SENSE Sensors & Instruments is now part of TE connectivity

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INSTRUCTION MANUAL

Standard Line - Direct Current

The Standard line is the standard series of Inductive Proximity Sensors and comprises a family of products for the most diverse industrial applications.

1 - Modelos: PS 5 - 18 G M 50 - A2 - 6 Ex

Sensor Type
PS - Inductive proximity sensor

Sensing Distance
0,8F* - 0,8mm
1 - 1 mm
1,5 - 1,5 mm
2 - 2 mm
2F** - 2 mm
4 - 4 mm
5 - 5 mm
8 - 8 mm
10 - 10 mm
15 - 15 mm
* Flush only for Φ4 and M5 models
** Flush only for M8 models

Tube Diameter
Smooth: Φ4mm; Φ6,5mm and Φ8mm
Threaded: M5; M8; M12; M18 or M30

Tube
G - Threaded tube

Tube Type
I - Nickel-plated brass, back LED
M - Nickel-plated brass, side LED
P - Enginnering plastic, back LED
X - Stainless steel, back LED
T - PTFE-plated brass, back LED

Tube Length
25, 30, 45, 50, 60 or 70 mm

Output Type
N4 - DC NO 2-wire
N5 - DC NC 2-wire
E - DC NPN 3-wire
E2 - DC PNP 3-wire
A - DC NPN NO+NC 4-wire
A2 - DC PNP NO+NC 4-wire

Electrical Connection*
_ - 2-meter PVC cable
6 - 6-meter PVC cable
10 - 10-meter PVC cable
15 - 15-meter PVC cable
20 - 20-meter PVC cable
25 - 25-meter PVC cable
V1 - M12 4-pin connector
V8 - M8 3-pin connector
PV83 - Pigtail with M8 3-pin connecto
* Version with M8 connector not Ex certified
* Polyurethane cable is available as option

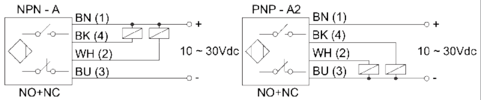
Area Classification
_ - Application in common industrial area
Ex - Applications in industrial areas containing combustible dust

1.1 - Technical Characteristics E, E2, A and A2:

Supply voltage..........10 to 30Vcc (ripple 10%)
Max. switching current..........200mA
Consumption current..........<10mA (except M18, M30 A and A2 <20mA)
Output protection..........against short circuit and overload
Voltage drop in the sensor..........≤2V
Hysteresis..........typical 5%
Repeatability..........<0,01mm
Standard..........IEC 60957-5-2
Operating temperature..........-25°C a +70°C
Protection degree..........IP-67
Tubular metal enclosures........brass with chemical nickel plating
Plastic tubular enclosures..........rynite thermoplastic

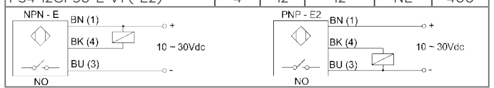
1.2 - Mod. A and A2 with Cable and Connector:

Models A(NPN) and A2(PNP) with cable	Sn mm	Φ mm	Target mm	Assembly	Freq. Hz
PS2-12GM(GI;GP)50-A (A2)	2	12	12	E	800
PS2-12GM(GI)60-A (A2)	2	12	12	E	800
PS2-12GI70(GP)70-A (A2)	2	12	12	E	800
PS4-12GM(GI;GP)50-A (A2)	4	12	12	NE	400
PS4-12GI(GP)70A (A2)	4	12	12	NE	400
PS5-18GM(GI;GP)50-A (A2)	5	18	12	E	500
PS5-18GI(GP)70-A (A2)	5	18	12	E	500
PS8-18GM(GI;GP)50-A (A2)	8	18	12	NE	200
PS8-18GI(GP)70-A (A2)	8	18	12	NE	200
PS10-30GM(GI;GP)-50-A (A2)	10	30	12	E	300
PS10-30GI(GP)-70-A (A2)	10	30	18	E	300
PS15-30GM(GI;GP)-70-A (A2)	15	30	18	NE	100
PS15-30GI(GP)-70-A (A2)	15	30	18	NE	100
Models A(NPN) and A2(PNP) with cable	**Sn mm**	**Φ mm**	**Target mm**	**Assembly**	**Freq. Hz**
PS2-12GI(GP)50-A-V1 (A2)	2	12	12	E	800
PS4-12GI(GP)50-A-V1 (-A2)	4	12	12	NE	400
PS5-18GI(GP)50-A-V1 (A2)	5	18	18	E	500
PS8-18GI(GP)50-A-V1 (A2)	8	18	24	NE	200
PS10-30GI(GP)50-A-V1 (A2)	10	30	30	E	300
PS15-30GI(GP)50-A-V1 (A2)	15	30	45	NE	100



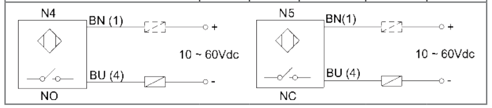
1.3 - Mod. E and E2 with Cable and Connector:

Models E(NPN) and E2(PNP) with cable	Sn mm	Φ mm	Target mm	Assembly	Freq. Hz
PS0,8F-4-25-E2	0,8	4	4	E	6K
PS0,8F-5GM25-E2	0,8	5	5	E	6K
PS1,5-6,5-45-E (-E2)	1,5	6,5	8	E	1K
PS1,5-8-45-E (-E2)	1,5	8	8	E	1K
PS1,5-8GM45-E (-E2)	1,5	8	8	E	1K
PS2-6,5-45-E (-E2)	2	6,5	8	NE	600
PS2-8-45-E (-E2)	2	8	8	NE	600
PS2-8GM45-E (-E2)	2	8	8	NE	600
PS2F-8GM45-E (-E2)	2	8	8	E	600
PS2-12GM(GI;GP)50-E (-E2)	2	12	12	E	800
PS2-12GI(GP)70-E (-E2)	2	12	12	E	800
PS4-12GM(GI;GP)50-E (-E2)	4	12	12	NE	400
PS4-12GI(GP)70-E (-E2)	4	12	12	NE	400
PS5-18GM(GI;GP)50-E (-E2)	5	18	18	E	500
PS5-18GI70-E (-E2)	5	18	18	E	500
PS8-18GM(GI;GP)50-E (-E2)	8	18	24	NE	200
PS8-18GI70-E (-E2)	8	18	24	NE	200
PS10-30GM(GI;GP)50-E (-E2)	10	30	30	E	300
PS10-30GI70-E (-E2)	10	30	30	E	300
PS15-30GM(GI;GP)50-E (-E2)	15	30	45	NE	100
PS15-30GI70-E (-E2)	15	30		NE	100
Models E(NPN) and E2(PNP) with connector	**Sn mm**	**Φ mm**	**Target mm**	**Assembly**	**Freq. Hz**
PS0,8F-4-25-E2-PV83	0,8	4	4	E	6K
PS0,8F-5GM25-E2-PV83	0,8	5	5	E	6K
PS1,5-6,5-60-E-V8 (-E2)	1,5	6,5	8	E	1K
PS1,5-8GM45-E-V1 (-E2)	1,5	8	8	E	1K
PS1,5-8GM60-E-V8 (-E2)	1,5	8	8	E	1K
PS2-6,5-60-E-V8 (-E2)	2	6,5	8	NE	600
PS2F-8GM45-E-V8 (-E2)	2	8	8	E	600
PS2-8GM45-E-V1 (-E2)	2	8	8	NE	600
PS2F-8GM45-E2-V1	2	8	8	E	600
PS2-8GM60-E-V8 (-E2)	2	8	8	NE	600
PS2-12GM50-E-V1 (-E2)	2	12	12	E	800
PS2-12GP50-E-V1 (-E2)	2	12	12	E	800
PS4-12GM50-E-V1 (-E2)	4	12	12	NE	400
PS4-12GP50-E-V1 (-E2)	4	12	12	NE	400



1.4 - N4 and N5 models:

N4 and N5 models with cable and connector	Sn mm	Φ mm	Target mm	Mont.	Freq. Hz
PS2-12GI50-N4	2	12	12	E	450
PS2-12GI50-N5	2	12	12	E	600
PS4-12GI50-N4	4	12	12	NE	650
PS4-12GI50-N5	4	12	12	NE	800
PS5-18GI50-N4	5	18	18	E	550
PS5-18GI50-N5	5	18	18	E	600
PS8-18GI50-N4	8	18	24	NE	500
PS8-18GI50-N5	8	18	24	NE	550
PS10-30GI50-N4	10	30	30	E	150
PS10-30GI50-N5	10	30	30	E	150
PS15-30GI50-N4	15	30	45	NE	150
PS15-30GI50-N5	15	30	45	NE	150

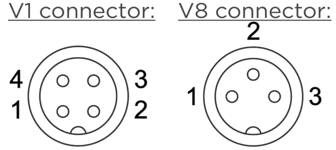


1.4.1 - Technical Characteristics N4 and N5:

Supply voltage..........10 to 60Vcc (ripple ≤ 10%)
Max. switching current..........200mA
Residual current in the load (de-energized load).......<2,5mA
Minimum load current (disconnected)..........5mA
Voltage drop at the sensor (energized load)..........<5V
Operating temperature..........-25°C to 70°C
Hysteresis..........typical 5%
Repeatability..........<0,01mm
Standard..........IEC 60957-5-2
Protection degree..........IP 67
Tubular metal enclosure..........brass with chemical nickel plating
Plastic tubular enclosure..........rynite thermoplastic

1.6 - Connections:

V1 connector: V8 connector:



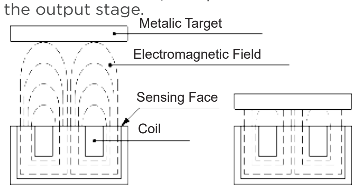
Cable:
MR- brown
AZ- blue
PR- black
BR- white

2 - Inductive Proximity Sensors:

Inductive Proximity Sensors are electronic devices capable of detecting the approach of metal parts, components, machine elements, etc., replacing traditional limit switches. Detection takes place without physical contact between the sensor and the actuator, increasing the life of the sensor as it has no moving parts subject to mechanical wear.

2.1 - Principle of Operation:

The operating principle is based on the generation of a high-frequency electromagnetic field, which is developed by a resonant coil installed on the sensor face.
The coil is part of an oscillator circuit which generates a sinusoidal signal under normal conditions (switched off). When a metal comes close to the field, it absorbs the field's energy through surface currents (Foulcault), reducing the amplitude of the signal generated in the oscillator.
The amplitude variation of this signal is converted into a continuous variation which, compared to a standard value, acts on the output stage.

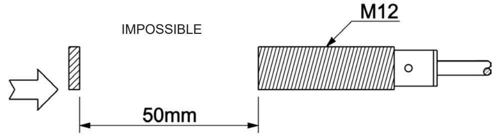


2.2 - Sensing Face:

It is the surface through which the electromagnetic field emerges.

2.3 - Sensing Distance (S):

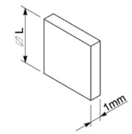
This is the distance at which approaching the actuator to the sensor face changes the state of the output. The trigger distance is a function of the coil size. Therefore, we cannot specify the sensing distance and the sensor size at the same time.



2.4 - Rated Sensing Distance (Rated Sn):

This is the theoretical (maximum) sensing distance, which uses a standard target as a trigger and does not take into account variations caused by industrialization, operating temperature and supply voltage. This is the value at which proximity sensors are specified.

L=D (se 3xSn < D) or
L=3xSn (se 3xSn>D)
Sn - nominal sensing distance
D - diameter of the area where the electromagnetic field emerges



2.5 - Assured Sensing Dist. (Assured Sa):

This is the distance at which it is safe to operate, taking into account all variations in industrialization, temperature and supply voltage:

Sa≤72% Sn

2.6 - Standard Target (DIN 50010 standard):

It is a standardized trigger used to calibrate the nominal sensor distance during the sensor manufacturing process.

Wire Colors: BN brown - BK black - BU blue - **Output Function:** NO - Normally Open and NC - Normally closed.

N4 an... cabl...
PS2-12G
PS2-12G
PS2-12G
PS4-12G
PS4-12G
PS4-12G
PS5-18G
PS5-18G
PS5-18G
PS8-18G
PS8-18G
PS8-18G
PS10-30
PS10-30
PS10-30
PS15-30
PS15-30
PS15-30

Note: If the sensor supplied is not listed above, but has the same electrical configuration code "E, E2, A, A2, N4 or N5", these instructions remain valid. Example: PS2-12GM40-E2 (special model with smaller tube).

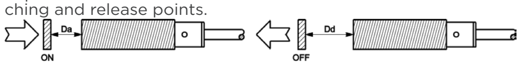
E - Flush NE - Non-Flush

DC Electrical Configuration:

2.7 - Target Material:
The operational sensing distance also varies depending on the type of metal, that is, it is specified for iron or steel and needs to be multiplied by a reduction factor.

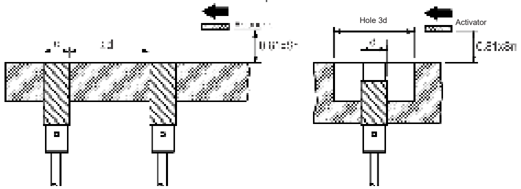
Material	Factor
Ferro ou Aço	1,0
Cromo Níquel	0,9
Aço Inox	0,85
Latão	0,5
Alumínio	0,4
Cobre	0,3

2.8 - Hysteresis:
It is the difference between the switching point (when the metallic target approaches the sensing face) and the release point (when the target moves away from the sensor). This value is important because it ensures a distinction between the switching and release points.



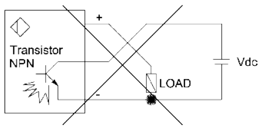
2.9 - Flush:
This type of sensor has the electromagnetic field emerging only from the sensing face and allows it to be mounted on a metallic surface.

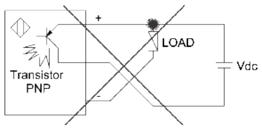
2.10 - Non-Flush:
In this type, the electromagnetic field also emerges from the lateral surface of the sensing face, making it sensitive to the presence of metal around it.



3 - Three or Four Wires DC Models (E, A):
The DC proximity sensors are powered by a DC supply and it has a output transistor with a function to switch (on/off) the load connected to the sensor. There are still two types of output transistor: one to switch the positive terminal of the power supply, knowledge as PNP type and other to switch the negative terminal, the NPN type.

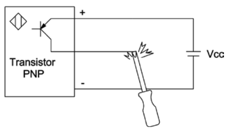
3.1 - Switching Current:
This is one of the most important features of the sensors, because it establishes the compatible load. It is defined as the most current which can be switched by the output transistor without damaging it.

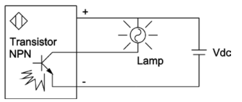




Caution!
When using sensors without short-circuit protection, because any tool touching the terminals can damage instantly the sensor.

Solenoid valves and incandescent lights have high peak current that also can damage the sensors output without protection.

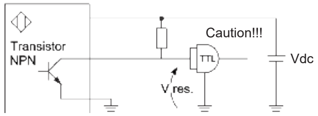




3.2 - Supply Voltage:
Take care to do not exceed the sensor supply voltage or connected it on AC line. The proximity sensors usually get a range for the supply voltage, for instance 10 to 30Vdc, where it can operate in any voltage without significant changes.

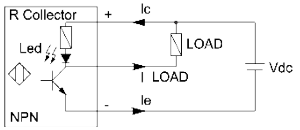
3.3 - Protection:
DC sensors typically feature protection against reverse polarity, short circuits, and overloads. This protection disables the output transistor when the load current exceeds the maximum allowed value, and it is automatically restored once the overload is removed. It is important to note that even sensors with short-circuit protection can be damaged by transient noise and/or high voltage spikes.

3.4 - Voltage Drop:
It is the voltage drop between the collector / emitter of the output transistor when it is closed (saturated) and this value is less than 2 V.



Caution! When using NPN sensor switching TTL level (5V), please verify if the sensor has a voltage drop is under 0.5V, as this voltage could be understood as a level "1" permanently by the TTL circuit.

3.5 - Output Resistance:
The inductive sensors are supplied with a resistance on the output transistor collector, that it is used to decrease the circuit impedance when the output transistor is open. It must not be used to power the load.



4 - Two Wires DC Models (N54):
In this version, the output stage has only two terminals, which must be connected in series with the load. When the load is de-energized, a small residual current flows through it, and when the load is energized, a voltage drop appears across the sensor. This occurs because the sensor is powered by the load connected in series.

4.1 - Residual Voltage:
When the sensor is activated, a voltage drop of 5V will be reduce by the sensor output from the load and must be considered for powering low loads, mainly in electronic circuits and programmable controllers. (EG: with a supplying of 24Vdc, the sensor supplies just 19V to the load, what is must be sufficient for load activation).

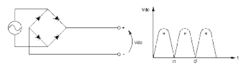
4.2 - Residual Current:
A small residual current (<2.5 mA) flows through the load when the sensor is deactivated, which is necessary for the sensor's internal power supply. It is important to ensure that high-impedance loads, such as logic controllers, are not triggered by this leakage current.

4.3 - Minimum Load:
The two-wire sensor requires a least current, nearly 5mA, to keep the sensor fed while the load is being powered. It is necessary to take care with load consumption current, mainly the logical controllers, in order to get the devices compatibility.

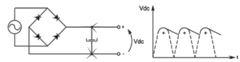
4.4 - Programmable Output:
Sense's 2-wire sensors, model N45, feature a reversible output stage from NO to NC, simply by switching the polarity of the wires. In other words, to change from NO to NC, just invert the wire connections.

5 - Power Supply:
The power supply for continuous current sensors is very important, because both the working stability and useful life of the sensors depend on it. A good power supply must have filter to decrease the effect of electrical noise generated by loads, which can even damage the proximity sensors and other electronic equipment connected to the source.

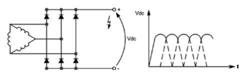
5.1 - Complete Wave:
This power supply is not suitable because the ripple is very high(>10%) and there are close points at t1 and t2, where there is no voltage, besides the peak voltage is much higher than the average value.



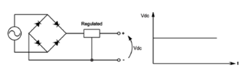
5.2 - Filtered Power Supply:
This source can be used depending on the ripple, which must be calculated with all loads connected to the source. Typically for loads under 300mA.



5.3 - Three Phase Power Supply:
This power supply presents a ripple ≤5% without the use of a filter capacitor, making it suitable as long as there are not many inductive loads.



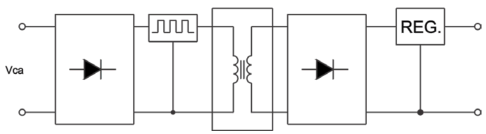
5.4 - Regulated Power Supply:
It is highly suitable for sensor applications, as the output voltage remains constant regardless of fluctuations in the power grid.



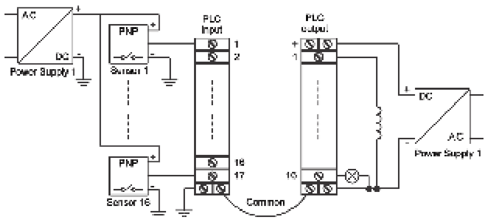
5.5 - Switching Power Supply:
This technique is the most suitable, as it features a short-circuit protected output and stabilized voltage regardless of the power grid. Due to its rectification and oscillation system, the power supply eliminates voltage spikes generated by the grid, thereby increasing the lifespan of sensors and other electronic circuits.

5.6 - Ripple:
Ripple is the AC voltage over imposed on the DC voltage and must be less than 10% (peak to peak over the arithmetic average of DC) in order to keep the stability for the proximity sensor circuits.

5.7 - Line Noise:
The power line that serves proximity sensors and noise generator elements such as: solenoid valves, electromagnets, motors, etc., will have electrical peaks called noise that can introduce wrong commands, erroneous signals or even damage the sensors.

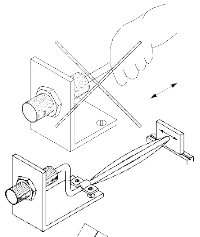


5.8 - Example of an Ideal Installation:
Power supply 1 is a low-power regulated source intended solely for powering the controller's input cards. Power supply 2 is a high-power source and does not require sophistication; it can simply be a rectifier, which is usually sufficient for inductive loads.

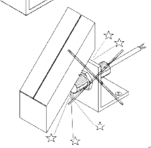


6- General Precautions:
6.1 - Connecting Cable:
Avoid subjecting the sensor's connection cable to any type of mechanical stress.

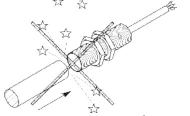
6.2 - Vibration:
Since the sensors are potted, they can be used on machines with movement, as long as the cable is secured to the sensor using clamps, allowing only the middle section of the cable to flex.



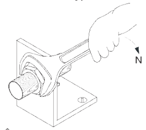
6.3 - Mounting Bracket:
Avoid exposing the sensor to impacts with other parts or components, and do not use it as a support.



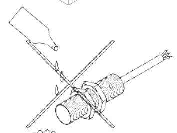
6.4 - Mobile Parts:
When setting up, please be carefully with the sensing distance of the sensor and its position, avoiding thus, impacts with the activator.



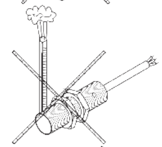
6.5 - Mounting Nuts:
Avoid overtightening the mounting nuts.



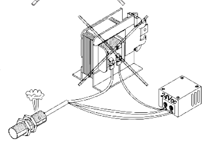
6.6 - Chemical Resistance:
For installations in harsh environments, please contact our technical department to specify the most suitable sensor for the application.



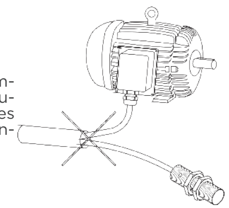
6.7 - Environment Cond:
Avoid exposing the sensor to environmental conditions with operating temperatures above its specified limits.



6.8 - Inductive Loads:
Using the sensor to switch high inductive loads may permanently damage the sensor's output stage and generate high voltage spikes in the power supply.



6.9 - Cabling:
According to standard recommendations, sensor and measurement/control instrument cables should not share the same conduits as actuator circuits.



Note: Although the sensors have noise filters, if the sensor or power supply cables share the same conduits as power circuits with motors, electric brakes, circuit breakers, contactors, etc., the induced voltages may carry enough energy to permanently damage the sensors.

Wire Colors: BN brown - BK black - BU blue - **Output Function:** NO - Normally Open and NC - Normally closed.