Capacitive Proximity Sensors Application Notes

DURAKOOL

1 DESCRIPTION

Capacitive Proximity Sensors sense both electrically conducting and non-conducting materials, solids and liquids, without making contact. Adjustable sensitivity allows them to be tuned to differentiate between various materials or cope with different installations.

2 FEATURES

- -30 to 100ºC operating range
- Fixed lead, or connector versions. M18, M30 & 34mm body sizes available.
- Reverse polarity & short circuit protection.
- Adjustable sensitivity to sense different targets.
- Adjustable range 1-40mm depending on switch & target.
- LED for switch state. Connector versions include power on LED.
- AC, PNP & NPN versions, NO or NC
- All switches are available as normally open or closed, i.e. CPO or CPC
- Analog 4-20mA also available.
- Tough chemically resistant GRP housing.
- 5m and 10mm cable options are available, please call the factory.
- Special static resistant sensors are available for particular applications.
- AC versions for the US market feature 1/2" UNF connector thread. Add –US to part number (for 1/2" UNF 20TPI thread), -EU (for European M12 x 1)

3 TYPICAL APPLICATIONS

- Non-invasive contents detection through on metallic containers.
- Level detection or flow indication of solids or liquids. E.g. for filling processes, hoppers, silos, pipelines, granules, powders, confectionary, foodstuffs or inks.
- Bottle counting with contents detection.
- Packaging counting.
- Band Loop controlling or breakage indication.
- Use as non-contact switches.
- Wire winding break detection.

4 SPECIFIC APPLICATIONS

Feed control of plastic granules in moulding,
Hopper feed control of granules in color mixing,
Feed control of flour level
High level of Molten Glue,
Shower switch with no touch activation,
Counting or monitoring of non-metallic parts,
Low cost moisture control in foodstuffs,
Level control in powder materials,
Wet spot detection for process control,
Ink level detection,
Liquid level detection in sight tube (non-invasive),
Overflow/high level detection in the blind spot of ultrasonic sensors,
Detection of stretch and sag-in non-metallic belts,
Paper out detection,
Detection of liquid flow from outflow pipe.

INSTALLING, CONNECTING AND SETTING UP YOUR CAPACITIVE PROXIMITY SENSOR

MECHANICAL INSTALLATION (non flush or semi flush)

Non-Flush Mounting: Capacitive Proximity Sensors function best when non-flush mounted separate from surrounding materials as shown. Wherever possible and in order to achieve maximum range, mount your Capacitive Proximity Sensor non-flush.


NON FLUSH FITTING   A = NOT less than 3d
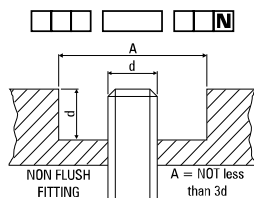
In any installation, including the above, the maximum sensitivity setting for the sensor will be just below the point at which it detects itself, its mounting or surrounding material.

Flush or semi-Flush Mounting.
Capacitive Proximity Sensors can be flush or semi-flush mounted in surrounding metal (or other material). There will be a reduction in available sensitivity. Adjust your Sensor according to "Find maximum settings to detect targets of very low dielectric or if semi flush fitting" on Page 4.

FLUSH FITTING
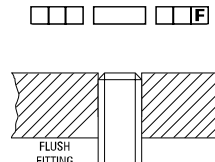
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1101 Lafayette Street, Elkhart, Indiana. USA
Tel: +1-574-295-6330 Fax: +1-574-293-8013
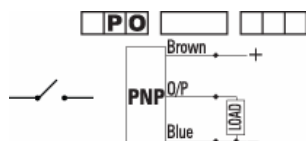**Email: sales@aecsensors.com**
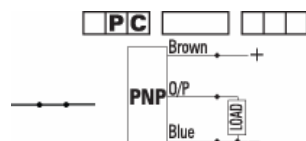**http://www.aecsensors.com**

ELECTRICAL CONNECTION

Single Units DC
Capacitive Proximity Sensors for DC use have transistor outputs, and normally have three wires.
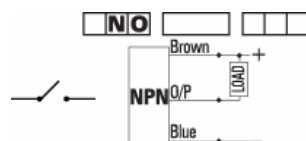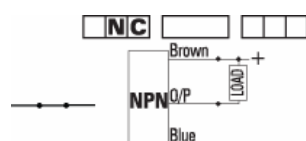
3 Wire DC switch

Normally open, switching positive (PNP)

Normally closed, switching positive (PNP)
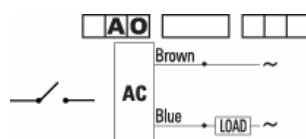
Normally open, switching negative (NPN)

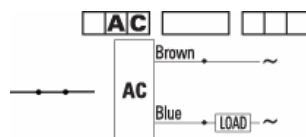Normally closed, switching negative (NPN)

Single units AC
Capacitive Proximity Sensors suitable for AC supply have thyristor outputs. AC Capacitive switches have two wires.
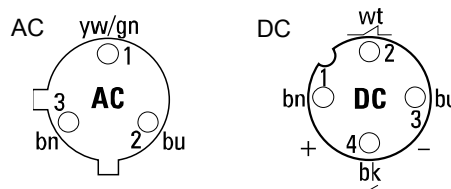
2 Wire AC switches

Normally open

Normally closed

Units with Connectors
Capacitive Proximity Sensors for use with plug systems are connected to cables that are connected as follows:

Logic Interface
Capacitive Proximity Sensors may be interfaced with most types of industrial logic. DC Capacitive Proximity Sensors are open collector type and therefore require an external pull up resistor when used with TTL as shown.
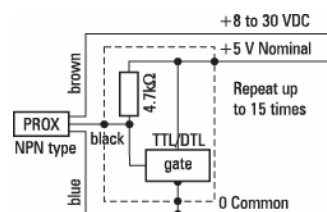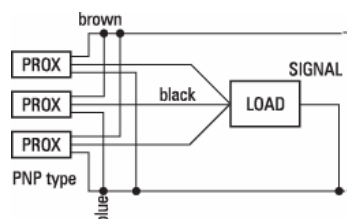
Note: Most programmable logic controllers (PLC) have AC interfacing options. These may be driven by AC Capacitive Proximity Sensors provided the leakage current (mA) is not interpreted by the PLC as an 'ON' condition and the PLC draws the minimum load current (3mA Capacitive) in the 'ON' condition (fit an additional external load if necessary or use DC interface and DC switch).

Multiple Units: Parallel
DC
The number (N) of switches is usually only limited by the availability of sufficient supply current.

AC

Capacitive Proximity Sensors for AC use cannot, as a rule be operated in parallel. Buffering relays should be installed. Alternatively, the relay may be dispensed with if only one switch is ever actuated at a time.
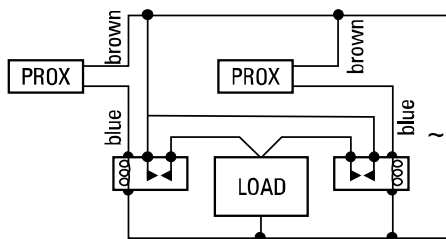
Multiple Units: Series
DC

The maximum number of DC Capacitive Proximity Sensors in series is limited by the supply voltage (V supply), the voltage drop across a closed switch (V switch) and either the minimum working voltage of the switch or the minimum working voltage of the load, whichever is greater (Vmin).
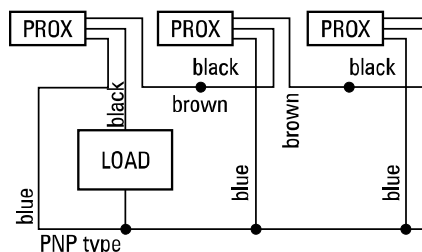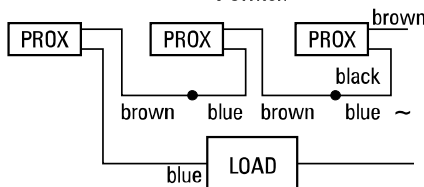
$$N = \frac{V \text{ supply} - V \text{ min}}{V \text{ switch}}$$

AC

The number of AC Capacitive Proximity Sensors which will operate in series is limited by the supply voltage (V supply), the minimum switch operating voltage (V switch), and the voltage dropped across the load by the current consumption of the switch (V load).

$$N = \frac{V \text{ supply} - V \text{ load}}{V \text{ switch}}$$

SETTING UP AND ADJUSTING SENSITIVITY

Durakool Capacitive Proximity Sensors are adjustable. To adjust the sensing range (sensitivity) first remove the black protecting cover from the potentiometer adjusting screw. Insert the screwdriver, supplied with the sensor, to engage the potentiometer screw.
Turn the screw clockwise to increase sensitivity or anticlockwise to decrease sensitivity.

Switch State Indication by LED
On normally open or closed Capacitive Proximity Sensors, the LED indicates the output of the sensor.
On normally open / closed selectable "CXU" types a lit LED indicates detection of a target.
(on connector versions an additional green LED indicates power is on).
With Analog "CIC" types, a bicolour LED (red/green) indicates a target is in the linear area.

Setting up for direct sensing of a target material.

CAUTION: Capacitive Proximity Sensors will detect your body or hands. When adjusting the sensor, keep clear of the sensing field.

Adjusting a normally open unit. "CXO" type.
With your intended target present and the sensor installed and powered.
1)	Ensure the sensor is in the off state (turn screw anticlockwise until the LED is out).
2)	Now slowly turn the screw clockwise until the LED comes on.
3)	Now turn the screw clockwise another 1/4 turn and replace the black protecting cover over the adjustment screw.
4)	The sensor is now set up to detect when the target is present. To check the sensor switches off correctly, remove the target

Adjusting a normally closed unit. "CXC" type.
With your intended target present and the sensor installed and powered.
1)	Ensure that the sensor is in the on state (turn the screw anticlockwise until the LED is on).

1) Now turn the screw clockwise until the LED goes out.
2) Now slowly turn the screw clockwise another 1/4 turn and replace the black cover over the screw.
3) The sensor is now set up to detect when the target is present. To check the sensor switches on correctly, remove the target.

If the sensor does not change state when the target is removed; the difference between the target present and absent is very small or perhaps because of the effect of surrounding materials in the installation then follow the procedure below:

Find the maximum settings to detect targets of very low dielectric or if semi– flush fitting. With no target present, ensure that the sensor is powered and installed correctly.

1) Ensure the sensor is in the "no target present" state by turning the screw anticlockwise to decrease sensitivity. (For normally Open sensors the "no target present state" is open circuit with output/load LED off, for normally closed its is closed with output/load LED On.
2) To establish the "stay on point", turn the screw clockwise to increase sensitivity, until the sensor changes state. The "stay on point is when the sensor is detecting its surroundings or itself.
3) To establish the maximum setting below the "stay on point", turn the screw anticlockwise to decrease sensitivity until the sensor switches off and then 1/4 turn more. Replace the black cover over the adjuster.

Setting up through a sight glass, window or into a metallic container.
The sensing face of the Capacitive Proximity Sensor should be as near as possible to the face of the sight glass or window. Follow the procedure to set up for direct sensing of a target. If there is a problem with the sensor achieving the "no target present state" follow the procedure for detecting targets with very low dielectric.

Caution: If there are liquid residues deposited on the inside of a container, this can establish a path to earth and cause false detection. If the target material leaves residues, re-adjust the sensor with the residue present.

CAPACITIVE SENSING DISTANCE

Nominal sensing range is specified with a standard 1mm thick square target of earthed mild steel having sides equal to 3x the nominal sensing distance. If the target is of another material, or of a different size, there will be a variation in the sensing distance achieved.

Material	Material Factor
Mild Steel	1.0
Cast Iron	1.0
Aluminium Foil	1.0
Stainless Steel	1.0
Brass	1.0
Aluminium	1.0
Copper	1.0
Water	0.9
Alcohol	0.7
PVC	0.5
Glass	0.5
Ceramics	0.4
Wood from	0.2
Beer	0.9
Coca Cola	0.9
Lubricating Oil	0.1

CONSTRUCTION MATERIALS

Housing Material
All Durakool Capacitive Proximity Switches and Sensors feature a GRP Crastine housing which is resistant to impact and shock and is flame retardant to UL90V0. The following solvents will not effect the housing material.

Acetone, Brake Fluid ATF, Carbon Tetrachloride, Diesel Oil, Ethanol, Ethyl Acetate, High Octane Petrol, Hydrochloric acid 10%, Methanol, Nitric acid 10%, Seawater, Sodium Hydroxide, Sulphuric acid 28%, Toluene and Trichloroethylene.

For information on solvents not listed here, please contact the factory.

Cable Materials
Unless otherwise specified, cables are PVC insulated.

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General Information

Specifications are supplied with the product. When power is first applied some AC Capacitive Sensors may be momentarily operated for about 50msecs. The maximum voltage of DC Sensors is 30V. It is sometimes forgotten that a rectified 24VAC supply has a peak value of 1.4 x the AC RMS value. (i.e. 34V)

All Durakool Capacitive Proximity Sensors are covered by a 2 year replacement guarantee against faulty material or workmanship.

IMPORTANT
These switches should only be installed by competent personnel only.

FURTHER INFORMATION

If there are any other technical queries regarding the installation of Durakool Capacitive Proximity Sensors, please contact your local distributor or our Sales Office.

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Is a registered trade mark.

We take no responsibility for the effects of using the product outside its specification and in areas for which it was not designed. We also reserve the right to alter specifications without notice.

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