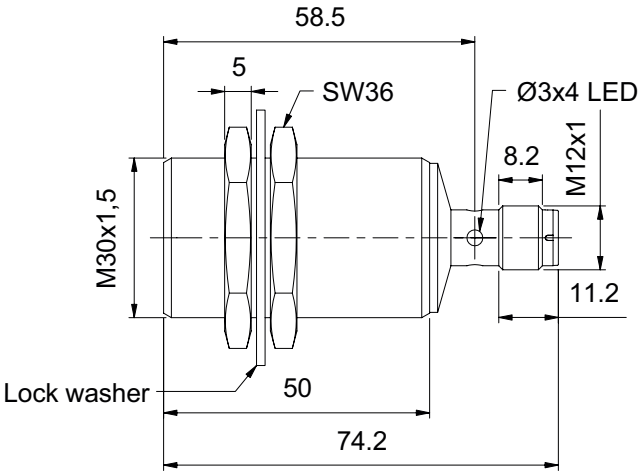


Fig. 23 *Long body, flush version, plug*

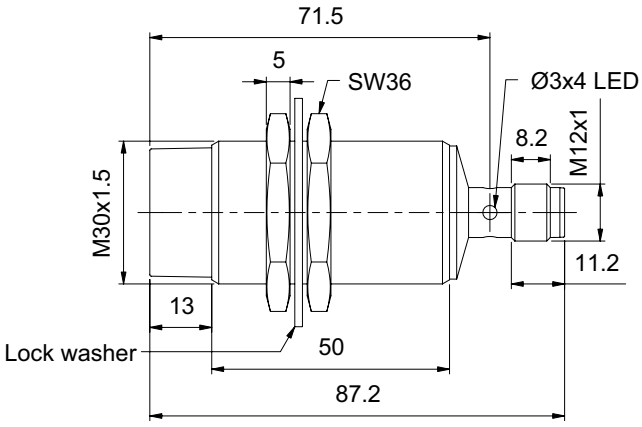


Fig. 24 *Long body, non-flush version, plug*

Installation

M12, M18 and M30 flush

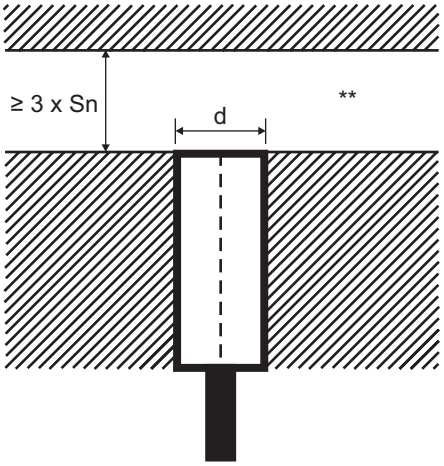


Fig. 25 *Flush sensor, when installed in damping material*

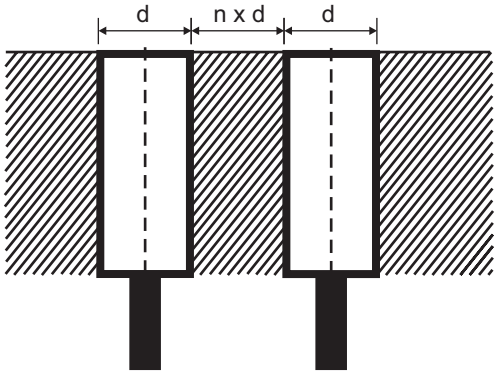


Fig. 26 *Flush sensors, when installed together in damping material*

M12, M18 and M30 non-flush

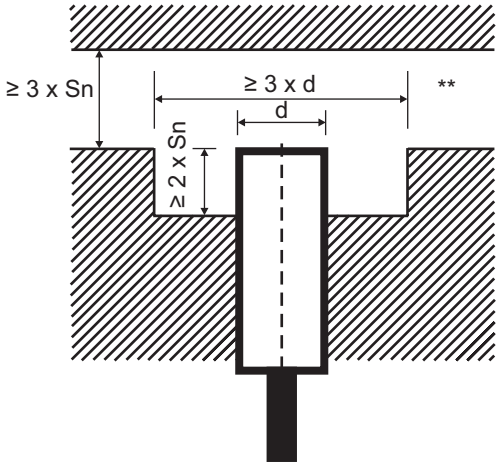


Fig. 27 *Non-flush sensor, when installed in damping material*

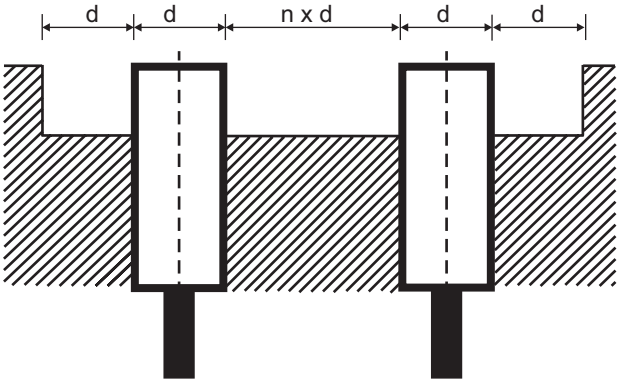


Fig. 28 *Non-flush sensors, when installed together in damping material*

Sensor	d	n
ICS12 Flush	12 mm	1
ICS12 Non-flush	12 mm	4
ICS18 Flush	18 mm	1
ICS18 Non-flush	18 mm	2
ICS30 Flush	30 mm	2
ICS30 Non-flush	30 mm	5

** Free zone or non-damping material

Sensors installed opposite each other

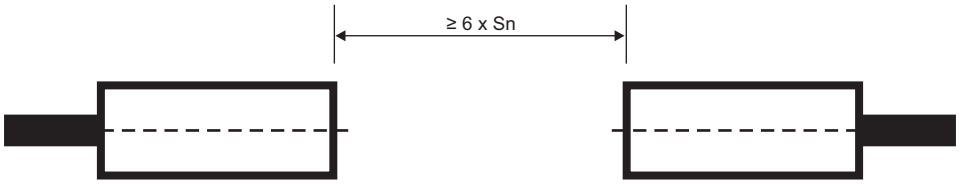


Fig. 29 *For sensors installed opposite each other, a minimum space of 6 x Sn (the nominal sensing distance) must be observed*

S_n: nominal sensing distance

Cable version