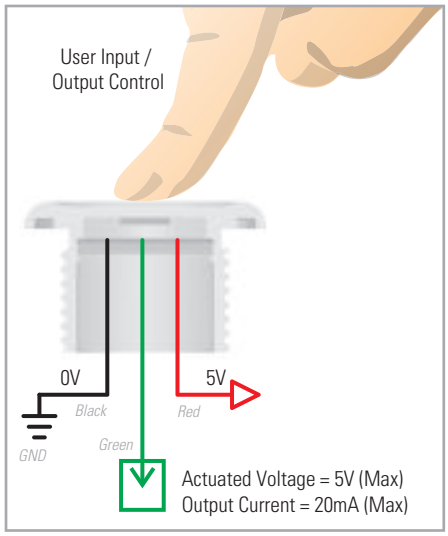
ACTIVEMETAL™

ULTRA-RUGGED TOUCH SENSORS

WIRING SCHEMES

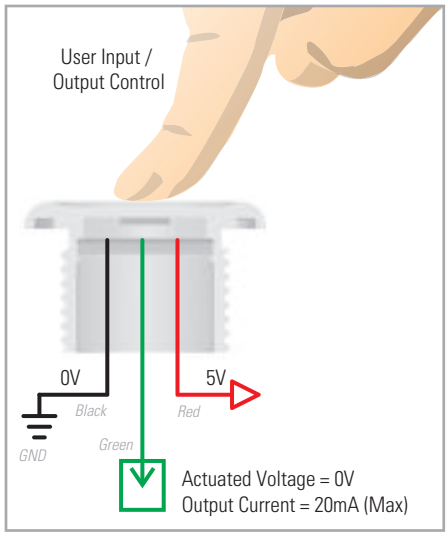
19mm, 22mm, 30mm Switches

DIGITAL OUTPUT (NORMALLY LOW)



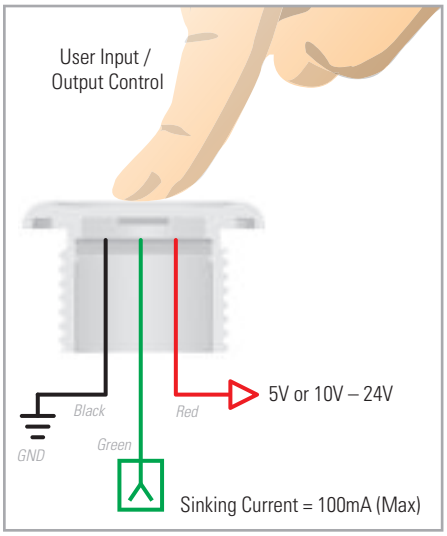
In the untouched state the switch output is 0 VDC. When touched, the output is 5 VDC with a maximum current of 20mA (100mW). This ActiveMetal configuration is commonly used to communicate with a control device.

DIGITAL OUTPUT (NORMALLY HIGH)



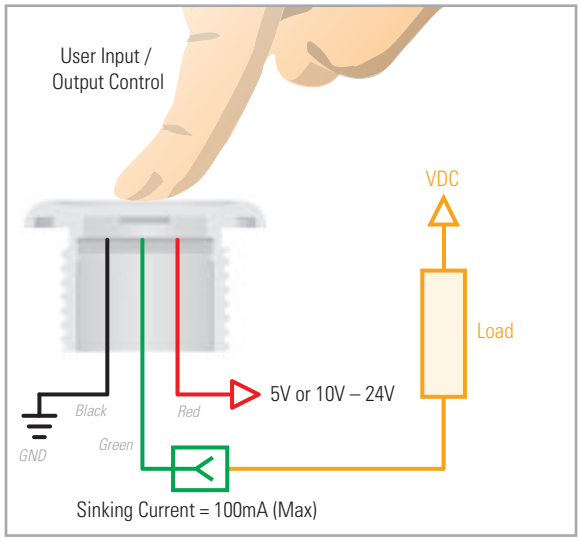
In the untouched state the switch output is 5 VDC, with a maximum current of 20mA (100mW). When touched, the output becomes 0 VDC. This ActiveMetal configuration is commonly used to communicate with a control device.

OPEN COLLECTOR SINKING OUTPUT



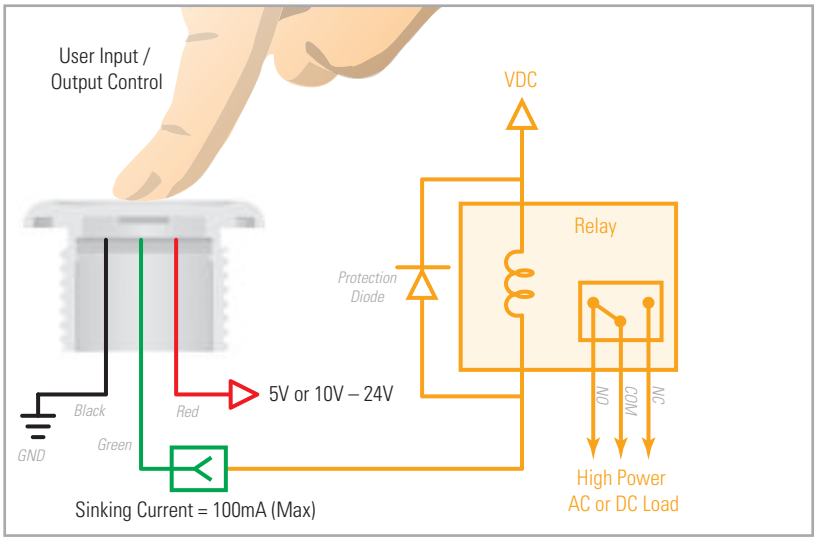
For a Normally Open switch the output line is open in the untouched state. In the touched state the output line is pulled to ground, completing a circuit. The states are reversed for a Normally Closed switch — the output line is pulled to ground in the untouched state and open in the touched state. The switch can sink up to 100mA.

OPEN COLLECTOR SINKING OUTPUT
LOW POWER LOAD (DC)



Using a normally open switch, in the untouched state the output line is open. In the touched state the output line is pulled to ground sinking up to 100mA. This configuration could be used to directly control DC devices of less than 100mA.

OPEN COLLECTOR SINKING OUTPUT
LOW POWER RELAY



In the untouched state the output line is open. In the touched state the output line is pulled to ground and can sink up to 100mA. When wired to the low side of a relay coil, this configuration could be used to energize a relay and control higher power DC or AC devices.

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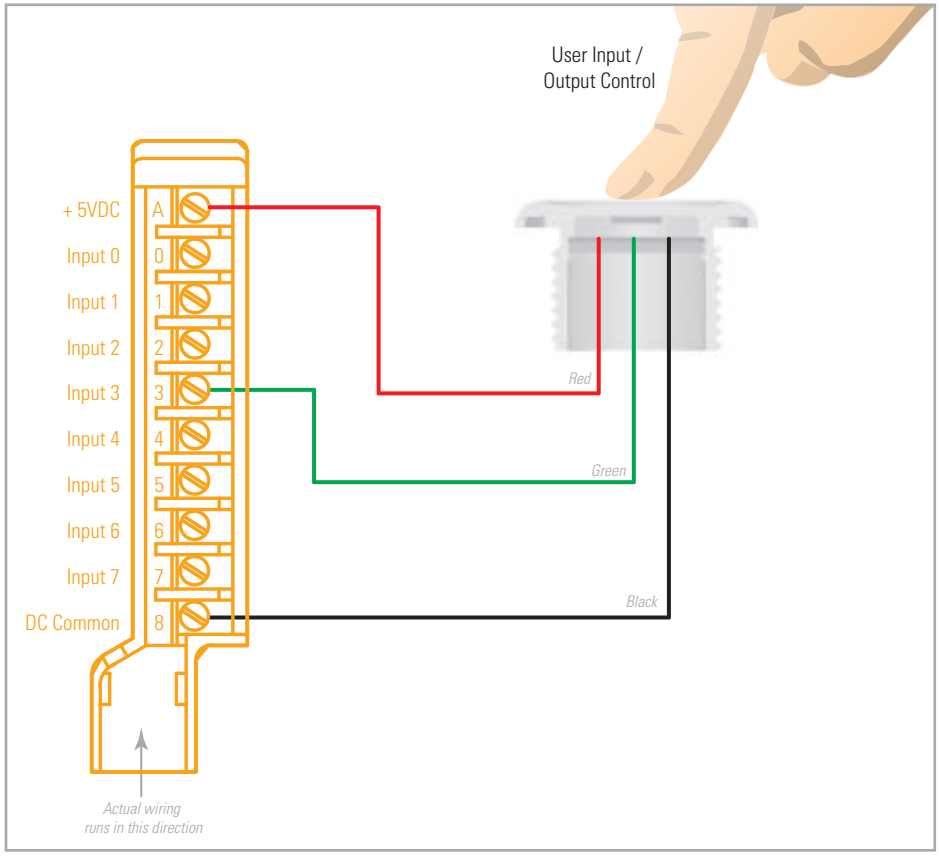
ACTIVEMETAL WITH A LOGIC PLC INPUT MODULE

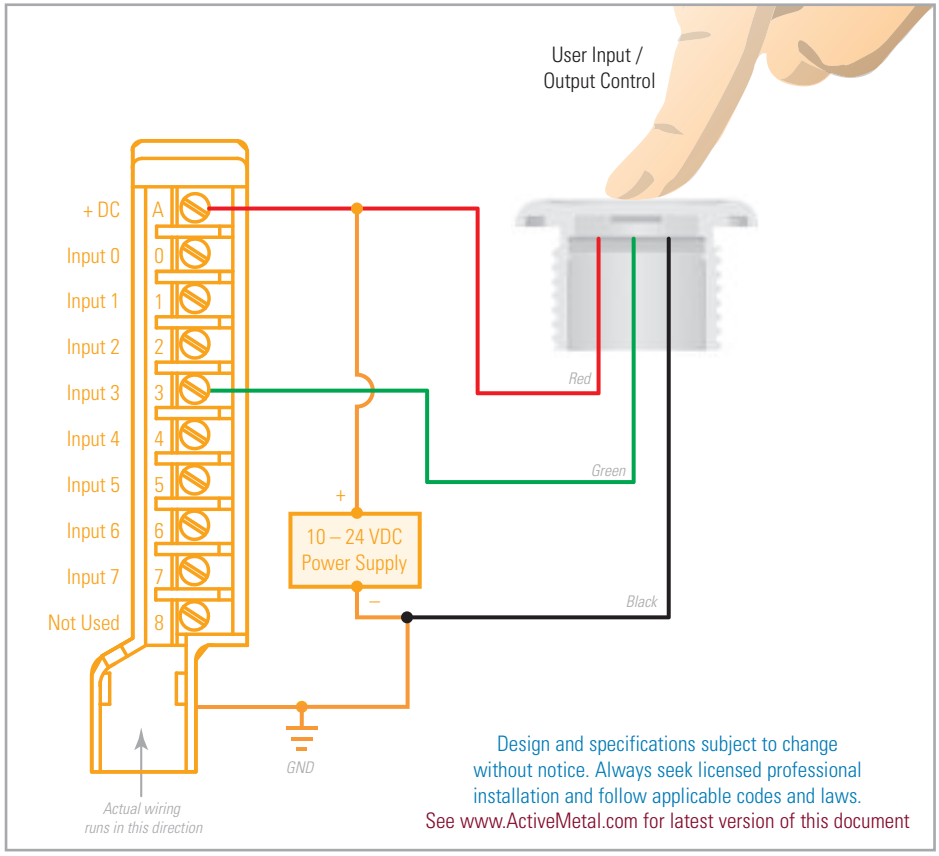


Interfacing with a PLC can be accomplished in a number of ways, depending on the I/O for the PLC. Following are three possibilities.

The example to the left shows the connection between an ActiveMetal 5V digital output switch and an Allen Bradley 1771-IG logic input module.

Note that ActiveMetal Switches can be "Normally High" or "Normally Low"; the PLC programming should reflect the type of switch used and function desired.

ACTIVEMETAL WITH A SOURCING (SINK LOAD) PLC INPUT MODULE



A Normally Open Open Collector ActiveMetal Switch is wired into a sourcing PLC input module in the example to the left.

Note that the above examples are neither an endorsement of Allen-Bradley PLCs, or by Allen Bradley of ActiveTouch. They are examples of how an ActiveMetal switch could be used with a PLC based on readily available public information. Using an ActiveMetal switch with other manufacturers' PLC input modules will likely require comparable considerations.

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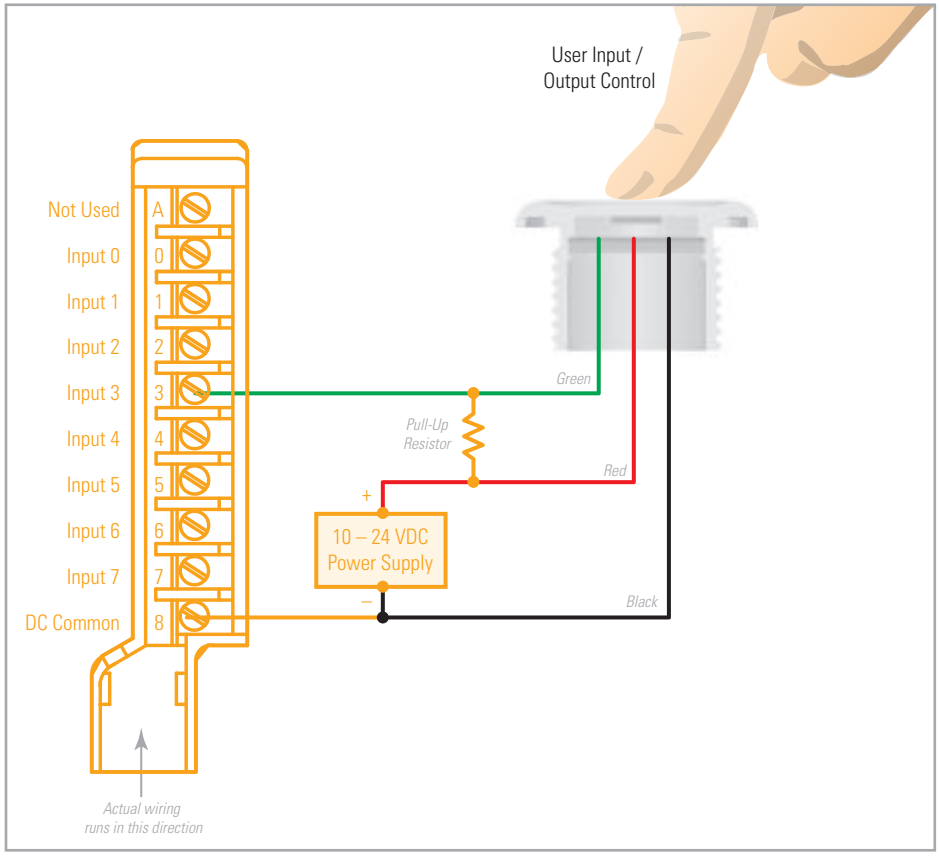
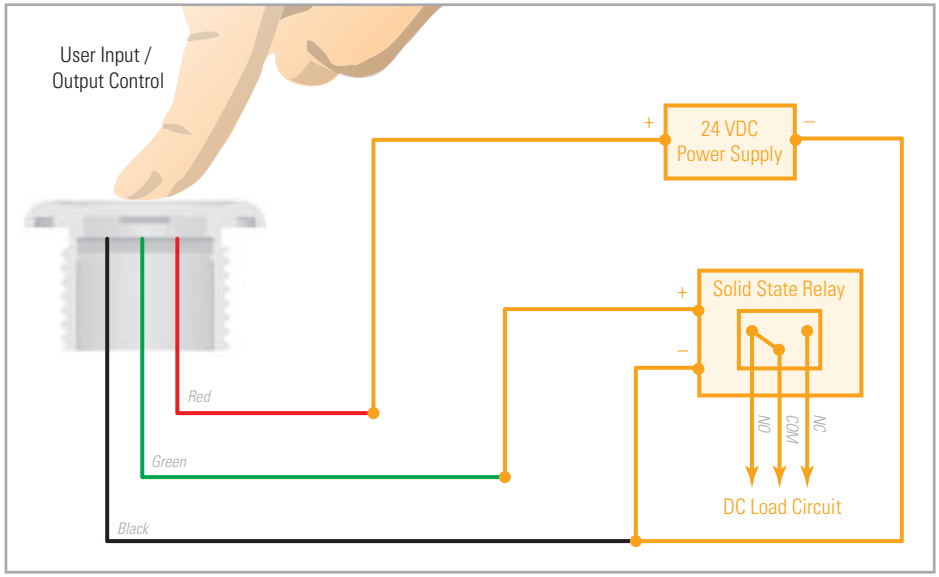
ACTIVEMETAL WITH A SINKING (SOURCE LOAD) PLC INPUT MODULE



A Normally Closed Open Collector ActiveMetal Switch is wired into PLC sinking input module as shown in the graphic on the left. The value of the pull-up resistor will vary based on the PLC input module used and supply voltage.

The example to the left shows the Allen Bradley 1771-IB that has an input impedance of 1K to 2K in the on-state. Minimum on state voltage is 10VDC. A minimum on-state input current can be calculated of 5mA to 10mA. With a 24V supply, a 2.4K Ohm pull-up resistor would allow 10mA input into the PLC. Allowing the PLC input impedance to limit the current flow is recommended. The resistor for this example would be a maximum of 2.4K Ohms at 0.5 Watts.

DIGITAL OUTPUT ACTIVEMETAL CONTROLLING A SOLID STATE RELAY



A low power solid state relay can be controlled by a Digital Output ActiveMetal switch (left) or an Open Collector ActiveMetal switch (next page). The ActiveMetal Digital Output is 5VDC and 20mA. This output should meet this solid state relay's input requirements of an input voltage of 3-30VDC.

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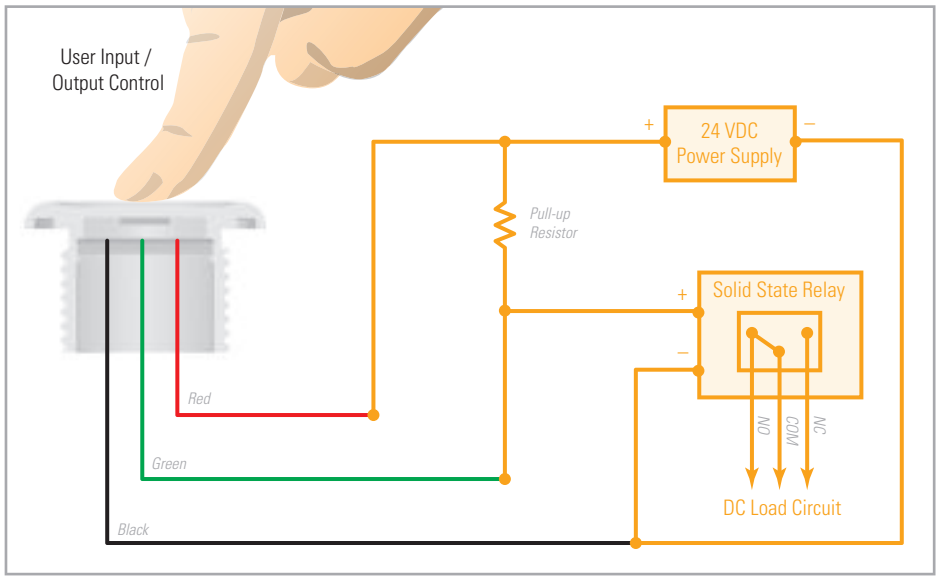
ACTIVEMETAL CONTROLLING A SOLID STATE RELAY



For solid state relays requiring higher input voltages, the Open Collector ActiveMetal with pull-up resistor would be required as shown in the illustration to the left. A Normally Open relay will require a Normally Closed ActiveMetal switch for the load circuit to be open in the untouched switch state. Alternatively, a Normally Closed relay paired with a Normally Open ActiveMetal switch will produce an open load circuit in the untouched state.

EXAMPLE OF SOLID STATE RELAY

Specifications	
Component Type	Solid State
Mounting Type	Panel
Rated Current Load	5A
Contact Configuration	SPST-NO
Control Voltage	DC
Load Type	DC
Input Voltage Range	3 – 30 VDC
Output Voltage Range	3 – 60 VDC
Switching Type	DC Switching

Output Characteristics	
Switching Device	Triac
Current Rating	5A
Switching Voltage	3 – 60 VDC
Minimum Load Current to Maintain On	100 mA
Non-Repetitive Surge Current (1 Cycle)	7 (1 Sec) A
Maximum Off State Leakage Current (rms)	10 µA
Minimum Peak Blocking Voltage	105 VDC
Typical On State Voltage Drop (rms)	1.85 VDC

Input Characteristics	
Voltage Range	3 – 30 VDC
Must Release Voltage	1 VDC
Typical Input Current @ 5 VDC or 240 VAC	5 – 40 mA
Maximum Reverse Control Voltage	3 VDC

SIZING THE RESISTOR

The maximum size of the pull-up resistor will be determined by the current requirements to drive the relay. For this example, the relay is normally open with an input voltage of <1VDC. With an input voltage of >3V and input current >5mA the 'contacts' close and can pass 5A. The pull-up resistor must allow enough current to drive the solid state relay. Assuming 24VDC input, the resistor value can be calculated as **Resistance = Voltage / Current, or**

$$R = \frac{V}{I} = \frac{24\text{VDC}}{0.005\text{AMPS}} = 4800\ \Omega$$

4.7K Ohms is a common resistor size. The current supplied to the relay will increase slightly with the lower resistor value, but is well within the 100mA capability of the ActiveMetal switch:

$$I = \frac{V}{R} = \frac{24\text{VDC}}{4700\ \Omega} = 0.0051\ \text{AMPS}$$

The wattage of the resistor can be calculated as **Power = Current² * Resistance, or (0.0051 Amp)² * (4700 Ohm) = 0.123W.** A quarter watt 4.7K Ohm resistor should be sufficient for this application.

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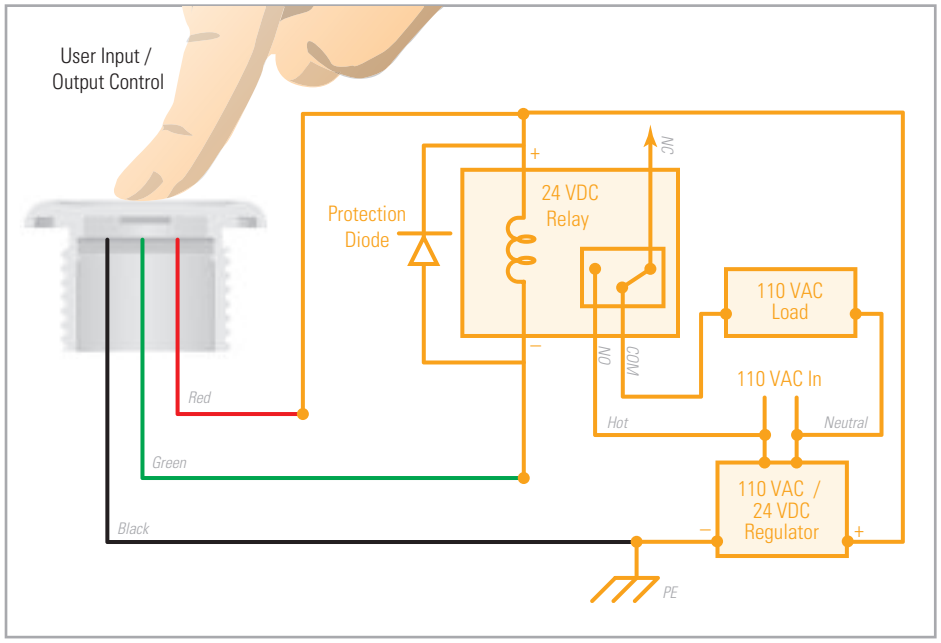
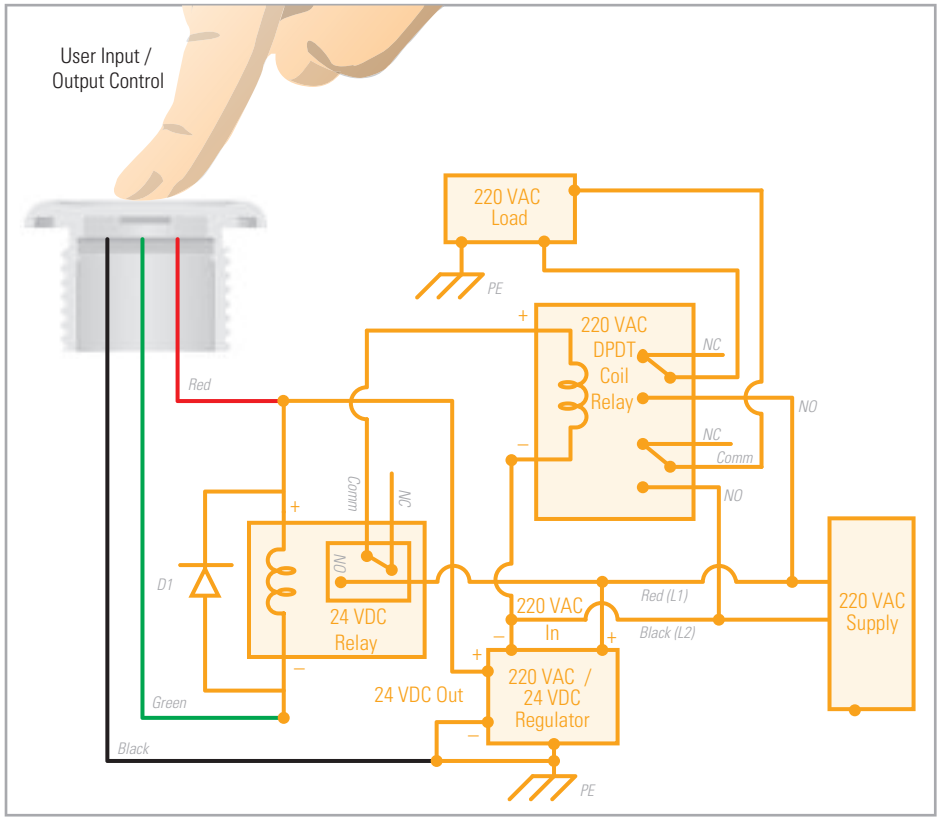
ACTIVEMETAL SWITCHING 110 VAC OR 220 VAC





The schematics on the left are for using an Open Collector ActiveMetal switch to control power to a 110V or 220V device.

Notes:

1. The 24VDC coil relays shown in the diagrams are powered from the same source as the ActiveMetal switches (12V or 24V DC regulator or power supply).
2. In both examples, the relay coil current must be less than 100mA. The 220V example uses a pilot relay to control the current to the AC coil of the larger Double Pole Double Throw (DPDT) relay.
3. The electromechanical relays controlled by the ActiveMetal switch have a protection diode (D1) across them to dissipate the energy in the coils when they are de-energized. The diode size is such that the diodes' forward current exceeds the relay coil current and the dode's reverse voltage is several times the operating voltage of the coil.

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TROUBLE SHOOTING ACTIVEMETAL SWITCH WIRING

Goal: Provide information for an individual to confirm the switch is wired correctly using a hand held multimeter.

DIGITAL OUTPUT (5VDC INPUT)

Switch Status:	Normally High	Normally Low
Switch Action:*	Momentary	Momentary
Confirm Input: Red Wire (V+) (**Voltage** relative to black wire)	5VDC	5VDC
Output in Untouched state: Green Wire (**Voltage** relative to black wire)	5VDC +/- 10%	<0.5VDC
Output in Touched state: Green Wire (**Voltage** relative to black wire)	<0.5VDC	5VDC +/- 10%

**Alternate Action switches toggle between the Untouched and Touched states of the momentary switches.*

OPEN COLLECTOR OUTPUT

Input:	5VDC	5VDC	10 – 24VDC	10 – 24VDC
Switch Status:	Normally Open	Normally Closed	Normally Open	Normally Closed
Switch Action:*	Momentary	Momentary	Momentary	Momentary
Confirm Input: Red Wire (V+) (**Voltage** relative to black wire)	5VDC	5VDC	10 – 24VDC	10 – 24VDC
Output in Untouched state: Green Wire (Equivalent **resistance** relative to black wire)	>1 MOhm	<1 Ohm	>1 MOhm	<1 Ohm
Output in Touched state: Green Wire (Equivalent **resistance** relative to black wire)	<1 Ohm	>1 MOhm	<1 Ohm	>1 MOhm

NOTE: Maximum current sinking capability is 100mA.

**Alternate Action switches toggle between the Untouched and Touched states of the momentary switches.*

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