

**Proximity** CE RoHS

**2016**

3mm - 6.5mm Inductives



**INDUCTIVE**

METAL FACE

HIGH/LOW TEMPERATURE

PHOTOELECTRIC

ULTRASONIC

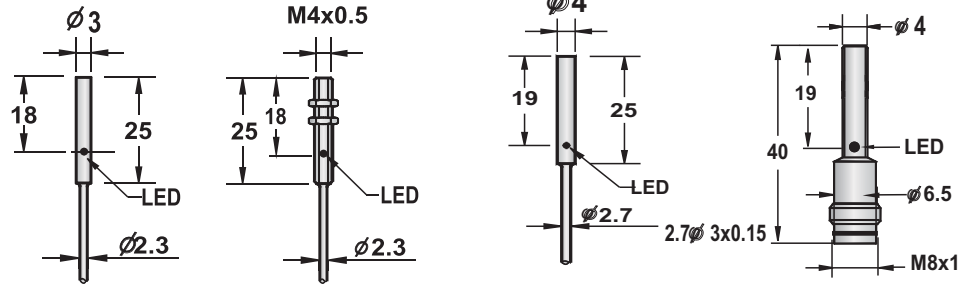
ADAPTIVE

CAPACITIVE

QUICK CONNECT CABLES

CUSTOMIZATION

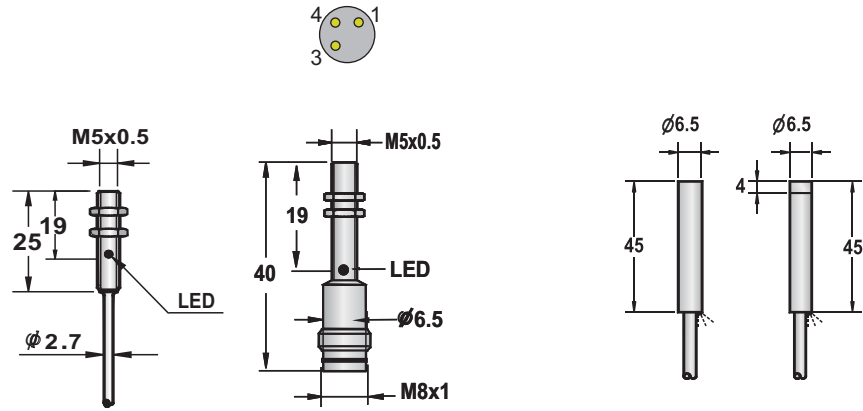
3-Wire DC Inductive



Diameter	Ø3mm	4mm	Ø4mm	Ø4mm - Pico 3-Pin	
● Flush ○ Non-flush	●	●	●	●	
Switching Distance Sn:mm	0.6mm	0.6mm	0.8mm	0.8mm	
LED Indicator	Yes		Yes		
Operating Voltage	10 - 30 vdc		10 - 30 vdc		
Ripple	<10%		<10%		
No Load Current	<10mA		<10mA		
Max Load Current	100mA		100mA		
Leakage Current	<0.01mA		<0.01mA		
Voltage Drop	<1.5v		<1.5v		
Switching Frequency	2 KHz	2 KHz	2 KHz	2 KHz	
Response Time	0.2ms/0.2ms	0.2ms/0.2ms	0.2ms/0.2ms	0.2ms/0.2ms	
Switching Hysteresis	<15%(Sr)		<15%(Sr)		
Repeat Accuracy	<2%(Sr)	<2%(Sr)	<2%(Sr)	<2%(Sr)	
Enclosure Rating	IP67		IP67		
Operating Temperature	-25C-+70C		-25C-+70C		
Temperature Drift	<10%(Sr)		<10%(Sr)		
Protection	Reverse Polarity		Short Circuit, Reverse Polarity		
Connection Type	3-wire, 2-meter Cable		3-wire, 2-meter Cable	3-pin Pico DC	
Material Tube/Face	SST/PA66		SST/PA66		
Cable Material	PVC, Dia 2.5mm		PVC, Dia 2.5mm	-	
<b>Product Style</b>	Wiring Diag.	<b>2-meter Cable</b>		<b>2-meter Cable</b>	<b>3-pin Pico DC</b>
NPN N.O.	1	ISFS-030.6-NONC2	IRFS-040.6-NONC2	ISFS-040.8-NOWC2	ISFS-040.8-NOWP3
NPN N.C.	2	-	-	ISFS-040.8-NNWC2	ISFS-040.8-NNWP3
PNP N.O.	3	ISFS-030.6-PONC2	IRFS-040.6-PONC2	ISFS-040.8-POWC2	ISFS-040.8-POWP3
PNP N.C.	4	-	-	ISFS-040.8-PNWC2	ISFS-040.8-PNWP3

Note: See Terminal Connection page for wiring diagram

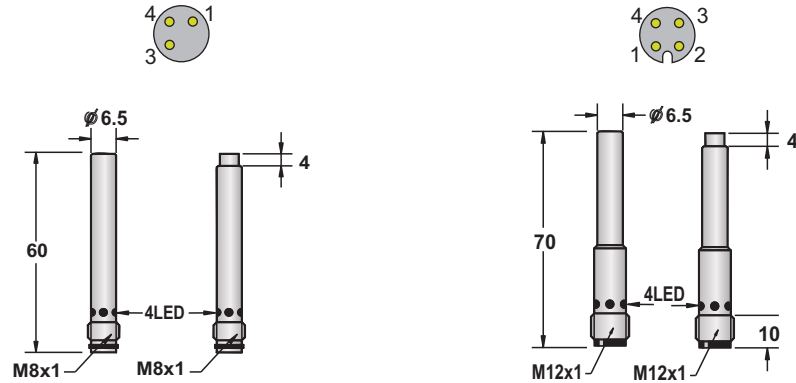
3-Wire DC Inductive



Diameter	M5		M5 - Pico 3-Pin		ø6.5mm	
	● Flush	○ Non-flush	●	●	●	○
Switching Distance Sn:mm	0.8mm		0.8mm		1mm	2mm
LED Indicator	Yes				Yes	
Operating Voltage	10 - 30 vdc				10 - 30 vdc	
Ripple	<10%				<10%	
No Load Current	<10mA				<10mA	
Max Load Current	100mA				150mA	
Leakage Current	<0.01mA				<0.01mA	
Voltage Drop	<1.5v				<1.5v	
Switching Frequency	2 KHz		2 KHz		2 KHz	1.2 KHz
Response Time	0.2ms/0.2ms		0.2ms/0.2ms		0.2ms/0.2ms	0.4ms/0.4ms
Switching Hysteresis	<15%(Sr)				<15%(Sr)	
Repeat Accuracy	<2%(Sr)		<2%(Sr)		<2%(Sr)	<2%(Sr)
Enclosure Rating	IP67				IP67	
Operating Temperature	-25C-+70C				-25C-+70C	
Temperature Drift	<10%(Sr)				<10%(Sr)	
Protection	Short Circuit, Reverse Polarity				Short Circuit, Reverse Polarity	
Connection Type	3-wire, 2-meter Cable		3-pin Pico DC		3-wire, 2-meter Cable	
Material Tube/Face	SST /PA66				SST /PA66	
Cable Material	PVC, Dia 2.5mm		3-pin Pico DC		PVC, Dia 2.5mm	
<b>Product Style</b>	Wiring Diag.	<b>2-meter Cable</b>	<b>3-pin Pico DC</b>		<b>2-meter Cable</b>	
NPN N.O.	1	IRFS-050.8-NOWC2	IRFS-050.8-NOWP3		ISFS-6.501-NOWC2	ISNS-6.502-NOWC2
NPN N.C.	2	IRFS-050.8-NNWC2	IRFS-050.8-NNWP3		ISFS-6.501-NNWC2	ISNS-6.502-NNWC2
PNP N.O.	3	IRFS-050.8-POWC2	IRFS-050.8-POWP3		ISFS-6.501-POWC2	ISNS-6.502-POWC2
PNP N.C.	4	IRFS-050.8-PNWC2	IRFS-050.8-PNWP3		ISFS-6.501-PNWC2	ISNS-6.502-PNWC2

Note: See Terminal Connection page for wiring diagram

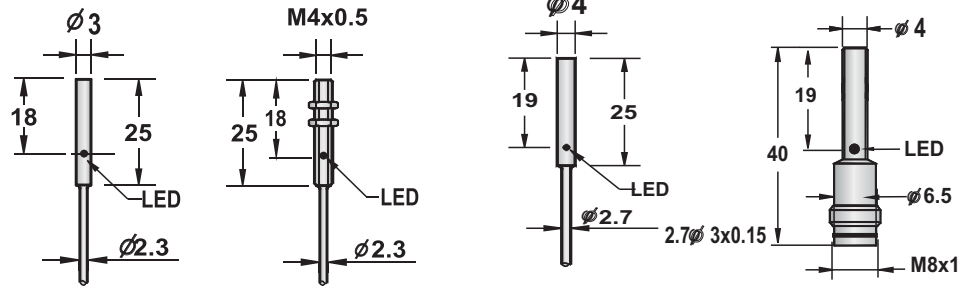
3-Wire DC Inductive



Diameter	ø6.5mm - Pico 3-Pin		ø6.5mm - Micro 4-Pin					
	● Flush	○ Non-flush	● 1mm	○ 2mm	● 1mm	○ 2mm		
Switching Distance Sn:mm			1mm	2mm	1mm	2mm		
LED Indicator	Yes				Yes			
Operating Voltage	10 - 30 vdc				10 - 30 vdc			
Ripple	<10%				<10%			
No Load Current	<10mA				<10mA			
Max Load Current	150mA				150mA			
Leakage Current	<0.01mA				<0.01mA			
Voltage Drop	<1.5v				<1.5v			
Switching Frequency	2 KHz		1.2 KHz		2 KHz		1.2 KHz	
Response Time	0.2ms/0.2ms		0.4ms/0.4ms		0.2ms/0.2ms		0.4ms/0.4ms	
Switching Hysteresis	<15%(Sr)				<15%(Sr)			
Repeat Accuracy	<2%(Sr)		<2%(Sr)		<2%(Sr)		<2%(Sr)	
Enclosure Rating	IP67				IP67			
Operating Temperature	-25C-+70C				-25C-+70C			
Temperature Drift	<10%(Sr)				<10%(Sr)			
Protection	Short Circuit, Reverse Polarity				Short Circuit, Reverse Polarity			
Connection Type	3-pin Pico DC				4-pin Micro			
Material Tube/Face	SST /PA66				SST /PA66			
Cable Material	-				-			
Product Style	Wiring Diag.	3-pin Pico DC		4-pin Micro				
NPN N.O.	1	ISFS-6.501-NOWP3	ISNS-6.502-NOWP3	ISFS-6.501-NOWE3	ISNS-6.502-NOWE3			
NPN N.C.	2	ISFS-6.501-NNWP3	ISNS-6.502-NNWP3	ISFS-6.501-NNWE3	ISNS-6.502-NNWE3			
PNP N.O.	3	ISFS-6.501-POWP3	ISNS-6.502-POWP3	ISFS-6.501-POWE3	ISNS-6.502-POWE3			
PNP N.C.	4	ISFS-6.501-PNWP3	ISNS-6.502-PNWP3	ISFS-6.501-PNWE3	ISNS-6.502-PNWE3			

Note: See Terminal Connection page for wiring diagram

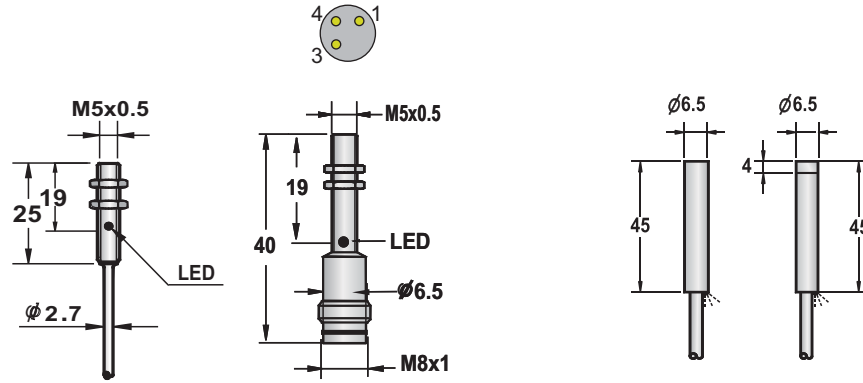
3-Wire DC Inductive



Diameter	Ø3mm	4mm	Ø4mm	Ø4mm - Pico 3-Pin	
● Flush ○ Non-flush	●	●	●	●	
Switching Distance Sn:mm	0.8mm	0.8mm	1mm	1mm	
LED Indicator	Yes		Yes		
Operating Voltage	10 - 30 vdc		10 - 30 vdc		
Ripple	<10%		<10%		
No Load Current	<10mA		<10mA		
Max Load Current	100mA		100mA		
Leakage Current	<0.01mA		<0.01mA		
Voltage Drop	<1.5v		<1.5v		
Switching Frequency	1.5 KHz	1.5 KHz	1 KHz	1 KHz	
Response Time	0.3ms/0.3ms	0.3ms/0.3ms	0.5ms/0.5ms	0.5ms/0.5ms	
Switching Hysteresis	<15%(Sr)		<15%(Sr)		
Repeat Accuracy	<2%(Sr)	<2%(Sr)	<2%(Sr)	<2%(Sr)	
Enclosure Rating	IP67		IP67		
Operating Temperature	-25C-+70C		-25C-+70C		
Temperature Drift	<10%(Sr)		<10%(Sr)		
Protection	Reverse Polarity		Short Circuit, Reverse Polarity		
Connection Type	3-wire, 2-meter Cable		3-wire, 2-meter Cable	3-pin Pico DC	
Material Tube/Face	SST/PA66		SST/PA66		
Cable Material	PVC, Dia 2.5mm		PVC, Dia 2.5mm	-	
<b>Product Style</b>	Wiring Diag.	<b>2-meter Cable</b>		<b>2-meter Cable</b>	<b>3-pin Pico DC</b>
NPN N.O.	1	ISFS-030.8-NONC2	IRFS-040.8-NONC2	ISFS-0401-NOWC2	ISFS-0401-NOWP3
NPN N.C.	2	-	-	ISFS-0401-NNWC2	ISFS-0401-NNWP3
PNP N.O.	3	ISFS-030.8-PONC2	IRFS-040.8-PONC2	ISFS-0401-POWC2	ISFS-0401-POWP3
PNP N.C.	4	-	-	ISFS-0401-PNWC2	ISFS-0401-PNWP3

Note: See Terminal Connection page for wiring diagram

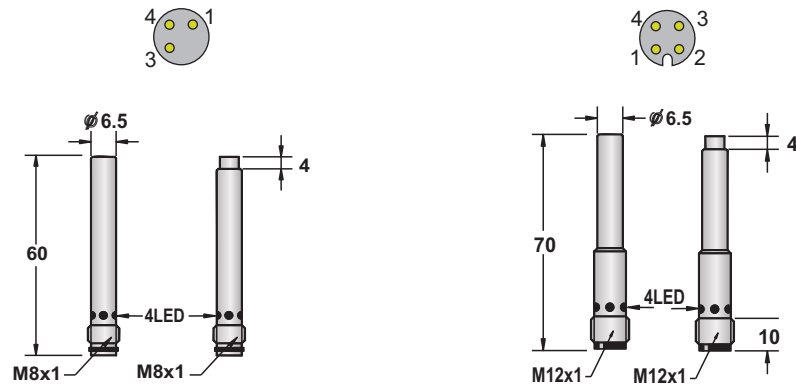
3-Wire DC Inductive



Diameter	M5		M5 - Pico 3-Pin		ø6.5mm	
	● Flush	○ Non-flush	●	●	●	○
Switching Distance Sn:mm	1mm		1mm		2mm	
LED Indicator	Yes				Yes	
Operating Voltage	10 - 30 vdc				10 - 30 vdc	
Ripple	<10%				<10%	
No Load Current	<10mA				<10mA	
Max Load Current	100mA				150mA	
Leakage Current	<0.01mA				<0.01mA	
Voltage Drop	<1.5v				<1.5v	
Switching Frequency	1.5 KHz		1.5 KHz		1.2 KHz	
Response Time	0.3ms/0.3ms		0.3ms/0.3ms		0.4ms/0.4ms	
Switching Hysteresis	<15%(Sr)				<15%(Sr)	
Repeat Accuracy	<2%(Sr)		<2%(Sr)		<2%(Sr)	
Enclosure Rating	IP67				IP67	
Operating Temperature	-25C-+70C				-25C-+70C	
Temperature Drift	<10%(Sr)				<10%(Sr)	
Protection	Short Circuit, Reverse Polarity				Short Circuit, Reverse Polarity	
Connection Type	3-wire, 2-meter Cable		3-pin Pico DC		3-wire, 2-meter Cable	
Material Tube/Face	SST /PA66				SST /PA66	
Cable Material	PVC, Dia 2.5mm		3-pin Pico DC		PVC, Dia 2.5mm	
<b>Product Style</b>	Wiring Diag.	<b>2-meter Cable</b>	<b>3-pin Pico DC</b>		<b>2-meter Cable</b>	
NPN N.O.	1	IRFS-0501-NOWC2	IRFS-0501-NOWP3		ISFS-6.502-NOWC2	ISNS-6.504-NOWC2
NPN N.C.	2	IRFS-0501-NNWC2	IRFS-0501-NNWP3		ISFS-6.502-NNWC2	ISNS-6.504-NNWC2
PNP N.O.	3	IRFS-0501-POWC2	IRFS-0501-POWP3		ISFS-6.502-POWC2	ISNS-6.504-POWC2
PNP N.C.	4	IRFS-0501-PNWC2	IRFS-0501-PNWP3		ISFS-6.502-PNWC2	ISNS-6.504-PNWC2

Note: See Terminal Connection page for wiring diagram

3-Wire DC Inductive



Diameter	ø6.5mm - Pico 3-Pin		ø6.5mm - Micro 4-Pin		
	● Flush	○ Non-flush	● Flush	○ Non-flush	
Switching Distance Sn:mm	2mm	4mm	2mm	4mm	
LED Indicator	Yes		Yes		
Operating Voltage	10 - 30 vdc		10 - 30 vdc		
Ripple	<10%		<10%		
No Load Current	<10mA		<10mA		
Max Load Current	150mA		150mA		
Leakage Current	<0.01mA		<0.01mA		
Voltage Drop	<1.5v		<1.5v		
Switching Frequency	1.2 KHz	1 KHz	1.2 KHz	1 KHz	
Response Time	0.4ms/0.4ms	0.5ms/0.5ms	0.4ms/0.4ms	0.5ms/0.5ms	
Switching Hysteresis	<15%(Sr)		<15%(Sr)		
Repeat Accuracy	<2%(Sr)	<2%(Sr)	<2%(Sr)	<2%(Sr)	
Enclosure Rating	IP67		IP67		
Operating Temperature	-25C-+70C		-25C-+70C		
Temperature Drift	<10%(Sr)		<10%(Sr)		
Protection	Short Circuit, Reverse Polarity		Short Circuit, Reverse Polarity		
Connection Type	3-pin Pico DC		4-pin Micro		
Material Tube/Face	SST /PA66		SST /PA66		
Cable Material	-		-		
Product Style	Wiring Diag.	3-pin Pico DC		4-pin Micro	
NPN N.O.	1	ISFS-6.502-NOWP3	ISNS-6.504-NOWP3	ISFS-6.502-NOWE3	ISNS-6.504-NOWE3
NPN N.C.	2	ISFS-6.502-NNWP3	ISNS-6.504-NNWP3	ISFS-6.502-NNWE3	ISNS-6.504-NNWE3
PNP N.O.	3	ISFS-6.502-POWP3	ISNS-6.504-POWP3	ISFS-6.502-POWE3	ISNS-6.504-POWE3
PNP N.C.	4	ISFS-6.502-PNWP3	ISNS-6.504-PNWP3	ISFS-6.502-PNWE3	ISNS-6.504-PNWE3

Note: See Terminal Connection page for wiring diagram

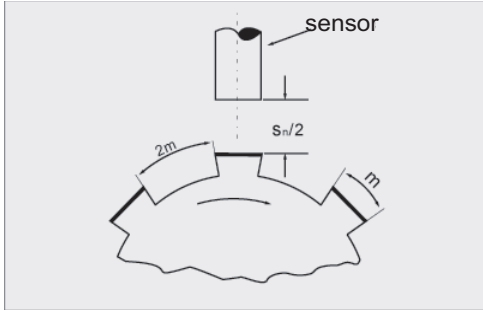
## The minimum working current

To achieve the minimum load output current switch function

## The pressure drop of the switch

After the load circuit to switch on both ends of the voltage value (load current is rated current)

## Switching frequency



Every second, switch the maximum times, measure conform to: EN 60947-5-2/IEC 947-5-2

## Through to delay

Moment of power supply is connected to the sensor prepared and normal output signal interval

## Shut off the time delay

Sensors to cut off the power supply of the moment to its ready and shut off the normal signal interval

## The response time

When the sensor switch to enter or leave the response time of the action zone

## Working environment temperature

Is to ensure reliable sensor working environment temperature range

## Protection grade

IP protection grade shall be formulated by the DIN 40050/IEC 60529 the following sensor is commonly used protection grade rules:

- IP 6 7
  - 6 Completely avoid contact with the shell between internal activity components, to prevent dust intrusion protection
  - 4 The waterproof splash, protection for water splashing from any direction Test conditions for 1 bar pressure, 10 l/minutes plus or minus 5% of the water spray for 5 minutes
  - 5 Water protection, under specific conditions, any direction nozzle spray out of the water without adverse effects Test conditions for 1 bar pressure 12.5 MM diameter nozzle distance is 3 meters
  - 7 Flood protection, in a certain pressure and time water shall not enter the shell. Test conditions, to 1 m deep water for 30 minutes
  - 8 Immersed in a specific pressure and time such as water, water will not invade the damage to the equipment. Test conditions for more than 5 meters deep water for a month

## Electromagnetic compatibility

Conform to the IEC international standards

## Allow the shock and vibration

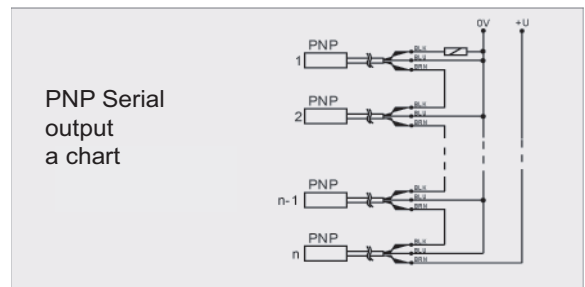
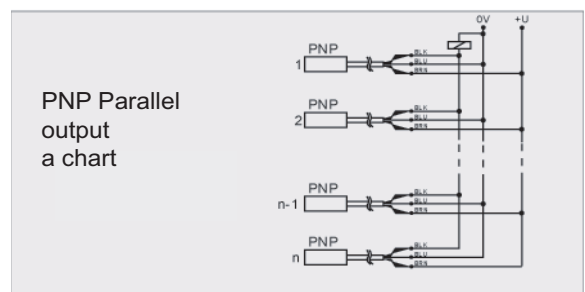
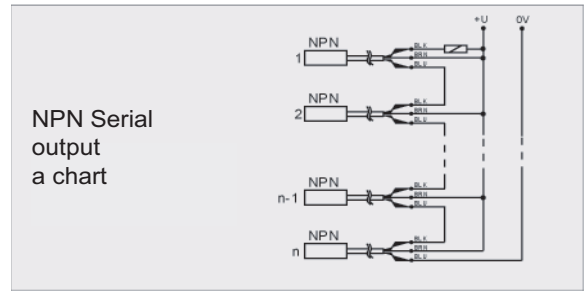
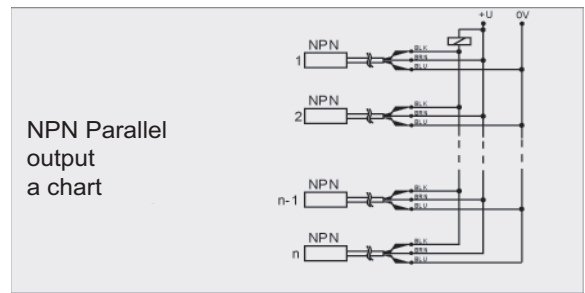
Mechanical shock test was conducted under the following conditions: conform to the IEC 60947-5-2, 30 g, using acceleration duration of 11 ms, X, Y, Z direction of the six times.

Mechanical vibration test was conducted under the following conditions: accord with IEC 60947-5-2, the amplitude of 1 mm, frequency of 10-66 hz, IEC 60947-5-2, the amplitude of 1 mm, frequency of 10-66 hz,



Products in the list of products meet the European standard EN 60947 - and EN 60947-5-22, so all have the CE mark .

## Sensor series-parallel a chart





## Functional description

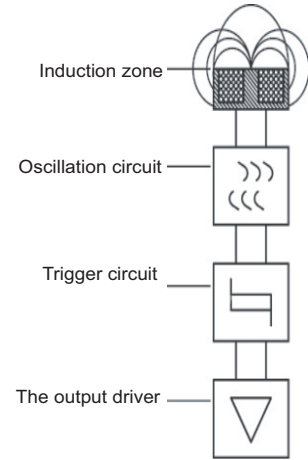
### The working principle of inductive proximity switch

Inductive proximity switch mainly is to use the metal conductor and the mutual inductance alternating electromagnetic field theory, can make the magnetic field will produce eddy current attenuation of metal materials.

This will make the magnetic field energy attenuation and decreasing amplitude, in the inductive proximity switch such changes will make the corresponding output level flip (as shown in the right 1)

### Inductive proximity switch standard induction

By induction type material for Fe37 steel to define the induction area, its thickness to 1 mm. (according to EN 60947-5-2) dimension is take induction floor for the side length of the square or for three times the diameter circle detection distance (either the head).



(figure 1)

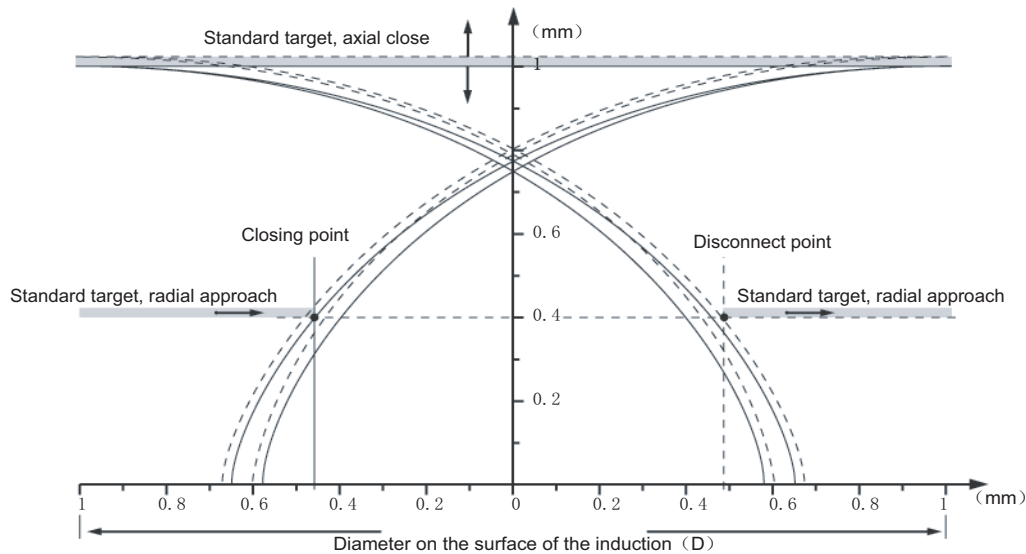
### The correction coefficient of inductive proximity switch

Relative to the standard test, the detection distance of the provisions in the specified measurement conditions, tend to reduce the detection distance, the smaller the correction factor, the action of a particular material the smaller distance, the attenuation coefficient depending on the shell, especially the shielding materials will be change. For inductive proximity switch, the electrical conductivity of the test material is the main parameters affecting the attenuation coefficient. The following data shows the induction of different objects, the induction distance attenuation coefficient, Such as right as shown in table 1.

Material:	
Target Material	Reduction Rate
Fe37 steel	1
Aluminum	0.35-0.6
Yellow copper	0.4-0.7
Copper	0.25-0.5
Stainless steel	0.8-1
Cast iron	0.95-1
Nickel	0.6-0.75

(table 1)

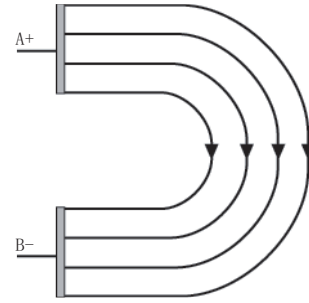
### Inductive proximity switch standard response curve (as shown in figure 2)



(figure 2)

## The working principle of capacitive proximity switch

Induction of capacitive sensor surface is composed of two concentric metal electrodes, similar to A non line around the capacitor electrode, the surface of the electrode (as shown in figure 3) A and B even received A high frequency oscillator in the feedback branch, adjustment of the oscillator to make it happen not in surface free oscillation, when the object approaches the effective sensor table surface, it entered the electric field on the surface of the electrode and the capacity of the capacitor will increase, make the oscillator start oscillation, oscillation amplitude recorded by the evaluation of A circuit, and is converted to a switch command, helps to detect any object of mesh.



(figure 3)

Capacitance sensors that can detect metal objects, but also to detect non-metallic objects, to detect metal objects can obtain larger movement distance, non-metallic materials depends on The dielectric constant. see chart 2:

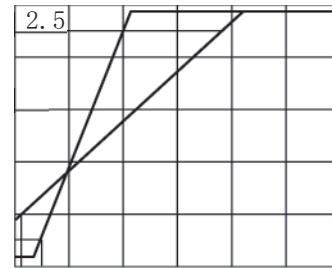
Material	Dielectric constant	Material	Dielectric constant
air, vacuum	1	alcohol	25.8
synthetic resin binder	3.6	bakelite	3.6
glass	5	mica	6
hard rubber	4	cardboard	4.5
cable rubber compounds	2.5	the marble	8
oiled paper	4	paper	2.3
gasoline	2.2	organic glass	3.2
polyamide	5	polyethylene	2.3
polypropylene	2.3	styrene	3
polyethylene compounds	2.9	ceramic	4.4
compression confetti	4	paraffin	2.2
quartz glass	3.7	quartz sand	4.5
silicon	2.8	soft rubber	2.5
teflon	2	turpentine oil	2.2
transformer oil	2.2	water	80
wood	2.7		

(table 2)

## Capacitive proximity switch standard response curve (as shown in figure 4)

### Analog proximity switch

According to the sensing surface to the change in its induction target distance lose out a continuous variation signal. Output signal voltage signal, current signal (as shown in figure 5, 6)



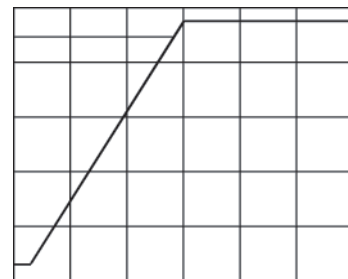
(figure 5)

## The correction coefficient of capacitance proximity switch

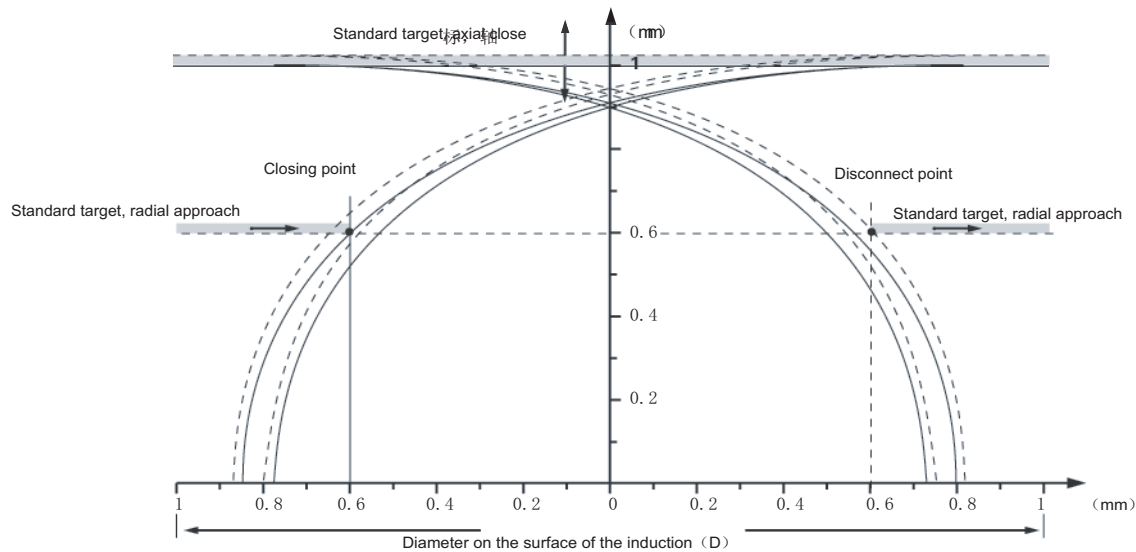
Part of the following is a list of the attenuation coefficient of material value (table 3)

Content material being tested	Attenuation coefficient
water	1
alcohol	0.7
ceramic	0.6
glass	0.5
oil	0.3

(table 3)



(figure 6)



(figure4)

## Movement distance

Movement distance is on the turn signal standard induction target and induction distance (defined in accordance with EN 60947-5-2), for normally open from disconnect to connect, normally closed from on to off. Movement distance mainly depends on the diameter of the sensor, shape and materials of sensing target and environment temperature also affect the range of induction.

## Movement distance related parameters:

Rated the movement distance is a theoretical value, this value does not take into account of tolerance, operating temperature, power supply voltage, and other issues. All action distance there is a standard test measured the effective action distance of  $S_r$

A single proximity switch in the rated working voltage and temperature of the induction distance

$$0.9S_n \leq S_r \leq 1.1S_n$$

Useful induction distance  $S_u$

Allows a single proximity switch in can guarantee the environment -25 + 70 °C temperature, input voltage rating, in line with the voltage fluctuation, measured the induction distance

$$0.81S_n \leq S_u \leq 1.1S_n$$

Reliable induction distance  $S_a$

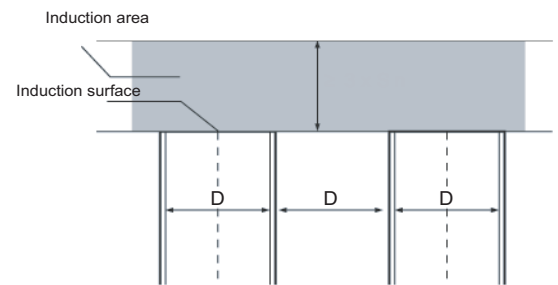
Target detection in this movement range, the switch action is reliable

$$0 \leq S_a \leq 0.81S_n$$

## Installation requirements

The installation of flush proximity switch

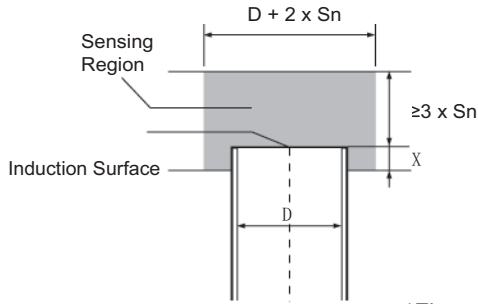
Flush switch installed near the end of the induction surface can be installed and metal surface flush, but for the sake of safety work, switch surface to the opposite of metal objects at a distance of 3 or higher sn, the distance between the adjacent two proximity switch must be  $D$  ( $D$  is the diameter of the switch) or higher (see figure 7)



(figure 7)

The installation of quasi flush proximity switch

Must flush the installation induction surface to the proximity switch table surface need to have a distance is not magnetic materials. Satisfy this condition when the switch is effective, and is not restricted. Switch induction surface to the permeability material underneath must meet minimum distance  $X$ , the following is a different diameter of sensors and the relations of  $X$  (as shown in table 4). Install schematic diagram (shown in figure 8).



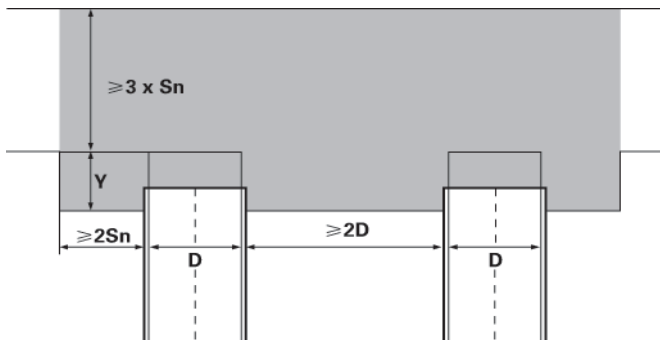
(Figure8)

Installed in the metal		
SizeD	X (mm)	Y (mm)
Φ 6.5	2	6
M8	2	6
Q8	2	6
M12	2.5	9
M18	4	16
M30	8	22

(Table4)

## The installation of the flush proximity switch

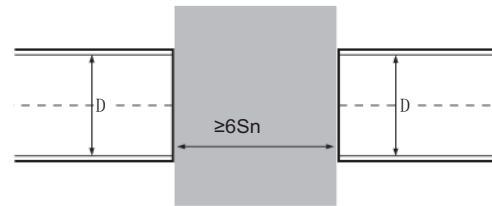
Not flush proximity switch can be identification based on their head, not flush the area around the induction surface no metal shell. Induction surface to metal installation media  $Y \geq 2S_n$  (Y values in table 4). Induction on the surface of the distance to the other side of the metal objects must be 3 or more sn, two adjacent installed close to the distance of the switch must be 2 d or higher. Install schematic diagram (as shown in figure 9).



(Figure9)

## Relative proximity switch installation

For relative proximity switch installed, the minimum distance between two induction surface must be 6 or more sn (shown in figure 10)



(Figure10)

## Tightening torque

Metal case proximity switch biggest fastening torque:	
M5	1.5Nm
M8	10Nm
M12	15Nm (Brass Shell)
	30Nm (Stainless Steel Shell)
M18	40Nm
M30	40Nm
Plastic shell proximity switch biggest fastening torque:	
M12	1Nm
M18	1.5Nm
M30	1.5Nm

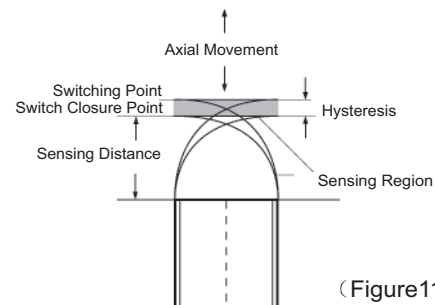
## Repeatability R

According to IEC60947-5-2, repeatability refers to the following conditions, the detection distance, cycle 8 hours,  $23 \pm 5^\circ\text{C}$  temperature humidity of 90% or less, the input voltage, the effective distance measuring the amount of change.

## Switch hysteresis H

When testing piece near the proximity switch and when testing piece left the proximity switch for the distance between the two switch points, the distance is relative to the effective distance of a percentage of the  $S_r$ . Measuring the temperature of the environment to  $23 \pm 5^\circ\text{C}$ , 3% of the rated voltage range closed to H acuties were below 15% or less.

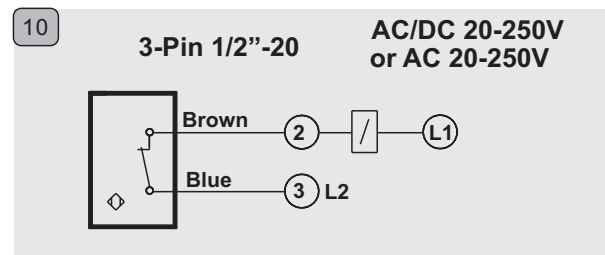
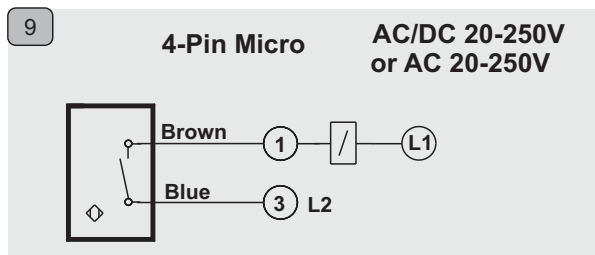
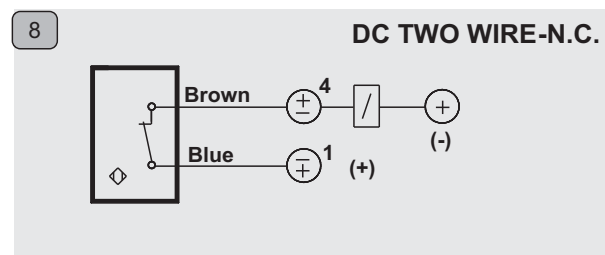
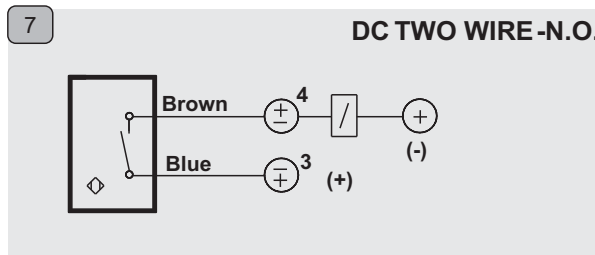
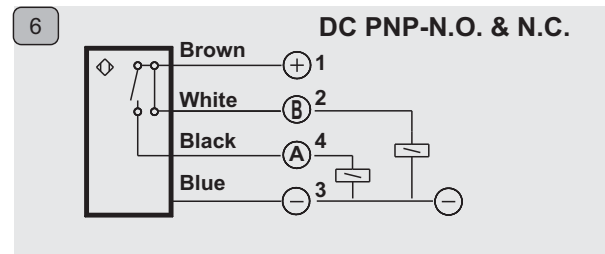
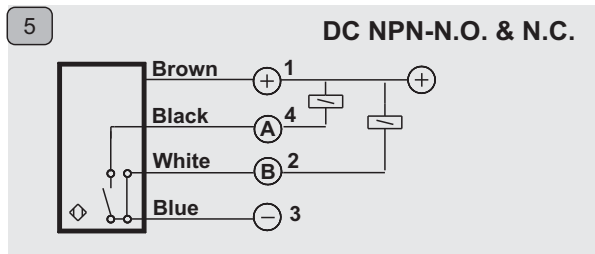
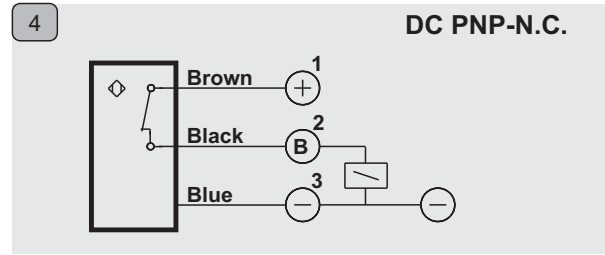
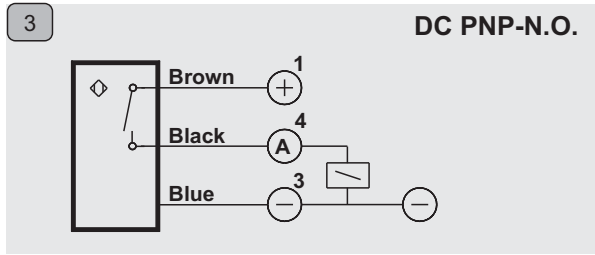
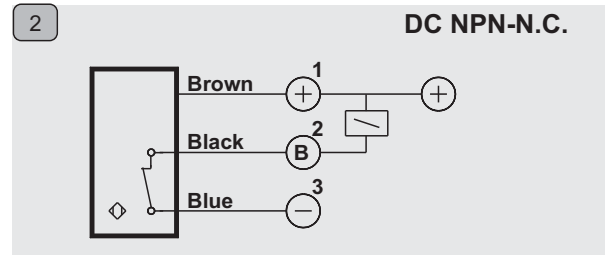
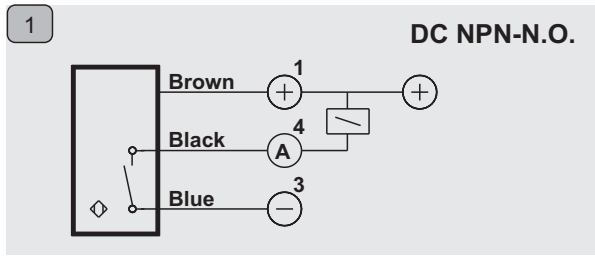
For the sensor moves switch hysteresis (as shown in figure 11, 12)



(Figure11)

# TERMINAL CONNECTIONS:

Note: For cable version use color code, for connectors use pin numbers



12mm 4-Pin Micro DC



1/2"-20 3-Pin Micro AC



8mm 3-Pin Pico DC

## Sensor View