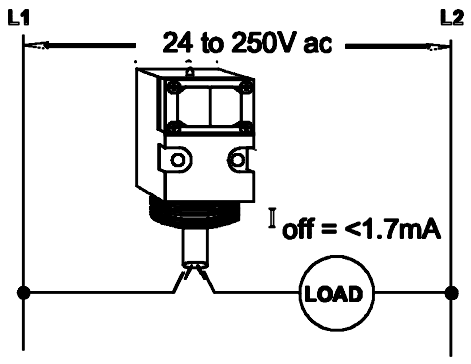
Hookup Diagrams for ac SM2A912 Series Sensors

NOTE: maximum load capacity of output is 500mA.

Basic ac Hookup

For emitter hookup, see preceding page.

VALU-BEAM 2-wire ac sensors wire in series with an appropriate load. This combination, in turn, wires across the ac line.



These sensors operate in the range of 24 to 250V ac, and may be programmed for either normally open (N.O.) or normally closed (N.C.) operation by way of the light-dark operate switch on the back of the sensor. A 2-wire ac sensor may be connected exactly like a mechanical limit switch.

The sensor remains powered when the load is "off" by a residual current which flows through the load. The off-state leakage current (I_{off}) is always less than 1.7mA. The effect of this leakage current depends on the characteristics of the load. The voltage which appears across the load in the off-state is equal to the leakage current of the sensor multiplied by the resistance of the load:

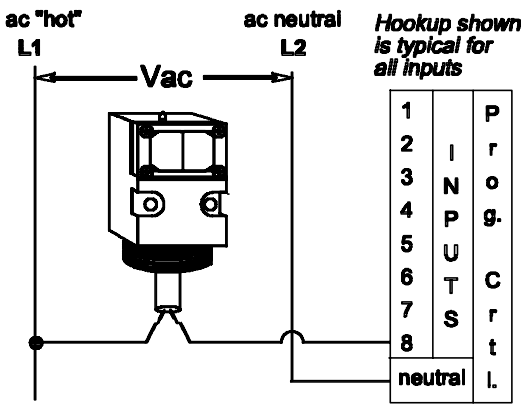
$$V_{off} = 1.7mA \times R_{load}$$

If this resultant off-state voltage is less than the guaranteed turn-off voltage of the load, then the interface is direct. If the off-state voltage causes the load to stay "on", then an artificial load resistor must be connected in parallel with the load to lower the effective resistance. Most loads, including most programmable controller inputs, will interface to 2-wire sensors with 1.7mA leakage current without an artificial load resistor. *These sensors are <u>not</u> polarity sensitive: all hookups are without regard to wire color.*

WARNING: VALU-BEAM 2-wire ac sensors will be destroyed if the load becomes a short circuit!!

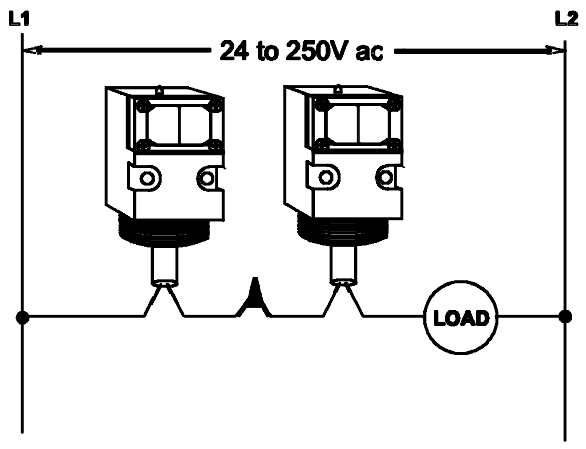
Connection to Programmable Controllers

Hookup shown is typical for all inputs.



AC Sensors in Series

Multiple 2-wire ac VALU-BEAMs may be wired together in series for "AND" or "NOR" logic functions. The maximum number of sensors which may be wired in series to a load depends upon the level of the line voltage and the switching characteristics of the load. Each sensor connected in series adds an amount of voltage drop across the load. The amount of voltage drop that each sensor adds depends upon the current demand of the load. Each sensor in series adds approximately 5 volts drop across a 500mA load. A 15mA load will see about a 10 volt drop from each sensor added in series. To determine compatibility, compare the resultant on-state voltage across the load against the load's guaranteed turn-on voltage level (from the manufacturer's specifications).

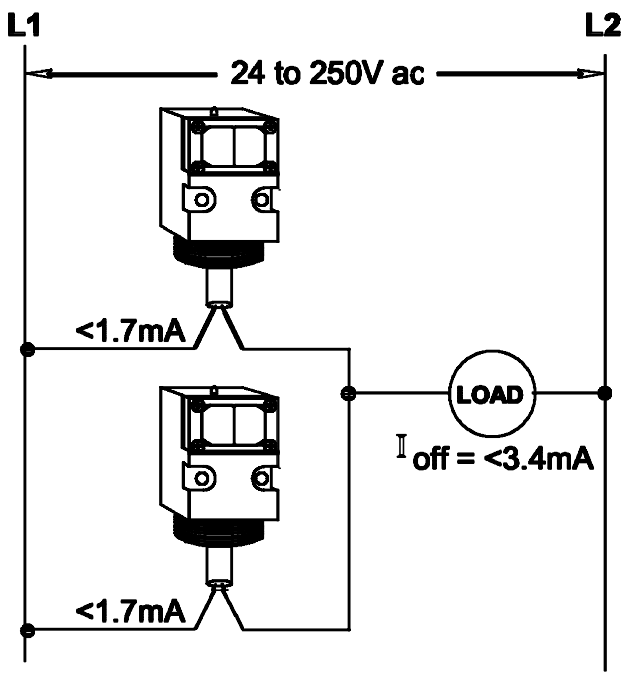


Most non-compatibility of series-connected sensors with loads occurs in low-voltage applications (e.g. 12, 24, or 48V ac circuits) where the on-state voltage drop across the load is a significant percentage of the supply voltage. The power-up inhibit time (up to 300 milliseconds per sensor) is also additive.

AC Sensors in Parallel

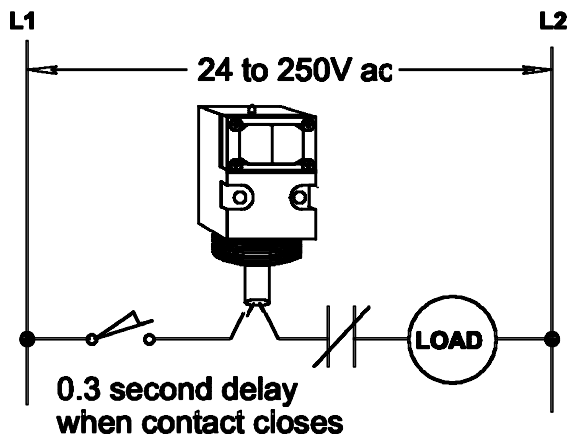
Multiple 2-wire ac VALU-BEAMs may be wired in parallel to a load for "OR" or "NAND" logic functions. With sensors wired in parallel, the off-state leakage current through the load is equal to the sum of the leakage currents required by the individual sensors. Consequently, loads with high resistance like small relays and solid state inputs may require artificial load resistors.

AC VALU-BEAMs wired together in parallel will *not* cause momentary drop-out of the load, as is experienced when wiring in parallel with contacts (see below). However, it is likely that the power-up delay feature *will* cause a momentary drop-out of the load if an ac VALU-BEAM is wired in parallel with a different brand or model of 2-wire sensor. Contact the Banner applications group to verify compatibility.



AC Sensors in Series with Contacts

When 2-wire ac sensors are connected in series with mechanical limit switch or relay contacts, the sensor will receive power to operate only when all of the contacts are closed. The false-pulse protection circuit of the sensor will cause a 0.3 second delay between the time the contacts close and the time that the load can energize.



AC Sensors in Parallel with Contacts

When 2-wire ac sensors are connected in parallel with mechanical switch or relay contacts, the sensor loses the current it needs to operate while any contact is closed. When all of the contacts open, the sensor's 0.3 second power-up delay may cause a momentary drop-out of the load.