DESCRIPTION:

The model 3223 is a three-phase, time proportioning, zero-cross SCR controller. Time proportioning zero-cross control implies that the load voltage is switched on, or off, only when the instantaneous value of the sinusoidal supply voltage is zero and that the load power is controlled by varying the percentage of a fixed cycle time that power is applied to the load. The cycle time for the model 3223 is set at 1 second (± 0.2sec).

The controller is capable of accepting a 4/20mA command signal, a 1 to 15Vdc command signal, or it may be controlled by a 135 ohm slidewire. It may also be controlled by an on-off logic signal. The command input selection may be changed by moving jumpers on the circuit board.

The command signal is isolated from the line and load voltages, and all are isolated from the heatsink.

THEORY OF OPERATION:

THE SCR

The heart of the SCR power controller is the SCR (silicon controlled rectifier, also sometimes referred to as a thyristor).

The SCR has two states, ON and OFF, and allows current to flow in only one direction. SCR's can remain in the off state even though the applied potential may be several hundred volts; in the on state, they can pass several thousand amperes. When a small signal is applied between the gate and cathode terminals (Figure 1), the SCR will turn on within 10-100 microseconds. Once turned on, it will remain on until the current through it is reduced below a very low value, called the holding current.

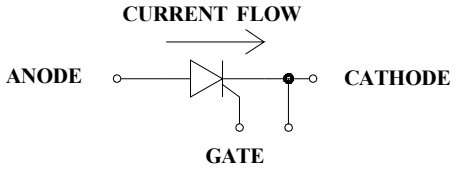


Figure 1. SCR symbol.

Because the SCR allows current to flow in only one direction, two SCR's are connected in a "back to back" configuration to control AC current (Figure 2).

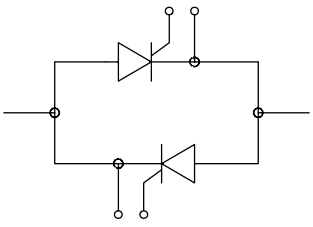


Figure 2. SCR AC switch.

ZERO-CROSS TIME-PROPORTIONING OPERATION

In zero-cross time proportioning, the load power is turned on or off only when the instantaneous value of the sinusoidal waveform is zero. Load power is controlled by switching the SCRs "on" for a percentage of the complete time cycle, which is set at 1 second.

The circuit determines the ON versus the OFF time of the silicon controlled rectifiers (SCRs) such that the load power is linear with the command signal.

At 25% power, the SCRs are ON for 0.25 second and OFF for 0.75 second.

At 50% power, the SCRs are ON for 0.5 second and OFF for 0.5 second.

At 75% power the SCRs are ON for 0.75 second and OFF for 0.25 second.

The SCRs are turned ON and OFF only at the beginning and end of an electrical half cycle.

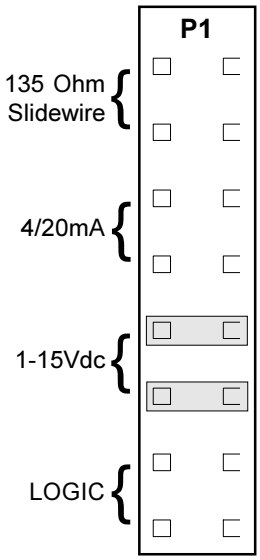
INSTALLATION:

The controller must be mounted with the fins oriented vertically such that air will flow over the heat dissipating fins.

24 Volts AC must be provided for the power to the circuit. The 2 pin connector (P3) on the circuit board is provided for this purpose.

The 8 pin connector (P2) will accept the command signal input, and provide the necessary output signals.

The command signal type is selected by installing two (2) jumpers on connector P1 on the circuit board near the input connector.



PLACE THE JUMPERS ON THE 2 SETS OF PINS WHICH ARE ADJACENT TO THE DESIRED COMMAND INPUT SIGNAL.

Note: When this controller is used with a Barber-Colman module, be sure to connect circuit common to the ***COM*** terminal on the 24Vac connector on the circuit board, as this terminal is connected to circuit common. See fig. 4.

CONTROL RANGE:

The 3223 controller is off at the minimum input value and 100% on at the maximum input value. The load power output is linear between the minimum and maximum input values.

INPUT (set by jumpers)	OFF (minimum)	ON (maximum)
4/20mA	5mA	19mA
1-135 Ohm	15 Ohms	120 Ohms
1-15 Volts	6.0V	9.0 V
Logic	1.5V	4.5 V

ELECTRICAL CONNECTIONS:

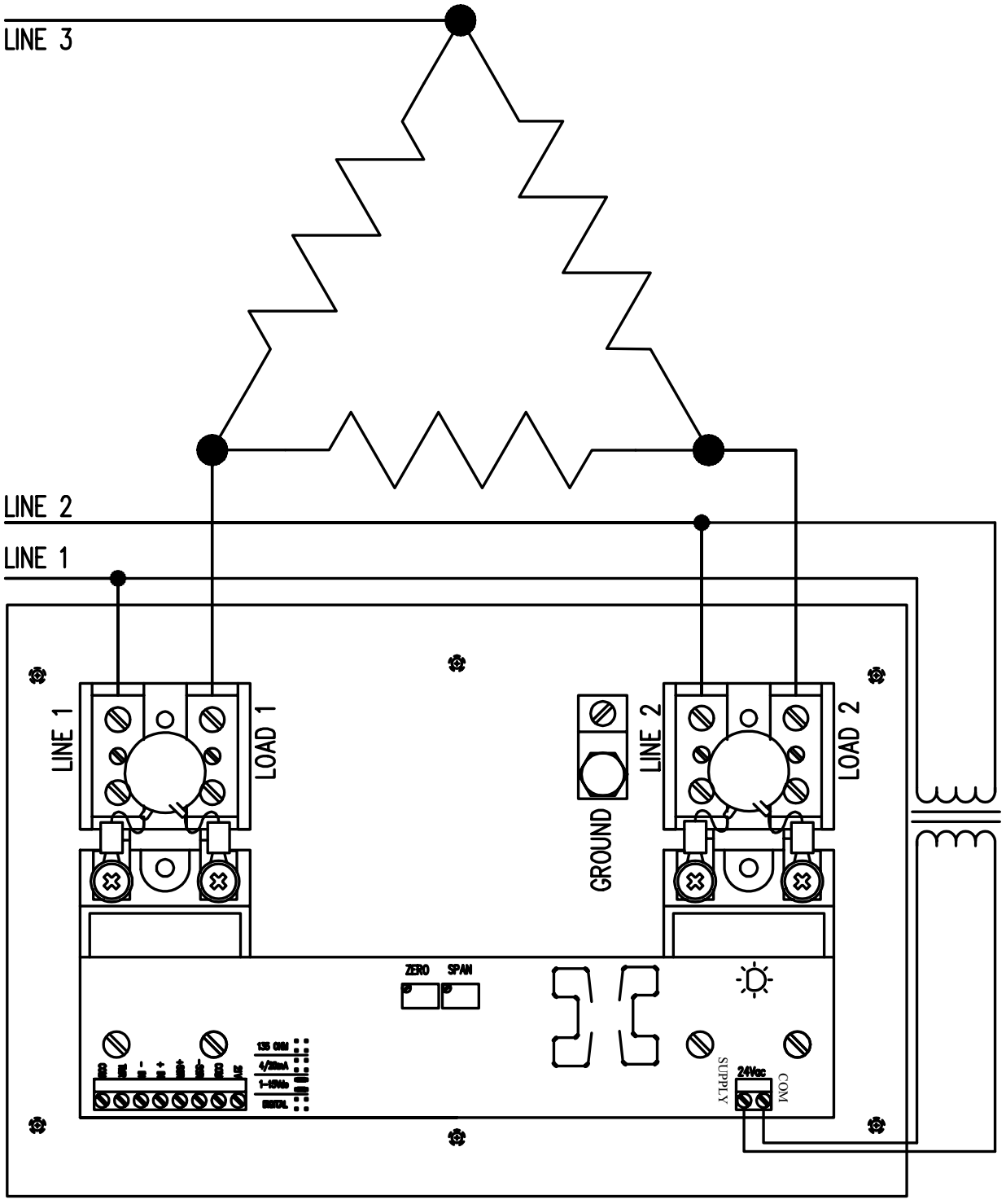


Figure 3. Line and Load electrical connections.

CONTROL CONNECTIONS:

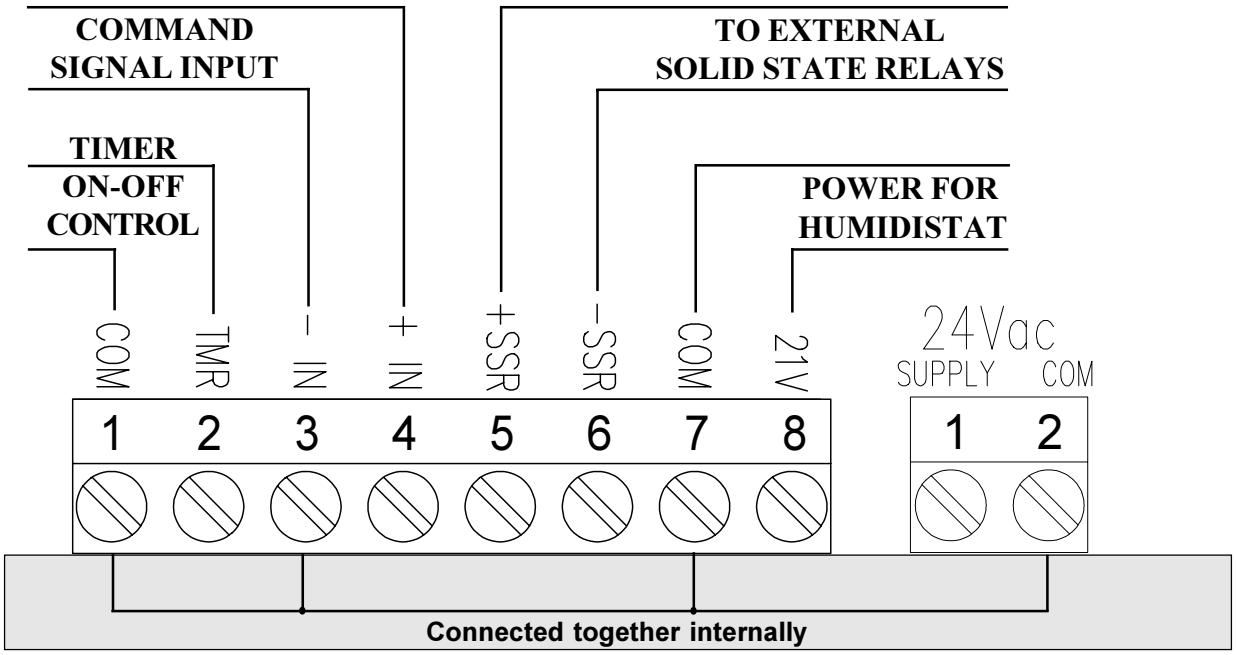


Figure 4. Signal and power connections.

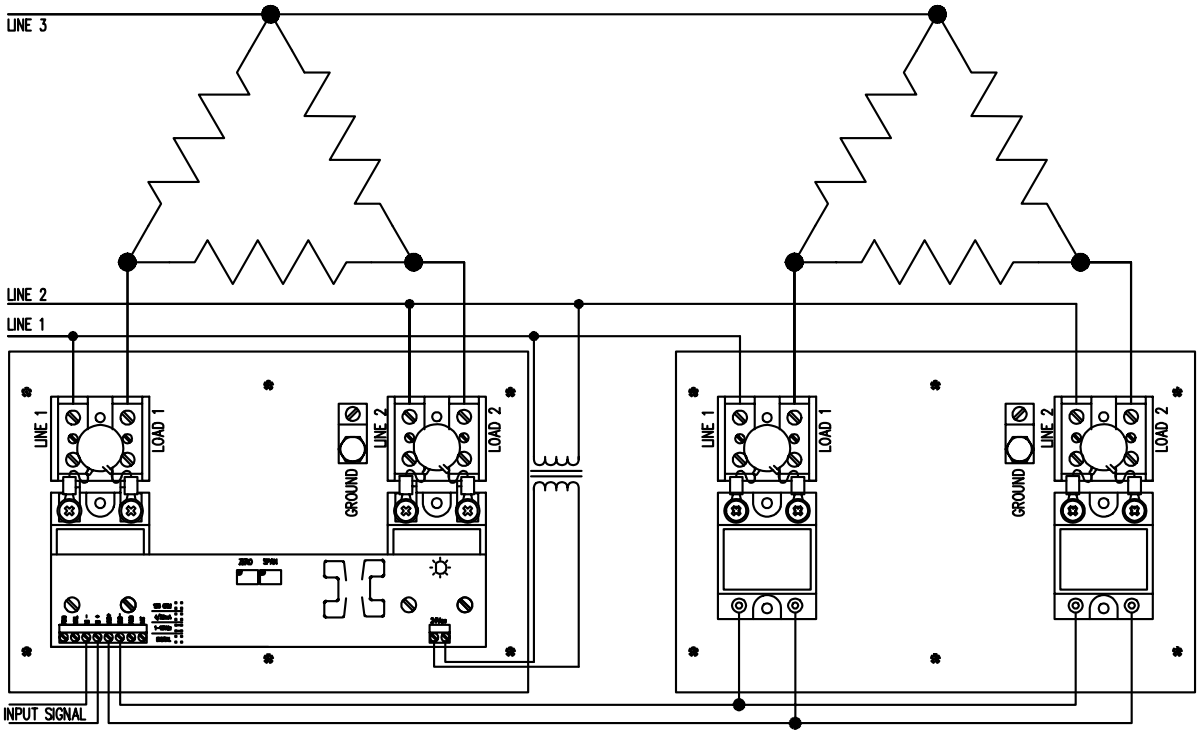


Figure 5. Master/slave wiring.

SIGNAL INPUT CONNECTIONS:

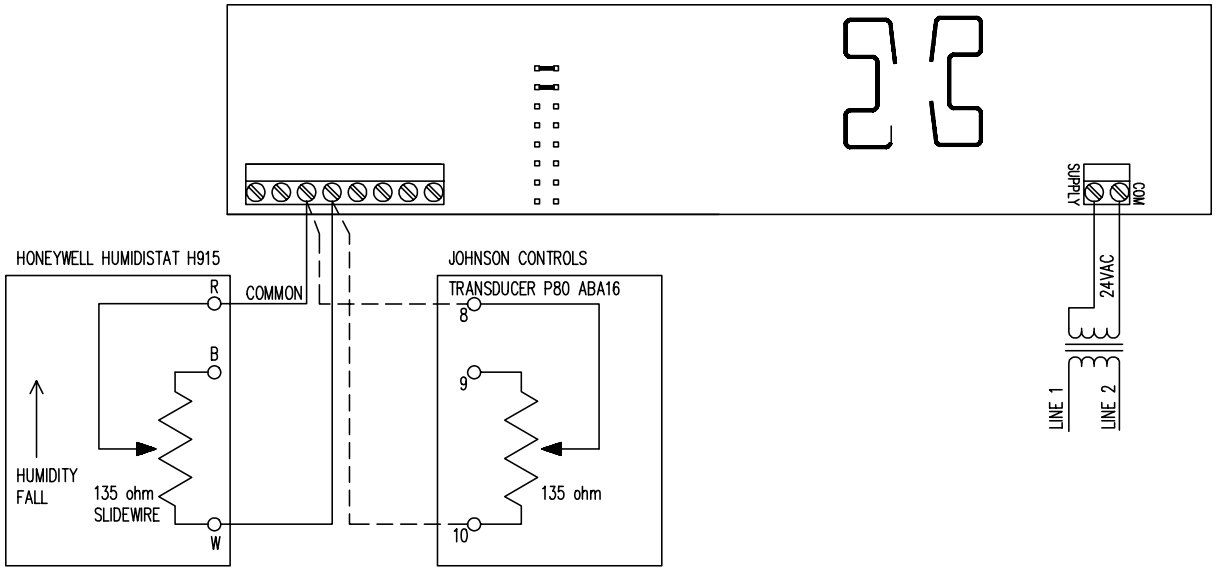


Figure 6. Signal from 135 ohm humidistat or transducer.

FIRING CIRCUIT LAYOUT:

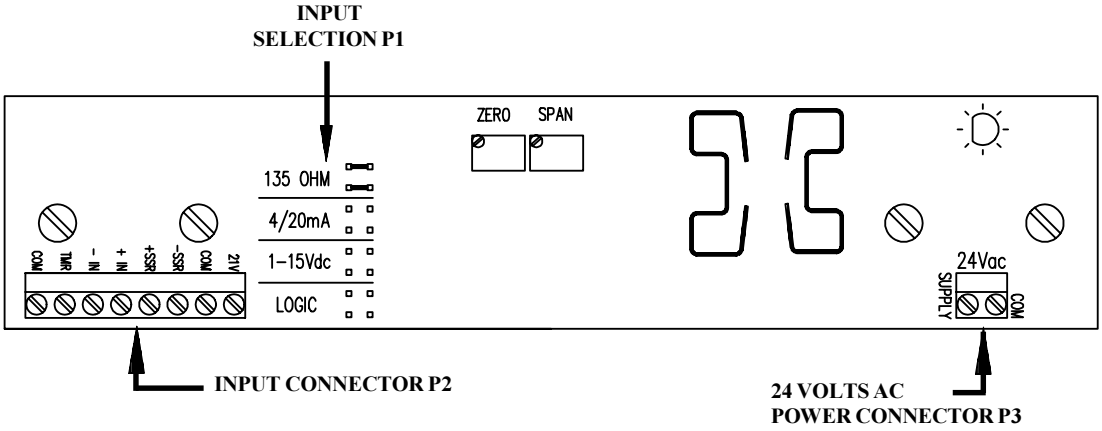


Figure 7. Firing circuit, showing location of adjustments, input selection and connectors.

SIGNAL INPUT CONNECTIONS:

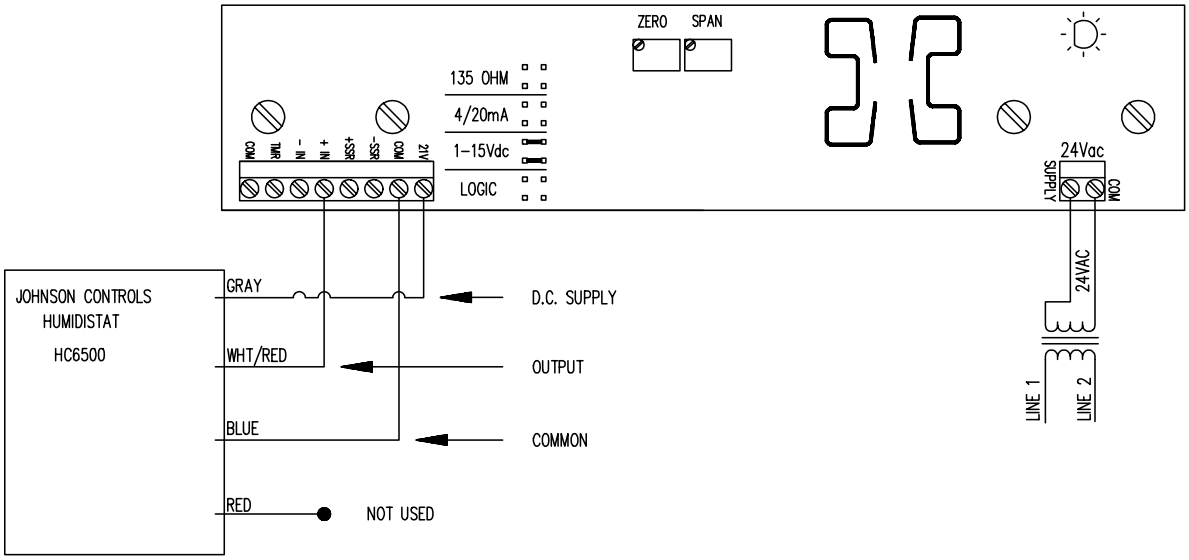
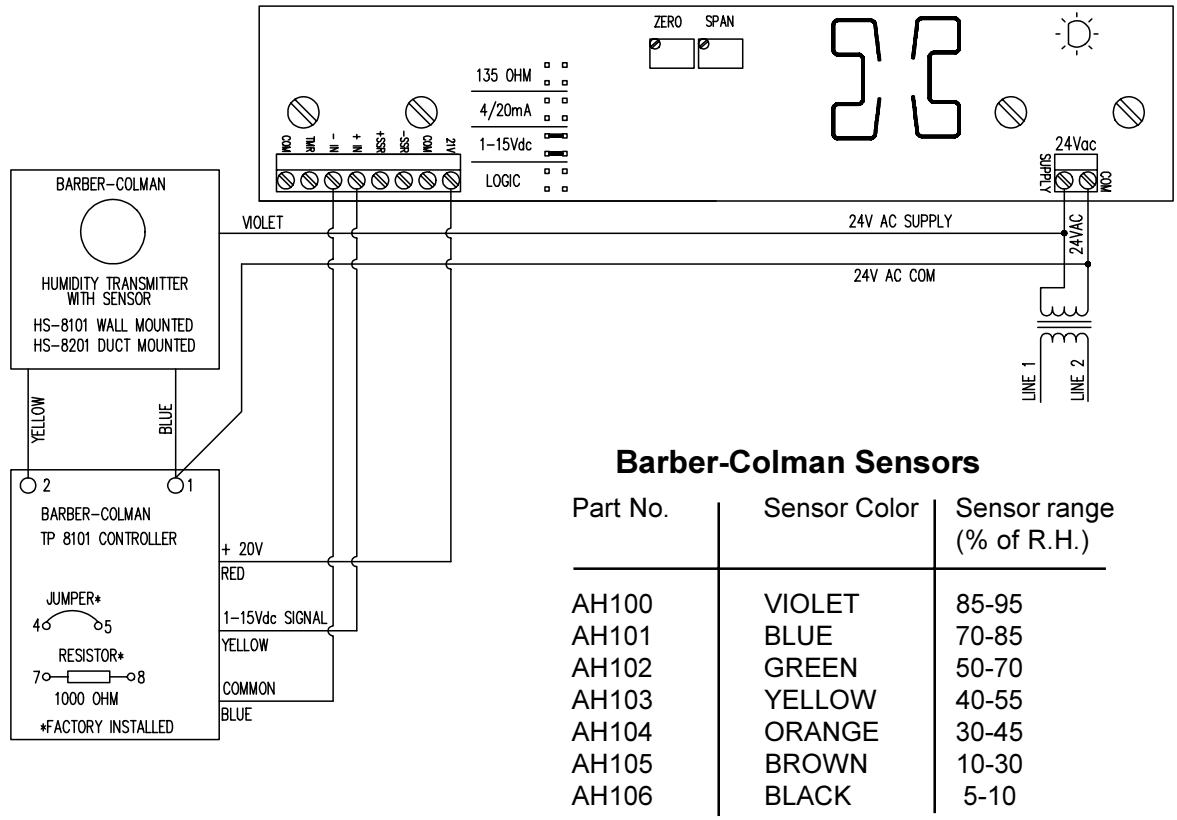


Figure 8. Connection of Johnson Controls humidistat with D.C. voltage output.



Barber-Colman Sensors

Part No.	Sensor Color	Sensor range (% of R.H.)
AH100	VIOLET	85-95
AH101	BLUE	70-85
AH102	GREEN	50-70
AH103	YELLOW	40-55
AH104	ORANGE	30-45
AH105	BROWN	10-30
AH106	BLACK	5-10

Figure 9. Connection of Barber-Colman humidity controller.

INSTALLATION DRAWINGS:

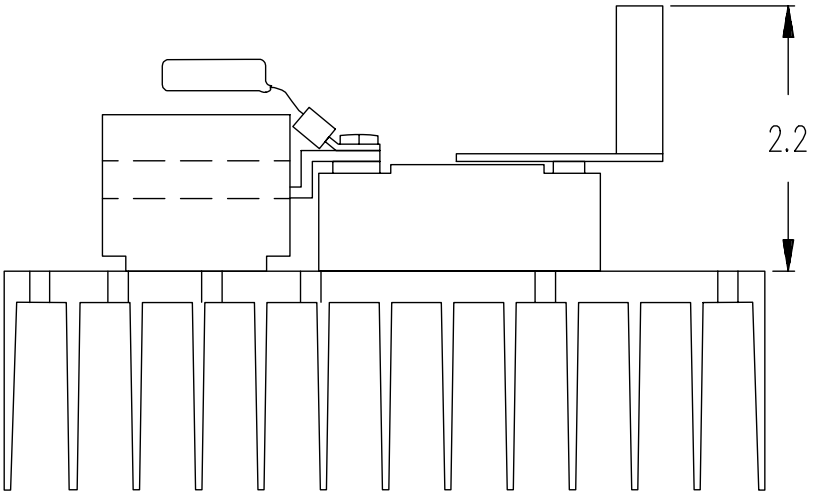


Figure 10. End view of 50 amp controller.

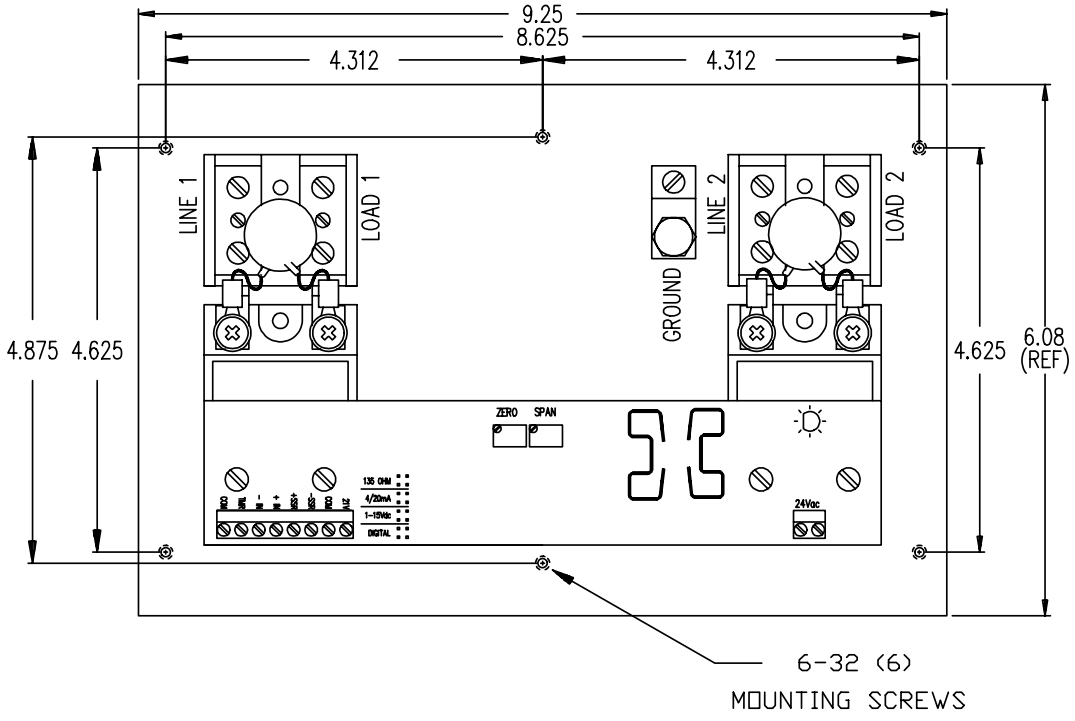


Figure 11. Top view of 50 Amp controller.

INSTALLATION DRAWINGS:

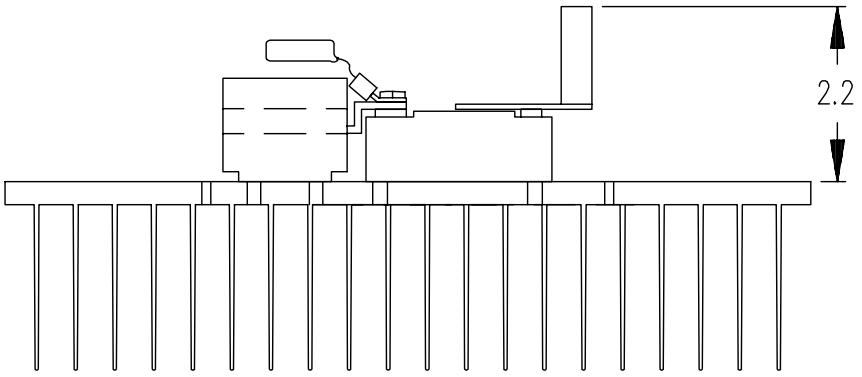


Figure 12. End view of 70 amp controller.

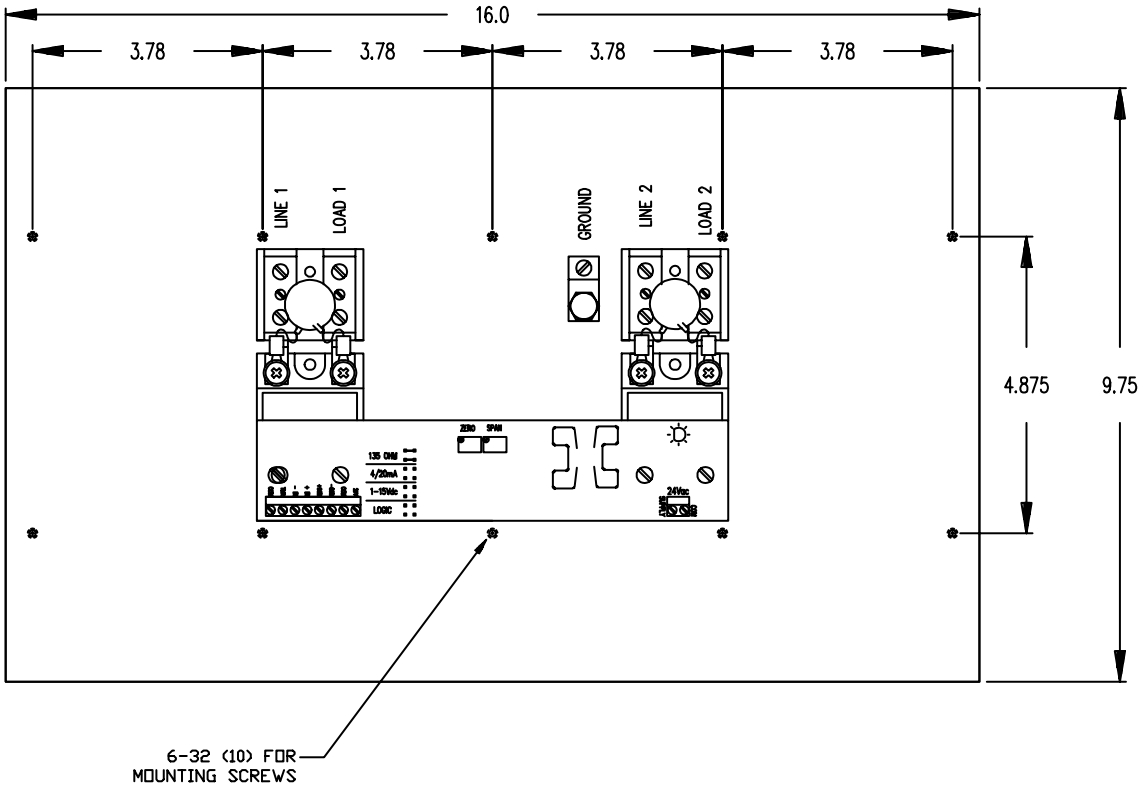


Figure 13. Top view of 70 Amp Controller.

SPECIFICATIONS:

CURRENT RATING. The load current term (50 or 70) within the model number, identifies the maximum current rating for the controller at 55C maximum operating temperature.

COMMAND SIGNAL.	Input resistance
1 to 15 Vdc	21K ohms
4/20mA	249 ohms
135 ohm slidewire	N.A.
Logic Signal	110k ohms

ISOLATION.
2500 Vrms; input signal to line and load voltages.

CONTROL MODE.
Time proportioning zero-cross.

MODEL No. IDENTIFICATION:

The characteristics of the 3223 SCR power controller are defined by the terms in the model number as follows:

3223-(XX)A [-(HV)] (Master)
3224-(XX)A [-(HV)] (Slave)

3223 The model 3223 specifies a 2 leg, three-phase, time proportioning zero-cross, SCR firing circuit featuring selectable command input signals, on a single heat-sink. The normal operating voltage range is from 50Vac to 480Vac.

(AMPS)A specifies the maximum continuous current rating, as well as the frame size.
50 = 50 Amps AC 50/60 Hz.
70 = 70 Amps AC 50/60 Hz.

(HV) specifies a higher operating voltage range of 50Vac to 600Vac.

3224 The model 3224 has all of the same electrical specifications of the model 3223, but there will be no firing circuit on this unit. The model 3224 may be operated as a slave by the firing circuit on a model 3223, or by an on-off digital signal from a computer.

TROUBLESHOOTING:

Caution. The terminals on this controller are at line potential.
Disconnect the power before servicing.

The LED located on the firing circuit board can be used to aid in determining problems. This LED should be ON whenever the SCR module is ON and whenever power is being applied to the load.

THE FOLLOWING ARE SYMPTOMS AND POSSIBLE CAUSES:

NO LOAD POWER AND LED IS NOT ON:
Determine that the command signal is applied to the controller. Determine that 24 volts is applied to the circuit. Also determine that the jumpers are in the right position. The firing circuit may be faulty.

LED IS OFF BUT POWER IS APPLIED TO THE LOAD:
The SCR module has probably failed in the shorted mode, allowing full or partial load power to be applied.

NO LOAD POWER AND LED IS ON:
Determine that power has been applied to SCRs. If the SCR module has failed in the open mode, the supply voltage can be measured across the line and load terminals with the LED on.

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