

**CONTROL
CONCEPTS
INC.**

**INSTRUCTION MANUAL
MODEL 1031**

DESCRIPTION:

The model 1031 controller accepts either a 1 to 5Vdc command signal, or the signal from a remote potentiometer such that the power applied to the load is linear with respect to the command signal or the potentiometer setting. The circuit uses a distributive control technique in which the time frame varies as a function of on and off cycles as opposed to a time proportioning technique in which the on or off time is a percentage of a fixed time frame.

The circuit is powered by a 24Vac transformer which should be connected to the same line as the controller for optimum operation. The remote 1K potentiometer is powered by the circuit. A single pole double throw switch can be used to connect terminal "W" to either the wiper of the potentiometer or to the positive potential of the 1 to 5Vdc command signal as shown in the electrical connections section. (See Fig. 6, on P.2.)

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.

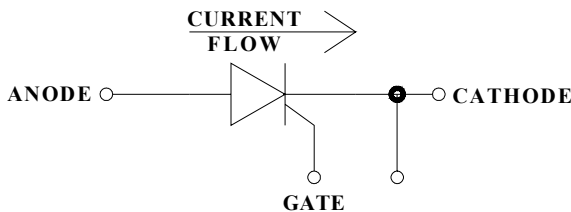


Figure 1. SCR Symbol

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).

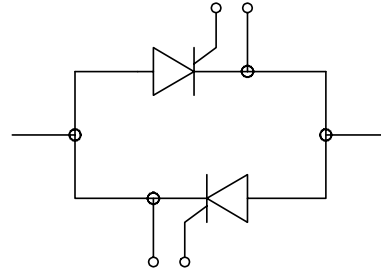


Figure 2. SCR AC Switch

ZERO-CROSS 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.

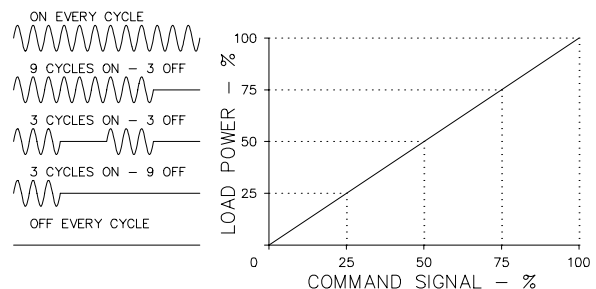


Figure 3. Distributive Zero-Cross Operation.

INSTALLATION DRAWINGS:

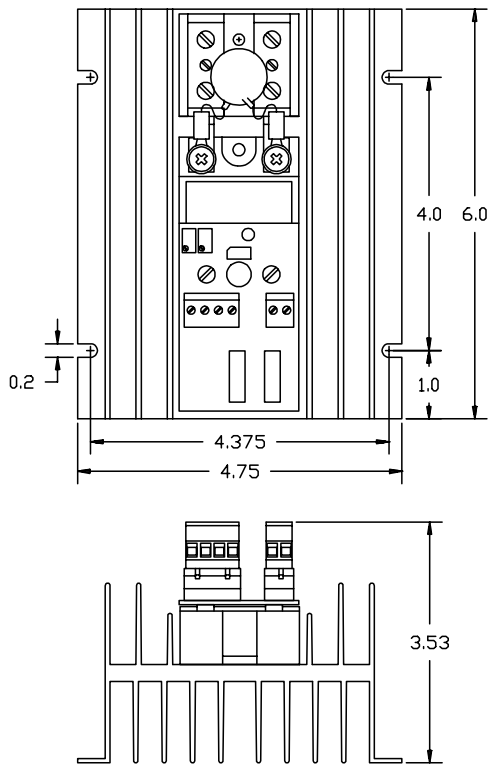


Figure 4. 10, 20, 30 & 40 Amp frame.

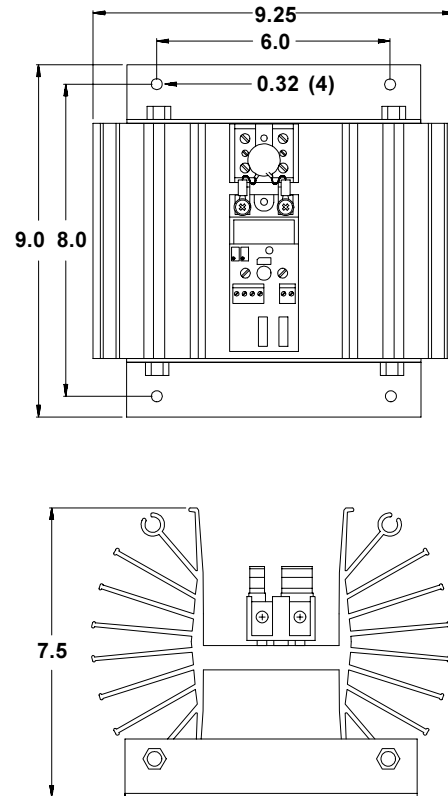


Figure 5. 70 Amp frame.

ELECTRICAL CONNECTIONS:

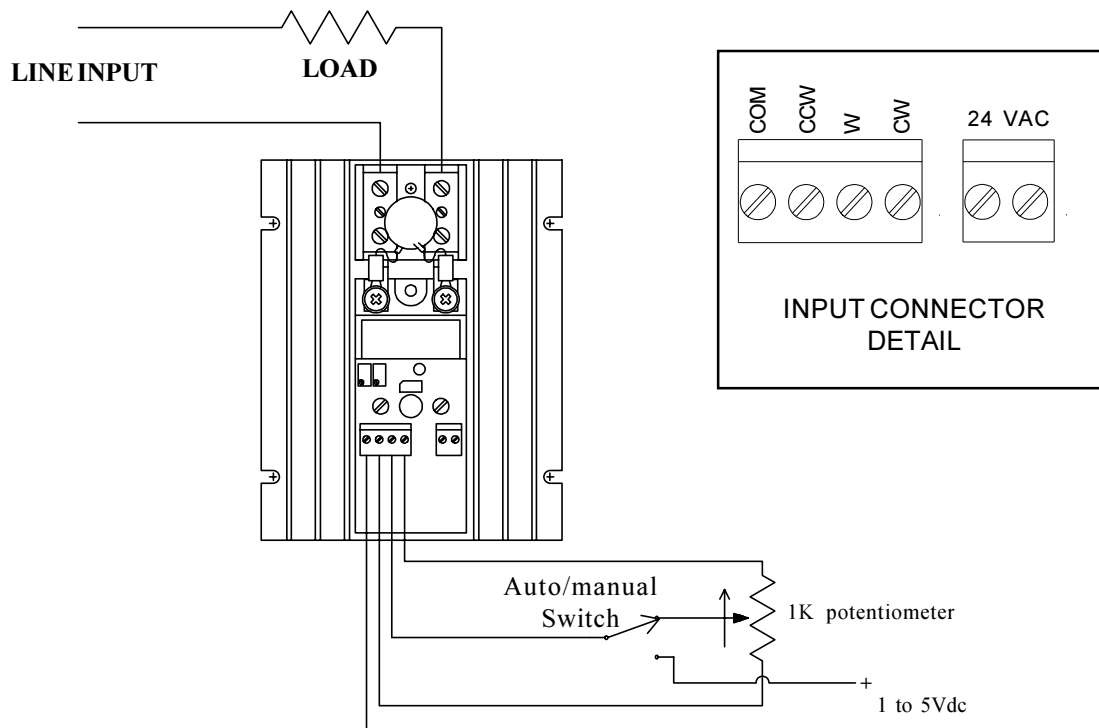


Figure 6. Load and control connections.

TROUBLE SHOOTING:

CAUTION

To avoid electrical shock, do not attempt to service the controller unless power has been removed or shut off.

The LED lamp is "ON" when power is to be applied to the load. If the LED will not turn "ON" check that the command signal is correctly applied to the circuit card. If the command signal is correct, the circuit card may have failed. If the LED is "ON" and no load power exists the SCR switch has likely failed. If the load power is applied when the led is "OFF" The SCR switch has failed.

SPECIFICATIONS:

Command:

Potentiometer: 1K preferred,
20k permissible
1-5Vdc: 100K input impedance
Max.

Environment:

Operating temp: 0 to 55°C
Storage: -40 to 85°C
Humidity: 0-95% non-condensing

Supply voltage:

120Vac, 240Vac, 480Vac or 575Vac.

Control range:

0 to 97% of line voltage.

Zero and span adjustment

Field adjustable over $\pm 20\%$ range.

MODEL No:

1031-(VOLTAGE)-(CURRENT RATING)

(VOLTAGE) = Rated operating voltage

12 = 120 Vac
24 = 240 Vac
48 = 480 Vac
57 = 570 Vac

(CURRENT RATING) = Current rating at 100% command signal.

ADJUSTMENTS:

The zero and span adjustments have been factory calibrated and should require no adjustments in the field. If adjustments are made follow these procedures:

Zero:

The zero adjustment determines the output when the command signal is zero. Adjust the zero potentiometer with either the control potentiometer full counterclockwise or with the command signal set at 1Vdc until the desired output is obtained. Clockwise rotation of the potentiometer increases the output.

Span:

The span adjustment determines the output when the command signal is maximum. Adjust the span potentiometer with either the control potentiometer full clockwise or with the command signal set at 5Vdc until the desired output is obtained.

The span and zero adjustments do interact and it may be necessary to repeat the above steps for maximum accuracy.

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 connectors may be removed by pulling them away from the circuit board.

REFERENCE DRAWINGS:

AS1401 Transformer Inst. Dwg.
B1000482A2 Schematic Drawing

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