

AC and AC/DC Outputs

Figure 1 AC/DC Outputs - "3", "31", "33", non-SCP

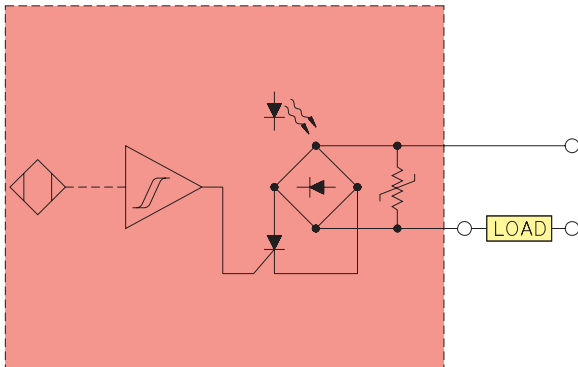
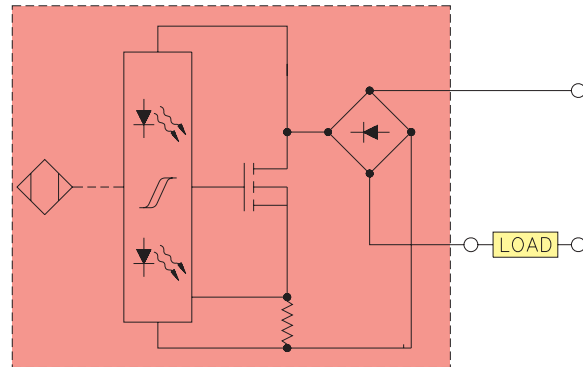


Figure 2 AC/DC Outputs - "30", "32", "40" SCP

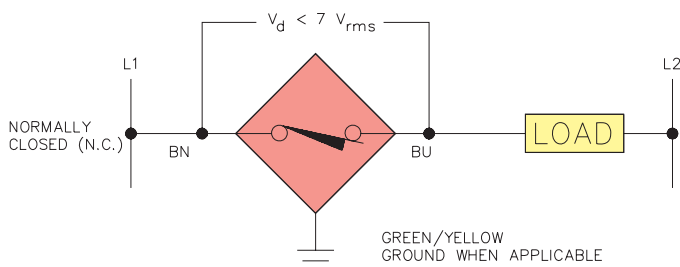
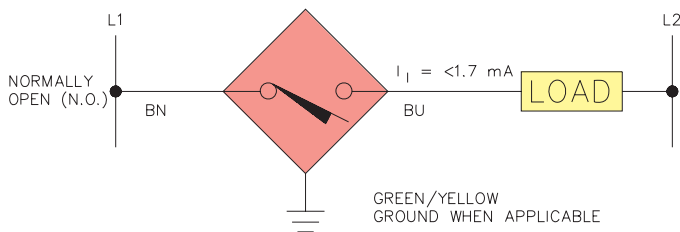


SCP = Short-circuit Protected

These sensors are used as pilot devices for AC-operated loads such as relays, contactors, solenoids, etc. The solid-state output permits use of the sensors directly on the line in series with an appropriate load. They, therefore, replace mechanical limit switches without alteration of circuitry, where operating speed or environmental conditions require the application of solid-state sensors.

These sensors are typically available in a voltage range of 20-250 VAC. All models are available with either normally open (N.O.), normally closed (N.C.) or programmable outputs (from N.O. to N.C.). Careful consideration must be given to the voltage drop across AC/DC sensors when used at 24 VDC.

Figure 3 Electro-Mechanical Equivalents



Since the sensors are connected in series with the load by means of only two leads, an off-state current flows through the load in the magnitude of approximately 1.7 mA.

This, however, does not affect the proper and reliable performance of most AC loads. Another characteristic of solid state sensors is a 5 to 7 volt drop developed across the sensor in the ON state.

All models contain a snubber network to protect against transients from inductive loads, which can cause false triggering.

Short-Circuit and Overload Protection

TURCK AC sensors with the Voltage Range designation "30", "32" or "40" are short-circuit and overload protected (manual reset). These sensors incorporate a specially designed circuit which continuously monitors the ON state output current for a short-circuit or overload condition. If either of these fault conditions occurs, the output is latched OFF until the power has been cycled OFF and ON again.

Always select short-circuit and overload protected sensors whenever possible.



CAUTION!



DO NOT...

operate an incandescent light bulb as a load.
The extremely high cold current will cause an overload condition.



DO NOT...

operate a proximity sensor from a wall outlet without a load.
This is considered a "dead" short and can cause catastrophic damage to nonshort-circuit protected sensors.



DO NOT...

directly operate a motor with a proximity sensor.
The inrush current can cause an overload condition.
Always use a motor starter, relay or other appropriate device.

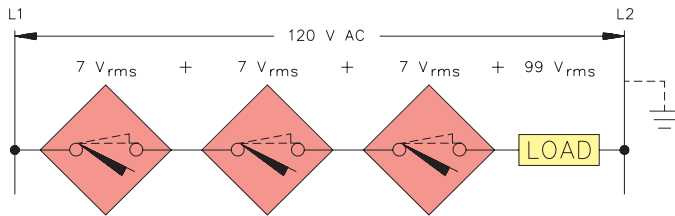


DO NOT...

forget to ground. AC and AC/DC sensors must be grounded or there exists a potential of electrical shock.

Series Connection

Figure 4



Series-connection: (Figure 4)

N.O. sensors: AND Function
(target present, all sensors: load “on”)

N.C. sensors: NOR Function
(target present, any sensor: load “off”)

The maximum number of sensors to be operated in series depends on the stability of the line voltage and the operating characteristics of the load in question. The supply voltage minus the accumulative on state voltage drop across the series connection (approximately 7 Vrms per sensor) must be \geq the minimum required load voltage.

Mechanical Switches in Series

Problem:

Mechanical switches in series with proximity sensors should always be avoided because they can create an open circuit, leaving the proximity sensor without power. In order to operate properly, a proximity sensor should be powered continuously. A typical problem encountered when the mechanical contact closes while the target is present is a short time delay that is experienced before the load energizes (time delay before availability).

Solution:

A 33 k Ω , 1W by-pass resistor can be added across the mechanical contact to eliminate the time delay before availability. This will allow enough leakage current to keep the sensor ready for instantaneous operation.

Figure 5

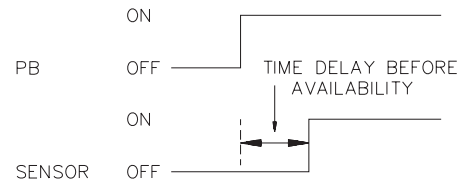
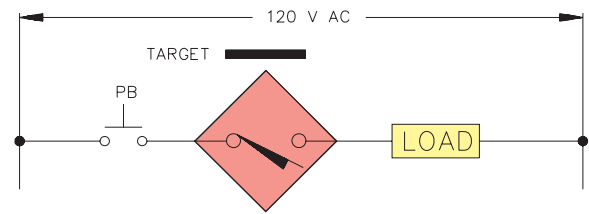
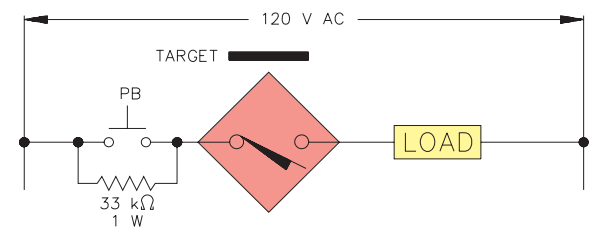


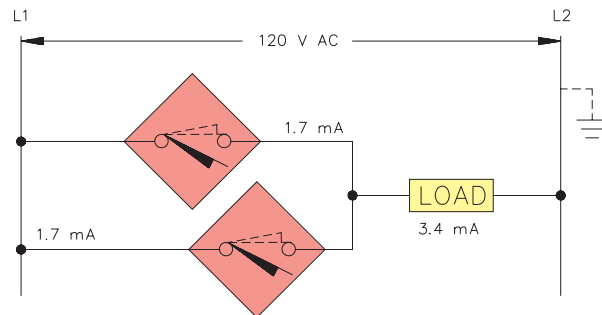
Figure 6



Parallel Connection

Figure 7

Parallel Connection: (Figure 7)
 N.O. sensors: OR Function
 (target present, any sensor: load “on”)
 N.C. sensors: NAND Function
 (target present, all sensors: load “off”)



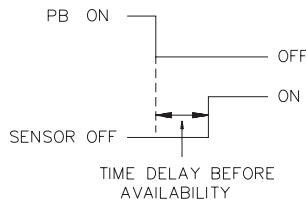
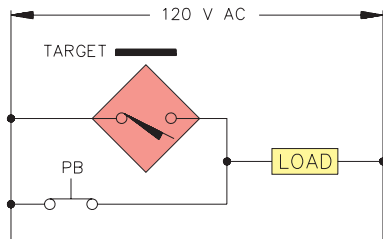
Wiring AC proximity sensors in parallel can result in inconsistent operation and should generally be avoided.

On-state voltage drop: With any sensor ON, the voltage across all other sensors is typically 7 Vrms. Since the minimum rated voltage for AC sensors is 20 Vrms, no other sensor with a target present can turn ON until the first sensor turns OFF. This transition is not instantaneous due to the time delay before availability, during which the load may drop out.

Leakage current through the load: This is equal to the total leakage of all sensors wired in parallel. Too much leakage into a solid state load can cause the input to turn ON and not turn OFF. Small relays may not drop out if the leakage current exceeds the relay’s holding current.

Mechanical Switches in Parallel

Figure 8

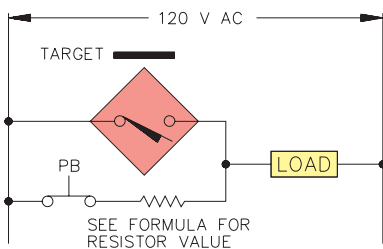


Problem:

As previously discussed, proximity sensors should be powered continuously to avoid the time delay before availability during power-up.

With mechanical switches in parallel, the sensor is shorted out every time the contact is closed, leaving it without power. If the target is present when the mechanical contact is opened, a small delay will be experienced during which the load may drop out.

Figure 9



Solution:

This delay can be avoided by adding a resistor in series with the mechanical contact. The voltage drop developed across the resistor with the contact closed will be enough to keep the sensor active. Use the formula below to determine the value and wattage.

Formula:

$$R = \frac{\text{minimum operating voltage of proximity sensor}}{\text{load current at operating voltage}}$$

Example:

$$R = \frac{20 \text{ V}}{180 \text{ mA}}$$

$$R = 110 \text{ W}$$

Minimum resistor wattage rating: $E \times I$
 Example: $20 \text{ V} \times 180 \text{ mA} = 3.6 \text{ W} \approx 5$ watts recommended