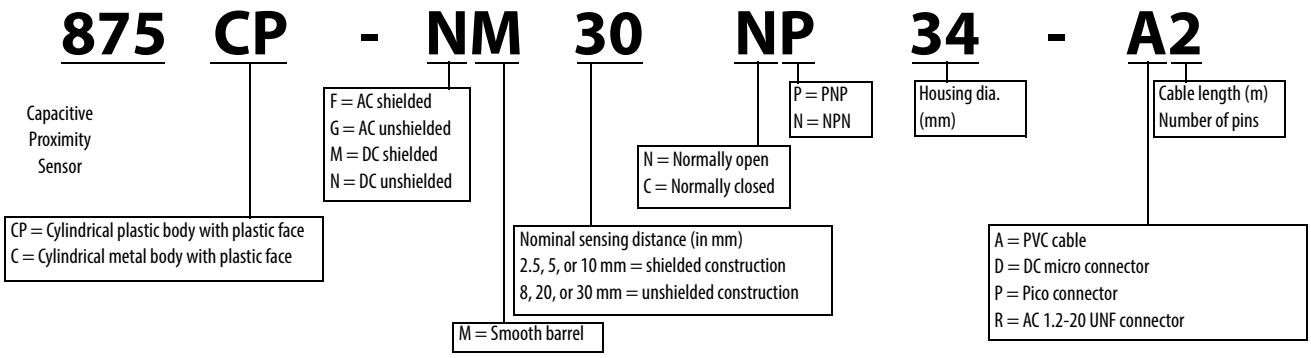
Installation Instructions

Original Instructions

Capacitive Proximity Sensors

Catalog Numbers 875C-*x*, *875CP-x*

Catalog Number Configuration



ATTENTION: If a hazardous condition can result from the unintended operation of this device, access to the sensing area should be guarded.

Specifications—AC Models

Attribute	Value
Load current, maximum	300 mA
Inrush current	2 A
Leakage current	≤1.5 mA
Operating voltage	24…240V AC
Voltage drop	≤7.5V AC
Repeatability	≤10%
Hysteresis	≤20%
Switching frequency, maximum	25 Hz
Transient noise protection	Incorporated
Enclosure	NEMA 1, 3, 4, 6, 13; IP67 Plastic or nickel-plated brass
Certifications	UL CSA and CE Marked for all applicable directives; IEC 947-5-2
Connections	Cable: 2 m (6.56 ft) length, 2-conductor PVC Quick-disconnect: 3-pin micro
Status indicators	Green: Power; Yellow: Output
Operating Temperature [C (F)]	-25…+70° (-13…+158°)

Specifications—DC Models

Attribute	Value
Load current, maximum	300 mA
Leakage current	--
Operating voltage	10…48V DC
Voltage drop	<2V
Repeatability	≤10%
Hysteresis	≤20%
Switching frequency, maximum	100 Hz
Transient noise protection	Incorporated
Reverse polarity protection	Incorporated
Short circuit protection	Incorporated
Overload protection	Incorporated
Enclosure	NEMA 1, 3, 4, 6, 13; IP67 Plastic or nickel-plated brass
Certifications	UL CSA and CE Marked for all applicable directives; IEC 947-5-2
Connections	Cable: 2 m (6.56 ft) length, 3-conductor PVC Quick-disconnect: 4-pin micro, 3-pin pico Conduit opening: 1/2 14 NPT internal thread with screw terminals
Status indicators	Green: Power; Yellow: Output
Operating Temperature [C (F)]	-25…+70° (-13…+158°)

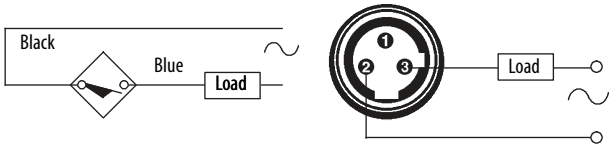
Wiring

All external wiring should conform to the National Electric Code and applicable local codes. Connect the proximity switch to the power supply and load as shown in the wiring diagrams. If the positive (+) and the negative (-) wires are reversed, the switch will not operate properly. The sensor will not be damaged because it is equipped with reverse polarity protection.

Wiring Diagrams for AC Switches

Cable *Micro Connector*

Normally Open or Normally Closed

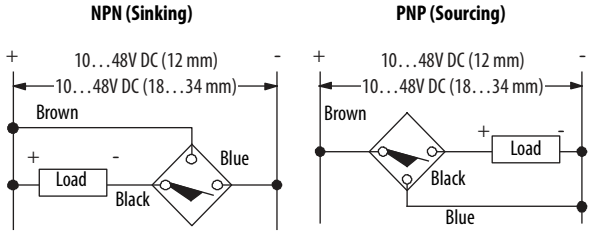


Note: Load can be switched to pin 2.

Wiring Diagrams for DC Switches

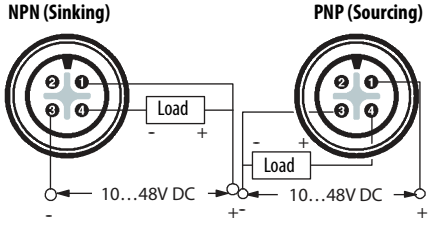
Cable

Normally Open or Normally Closed



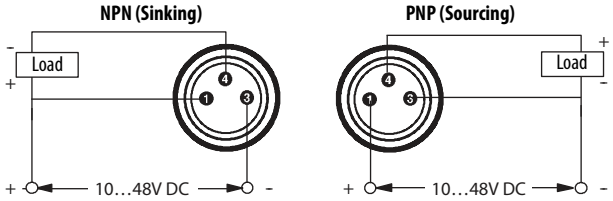
Micro connector

Normally Open or Normally Closed



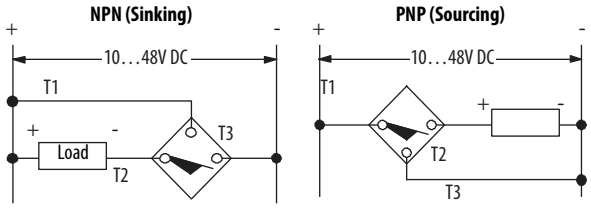
Pico connector

Normally Open or Normally Closed



Terminal Chamber

Normally Open or Normally Closed



Wiring Switches in Series

Switches can be connected in series with a load. For proper operation, the voltage across the energized load must be less than or equal to the minimum supply voltage minus the voltage drops across all sensors. The load is energized only when all switches are closed.

Wiring Switches in Parallel

Switches can be connected in parallel to energize a load. The sum of the maximum leakage currents for the switches must be less than the maximum off-state current of the load device. The load is energized when one or more of the switches are closed.

Sensing Distance Adjustment

The sensing distance of an Allen-Bradley® capacitive proximity sensor can be adjusted via a 20-turn potentiometer at the rear of the sensor housing. Although this is a clutched potentiometer, it does not emit an audible "click" when turned beyond its range.

The maximum sensing distance for each sensor can be determined using the Catalog Number Configuration on page 1. If the sensing distance is set higher than the maximum, the unit may lock in the triggered state. The minimum distance to which each sensor can be adjusted is listed in the Minimum Adjusted Sensing Distance table. Nominal sensing distances are measured using a standard target (see Target Considerations on page 3).

Minimum Adjusted Sensing Distance

Target	Minimum Distance
12 mm (0.47 in.) metal housing	0.4 mm (0.01 in.)
18 mm (0.71 in.) metal housing	1.0 mm (0.04 in.)
18 mm (0.71 in.) plastic housing	2.0 mm (0.08 in.)
30 mm (1.18 in.) metal housing	2.0 mm (0.08 in.)
30 mm (1.18 in.) plastic housing	5.0 mm (0.20 in.)
34 mm (1.34 in.) plastic housing	7.0 mm (0.27 in.)
Limit switch style housing	10.0 mm (0.39 in.)

This unit is not designed for reliable operation when adjusted to distances shorter than those in the Minimum Adjust Sensing Distance table.

Adjustment Procedure

1. Mount the sensor on a stable surface or support (see Mounting Consideration).
2. Apply power to the sensor per wiring diagram (see Wiring). Check that the green "power" status indicator turns on.
3. Determine a desired sensor-to-target distance, which is between the rated minimum and maximum sensing distances for the unit (see Target Considerations and Dielectric Constants).
4. Multiply this desired sensing distance by 1.2 and place the target at the resulting new distance from the sensor. Check the yellow "output" status indicator.
5. **Normally open models only**: If the yellow status indicator is off, turn the potentiometer slowly clockwise until the indicator turns on. If the yellow status indicator is already on, turn the potentiometer counterclockwise until the indicator turns off, then slowly clockwise until the indicator turns on again.

   Normally closed models only: If the yellow status indicator is on, turn the potentiometer slowly clockwise until the indicator turns off. If the yellow status indicator is already off, turn the potentiometer counterclockwise until the indicator turns on, then slowly clockwise until the indicator turns off again.
6. Remove the target and check that the yellow status indicator turns off for normally open models and on for normally closed models.
7. Place the target at the original desired sensor-to-target distance determined in step 3. If the yellow status indicator turns on for normally open models and off for normally closed models, the sensor is correctly adjusted.

Target Considerations

Standard Target

The standard target is a grounded, 1 mm (0.04 in.)-thick square of mild steel. The side lengths of a standard target are equal to either the diameter/width of the sensor face or three times the nominal sensing distance, whichever is greater.

Shielded vs. Unshielded

Shielded capacitive sensors can be used to sense with conductive (metal, water) or nonconductive (wood, paper, glass, plastic) materials. Their internal ground allows them to detect grounded or ungrounded targets. It also makes them more susceptible to dust and moisture in the environment than unshielded sensors. Unshielded capacitive sensors are used primarily to sense grounded, conductive materials at maximum sensing distances. They are less sensitive to nonconductive materials than shielded sensors. This makes them able to detect conductive materials through a nonconductive material, such as water inside a plastic tank. In this case, the nonconductive material can be no thicker than the sensor sensing distance. (**Note:** capacitive sensors cannot sense through metals.) Dust and moisture in the atmosphere have less effect on unshielded sensors than on shielded models.

Grounding

Targets should be grounded for most reliable sensing. If a ground path to the target is not available, shielded sensors are recommended. When attempting to detect nonconductive materials with an unshielded sensor, a path to ground is required.

Dielectric Constants

The dielectric constant is one of the material properties of a target. Materials with higher dielectric constants are more easily detected by capacitive sensors and are therefore detected at greater sensing distances than those with low constants. See **Dielectric Constants of Industrial Materials on page 4** for a list of common industrial materials and their dielectric constants.

Correction Factors

Correction factors are multipliers, which are determined by the mass, material, and grounding state of the target. To calculate an approximate sensing distance for an application, multiply the nominal sensing distance S_n by the correction factor for that applications target (see the Correction Factors for Most Common Materials on page 4).

Correction Factors for Most Common Materials

Material	Correction Factor
Grounded metals	1.0
Unground metals	0.85
Water	1.0
Glass	0.55
Paper (1 ream, 500 sheets)	0.55
Wood	0.45
Stone	0.65
Ceramic tile	0.25
PVC	0.15

Environmental Factors

Capacitive sensors can be compromised by humidity and moisture on the sensor face. Oil or water droplets on the sensor face can cause the unit to become unstable. Dust and moisture in the atmosphere have less of an effect on unshielded sensors than on shielded models.

Mounting Considerations

The sensor must be securely mounted on a firm, stable surface, or support. A mounting configuration, which is unstable or subject to excessive vibration, may cause intermittent operation.

Shielded vs. Unshielded

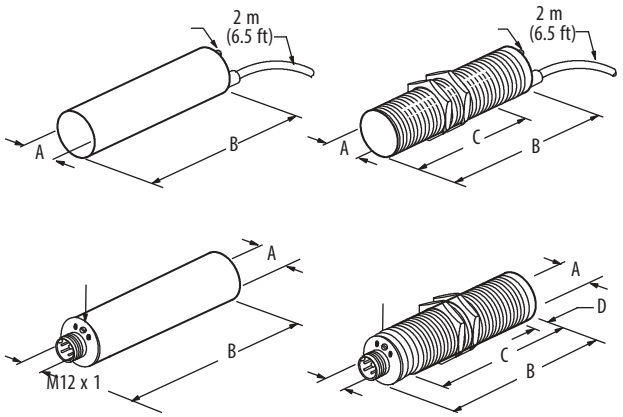
Shielded sensors can be mounted flush with surrounding materials. Unshielded sensors must be mounted such that the area around the sensing face is free of any material, which could trigger the sensor. Minimum clearance in all directions should be equal to the diameter or width of the sensor.

Spacing Between Devices

When two shielded or unshielded sensors are facing each other, they must be mounted far apart to avoid interference. Minimum spacing should be eight times the housing diameter or width. When two shielded sensors are mounted side by side, the minimum distance between them must be greater than one diameter or width. When two unshielded sensors are mounted side by side, the distance between them should be at least four times their diameter or width. See Dimensions section for housing sizes.

Dimensions

Cylindrical Style



Dimensions

Thread	Shielded	Connection	mm (in.)		
			A	B	C
M12x1	Y	Cable	12 (0.47)	61.5 (2.42)	40.5 (1.59)
	Y	Pico	12 (0.47)	63.5 (2.50)	40.5 (1.59)
M18x1	Y	Cable	18 (0.71)	51.4 (2.02)	47.4 (1.87)
	Y	Pico			
	N	Cable		51.8 (2.04)	51.8 (2.04)
	N	Pico			
M30x1.5	Y	Cable	30 (1.18)	53.1 (2.09)	53.1 (2.09)
	Y	Micro			
	N	Cable		52.1 (2.05)	46.1 (1.81)
	N	Micro			
N/A	N	Cable	34 (1.34)	52 (2.05)	N/A
	N	Micro			

Dielectric Constants of Industrial Materials

This is a partial listing. For more information, see the CRC Handbook of Chemistry and Physics (CRC Press), the CRC Handbook of Tables of Applied Engineering Science (CRC Press), or other applicable sources.

Dielectric Constants

Material	Value
Acetone	19.5
Acrylic resin	2.7…4.5
Air	1.000264
Alcohol	25.8
Ammonia	15…25
Aniline	6.9
Aqueous solutions	50…80
Bakelite	3.6
Benzene	2.3
Carbon dioxide	1.000985
Carbon tetrachloride	2.2
Celluloid	3
Cement power	4
Cereal	3…5
Chlorine liquid	2
Ebonite	2.7…2.9
Epoxy resin	2.5…6
Ethanol	24
Ethylene glycol	38.7
Fired ash	1.5…1.7
Flour	1.5…1.7
Freon R22 & 502 (liquid)	6.11
Gasoline	2.2
Glass	3.7…10
Glycerine	47
Marble	8.0…8.5
Melamine resin	4.7…10.2
Mica	5.7…6.7
Nitrobenzine	36
Nylon	4…5
Oil saturated paper	4
Parafin	1.9…2.5

Dielectric Constants

Material	Value
Paper	1.6…2.6
Perpex	3.2…3.5
Petroleum	2.0…2.2
Phenol resin	4…12
Polyacetal	3.6…3.7
Polyamide	5
Polyster resin	2.8…8.1
Polyethylene	2.3
Polypropylene	20.…2.3
Polystyrene	3
Polyvinyl chlorine resin	2.8…3.1
Porcelain	4.4…7
Powdered milk	3.4…4
Press board	2…5
Quartz glass	3.7
Rubber	2.5…35
Salt	6
Sand	3…5
Shellac	2.5…4.7
Shell lime	1.2
Silocon varnish	2.8…3.3
Soybean oil	2.9…3.5
Styrene resin	2.3…3.4
Sugar	3
Sulphur	3.4
Teflon	2
Toluene	2.3
Transformer oil	2.2
Terpentine oil	2.2
Urea resin	5…8
Vaseline	2.2…2.9
Water	80
Wood, dry	2…7
Wood, wet	10…30

Capacitive Proximity Sensor Accessories

Mating Cables

The following are straight connector, 2 m (6.56 ft) cables. Visit our website at http://ab.rockwellautomation.com/ for other types.

Description	Cat. No.
AC micro connector	871A-CS3-R2
DC micro connector	871A-CS4-D2
DC pico connector	871A-CS3-P2

Mounting Wells

Description	Cat. No.
12 mm Delrin® with external thread	871A-WTD12
12 mm Teflon™ with external thread	871A-WTT12
18 mm Delrin with external threads	871A-WTD18
18 mm Teflon with external thread	871A-WTT18
30 mm Delrin with external threads	871A-WTD30
18 mm Teflon with external thread	871A-WTT30
30 mm polyethylene, bolt-on type	871A-WSPE30
34 mm Delrin with external threads	871A-WTD34
34 mm Teflon with external thread	871A-WTT34

Mounting Brackets

Description	Cat. No.
Spring Return, stainless steel	
12 mm	871A-BXS12
18 mm	871A-BXS18
30 mm	871A-BXS30
Spring Return, anodized aluminum	
12 mm	871A-BXN12
18 mm	871A-BXN18
30 mm	871A-BXN30
Right Angle, stainless steel	
12 mm	871A-BRS12
12 mm with spring return bracket	871A-BRS22
18 mm	871A-BRS18
18 mm with spring return bracket	871A-BRS30
30 mm	871A-BRS30
30 mm with spring return bracket	871A-BRS47
Right Angle, nickel-plated brass	
12 mm	871A-BRN12
12 mm with spring return bracket	871A-BRN22
18 mm	871A-BRN18
18 mm with spring return bracket	871A-BRN30
30 mm	871A-BRN30
30 mm with spring return bracket	871A-BRN47
Clamp, plastic	
12 mm	871A-BP12
18 mm	871A-BP18
30 mm	871A-BP30
34 mm	871A-BP34
Swivel, Tilt, plastic	
30 mm	60-2439
End Caps, plastic (unshielded models)	
12 mm	871A-KP12
18 mm	871A-KP18
30 mm	871A-KP30
Conduit Adaptors, nickel-plated brass	
12 mm	871C-N13
18 mm	871C-N19
30 mm	871C-N31

Notes:

Rockwell Automation maintains current product environmental information on its website at
http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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