GENERAL SPECIFICATIONS OF INDUCTIVE AND CAPACITIVE SENSORS - EN50032

ACTIVE FACE

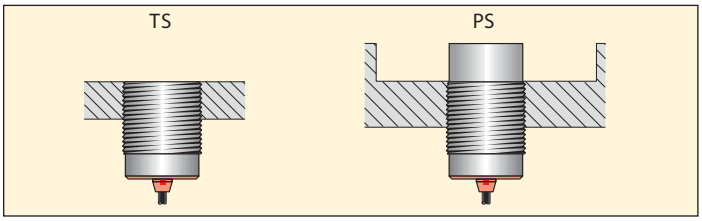
The active face of proximity sensor is the surface from which emits an oscillating field where a metallic object (inductive) or any material (capacitive) results in a change of state of the sensor without entering in contact with it.

EMBEDDABLE (FLUSH MOUNTING) SENSORS (TS)

The metal body covers the sensing area on all sides allows the unit to be installed in metal parts or next to other sensors without causing problems of reciprocal interference.

NOT EMBEDDABLE (NON FLUSH MOUNTING) SENSORS (PS)

The metal body leaves uncovered part of the sensing area resulting in an increased sensing distance. During installation it is important to remember the minimum distances from metallic parts in the case of inductive units and from any type of material in the case of capacitive units.
It is not possible to mount more than one sensor side by side.



INDUCTIVE SENSORS	
Aq 37	1 x Sn
Stainless steel	0,9 x Sn
Brass-bronze	0,5 x Sn
Aluminium	0,4 x Sn
Copper	0,4 x Sn

CAPACITIVE SENSORS	
Metals	≃ 1 x Sn
Water	≃ 1 x Sn
Plastic	≃ 0,5 x Sn
Glass	≃ 0,5 x Sn
Wood	≃ 0,4 x Sn

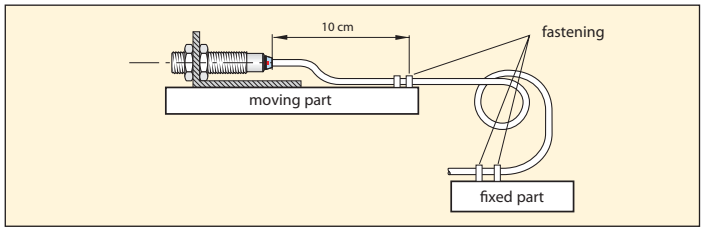
REDUCTION FACTORS IN INDUCTIVE AND CAPACITIVE SENSORS

If the object to be sensed is not Fe37 (inductives) or material other than metal (capacitives) the intervention distance reduces.

Futhermore if the object to be sensed has dimensions and thickness less than those indicated then the intervention distance will be further reduced.

SUGGESTIONS FOR MOUNTING

• Follow the indications listed in the technical characteristics for the various families of sensors.
• Take note of the temperature limits indicated for each family of sensors. Incorrect installation may result in a modification in the switching distance causing a change in equipment performance.
• When using sensors in areas where chemicals are present it is advised that they be installed so as not to come in direct contact with these substances as it may be difficult to establish their corrosiveness. Generally speaking the plastic parts have a high resistance to oil, salts, petrol and other hydrocarbons. It is recommeded that further information be requested from our technical department.
• Do not pull the cable with excessive force and if necessary use protective tubing.
• Avoid repetitive movements between cable and sensor if necessary follow the instructions in the diagram.

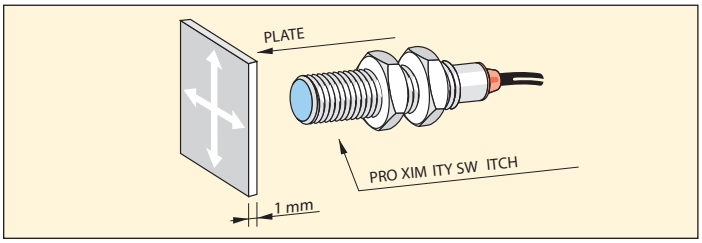


• All AECO sensors, in standard version, are supplied with cable in PVC and can also be supplied with pur or silicon cable.
The standard length of the cable is 2 mtrs, but upon request can also be supplied in lengths of 3.5 - 7.5 - 10 mtrs.
• Pay attention to the protection of the sensing face avoiding shock or mechanical pressure in order to avoid irreparable damage (particularly in the case of inductive sensors).
• Use suitable tools on the sensitivity regulation trimmer.
• Install both inductive and capacitive sensors in such a way as to avoid that any kind of material becomes deposited on the active surface.
• When installing sensor using locknuts do not overtighten them in order to avoid damage to the body of the sensor and the internal circuit. Particular attention should be given to sensors with a diameter equal to or less than 12 mm. Attention should all be given to avoid the installation of a sensor into a hole with the same diameter as this may cause irreparable damage.
• When preparing threaded holes for the fixing of sensors the following diameters should be followed:
M8 x 1 = ø7 o M12 x 1 = ø11 o M18 x 1 = ø17 o M30 x 1.5 = ø28.4

DESCRIPTION OF TECHNICAL TERMS

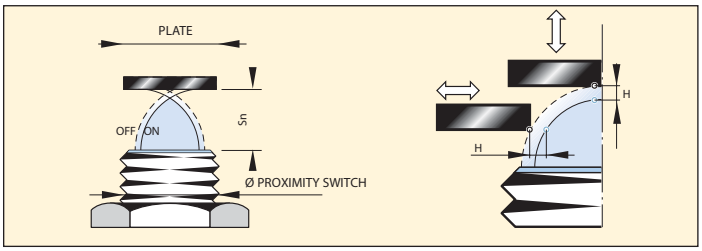
SWITCHING DISTANCE (Sn)

This is the switching distance measured at 20°C and nominal supply voltage, using a square piece of Fe 37 (EN50010) steel of 1 mm. thickness the side of which must be equal to or greater than the diameter of the active surface. In this condition the sensor switches in a Sn range of ± 10% Sn.



HYSTERESIS

Hysteresis is the distance between switching in both directions at nominal voltage and temperature values.
The value is expressed as a percentage of the switching distance.



GENERAL SPECIFICATIONS OF INDUCTIVE AND CAPACITIVE SENSORS - EN50032

REPEATABILITY
This indicates the intervention point variation of the sensor operated at the same conditions and in the same way.

SWITCHING FREQUENCY
The switching frequency is the maximum possible number of impulse repetitions per second. This is determinated by the measurement method according to din EN 50010 (right drawing). The max. values of the switching frequency of each sensor are indicated on the technical characteristics.

RATED VOLTAGE (Vn)
The rated voltage indicates the power supply values where the sensor works perfectly.

RESIDUAL RIPPLE
Ripple is the alternating voltage superimposed on the D.C. voltage (peak-peak) in %.

MAXIMUM OUTPUT CURRENT
Is the maximum current the sensor can generate in continuous operation.

MINIMUM OUTPUT CURRENT
It is the minimum current value which should flow through the sensor in order to guarantee a safe working.

PEAK CURRENT
The peak current indicates the maximum current value that the sensor can bear in a limited period of time.

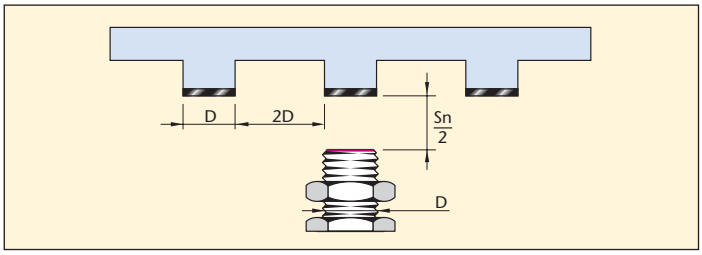
RESIDUAL CURRENT
It is the residual current which flows through the sensor when it is open.

ABSORPTION
Is the maximum current absorption of the sensor in relation to the maximum off load voltage.

VOLTAGE DROP
It is the voltage drop measured across the sensor.

SHORT CIRCUIT PROTECTION
Most of the D.C. sensors have incorporated a protection which prevents the internal circuit from being damaged by a short circuit or overload of the output.
When the short circuit is removed the sensor is automatically reactivated.

PROTECTION AGAINST REVERSAL OF POLARITY
All the sensors are protected against reversal of polarity, this prevents the internal components from being damaged by incorrect power-supply connection.



PROTECTION AGAINST INDUCTIVE PEAKS
All the sensors are protected against damage caused by the disconnection of inductive loads. It is advisable to keep the cable of the power conductors separate.

ISOLATION RESISTANCE
Expressed in ohm between the sensor circuit and the metal body, applying a voltage of 500 VCA.

DEGREE OF PROTECTION
This is the degree of protection of the body which contains the electrical parts expressed in IP followed by two numbers. In the case of inductive and capacitive switches the first is always 6 (complete protection against dust) and the second can be 5 (protected against jets of water) or 7 (protection against immersion for a fixed time).

TEMPERATURE LIMITS
Range of temperature within which the functions is guaranteed as per the technical characteristics.

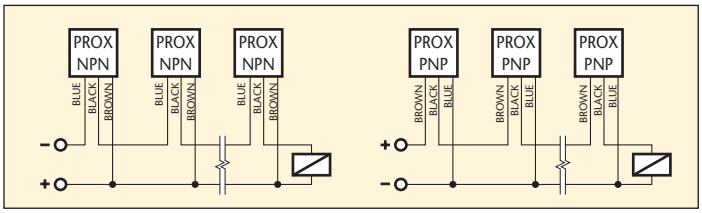
TEMPERATURE VARIATION
Maximum variation in the intervention distance (Sn) within the limits of temperature allowed expressed as a percentage of ± 10% Sn.

TYPE OF OUTPUT
All the inductive and capacitive sensors are of the different types N-B-C-A specified in page 5 and 57.

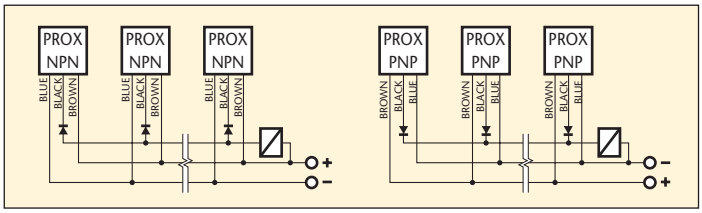
TYPE OF OUTPUT
For all AECO sensors the standard definitions are used N.O. normally open N.C. normally closed. This refers to the state of the sensor in the absence of switching material.
Most sensors can be supplied in the N.O. + N.C. output.

CONNECTION FOR INDUCTIVE AND CAPACITIVE SENSORS

CONNECTION OF D.C. TYPES IN SERIES (AND LOGIC)
In some applications it is necessary to obtain two corresponding signals before an action is carried out. Two sensors connected in this way will activate one output when they are excited simultaneously. When D.C. amplified types are used it is necessary to take into account the voltage drop present at the output of each sensor (<1,8V) the maximum load current of the sensors used and the current absorption of each single sensor (<10mA) as well as the final load.



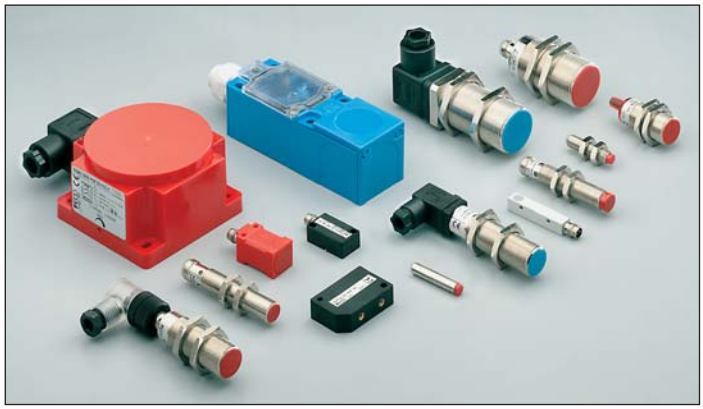
CONNECTION OF D.C. TYPES IN PARALLEL (OR LOGIC)
Connected in this way all sensors can activate the common output independently when excited. When amplified D.C. types are used it is necessary to take into account that each sensor has as an additional load of the resistance of the other sensors (collector resistances). Any incovenience caused by this can be overcome by asking specifically for sensors with the final stage which has an open collector or by adding disconnecting diodes as indicated by the drawing.



CONNECTION OF A.C. TYPES IN SERIES OR IN PARALLEL
A.C. sensors can be connected in series taking into account the voltage drop (≤ 6V) present in the sensor when connected in parallel. The off load current (≤ 4mA) should be summed and attention should be given when in the minimum load condition (high load impedance).
Such connections should in any case not be done as a function anomalous to the sensor can be generated. The "voltage drop" and the "residual current" is important in this type of connection.

24V A.C. POWER SUPPLY
In sensors supplied with 24V A.C. the voltage drop (≤ 6V) existing in the sensor and the possibile voltage drop due to the connecting wires between the sensor and the load should be taken into account.
In order to maintain an adequate voltage it is reccomended that the supply voltage be increased by at least 6V.

INDUCTIVE SENSORS SI SERIES



APPLICATIONS

Inductive sensors have wide uses in many applications, even in the most difficult working conditions for example in the presence of oils, powders, liquids and vibrations which do not have any effect on their secure functioning.
AECO sensors are mounted on machine tools, textile machines, transfer lines, transport systems, packaging equipment, in the automobile industry and in all applications where solutions for automation are required.

STANDARDIZED SENSING PLATE

Its use allows the comparison of the values of sensing distance (see table). The measuring method is defined by the european standard EN 50010. The normalized plate is square and has a thickness of 1 mm, the material of this plate must be steel (Fe37). Other materials mean that different intervention distances are obtained. The length of the sides of the plate must correspond to the diameter of a circle that is the active surface of the sensor. A larger plate does not result in an increase in the nominal intervention distance, however a reduction in the plate reduces the intervention distance.

NOMINAL INTERVENTION DISTANCE Sn

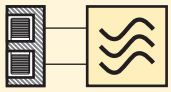
The nominal distance is defined as the switching value where variations due to changes in temperature and voltage are taken into account.

TABLE OF COMPARISON: SENSOR - DISTANCE - PLATE

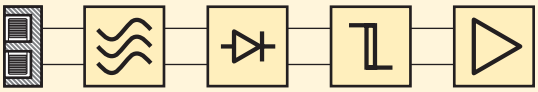
DIAMETER OR SIZE	DISTANCE Sn EMBEDDABLE mm	DISTANCE Sn NOT EMBEDDABLE mm	DOUBLE SWITCH DISTANCE Sn EMBEDDABLE mm	DOUBLE SWITCH DISTANCE Sn NOT EMBEDD. mm	SENSING PLATE Fe 37 SIDE x THICKNESS mm
4 - 5	0.8	-	-	-	5 x 1
6,5 - 8	1	2	2	3	8 x 1
12	2	4	4	8	12 x 1
14	3	5	-	-	14 x 1
18	5	8	8	16	18 x 1
30	10	15	15	20	30 x 1
SIP A8 - C8	2	-	-	-	8 x 1
SIP 10	2	-	-	-	8 x 1
SIP 12	2	4	-	-	12 x 1
SIP 17	-	5	-	-	12 x 1
SIP 25	5	-	-	-	18 x 1
SIP 40	15	20	-	-	45 x 1
SIQ 80	-	50	-		100 x 1

WORKING PRINCIPLE

By applying a voltage to the oscillator coil an alternating inductive field is created in front of the active surface of the unit.
When a metallic object (steel, aluminium, copper, brass etc.) enters this field from any direction and the state of the oscillator is modified until the threshold of the trigger is inverted this induces a change in the final stage and the subsequent command of an external load.
The intervention distance depends on the type of metal and as described earlier, in the reduction factors. All the sensors are protected against inversion of polarity and electrical disturbances of inductive sources and can be supplied with short circuit protection in the D.C. version. The main advantages offered by proximity sensors in relation to normal limit switches are mainly unlimited duration as they have no moving parts (wheels, springs etc.) lack of maintainance requirement and elimination of possible false contacts due to contact movement.



BLOCK DIAGRAM OF NON AMPLIFIED INDUCTIVE SENSOR



BLOCK DIAGRAM OF AMPLIFIED INDUCTIVE SENSOR

REAL INTERVENTION DISTANCE Sr

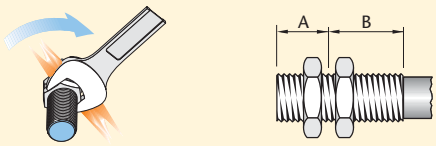
This is the distance measured according to the EN 50010 standard at nominal temperature and voltage: 0,9Sn ≤ Sr ≤ 1,1Sn.

INTERVENTION DISTANCE Su

This is the distance measured according to the EN 50010 standard at a specified temperature and voltage between the allowed limits 0,9Sr ≤ Su ≤ 1,1Sr.

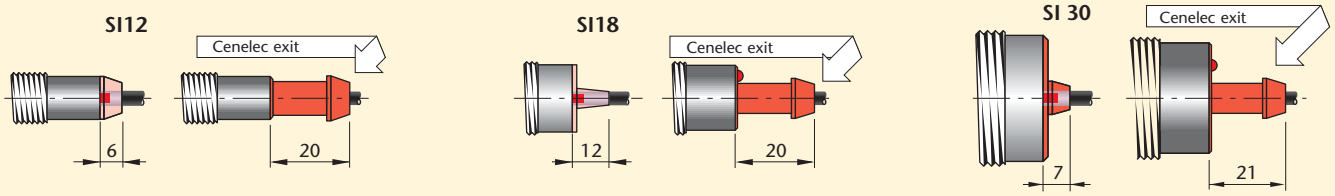
TIGHTENING TORQUES

To prevent mechanical damage to the proximity switch when installing, certain tightening torques on the mounting nuts should not be exceeded.



MODELS	DIM. A (mm)	TIGHTENING TORQUE (Nm) max.	
		A	B
SI5	4	0.5	1.5
SI8	7	8	12
SI12	10	12	28
SI18	10	30	40
SI30	13	35	40

CABLE EXIT - STANDARD AND CENELEC TYPES



N.B.: On request the sensors with standard cable exit type are also availbale with cenelec cable exit type.

INDUCTIVE SENSORS SI SERIES

SENSOR VERSION N IN ACCORDANCE WITH NAMUR STANDARDS - DIN 19234 (2 wire)

These are two-wire non amplified D.C. sensors which contain only the oscillator and are adapted to control an electronic amplified thereshold circuit.
Only a few components are needed, thus inevitably guaranteeing for this type of sensor the maximum operational safety and reliability. Thanks to its low-resistance termination this sensor is not susceptible to inductive or capacitive irradiations into the connecting lead with the amplifier. They can be supplied with EEx ia IIc T4 approval. They can be supplied together with power supplies: ALNC - ALN2 - ALTP.

SENSOR VERSION B FOR DIRECT VOLTAGE (2 wire)

These are two-wire amplified sensors which contain an ouput amplifier with function N.O. or N.C. in addition to the oscillator and can pilot a load connected in series. However due to this system a residual current flows through the load even when in the open state. In addition a voltage drop occurs to the sensor when it is in the closed state. Attention must be paid to these restrictions when selecting the relays or electronic controls required for connections. They are adapted for inputs of programmable controllers.

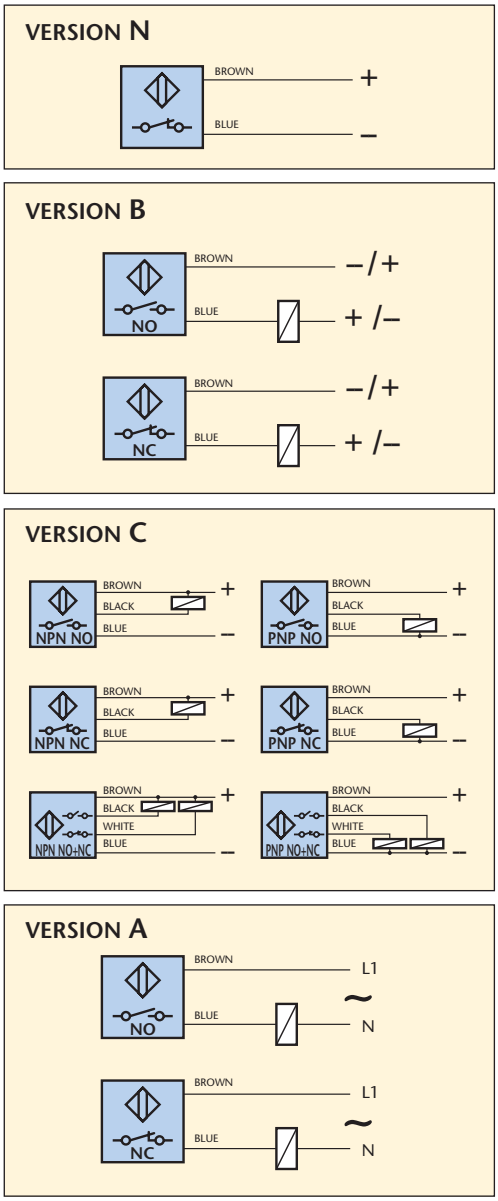
SENSORS VERSION C FOR DIRECT VOLTAGE (3 and 4 wire)

These are amplified D.C. sensors which contain an output amplifier in addition to the oscillator. They are supplied as 3 wires with function N.O. or N.C. and as 4 wire with antiphase outputs in the types NPN and PNP as standard this version of sensor is protected against short circuit, absolutely protected against polarity and peaks created by the disconnection of inductive loads. These sensors can be supplied together with power supplies: ALNC - ALTP. They are adapted for inputs of programmable controllers.

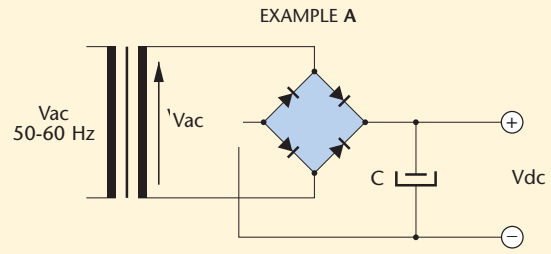
SENSORS VERSION A FOR ALTERNATING VOLTAGE (2 wire)

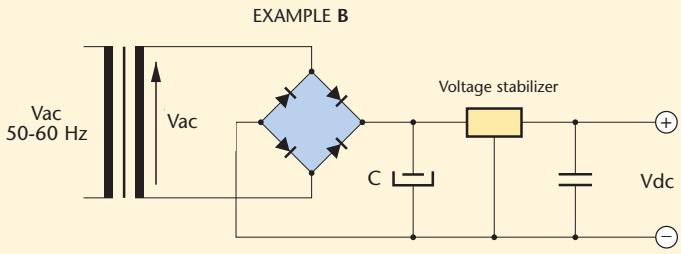
These are two-wire sensors which contain a thyristor output amplifier in addition to the oscillator. The load which is connected in series with the sensor is passed through by the same residual current that it is supplied by. It is particularly important to pay attention to the low consumption relay, in fact it is important to ensure that:
- The required current for the switching of the relay is EQUAL to or SUPERIOR to the minimun output current required by the sensor.
- The current required for the secure releasing of the relay is SUPERIOR to the residual current of the sensor.

If these parameters are not respected there will be an uncertain switching of the relay. Furthermore attention must be given to high impedance imput connections of electronic commands as the residual current in the sensor could be sufficient to cause activation.
In the closed state a voltage drop can be found this should be taken into account especially when there is a low voltage supply.
They are also protected against voltage transients coming from the power supply or generated by the load.
They are compatible with P.L.C. units.



SUGGESTION FOR SUPPLYING VOLTAGE TO INDUCTIVE SENSORS





The supply voltage should be adjusted according to the characteristics of the sensor used. It is recommended to use a trasformer with secondary voltage Vac lower than the direct voltage Vdc required.
The secondary voltage Vac is found as follows:
Vac = (Vdc + 1) : 1,41

The supply voltage Vdc of the sensor should be filtered with a capacity C at least 470 µF for each 200 mA used.
If the supply voltage Vdc is high it is recommended to follow the diagram B with a proper voltage stabilizer.