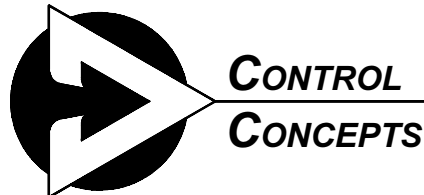


**CONTROL  
CONCEPTS  
INC.**

**INSTRUCTION MANUAL  
MODEL 1021A**



Distributed Worldwide By  
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## DESCRIPTION:

The model 1021A controller is a single-phase distributive zero-cross SCR controller. Distributive zero-cross control implies that the load voltage is switched on only when the instantaneous value of the sinusoidal supply voltage is zero and that the load power is controlled by varying the number of electrical cycles that power is applied and removed from the load.

The controller is capable of accepting mA command signals, DC voltage signals, or it may be controlled by a potentiometer. Electrical isolation is provided to isolate the command signal from the line and load voltages.

## 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 thousand 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 in 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.

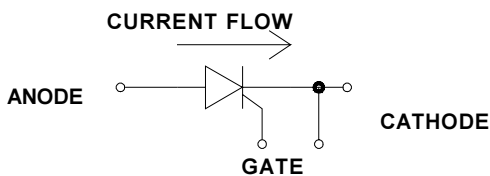


Fig 1. SCR Symbol.

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. (Fig 2).

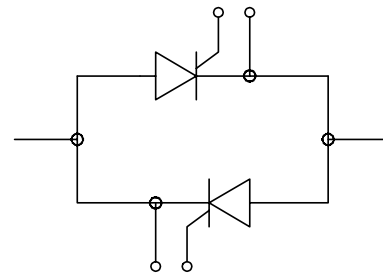


Fig 2. SCR AC Switch.

### ZERO-CROSS OPERATION

In zero-cross control, 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 number of complete electrical cycles, and then "off" for a number of complete electrical cycles. 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. The circuit at 50% power will cause the SCRs to be "on" for 3 cycles and "off" for 3 cycles. At higher power levels, the SCRs are ON for more cycles and OFF for 3 cycles. At lower power levels, the SCRs are ON for 3 cycles and OFF for more cycles. The SCRs are turned ON and OFF only at the beginning and end of each electrical cycle.

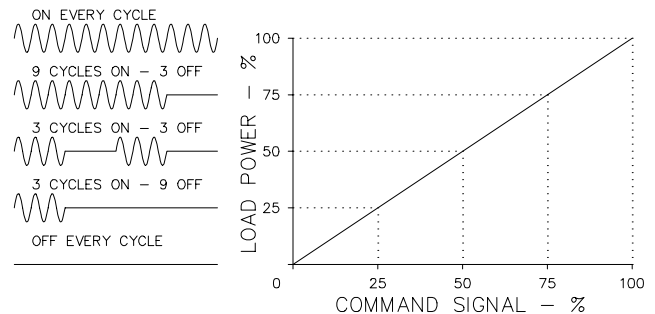


Fig 3. Distributive Control.

## INSTALLATION:

The controller must be mounted on a vertical surface with the fins oriented vertically such that air will flow over the heat dissipating fins. The plug-in connector may be removed by pulling it straight away from the circuit board.

The 24Vac transformer may be connected to any source of the correct voltage.

For the line voltage compensation feature to work properly, the 24Vac transformer must be connected to the same supply used to power the load.

## SPECIFICATIONS:

### CURRENT RATING

The (LOAD CURRENT) term within the model number specifies the maximum continuous RMS current rating at a 55°C maximum ambient temperature.

### COMMAND SIGNAL

	Input Resistance
0 to 5Vdc	100 K
0 to 10Vdc	200 K
4/20 mA	300 ohms
Potentiometer	200 K
(1K, 1/2 watt recommended, 20K maximum permissible.)	

### ISOLATION

2500V rms input signal to load and line voltages.

### CONTROL MODE

Zero-cross, distributive.

### LINE VOLTAGE COMPENSATION

The average load voltage remains constant within 2% over line voltage changes of +10% to -15%.

### FUSES

It is recommended that the controller and the load be protected with fast acting fuses such as the J2N and J2S, class "T", series of fuses manufactured by the Bussman company.

Control Concepts, Inc. stocks a complete line of Bussman class "T" fuses for controllers. Contact the factory for price and delivery information.

## ELECTRICAL CONNECTIONS:

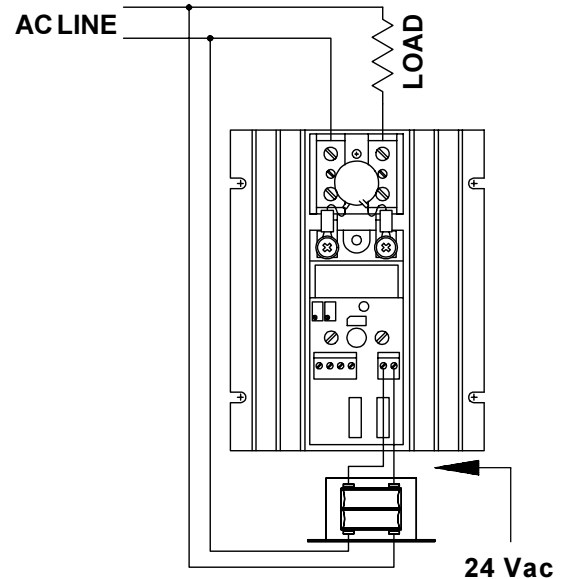


Fig 4. Electrical Hookup.

## CONTROL SIGNAL CONNECTIONS:

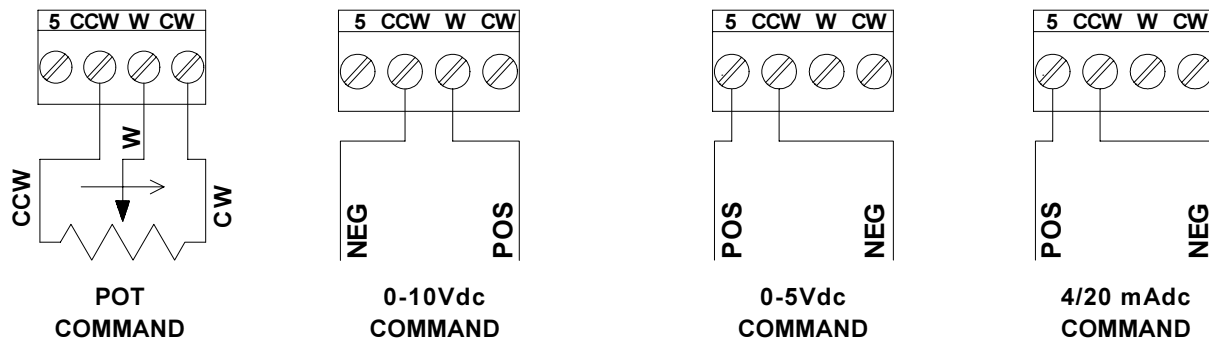
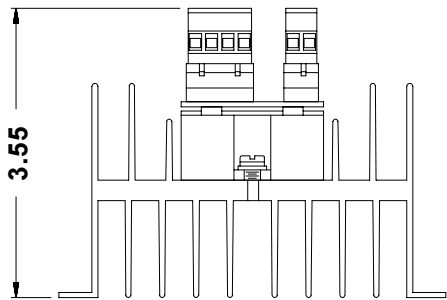
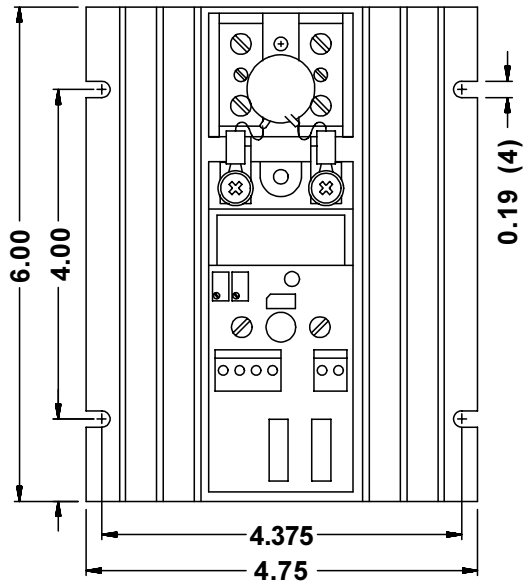
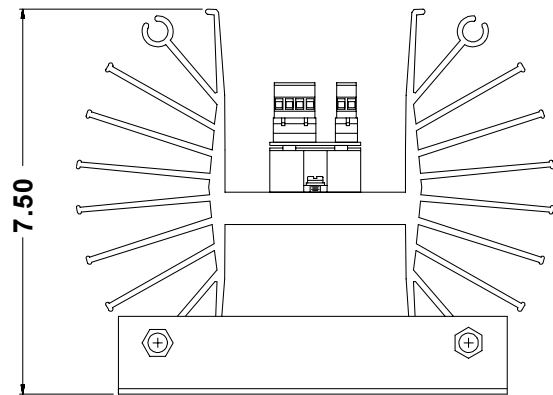
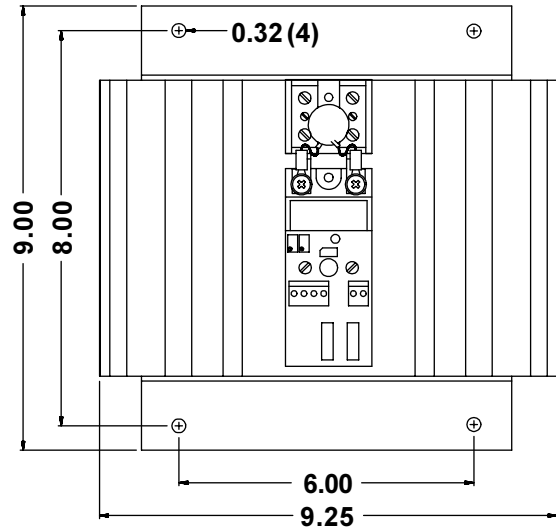


Figure 7. Signal Connections

**INSTALLATION DRAWINGS:**



**FIGURE 6. 10, 20, 30 AND 40 AMPS**



**FIGURE 7. 70 AMPS**

## TROUBLE SHOOTING:

Control Concepts has field service engineers who can aid in determining the cause of controller problems. Please call with any problems or questions you may have.

### CAUTION:

High voltage exists on the supply and load terminals of this controller and may exist on other equipment located near the controller. Use extreme caution to avoid electrical shock.

The LED located on the controller circuit can be used to aid in determining problems. This LED varies in intensity proportional to the command signal and therefore should be proportional to the load voltage.

### THE FOLLOWING ARE SYMPTOMS AND POSSIBLE CAUSES:

#### **NO LOAD POWER AND LED IS NOT ON:**

Determine that a command signal is applied to the controller. Determine that 24 volts is applied to the circuit.

#### **LED INTENSITY CAN BE VARIED:**

Determine that all fuses are "OK". If the voltage across the SCR module is equal to the line voltage the SCR module has probably failed. NOTE: If a replacement SCR module is ordered specify the voltage and current rating of the controller and the serial number of the failed unit.

#### **LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED: LED IS OFF:**

Remove the 24Vac plug in connector. If the load still has power, the SCR module has probably failed as a short allowing full power to be applied to the load. To determine if the SCR module has shorted, remove power and then the line and load connections and measure the resistance across the line and load terminals on the SCR module. If the resistance is less than 10,000 ohms the module has failed. NOTE: If a replacement SCR module is ordered; specify the voltage, current rating and serial number of the failed unit.

#### **LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED: LED IS ON:**

Determine that the command signal is adjusted to zero. Also remove the plug-in connection to remove the command signal. If the LED is not off; the circuit card has probably failed.

#### **MAXIMUM LOAD VOLTAGE CANNOT BE OBTAINED:**

Determine that the primary of the circuit transformer is connected to the same supply as the controller and load. Typically this problem is caused by the primary being connected across the load and line connection at the controller. Measure the 24Vac supply at the circuit board.

## MODEL No. IDENTIFICATION:

### **1021A-(VOLTAGE)-(LOAD CURRENT)-(XX)**

**(VOLTAGE)** = Rated operating voltage

**12** = 120 Vac

**24** = 240 Vac

**48** = 480 Vac

**57** = 570 Vac

**(LOAD CURRENT)** = Current applied to load at 100% command signal.

**(XX)** = Command signal: **0 to 5Vdc**,  
**0 to 10Vdc**,  
**4 to 20mA** or  
**POTENTIOMETER.**

## MANUFACTURED BY:

