

CONTROL CONCEPTS INC.

INSTALLATION MANUAL MODEL 1832A



CONTROL
CONCEPTS

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WARNING: The Control Concepts, Inc. power controllers use power thyristors to switch voltage to the connected load. Line voltage must be assumed at the output terminals at all times, even when the control signal has been removed and the load voltage appears to be off. It has been mandated by the National Electrical Code and the Occupational Safety and Health Act of 1970 that a physical disconnect be opened ahead of all remotely actuated controls before performing any maintenance work on the controller or its connected load.

PROPRIETARY DATA

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DESCRIPTION

The model 1832A is a DC output controller based on the Control Concepts model 1032A controller with its output routed through a full wave bridge. It is a single-phase, phase-angle, SCR power controller with features of field adjustable current limiting, softstart and missing cycle detection.

The model 1832A is available for 120 or 240 Vac 50/60 hertz, at current ratings of 10, 20 or 30 Amps. The controller can be ordered to accept command signals of 0-10Vdc, 0-5Vdc, 4-20mA, or a potentiometer signal.

The model 1832A linearly controls, with respect to the command signal, the RMS value of the voltage applied to the load. The 1832A has line voltage compensation, which, for a constant command signal, maintains the load voltage constant, independent of line or supply voltage variations.

The soft-start and missing cycle detection feature sets the load voltage to zero on power interruptions of one half cycle or more, and then increases the load voltage to the desired value at a predetermined rate. This feature, on start up or after power failures, prevents saturation of load transformers. The feature also eliminates in-rush currents that can occur, due to loads with a low cold resistance.

Current limiting allows the user to adjust the maximum current the controller will apply to the load. This feature is desired when controlling loads in which the resistance changes with temperature and/or time. Electrical isolation of the circuit card and the heat sink is achieved by the use of a module that electrically isolates the SCRs from its mounting plate, and which uses photo couplers to isolate the SCR gate signals.

SPECIFICATIONS

Control Mode:	Single-phase; Phase-angle; RMS or AVG value of the voltage or current applied to the load, (user selectable).		
Command Signal:	Input signal 0-5Vdc 0-10Vdc 1 to 20 K Pot. 4/20mA	Input Impedance: 100K ohms 200K ohms 200K ohms 300 ohms	
Control Range	6 to 97% of line voltage, RMS or AVG, typical. Subject to limiting.		
Linearity:	RMS load voltage is linear within 2% of span of the command signal		
Zero and Span Range:	User adjustable over a range of 20% of span.		
Current Limit Range:	User adjustable over a range from 20% to 110% of rated RMS or AVG current.		
Isolation:	Dielectric strength input/line & load voltage/heatsink: 2500 V(RMS) Insulation resistance input/line & load voltage/heatsink: 10^10 ohms Maximum capacitance input to output: 8 pF		
Cooling:	Convection, with fins oriented vertically.		
Mounting:	Must be mounted on vertical surface with fins oriented vertically. Units may be mounted adjacent to each other. Heat sink is electrically isolated from control signal and power.		
Line voltage:	120 or 240 Vac +10%,-20%, 50/60 Hertz. Consult factory, other voltages may be available.		
Load Current:	10, 20 or 30 Amps D.C., 50/60 Hertz.		
Diagnostic Indicators:	The intensity of the 'SSR DRIVE' LED varies proportionally to the voltage applied to the load. The intensity of the 'LOAD CURRENT' LED varies as a function of the load current. The 'LIMIT' LED comes on when the limit (voltage or current) has been reached. These LED's provide a quick and safe means to check controller operation.		
Physical:	Weight: 10 & 20 Amps: 5 lbs. max. 30 Amps: 9 lbs. max. Dimensions: See installation drawings.		
Environment:	Operating: 0 to 55°C (32 to 131°F). Storage: -40 to 80°C (-40 to 176°F). Humidity: 0 to 95% Non-condensing.		
dv/dt & Transient Voltage Protection:	200 volts/usec minimum. A dv/dt snubber and a metal oxide varistor (MOV) are provided to protect against high frequency transients (dv/dt) and voltage spikes.		
Heat dissipation:	1.5 watts per amp of controlled current.		
Recommended Fusing:	Special semiconductor fuses are not required. It is recommended that the controller and load be protected with fast acting class "T" fuses such as Bussmann type JJN fuses. Control Concepts maintains an inventory of fuses and fuse holders for your convenience.		

INSTALLATION

The controller must be mounted on a vertical surface such that the heat radiating fins are vertical. The controller should be located in an environment that will not exceed 55°C and is free of dust, dirt and moisture.

Figure 6, Figure 7 and Figure 8 show power and control connections. All wiring must be per local electrical codes. The supply and load terminals will accept aluminum wire from #2 to #8 and copper wires from # 2 to #14.

It is recommended that the controller and the load be protected with fast acting fuses such as the JJN class "T", series of fuses manufactured by the Bussmann Company.

RECOMMENDED TIGHTENING TORQUE
FOR GREEN CONNECTOR:



WIRE SIZE (AWG)	TORQUE
12 TO 26GA	5.0 IN-LBS

RECOMMENDED TIGHTENING TORQUE
USD CONNECTORS:



WIRE SIZE (AWG)	TORQUE
14 - 10 GA	35 IN-LBS
8 GA	40 IN-LBS
4 - 6 GA	45 IN-LBS
2 - 3 GA	50 IN-LBS

NOTE:

Wiring should be installed per local electrical codes.

START-UP

Set the command to zero and apply system power. The load voltage should start at zero and should increase as the command signal is increased.

ADJUSTMENTS

Zero:

(Factory set to provide zero load voltage when a zero command signal is applied) The zero potentiometer is used to adjust the controller to provide zero load voltage when the command is zero.

Span:

(Factory set to provide 100% output with 100% command) The span determines the load voltage for a given command input.

Current Limit:

Factory set at 105% of rated current unless ordered with a specific current limit setting. Counterclockwise rotation decreases the point at which current limit occurs.

CALIBRATION

The span and zero have been adjusted at the factory and should require no further adjustments.

If adjustments become necessary, the following procedures should be used:

1. Set the command signal to minimum and adjust the zero potentiometer until the output is zero.
2. Set the command signal to maximum and adjust the span potentiometer until the output is at the desired maximum value.
3. The span and zero adjustments may interact. It may be necessary to repeat steps 1 and 2.

Note: Loads with variable resistance may cause the current limiting feature to limit the output of the controller, which would appear as though the span is not adjusted properly.

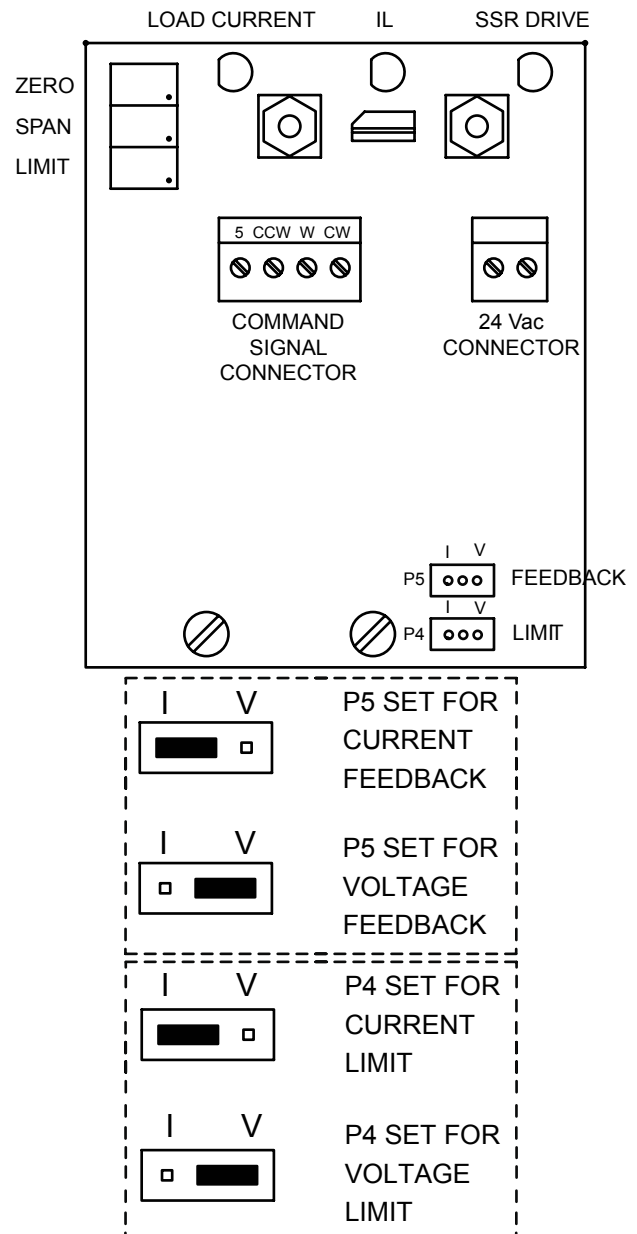


Figure 1. 1832A Board Layout.

INSTALLATION DRAWINGS (Continued)

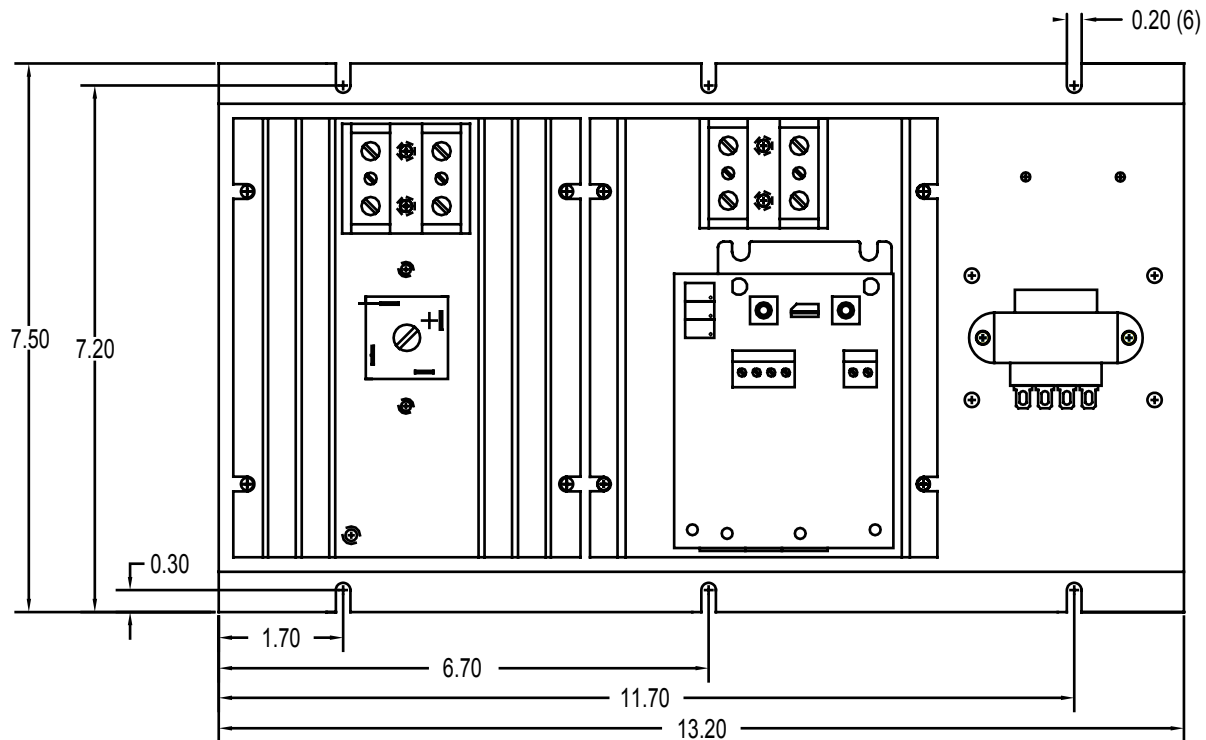


Figure 4. 30 Amp Controller (Top View).

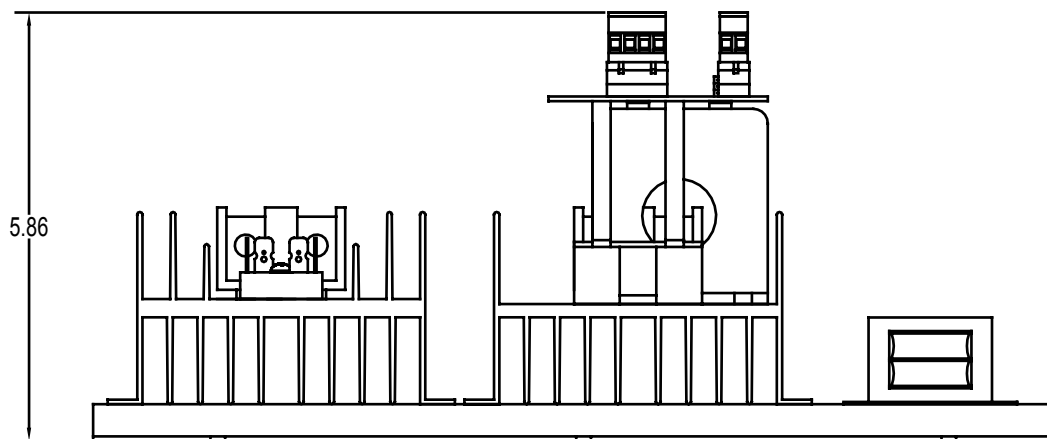


Figure 5. 30 Amp Controller (Side View).

POWER CONNECTIONS

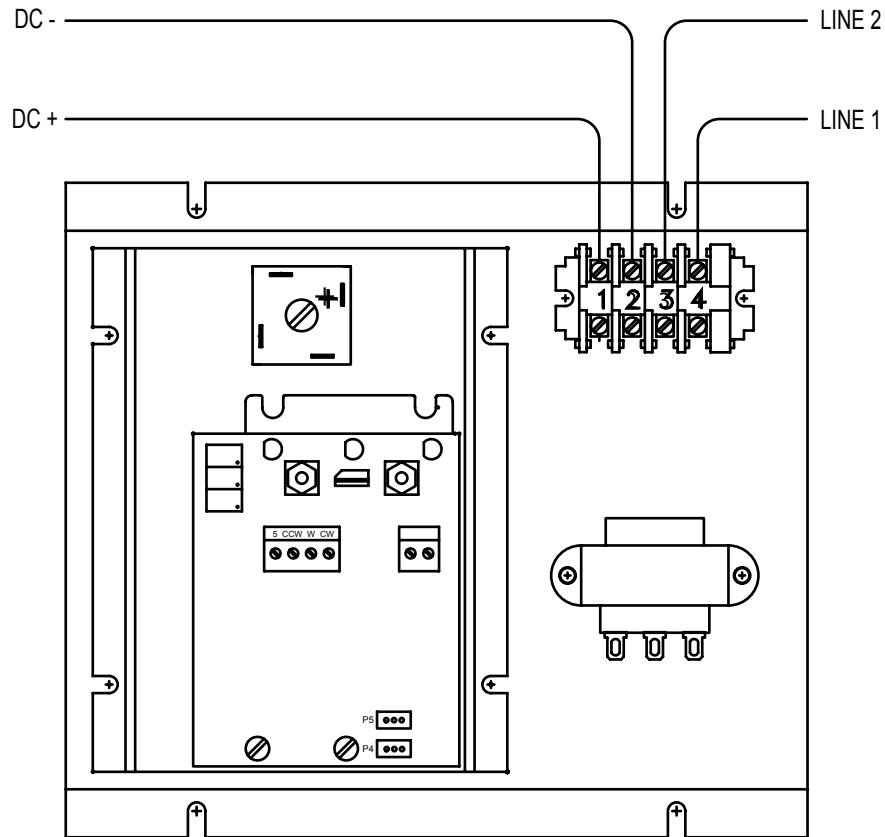


Figure 6. 10 & 20 Amp Controller.

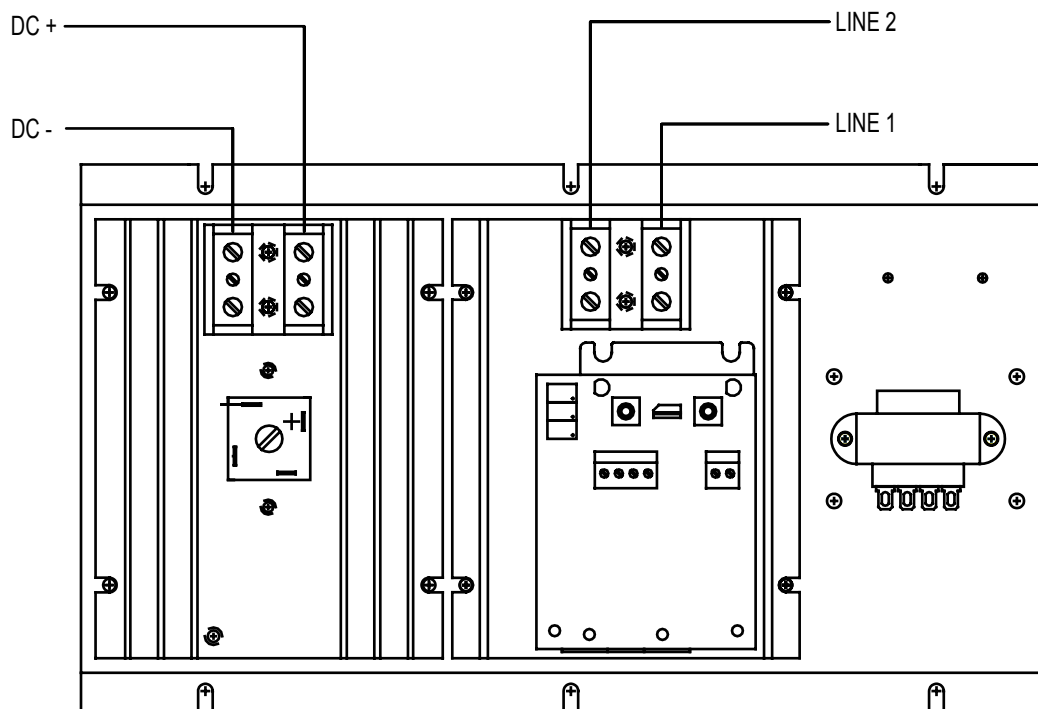


Figure 7. 30 Amp Controller.

COMMAND CONNECTIONS

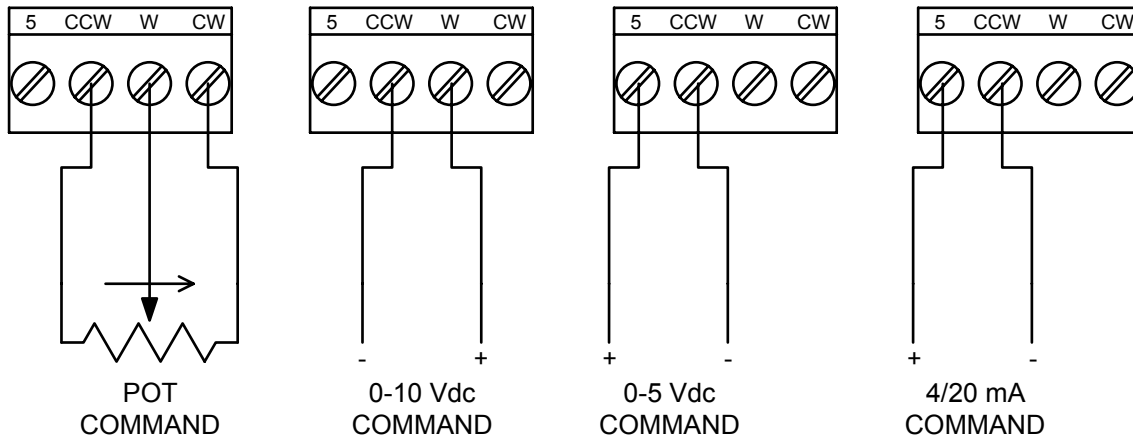


Figure 8. Signal Connections (Apply to all frame sizes).

TROUBLESHOOTING

USE EXTREME CAUTION TO AVOID ELECTRICAL SHOCK

Three LEDs on the circuit board may be used to aid in determining problems with the controller. The '**SSR DRIVE**' LED varies intensity proportional to command signal and is proportional to the load voltage. The '**LOAD CURRENT**' LED varies intensity proportional to current through load. If the load current or voltage reaches the limit setting, the intensity of the '**LOAD CURRENT**' LED will not get brighter. The '**LIMIT**' LED will light if the current limit has been reached when the jumper on P4 is in the current limit position. The '**LIMIT**' LED will light if the voltage limit has been reached when the jumper on P4 is in the voltage limit position.

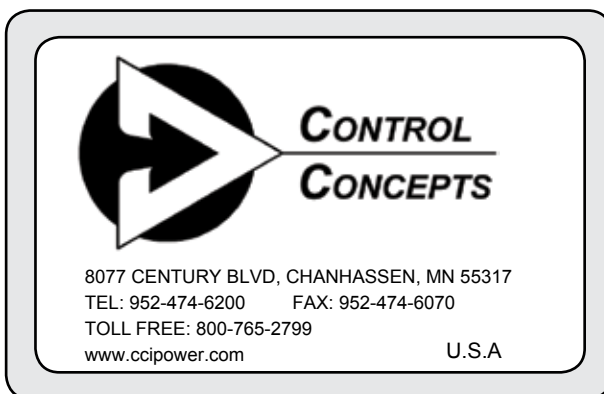
SYMPTOMS	POSSIBLE CAUSES
NO LOAD POWER: The 'LOAD CURRENT' LED is not on, the intensity of the 'SSR DRIVE' LED can be varied:	Determine that the load is wired correctly to the controller. Determine that all fuses are "OK". If the voltage across the SSR module is equal to the line voltage, the SSR module has probably failed. If a replacement SSR module is ordered, specify the voltage, current rating and serial number of the failed unit.
MAXIMUM LOAD VOLTAGE CANNOT BE REACHED:	The current limit feature may prevent maximum line voltage from being applied to the load. To determine if the current limit feature is preventing full voltage from being applied to the load, look at the IL led.
LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED: 'SSR DRIVE' LED is on: 'SSR DRIVE' LED is off:	Determine that the command signal is zero. To do this, remove the command signal connector. If the LED remains on, the circuit card has likely failed. If a replacement circuit card is ordered, specify the voltage rating, current rating and serial number of the controller. Remove the 24Vac power connector. If the load still has power, the SSR module has probably failed. To confirm that the SSR module is shorted, remove the line and load connections and measure the resistance across the line and load terminals of the controller. If the resistance is less than 10,000 ohms, the SSR module has likely failed. If a replacement SSR module is ordered, specify the serial number, and voltage and current ratings of the controller.

REPLACEMENT PARTS

If a replacement SCR module is ordered, specify the voltage, current rating and serial number of the failed unit.
When ordering an extra firing circuit, please specify the command range.

Model	FIRING CIRCUIT	SCR MODULE	RECOMMENDED CLASS "T" FUSES	FUSE KITS (Fuses & Holders)
	CCI PART #	CCI PART #	CCI PART #	CCI PART #
1832A-12-10	1832A-FC	1652-12-10-T	42110-0430-315	FK\32T15
1832A-12-20	1832A-FC	1652-12-20-T	42110-0430-325	FK\32T25
1832A-12-30	1832A-FC	1652-12-30-T	42110-0430-335	FK\32T35
1832A-24-10	1832A-FC	1652-24-10-T	42110-0430-315	FK\32T15
1832A-24-20	1832A-FC	1652-24-20-T	42110-0430-325	FK\32T25
1832A-24-30	1832A-FC	1652-24-30-T	42110-0430-335	FK\32T35

MANUFACTURED BY



MODEL NUMBER IDENTIFICATION

1832A-[V-A]-[Out]-[RFRL]-[CS]

1832A Basic model number

[V-A] Rated Voltage

12-10 = 120 Vac @ 10 Amps
12-20 = 120 Vac @ 20 Amps
12-30 = 120 Vac @ 30 Amps
24-10 = 240 Vac @ 10 Amps
24-20 = 240 Vac @ 20 Amps
24-30 = 240 Vac @ 30 Amps

[Out] DC output voltage @ 100% command

75 = Calibrated for 75 Vdc Avg.
95 = Calibrated for 95 Vdc Avg.
150 = Calibrated for 150 Vdc Avg.
190 = Calibrated for 190 Vdc Avg.

[RFRL] Feedback/Limit

AF/RL = Average Feedback / RMS Limit
AF/AL = Average Feedback / Average Limit
RF/RL = RMS Feedback / RMS Limit
RF/AL = RMS Feedback / Average Limit

[CS] Command Signal

0/5 = 0 to 5 Vdc
0/10 = 0 to 10 Vdc
Pot = 1K Potentiometer
4/20mA = 4 to 20 mA^{dc}*

*If the controller is supplied as a 4/20mA input, an appropriate shunt resistor will be added to the circuit to provide proper scaling. Check with factory for other mA input ranges.

Example:

1832A-24-10-190Vdc-RF/RL-4/20mA

Specifies 240 volt operation at 10 amps with a 190 Vdc output operating with RMS Feedback and RMS Limit with a 4/20 mA command signal.

THEORY OF OPERATION

The heart of the Solid State Relay module (SSR) is the Silicon Controlled Rectifier (SCR), also sometimes referred to as a thyristor.

The SCR has two states, ON and OFF, and allows current to flow in only one direction when turned on. SCRs can remain in the off state even though the applied potential may be several thousand volts. In the on state, they can pass large amounts of amperes. When a small signal is applied between the gate and cathode terminals, the SCR will turn on. (within 100 microseconds).

Once turned on, it will remain on until the current through it is reduced below a very low value, referred to as the holding current. Since the SCR conducts in only one direction, two are placed back to back in an inverse parallel configuration to control AC current. (Figure 9.)

Phase-angle: In phase-angle control, each SCR of the back-to-back pair is turned on for a variable portion of the half-cycle that it conducts (Figures 10 & 11). Power is regulated by advancing or delaying the point at which the SCR is turned ON within each half cycle. Light dimmers are an example of phase-angle control. Phase-angle control provides a very fine resolution of power and is used to control fast responding loads such as tungsten-filament lamps or loads in which the resistance changes as a function of temperature. Phase-angle control is required for inductive loads, or if the load is transformer-coupled.

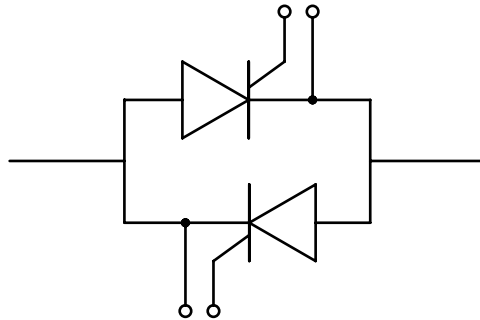


Figure 9. Simplified diagram of an SCR controller.

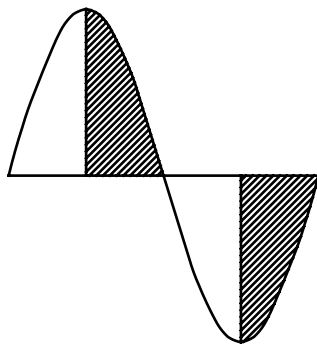


Figure 10. SCR "ON" time, shown by shaded area, is varied to apply the desired load voltage

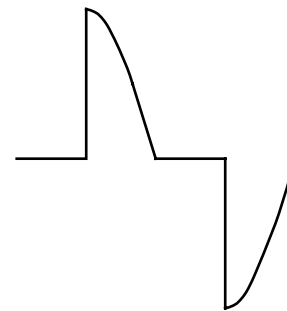


Figure 11. Power is regulated by advancing or delaying the point at which the SCR's are turned on.