Inductive proximity sensors
XS range

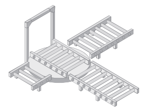
Catalogue

Simply easy!™

Telemecanique
Sensors

Inductive proximity sensors
XS range
Applications

Applications

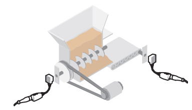


Conveying

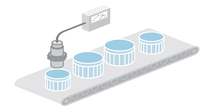
Sensor type: flush and non flush mountable		Adjustable range sensors			
Developed in accordance with the needs expressed by our customers, these sensors provide a complete solution for specific application functions: rotation monitoring, selective detection, analogue control, etc.					
Sensing dist. Sn (mm)	Flush mountable	**3...11** *(1)*	**15**	**25**	**60**
	Non flush mountable	**5...18** *(1)*	–	–	–
Form	**Cylindrical**	M12 x 54 M18 x 67 M30 x 71	–	–	–
	Block (W x H x D) dimensions in mm	–	26 x 26 x 13	40 x 40 x15	80 x 80 x 26
Case material		Nickel plated brass	PBT	PBT	PBT
Supply	⎓	●	●	●	●
	∿	–	–	–	–
	≂	–	●	●	●
Function	NO	●	●	●	●
	NC	●	●	●	●
	NO + NC	–	–	–	–
	NO/NC	–	–	–	–
Connection	Pre-cabled (L = 2 m) *(2)*	–	●	●	●
	M8 connector, 3-pin (⎓ 3-wire)	–	●	●	–
	M12 connector	–	–	–	●
	1/2"-20UNF connector	–	–	–	●
	Remote connector	●	●	●	●
	Screw terminals	–	–	–	–
Degree of protection		IP 67, double insulation ⧈	IP 67, double insulation ⧈ or IP 68, double insulation ⧈, depending on model.		
Special temperatures	- 40 °C, + 70	Add the suffix TF to the end of the reference *(3)*			
	- 25 °C, + 85	Add the suffix TT to the end of the reference *(3)*			
Type reference		**XS612B2 XS618 B2 XS630 B2**	**XS8E**	**XS8C**	**XS8D**
Pages		72	74		

(1) Depending on model.
(2) Also available in lengths of 5 and 10 m, depending on model.
(3) Product availability depending on model: please consult our Customer Care Centre.

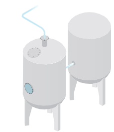
Telemecanique Sensors



Detection of underspeed, shaft overload



Position, displacement and deformation control/monitoring



Machine with stainless steel housing

	Sensors for rotation monitoring		Sensors with analogue output 0 ... 10 V or 4 ... 20 mA				Sensors for food/beverage and pharmaceutical applications		
							Cylindrical, stainless steel 316 L		**Cylindrical, plastic**
									
Sensing dist. Sn (mm) – Flush mountable	**10**	**10...15** *(1)*	**0.2...10** *(1)*	**5...40** *(1)*	–	–	**6,10 or 20** *(1)*	–	–
Non flush mountable	**10**	**10...15** *(1)*	**0.4...15** *(1)*	**5...40** *(1)*	**2...25**	**2...25**	**10, 20 or 40** *(1)*	**7...22** *(1)*	**7...22** *(1)*
Form – Cylindrical	M30 x 81	–	Threaded: M12, M18, M30	–	**–**	**–**	Threaded: M12, M18, M30	Plain: Ø 18 Threaded: M12, M18, M30	Threaded: M12, M18, M30
Block (W x H x D) dimensions in mm	–	26 x 26 x 13 40 x 40 x 15	–	32 x 15 x 8 26 x 26 x 13 40 x 40 x 15 80 x 80 x 26	40 x 40 x 70	40 x 40 x 117	–	–	–
Case material	Metal	PBT	Metal or plastic	PBT	PBT	PBT	Stainless steel, 316 L	Stainless steel, 316 L	Plastic, PPS
Supply ⎓	●	●	●	●	●	●	●	●	●
∿	–	–	–	–	–	–	–	–	–
≂	●	●	–	–	–	–	–	●	●
Function NO	–	–	–	–	–	–	●	●	●
NC	●	●	–	–	–	–	–	–	–
NO + NC	–	–	–	–	–	–	–	–	–
NO/NC	–	–	–	–	–	–	–	–	–
Connection Pre-cabled (L = 2 m) *(2)*	●	–	●	●	–	–	–	●	●
M8 connector, 3-pin (⎓ 3-wire)	–	–	–	–	–	–	–	–	–
M12 connector	–	–	–	●	●	–	●	●	●
1/2"-20UNF connector	–	–	–	–	–	–	–	●	●
Remote connector	–	●	–	●	–	–	–	–	–
Screw terminals	–	–	–	–	–	●	–	–	–
Degree of protection	IP 67	IP 67, double insulation ⧈	IP 67	IP 67 or IP 68 (pre-cabled version)	IP 65, IP 67 IP 69K	IP 65, IP 67 IP 69K	IP 68, IP 69K	IP 68 (pre-cabled version), double insulation ⧈ IP 69K conforming to DIN 40050	
Special temperatures - 40 °C, + 70	Add the suffix TF to the end of the reference *(3)*								
- 25 °C, + 85	Add the suffix TT to the end of the reference *(3)*								
Type reference	**XSAV**	**XS9●11R**	**XS1M●●●AB1 XS4P●●AB1**	**XS9●●●●A**	**XS9C2**	**XS9C4**	**XS9●●S●**	**XS2●●SA**	**XS2●●AA**
Pages	77	79	81	85 and 87	88	88	90	92 and 94	96 and 98

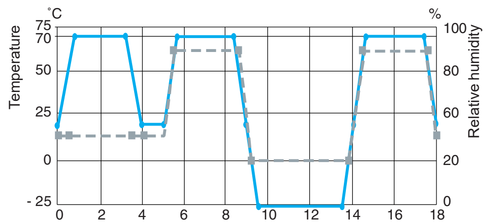
Telemecanique Sensors

Inductive proximity sensors
XS range

Recommendations

The sensors detailed in this catalogue are designed for use in standard industrial applications relating to presence detection.
These sensors do not incorporate the required redundant electrical circuit enabling their usage in safety applications.
For safety applications, please consult our website: www.tesensors.com

Standards and certifications
Parameters related to the environment



- 25° + 70 °C cycle, 95 % RH

Temperature °C
Humidity as %

Quality control

Our inductive proximity sensors are subject to special precautions in order to guarantee their reliability in the most arduous industrial environments.

- **Qualification**
  - The product characteristics stated in this catalogue are subject to a **qualification procedure** carried out in our laboratories.
  - In particular, the products are subjected to **climatic cycle** tests for 3000 hours whilst powered-up to verify their ability to maintain their characteristics over time.
- **Production**
  - The electrical characteristics and sensing distances at both ambient temperature and extreme temperatures are 100% checked.
  - Products are randomly selected during the course of production and subjected to **monitoring tests** relating to all their qualified characteristics.
- **Customer returns**

If, in spite of all these precautions, defective products are returned to us, they are subject to **systematic analysis** and **corrective actions** are implemented to eliminate the risks of the fault recurring.

Conformity to standards

All Telemecanique Sensors brand inductive proximity sensors conform to and are tested in accordance with the recommendations of standard IEC 60947-5-2.

Mechanical shock resistance

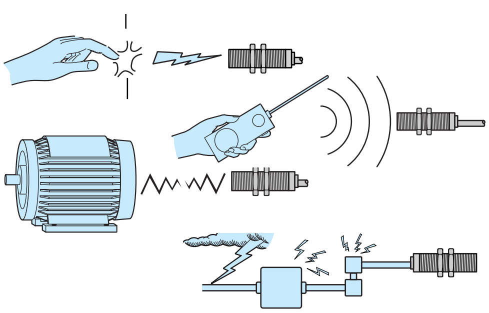
The sensors are tested in accordance with standard IEC 60068-2-27, 50 gn, duration 11 ms.

Vibration resistance

The sensors are tested in accordance with standard IEC 60068-2-6, amplitude ± 2 mm, f = 10…55 Hz, 25 gn at 55 Hz.

Resistance to the environment

- Please refer to the characteristics pages for the various sensors.
- **IP 67**: protection against the effects of immersion.
  Test conforming to IEC 60529: sensor immersed for 30 minutes in 1 m of water.
  No deterioration in either operating or insulation characteristics is permitted.
- **IP 68**: protection against prolonged immersion.
  Sensor immersed for 336 hours in 40 metres of water at 50 °C.
  No deterioration in either operating or insulation characteristics is permitted.
  Telemecanique Sensors with an IP 68 degree of protection are ideal for use in the most arduous conditions, such as machine tools, automatic car washers.
- **IP 69K**: protection against the effects of high pressure cleaning. Adherence to standard DIN 40050 which stipulates that the product must withstand a water jet at a pressure of 90 bar and temperature of +80 °C for 3 minutes.
  No deterioration in either operating or insulation characteristics is permitted.



Resistance to electromagnetic interference

■ Electrostatic discharges	∼ and ≂ versions: level 4 immunity (15 kV). **IEC 61000-4-2**
■ Radiated electromagnetic fields (electromagnetic waves)	⎓, ∼ and ≂ versions: level 2 (3 V/m) or level 3 (10 V/m) immunity. **IEC 61000-4-3**
■ Fast transients (motor start/stop interference)	⎓ version: level 3 immunity (1 kV). ∼ and ≂ versions: level 4 immunity (2 kV) except Ø 8 mm model (level 2). **IEC 61000-4-4**
■ Impulse voltage	⎓, ∼ and ≂ versions: level 3 immunity (2.5 kV) except Ø 8 mm and smaller models (level 1 kV). **IEC 60947-5-2**

Resistance to chemicals in the environment

- Owing to the very wide range of chemicals encountered in industry, it is very difficult to give general guidelines common to all sensors.
- To ensure lasting efficient operation, it is essential that any chemicals coming into contact with the sensors will not affect their casing and, in doing so, prevent their reliable operation.
- Cylindrical and flat plastic case sensors offer excellent overall resistance to:
  - chemical products such as salts, aliphatic and aromatic oils, petroleum, acids and diluted bases. For alcohols, ketones and phenols, preliminary tests should be made relating to the nature and concentration of the liquid.
  - food and beverage industry products such as animal or vegetable based products (vegetable oils, animal fat, fruit juice, dairy proteins, etc.).

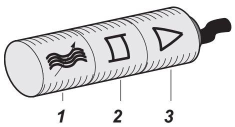
In all cases, the materials selected (see product characteristics) provide satisfactory compatibility in most industrial environments (for further information, please consult our Customer Care Centre).

Insulation

Class 2 devices ⧈

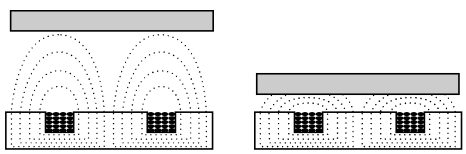
Electrical insulation conforming to standards IEC 61140 and NF C 20-030 relating to means of protection against electric shock.

Principle of inductive detection



1 Oscillator
2 Output driver
3 Output stage

Composition of an inductive proximity sensor



Detection of a metal object

Operating principle

■ An inductive proximity sensor is solely for the detection of metal objects.
It basically comprises an oscillator whose windings constitute the sensing face. An alternating magnetic field is generated in front of these windings.

■ When a metal object is placed within the magnetic field generated by the sensor, the resulting currents induced form an additional load and the oscillations cease.
This causes the output driver to operate and, depending on the sensor type, a normally open (NO) or normally closed (NC) output signal is produced.

Inductive proximity detection

■ Inductive proximity sensors enable the detection, without physical contact, of metal objects.
■ Their range of applications is very extensive and includes:
□ monitoring the position of machine parts (cams, end stops, etc.),
□ counting the presence of metal objects, etc.

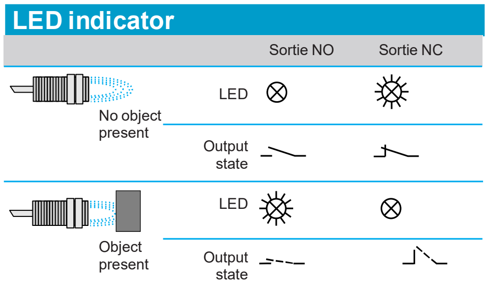
Advantages of inductive detection

■ No physical contact with the object to be detected, thus avoiding wear and enabling detection of fragile objects, freshly painted objects, etc.
■ High operating rates. Fast response.
■ Excellent resistance to industrial environments (robust products, fully encapsulated in resin).
■ Solid-state technology: no moving parts, therefore service life of sensor not related to number of operating cycles.

Flush mountable using teach mode sensors

■ The flush mountable sensors using teach mode are suitable for all metal environments (flush mountable or non flush mountable) since they ensure a maximum sensing distance, even if there is a metal background. Precise detection of the position of the object can be obtained using the teach mode. For further information, see page 70.

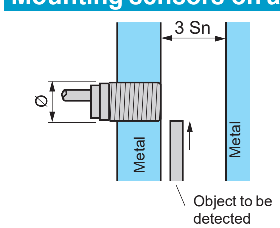
LED indicator

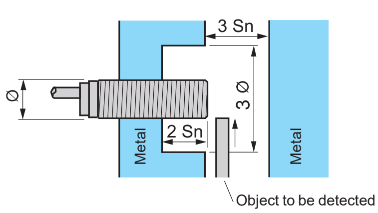


Output LED

All Telemecanique Sensors inductive proximity sensors incorporate an output state LED indicator.
The flush mountable sensors using teach mode are fitted with a green LED that indicates “Power on” and also assists the user during setting-up (teach mode).

Mounting sensors on a metal support





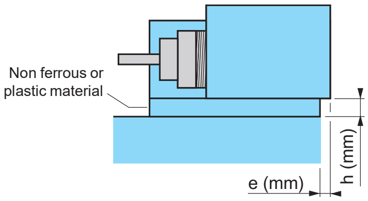
Flush mountable in metal

■ No side clearance required.
■ All flush mountable sensors using teach mode also enable detection of an object against a metal background. For further information, see pages 70 and 71.

Sensors not suitable for flush mounting in metal

■ Side clearance required.
Sensing distance greater than that for a standard flush mountable model.
■ Flush mountable sensors using teach mode eliminate the need for side clearance. For further information, see pages 70 and 71.

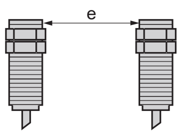
Mounting sensors on a metal support



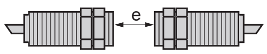
Mounting using fixing clamp

- Standard flush mountable models: e = 0, h = 0
- Standard non flush mountable models
  - Ø 6.5 / 8 / 12 mm: e = 0, h = 0
  - Ø 18 mm: if h = 0, e ⩾ 5; e = 0, h ⩾ 3.
  - Ø 30 mm: if h = 0, e ⩾ 8; e = 0, h ⩾ 4.
- Flush mountable sensors using teach mode: e = 0, h = 0

Mounting distance between sensors



Mounting side by side
e ⩾ 2 Sn



Mounting face to face
e ⩾ 10 Sn

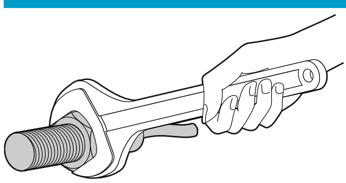
Standard sensors

If 2 standard sensors are mounted too close to each other they are likely to lock in the “detection state” due to interference between their respective oscillating frequencies.
To avoid this condition, the minimum mounting distances stated for the sensors should be adhered to or, alternatively, sensors with staggered oscillating frequencies should be used.

Staggered frequency sensors

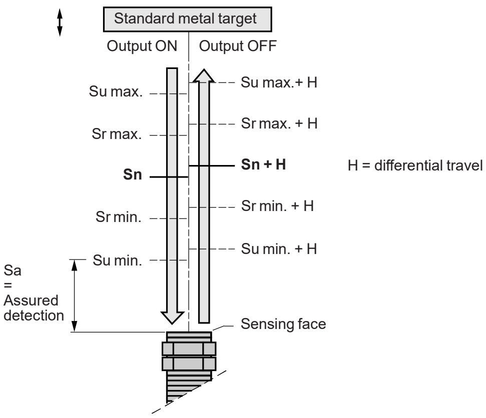
For applications where the minimum recommended mounting distances for standard sensors cannot be achieved, it is possible to overcome this restraint by using staggered frequency sensors. Please consult our Customer Care Centre.
In this case, a staggered frequency sensor is mounted adjacent to or opposite each standard sensor.

Tightening torque for cylindrical type sensors



	Maximum tightening torque for the various sensor case materials					
	Brass		**Stainless steel**		**Plastic**	
	XS1●●B● XS2●●B● XS5●●B● XS6●●B● XSAV●		**XS1●● XS2●● XS5●●B● XS6●●B● XS9●●R/S**		**XS2●●AA XS4P●**	
Diameter of sensor	**Maximum tightening torque**					
mm	**N.m**	**lb-in**	**N.m**	**lb-in**	**N.m**	**lb-in**
Ø 5	1.6	14.16	2	17.7	–	–
Ø 8	5	44.25	9	79.65	1	8.85
Ø 12	6	53.10	30	265.52	2	17.70
Ø 18	15	132.76	50	442.54	5	44.
Ø 30	40	354.03	100	885.07	20	177.01

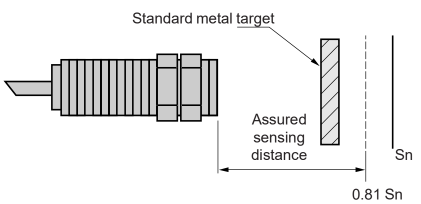
Sensing distance



Definitions

In order to ensure that customers can make reliable product comparisons and selection, the standard IEC 60947-5-2 defines various sensing distances, such as:

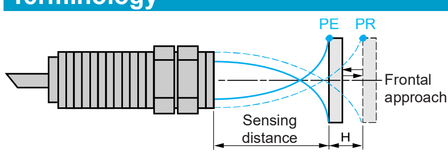
- **Nominal sensing distance (Sn)**
  The rated operating distance for which the sensor is designed. It does not take into account any variations (manufacturing tolerances, temperature, voltage).
- **Effective sensing distance (Sr)**
  The effective sensing distance is measured at the rated voltage (Un) and the rated ambient temperature (Tn).
  It must be between 90% and 110% of the nominal sensing distance (Sn): 0.9 Sn ⩽ Sr ⩽ 1.1 Sn.
- **Usable sensing distance (Su)**
  The usable sensing distance is measured at the limits of the permissible variations in the ambient temperature (Ta) and the supply voltage (Ub). It must be between 90% and 110% of the effective sensing distance: 0.9 Sr ⩽ Su ⩽ 1.1 Sr.
- **Assured operating distance (Sa).**
  This is the operating zone of the sensor. The assured sensing distance is between 0 and 81% of the nominal sensing distance (Sn): 0 ⩽ Sa ⩽ 0.9 x 0.9 Sn.



Standard metal target

The standard IEC 60947-5-2 defines the standard metal target as a square mild steel (Fe 360) plate, 1 mm thick.
The side dimension of the plate is either equal to the diameter of the circle engraved on the sensing face of the sensor or 3 times the nominal sensing distance (Sn).

Terminology



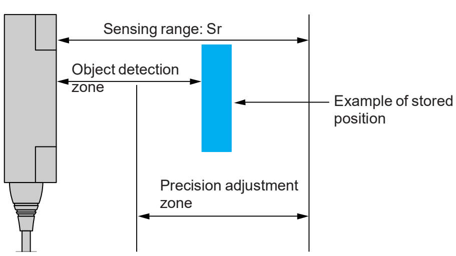
PE = pick-up point, the object is detected
PR = drop-out point, the object is no longer detected

Differential travel

The differential travel (H), or hysteresis, is the distance between the operating point, as the standard metal target moves towards the sensor, and the release point, as it moves away.
This hysteresis is essential for the stable operation of the sensor.

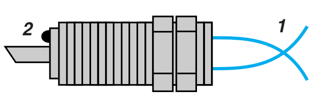
Repeat accuracy

The repeat accuracy (R) is the repeatability of the sensing distance between successive operations. Readings are taken over a period of time whilst the sensor is subjected to voltage and temperature variations: 8 hours, 10 to 30 °C, Un ± 5 %.
It is expressed as a percentage of the effective sensing distance Sr.
For all XS sensors, the repeat accuracy is 3 %.



Detection zone and precision adjustment zone

- Flush mountable sensors using teach mode, due to adjustment of sensitivity whilst teaching, enable the position of an object to be detected as it approaches from the front or side.
  The teach mode can be used when the object is located in the zone known as the "precision adjustment zone". When the object approaches from the front, the detection zone of the object ranges from the stored position down to zero.



1 Detection threshold curves
2 "Object detected" LED

Operating zone

- The operating zone relates to the area in front of the sensing face in which the detection of a metal object is certain.
  The values stated in the characteristics relating to the various types of sensor are for steel objects of a size equal to the sensing face of the sensor.
  For objects of a different nature (smaller than the sensing face of the sensor, other metals, etc.), it is necessary to apply a correction coefficient.

Inductive proximity sensors
XS range

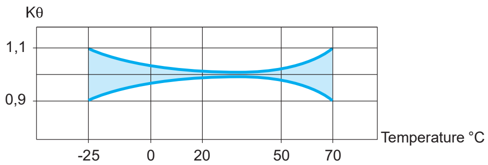
Correction coefficients to apply to the assured operating distance

Assured operating distance of a sensor

In practice, most objects to be detected are generally made of steel and are of a size equal to, or greater, than the sensing face of the sensor.

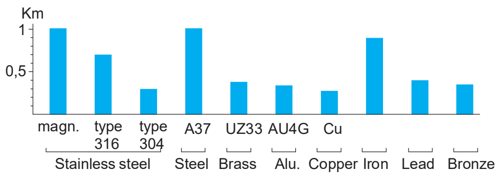
For the calculation of the assured operating distance for different operating conditions, one must take into account the correction coefficients that influence it.

The curves indicated are purely representative of typical curves. They are only given as a guide to the approximate usable sensing distance of a proximity sensor for a given application.



Influence of ambient temperature

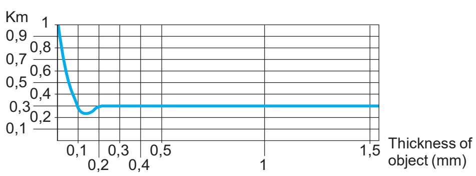
Apply a correction coefficient Kq, determined from the curve shown opposite.



Material of object to be detected

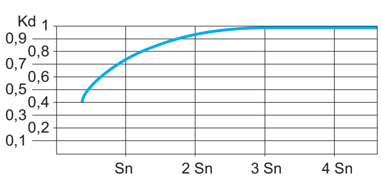
Apply a correction coefficient Km, determined from the diagram shown opposite.

The fixed sensing distance models for ferrous/non ferrous (Fe/NFe) materials enable the detection of different objects at a fixed distance, irrespective of the type of material.



Typical curve for a ***copper*** *object used with a Ø 18 mm cylindrical sensor*

Special case of a very thin object made of a non ferrous material.



Typical curve for a ***steel*** *object used with a cylindrical sensor*

Size of object to be detected

Apply a correction coefficient Kd, determined from the curve shown opposite.
When calculating the sensing distance for the selection of a sensor, make the assumption that Kd = 1.

Variation of supply voltage

In all cases, apply the correction coefficient Kt = 0.9.

Calculation examples

Correction of the sensing distance of a sensor

Sensor with nominal sensing distance Sn = 15 mm.
Ambient temperature variation 0 to + 20 °C.
Object material and size: steel, 30 x 30 x 1 mm thick.
The assured sensing distance Sa is determined using the formula:
Sa = Sn x Kq x Km x Kd x Kt = 15 x 0.98 x 1 x 0.95 x 0.9
i.e. Sa = 12.5 mm.

Selecting a sensor for a given application

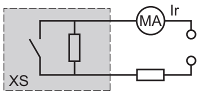
Application characteristics:
- object material and size: iron (Km = 0.9), 30 x 30 mm,
- temperature: 0 to 20 °C (Kθ = 0.98),
- object detection distance: 3 mm ± 1.5 mm, i.e. Sa max. = 4.5 mm,
- assume Kd = 1.

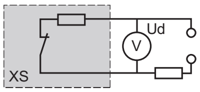
A sensor must be selected for which $\mathbf{Sn \geq \frac{Sa}{Kq \times Km \times Kd \times Kt} = \frac{4.5}{0.98 \times 0.9 \times 1 \times 0.9}}$

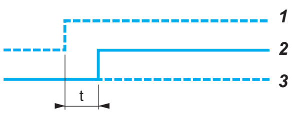
i.e. **Sn ≥ 5.7 mm**

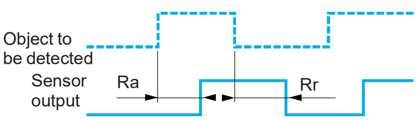
Inductive proximity sensors
XS range

Specific aspects of electronic sensors









Terminology

- ■ Residual current (Ir)
- □ The residual current (Ir) corresponds to the current flowing through the sensor when in the "open" state.
- □ Characteristic of 2-wire type proximity sensors.

- ■ Voltage drop (Ud)
- □ The voltage drop (Ud) corresponds to the voltage drop at the sensor's terminals when in the "closed" state (value measured at nominal current rating of sensor).

- ■ First-up delay
- □ The first-up delay corresponds to the time (t) between the connection of the power supply to the sensor and its fully operational state.

1 Supply voltage U on
2 Sensor operational at state 1
3 Sensor at state 0

- ■ Response time
- □ Response time (Ra): the time delay between the object to be detected entering the sensor's operating zone and the subsequent change of output state. This parameter limits the speed and size of the object.
- □ Recovery time (Rr): the time delay between an object to be detected leaving the sensor's operating zone and the subsequent change of output state. This parameter limits the interval between successive objects.

Supply

Sensors for AC circuits (∼ and ≂ models)

Check that the voltage limits of the sensor are compatible with the nominal voltage of the AC supply used.

Sensors for DC circuits

- ■ **DC source:** check that the voltage limits of the sensor and the acceptable level of ripple are compatible with the supply used.

- ■ **AC source** (comprising transformer, rectifier, smoothing capacitor): the supply voltage must be within the operating limits specified for the sensor.

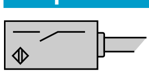
Where the voltage is derived from a single-phase AC supply, the voltage must be rectified and smoothed to ensure that:
- the peak voltage of the DC supply is lower than the maximum voltage rating of the sensor.

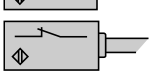
Peak voltage = nominal voltage x $\sqrt{2}$
- the minimum voltage of the supply is greater than the minimum voltage rating of the sensor,

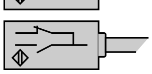
given that :
$\Delta V = (I \times t) / C$
ΔV = max. ripple: 10 % V),
I = anticipated load current (mA),
t = period of 1 cycle (10 ms full-wave rectified for a 50 Hz supply frequency),
C = capacitance (µF).
As a general rule, use a transformer with a lower secondary voltage (Ue) than the required DC voltage (U).

Example:
∼ 18 V to obtain ⎓ 24 V,
∼ 36 V to obtain ⎓ 48 V.

Outputs







Output signal (contact logic)

■ Normally open (NO)
Corresponds to a sensor whose output changes to the closed state when an object is present in the operating zone.

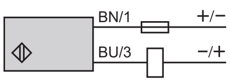
■ Normally closed (NC)
Corresponds to a sensor whose output changes to the open state when an object is present in the operating zone.

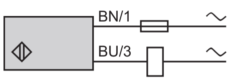
■ Complementary outputs (NO + NC)
Corresponds to a sensor with a normally closed output and a normally open output.

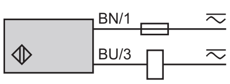
Inductive proximity sensors

XS range

Outputs (continued)







2-wire ⎓ type, non polarised NO or NC output

■ **Specific aspects**

These sensors are wired in series with the load to be switched.
As a consequence, they are subject to:

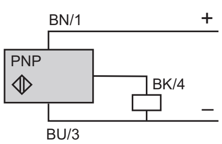
□ a residual current in the open state (current flowing through the sensor in the “open” state),
□ A voltage drop in the closed state (voltage drop across the sensor’s terminals in the “closed” state).

■ **Advantages**

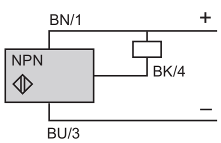
□ Only 2 leads to be wired: these sensors can be wired in series in the same way as mechanical limit switches,
□ They can be connected to either positive (PNP) or negative (NPN) logic PLC inputs,
□ No risk of incorrect connections.

■ **Operating precautions**

□ Check the possible effects of residual current and voltage drop on the actuator or input connected,
□ For sensors that do not have overload and short-circuit protection (AC or AC/DC symbol), it is essential to connect a 0.4 A “quick-blow” fuse in series with the load.



NO output



NO output

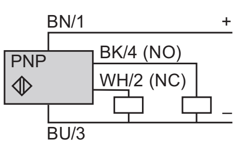
3-wire ⎓ type, NO or NC output, PNP or NPN

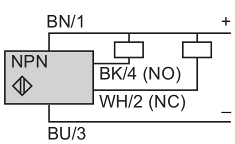
■ **Specific aspects**

□ These sensors comprise 2 wires for the DC supply and a 3rd wire for the output signal,
□ PNP type: switching the positive side to the load,
□ NPN type: switching the negative side to the load.

■ **Advantages**

□ Protection against supply reverse polarity,
□ Protection against overload and short-circuit,
□ No residual current, low voltage drop.

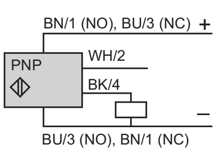


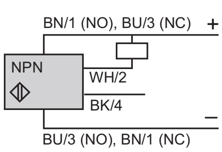


4-wire ⎓ type, complementary NO and NC outputs, PNP or NPN

■ **Advantages**

□ Protection against supply reverse polarity (+/-).
□ Protection against overload and short-circuit.

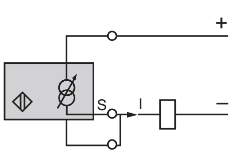




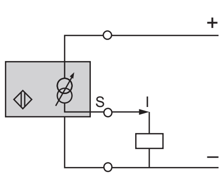
4-wire ⎓ type, multifunction, programmable NO or NC output, PNP or NPN

■ **Advantages**

□ Protection against supply reverse polarity (+/-).
□ Protection against overload and short-circuit.



2-wire connection

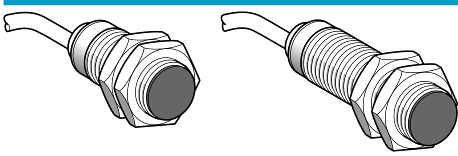


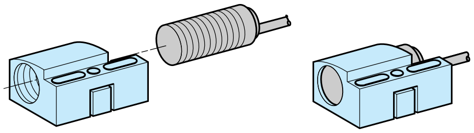
3-wire connection

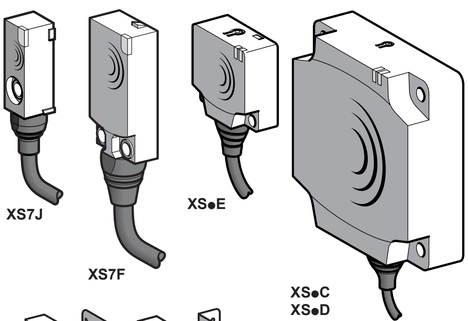
Specific output signals, analogue type

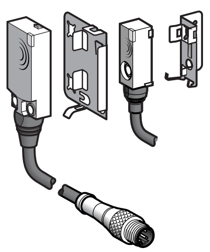
■ These sensors convert the approach of a metal object towards the sensing face into an output current variation which is proportional to the distance between the object and the sensing face.
■ Two models available:
- 0...10 V (0...10 mA) output for 3-wire connection,
- 4-20 mA output for 2-wire connection.

Features of the various models









Types of case

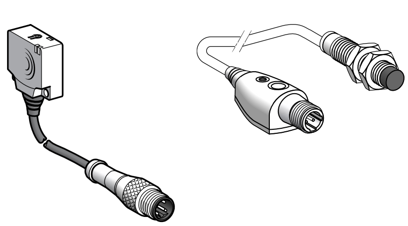
■ **Cylindrical case**
□ Fast installation and setting-up.
□ Short case and long case, 2-wire ⎓ and 3-wire ⎓ versions available.
□ Pre-cabled (moulded cable) and various integral connector (M8, M12, 7/8", M18) and remote connector (on flying lead) versions available.
□ Small size facilitates mounting in locations with restricted access.
□ **Interchangeability**, provided by indexed **fixing clamp**: when assembled, becomes similar to a block type sensor.

■ **Flat case**
□ Reduced size (sensor volume divided by 8).
□ Fast installation by mounting on clip-on brackets.
□ Precision detection with the flush mountable sensors using teach mode (see page 70).

Electrical connection

1


2


3


Connection methods

1 Pre-cabled: factory fitted moulded cable, good protection against splashing liquids (IP 68). Example: machine tool.
2 Connector: easy installation and maintenance (IP 67).
3 Remote connector: easy installation and maintenance (IP 68 at sensor level and IP 67 at remote connector level).

Wiring advice

■ **Length of cable**
□ No limitation up to 200 m or up to a line capacitance of < 100 nF (characteristics of sensor remain unaffected).
□ In this case, it is important to take into account the voltage drop on the line.

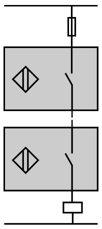
■ **Separation of control and power circuit wiring**
□ The sensors are immune to electrical interference encountered in normal industrial conditions.
□ Where extreme conditions of electrical "noise" could occur (large motors, spot welders, etc.), it is advisable to protect against transients in the normal way:
- suppress interference at source,
- separate power and control wiring from each other,
- smooth the supply,
- limit the length of cable.

■ **Connect the sensor with supply switched off.**

Inductive proximity sensors
XS range

Setting-up precautions

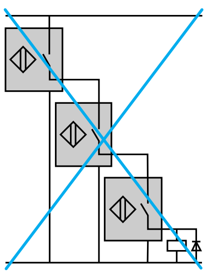
Connection in series



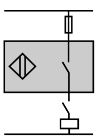
2-wire type sensors
- ■ The following points should be taken into account:
- □ Series wiring is only possible using sensors with wide voltage limits.
  Based on the assumption that each sensor has the same residual current value, each sensor, in the open state, will share the supply voltage, i.e.

$$U\ sensor = \frac{\textbf{U (supply)}}{\textbf{n sensors}}$$

U sensor and U supply must remain within the sensor's voltage limits.
- □ If only one sensor in the circuit is in the open state, it will be supplied at a voltage almost equal to the supply voltage.
- □ When in the closed state, a small voltage drop is present across each sensor. The resultant loss of voltage at the load will be the sum of the individual voltage drops and therefore, the load voltage should be selected accordingly.

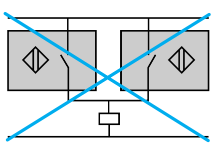


3-wire type sensors
This connection method is not recommended.
- ■ Correct operation of the sensors cannot be assured and, if this method is used, tests should be made before installation.
  The following points should be taken into account:
- □ Sensor 1 carries the load current in addition to the no-load current consumption values of the other sensors connected in series. For certain models, this connection method is not possible unless a current limiting resistor is used.
- □ When in the closed state, a small voltage drop is present across each sensor. The load should therefore be selected accordingly.
- □ As sensor 1 closes, sensor 2 does not operate until a certain time (t) has elapsed (corresponding to the first-up delay) and likewise for the following sensors in the sequence.
- □ The use of "flywheel" diodes is recommended when an inductive load is being switched.

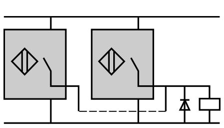


Sensors and devices in series with an external mechanical contact
2 and 3-wire type sensors
- ■ The following points should be taken into account:
- □ When the mechanical contact is open, the sensor is not supplied.
- □ When the contact closes, the sensor does not operate until a certain time (t) has elapsed (corresponding to the first-up delay).

Connection in parallel

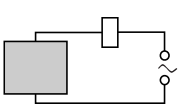


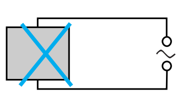
2-wire type sensors
This connection method is not recommended.
- ■ Should one of the sensors be in the closed state, the sensor in parallel will be "shorted-out" and no longer supplied.
  As the first sensor passes into the open state, the second sensor will become energised and will be subject to its first-up delay.
- ■ This configuration is only permissible where the sensors will be working alternately.
- ■ This method of connection can lead to irreversible damage of the units.



3-wire type sensors
- ■ No specific restrictions. The use of "flywheel" diodes is recommended when an inductive load (relay) is being switched.

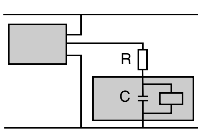
AC supply





- ■ **2-wire type sensors cannot be connected directly to an AC supply.**
- □ This would result in immediate destruction of the sensor and considerable danger to the user.
- □ An appropriate load (refer to the instruction sheet supplied with the sensor) must always be connected in series with the sensor.

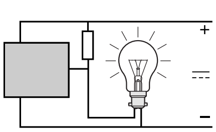
Capacitive load (C > 0.1 µF)

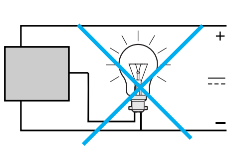


- ■ On power-up, it is necessary to limit (by resistor) the charging current of the capacitive load C.
- □ The voltage drop in the sensor can also be taken into account by subtracting it from the supply voltage for the calculation of R.

$$R = \frac{U\ supply}{I\ max.\ (sensor)}$$

Load comprising an incandescent lamp





- ■ If the load comprises an incandescent lamp, the cold state resistance can be 10 times lower than the hot state resistance. This can cause very high current levels on switching. Fit a pre-heat resistor in parallel with the sensor.

$R = \frac{U^2}{P} \times 10$, U = supply voltage and P = lamp power

Fast trouble shooting guide

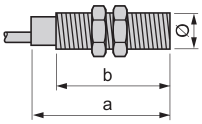
Problem	Possible causes	Remedy
The sensor's output will not change state when a metal object enters the detection zone	On a flush mountable sensor using teach mode: setting-up or programming error.	■ After a RESET, follow the environment teach mode procedure. Refer to instruction sheet supplied with sensor.
	Output stage faulty or complete failure of the sensor or the short-circuit protection has tripped.	■ Check that the sensor is compatible with the supply being used. ■ Check the load current characteristics: □ if load current I ⩾ maximum switching capacity, an auxiliary relay, of the CAD N type for example, should be interposed between the sensor and the load, □ if I ⩽ maximum switching capacity, check for wiring faults (short-circuit). ■ In all cases, a 0.4 A "quick-blow" fuse should be fitted in series with the sensor.
	Wiring error	■ Check that the wiring conforms to the wiring shown on the sensor label or instruction sheet.
	Supply fault	■ Check that the sensor is compatible with the supply (∿ or ⎓). ■ Check that the supply voltage is within the voltage limits of the sensor. Remember that with a rectified, smoothed supply, U peak = U nominal x $\sqrt{2}$ with a ripple voltage ⩽ 10 %.
False or erratic operation, with or without the presence of a metal object in the detection zone	On flush mountable sensor using teach mode: setting-up or programming error.	■ After a RESET, follow the environment teach mode procedure. Refer to instruction sheet supplied with sensor.
	Influence of background or metal environment	■ Refer to the instruction sheet supplied with the sensor. For sensors with adjustable sensitivity, reduce the sensing distance.
	Sensing distance poorly defined for the object to be detected	■ Apply the correction coefficients. ■ Realign the system or run the teach mode again.
	Influence of transient interference on the supply lines	■ Ensure that any DC supplies, when derived from rectified AC, are correctly smoothed (C > 400 µF). ■ Separate AC power cables from low-level DC cables (24 V low level). ■ Where very long distances are involved, use suitable cable: screened and twisted pairs of the correct cross-sectional area.
	Equipment prone to emitting electromagnetic interference	■ Position the sensors as far away as possible from any sources of interference.
	Response time of the sensor too slow for the particular object being detected	■ Check the suitability of the sensor for the position or size of the object to be detected. ■ If necessary, select a sensor with a higher switching frequency.
	Influence of high temperature	■ Eliminate sources of radiated heat or protect the sensor casing with a heat shield. ■ Realign, having adjusted the temperature around the fixing support.
No detection following a period of service	Vibration, shock	■ Realign the system. ■ Replace the support or protect the sensor.

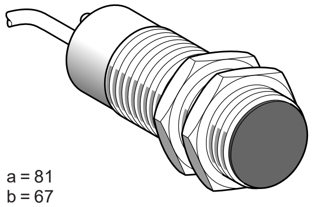
Inductive proximity sensors

XS range, Application

Sensors for rotation monitoring, slip detection, shaft overload detection
Cylindrical form

Flush mountable in metal





Lengths (mm):	
a = Overall	a = 81
b = Threaded section	b = 67
	Ø = M30

	DC	DC	AC/DC	AC/DC
Nominal sensing distance (Sn)	10 mm	10 mm	10 mm	10 mm
Adjustable frequency range	6…150 impulses/min	120…3000 impulses/min	6…150 impulses/min	120…3000 impulses/min

References

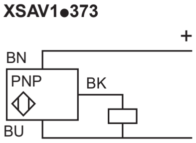
3-wire ⎓	**PNP / NC**	**XSAV11373**	**XSAV12373**	–	–
2-wire	⎓ **or** ~ **/ NC**	–	–	**XSAV11801**	**XSAV12801**
Weight (kg)		0.300			

Characteristics

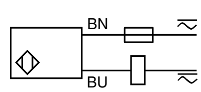
Connection	**Pre-cabled, 3 x 0.34 mm², length 2 m** *(1)*	**Pre-cabled, 2 x 0.34 mm², length 2 m** *(1)*
Degree of protection conforming to IEC 60529	IP 67	
Operating zone	0…8 mm	
Repeat accuracy	3 % of Sr	
Differential travel	3…15 % of Fr	
Operating temperature	- 25…+ 70 °C	
Output state indication	Red LED	
Rated supply voltage	⎓ **12…48 V with protection against reverse polarity**	~ **24…240 V (50/60 Hz) or** ⎓ **24…210 V**
Voltage limits (including ripple)	⎓ 10…58 V	~ or ⎓ 20…264 V
Switching capacity	≤ **200 mA with overload and short-circuit protection**	~ **5…350 mA or** ⎓ **5…200 mA** *(2)*
Voltage drop, closed state	≤ 1.8 V	≤ 5.7 V
Residual current, open state	–	≤ 1.5 mA
Current consumption, no-load	≤ 15 mA	–
Maximum switching frequency	6000 impulses/min (for **XSAV11●●●**); 48,000 impulses/min (for **XSAV12●●●**)	
“Run-up” delay following power-up	9 seconds ± 20 % + 1/Fr (3)	

Wiring schemes

3-wire ⎓
XSAV1●373



2-wire ~ or ⎓
XSAV1●801



(1) For a 5 m long cable add L05 to the reference, for a 10 m long cable add L10 to the reference.
Example: XSAV11373 becomes ***XSAV11373L05*** *with a 5 m long cable.*
(2) These sensors do not incorporate overload or short-circuit protection and therefore, it is essential to connect a 0.4 A “quick-blow” fuse in series with the load, see page 118.
(3) For a sensor without a “run-up” delay following power-up, replace XSAV1 in the reference by XSAV0. Example: XSAV11801 becomes ***XSAV01801*** *without a “run-up” delay. For a reduced “run-up” delay of 3 s, replace XSAV1 in the reference by XSAV3.*

Accessories:
page 118