Control Concepts
Model 1029C
Power Control System
Instruction Manual

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CONTROL CONCEPTS INC.

INSTALLATION MANUAL
MODEL 1029C

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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 Heath 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.

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50 to 750 AMPS

LISTED 3L32 FILE No: E136219
INDUSTRIAL CONTROL EQUIPMENT

NOTE: THE 1000 AMP UNIT IS NOT UL LISTED

DESCRIPTION

MODEL COVERED:
This manual describes the Control Concepts model 1029C controller with the following ratings:

CURRENT: 50 Amps to 750 Amps.
VOLTAGE: 120 Vac to 575 Vac. @ 50/60 Hz.

GENERAL DESCRIPTION:
The model 1029C is a single-phase, phase-angle power controller that has selectable feedback, dual command signals, adjustable current limiting & over-current trip, shorted SCR detection, estimated output voltage metering and output current metering.

FEATURES

CURRENT LIMITING:
A user adjustable setting prevents the load current from exceeding a presettable value. This feature is useful where variable resistance loads have a heavy current draw as they are warming up.

OVER CURRENT TRIP:
If the SCR current exceeds this preset value, a relay with form C contacts is energized, an LED is lighted and the SCR's are prevented from turning on. This provides a means to initiate an alarm or to remove system power in the event that excessive current occurs. Momentary closure of a remote switch or momentary interruption of main power will reset the O.C.T. circuit.

SOFT START AND MISSING CYCLE DETECTION:
The output voltage is ramped from zero to the desired output at a ramp rate equivalent to a time constant of 0.2 seconds on power interuptions of 1/2 cycle or more. This feature minimizes inrush currents when controlling variable resistance loads or inductive coupled loads.

SHORTED SCR DETECTION:
A relay with form C contacts and an LED is energized in the event an SCR fails in the ON state. This provides a means to initiate an alarm or to remove system power in the event an SCR fails in the "ON" state.

STATUS INDICATORS:

Command - Intensity of command indicator is proportional to the command signal and the “ON” time of the SCRs.

Load - The intensity of the load indicator is proportional to the load current.

Shorted SCR - When “ON”, an SCR has failed in the shorted mode.

Over Current Trip - When “ON” indicates that load current has exceeded the preset Over Current Trip level.

RUN OR IDLE INPUT SELECTION:
With this feature, either of two command signals can be selected by a remote switch. This allows the controller to be conveniently switched from a "RUN" to an "IDLE" state, or from an "AUTOMATIC" to a "MANUAL" control.

CHOICE OF FEEDBACK:
The Average value of the load voltage, the RMS value of the load voltage or the RMS value of the load current can be linearly controlled with respect to the command signal. The power (watts) applied to the load can also be linearly controlled with respect to the command signal. (Power feedback is an option that must be factory installed.) The controller will also accept external feedback signals of 0/5 Vdc or 100 uA representing other process parameters.

OUTPUT METERING:
A filtered 0/5 Vdc signal representing the load voltage and a 0/5 Vdc signal representing the load current are provided for remote monitoring.

SPECIFICATIONS

The following specifications apply over an ambient temperature of 0 to 55ºC and a supply voltage of 85% to 110% of the nominal supply voltage rating.	
CONTROL MODE:	Single phase SCR phase-angle control.
FRAME SIZE:	The "[AMPS]A" term within the model number specifies the maximum continuous RMS current rating at the maximum operating ambient temperature of 55ºC.
RUN COMMAND SIGNAL AND/OR IDLE COMMAND SIGNAL:	Command signal — Input Impedance 1/5mA — 1200 ohms 4/20mA — 300 ohms 0-5Vdc — 200K ohms Potentiometer — 200K ohms (1K, 1/4watt pot recommended for optimum linearity, up to 20K permissible) The control circuit supplies 5 Vdc to the potentiometer. Other command signal ranges may be available. Check with factory for special applications. **If it is desired to use a current command in both the run <u>and</u> idle command input, the signals must be common sourcing or they must be isolated from one another. Contact factory for more information.**
OPERATING VOLTAGE:	The control transformer installed in this controller has three selectable voltages; 240, 480 & 575 Vac. Other voltages are be available - contact factory for details.
SCR RATINGS:	Peak forward and reverse voltage 1600 volts
SCR SURGE CURRENT RATINGS : **(peak one cycle non-repetitive I_{TSM} @ 125°C)**	Controller Rating — Surge Current Rating 50 & 80 Amp: — 1750 Amps Peak 120 Amp: — 1900 Amps Peak 160 Amp: — 4000 Amps Peak 200 Amp: — 4500 Amps Peak 250 Amp: — 5200 Amps Peak 300 Amp: — 7000 Amps Peak 380 Amp: — 10,000 Amps Peak 425 Amp: — 13,000 Amps Peak 500 Amp: — 10,000 Amps Peak 600 Amp: — 13,000 Amps Peak 750 Amp: — 16,500 Amps Peak
SCR PROTECTION:	dV/dT rating = 200 volts/microsecond. dV/dT circuit consists of a capacitor in series with a noninductive resistor. This circuit is in parallel with the SCRs. The SCRs are protected from voltage transients by a Metal Oxide Varistor.
RUN/IDLE CONTROL:	A contact closure selects either the run command signal input or the idle command signal input. See Figure 10.
ELECTRICAL CONNECTIONS: # of LUGS PER LINE/LOAD CONNECTIONS	Connectors for line and load are provided for copper wire from 6 ga to 250MCM on controllers rated 50 to 425 Amps. Connectors for line and load are provided for copper wire from 1/0 to 500MCM on controllers rated 500 to 750 Amps.
ELECTRICAL ISOLATION:	50-160 Amp heatsink to supply and load voltage: 2500 Volts Peak 200-750 Amp heatsinks are at line voltage potential. Command signal to supply and load voltage: 1500 Volts Peak

SPECIFICATIONS (Continued)

ZERO AND SPAN:	Potentiometers on the circuit board allow zero and span adjustments of ± 25% of span for run and idle and are factory calibrated.
CURRENT LIMITING:	A potentiometer on the circuit board allows adjustment of the current limit setting from 20% to 105% of the controller rating. (The current limit potentiometer is factory set for 105% of the rated current unless otherwise specified.)
VOLTAGE METER OUTPUT:	A filtered metering signal equals 5.0 Vdc when the nominal line voltage is applied to the load. Metering load = 5mA max.
CURRENT METER OUTPUT:	A filtered metering signal equals 5.0 Vdc when the frame rating current is applied to the load. Metering load = 5mA max.
GATE DRIVE:	An optical coupled current source of 250mA with a minimum compliance of 10 volts provides the gate drives to the SCRs. Duration or "back porch" is approximately 1.4 milliseconds (60 electrical degrees).
VOLTAGE COMPENSATION:	When using voltage feedback, the load voltage remains constant, independent of supply voltage changes within + 10%, -15%.
POWER DISSIPATION:	1.5 Watts per amp of load current.
CERTIFICATION:	Model 1029C, 120 - 575 Volts, 50 - 750 Amps, is U.L. listed. U.L. File No. E136219.
INTERNAL FEEDBACK AVG:	User has choice of: True RMS Voltage, or True RMS Current. Power feedback can be factory installed if desired. Only one type of feedback may be selected.
EXTERNAL FEEDBACK:	An external 0 to 5Vdc or 0 to 50uA signal, (derived from the load,) may be used for external feedback into the controller. See Figure 19 for connections.
LINEARITY:	The controlled variable is linear within 2% of Span with respect to command signal.
COMMAND INDICATOR:	This green LED indicates that the gate drive is present.
LOAD CURRENT INDICATOR:	The intensity of this green LED is proportional to the load current.
OVER CURRENT TRIP INDICATOR:	This amber LED, when lighted, indicates the over current limit has been exceeded and the Over Current Trip relay has been energized. The SCR's will be prevented from turning on while this circuit is active. Reset by closure between Pins 9 & 10 or momentary power interruption. See Figure 7.
SHORTED SCR INDICATOR:	This red LED, when lighted, indicates a shorted SCR.
O.C.T. & SHORTED SCR RELAY CONTACT RATINGS:	The Over Current Trip, and the Shorted SCR circuits, each control a relay which has form C contacts rated for 5 Amps @ 120Vac. The contacts are available on the command connector. See Figure 7.
CONTROL RANGE:	0 to 98% of supply voltage.
ENVIRONMENT:	Operating temperature 0ºC to 55ºC (32ºF to 132ºF) Storage temperature: -40ºC to 80ºC (-40ºF to 176ºF) Humidity: 0 to 95%, non-condensing
PHYSICAL:	50 & 80 Amp controllers 16 pounds 120 & 160 Amp controllers 17 Pounds 200 to 425 Amp controllers 21 Pounds 500 to 750 Amp controllers 40 Pounds
LINE 2 REQUIREMENTS:	The Line 2 connection is the return for the internal control transformer rated at 50 VA. # 18 ga wire.

INSTALLATION

TRANSFORMER TAP:
Open lid and locate power transformer. Check voltage tap is on desired line voltage.

MOUNTING AND LOCATION:
Mount controllers on a vertical surface with the fins oriented so that air may flow vertically between them. For controllers with fans (excludes the 50 & 80 amp units) may be mounted in any direction.

COMMAND INPUTS:
The 1029C has two command inputs (RUN and IDLE) which are selected by a contact closure. A potentiometer, a DC voltage or a DC current may be used as a command signal into either input. These connections are made to the command connector as described below.

Run/Idle:
A remote switch can be used, as shown in Figure 10, to cause the controller to be controlled by either the run or idle inputs. Connecting terminal 10 (COM) to terminal 11 (RUN/IDLE) on the command connector causes the run signal input to be in control. Opening the connection between terminal 10 and terminal 11 causes the idle signal input to be in control.

COMMAND SIGNAL OPTIONS

Voltage:
A 0 to 5 Vdc signal may be used as the command signal by connecting the positive signal to terminal 13 (run), or terminal 15 (idle). Always connect negative (common) signal to terminal 14 (common). See Figure 9 or Figure 11.

Current:
Connect positive current connection to terminal 13 (run) or terminal 15 (idle). Connect negative or return current connection to terminal 14 (common). See Figure 9 or Figure 11.

When using a current command in both the run and idle command input, they must either be sourcing, or be isolated from one another. Contact factory for details.

Recommended tightening torque for edge card connector: 	
Wire Size (AWG)	Torque
14 to 26GA	**4.4 - 5.5 in-lbs**

Potentiometer:
A 1k ohm to 20k ohm potentiometer, 1/4 watt or more, may be used to adjust the load voltage. (A 1k ohm potentiometer provides the maximum linearity.) See Figure 8 or Figure 10. Consult factory for other options.

POWER & SAFETY CONNECTIONS

Over Current Trip Relay:
Connections to the form C contacts of the over current relay are shown in Figure 7. The contacts are rated for 5 Amps at 120 Vac and are intended for activating an alarm and/or removing power from the system by operating a contactor or a circuit breaker.

Over Current Trip Reset:
Momentary closure of a switch connected between terminals 9 and 10 on the command connector will reset the over current relay and will release the SCRs from the locked off state. The reset switch can also be used as an on off control. Closure of the switch causes the SCRs to be immediately turned OFF. When the switch is opened, the SCRs begin operation at zero conduction angle and slew at the soft start rate to the desired output. The Over Current Trip circuit may also be reset by a momentary interruption of supply power.

Shorted SCR Relay:
Connections to the 5 Amp 120 Vac form C contacts are shown in Figure 7. This relay energizes if an SCR fails in the shorted mode and is intended to activate an alarm and/or cause power to be removed from the system by operating a contactor or a circuit breaker.

Power Connections:
Figure 15 & Figure 16 show typical electrical connections. The LINE 1 and LOAD 1 connectors are approved for wire sizes from 6ga to 500 MCM.

Recommended tightening torque for the line and load connectors: 	
Wire Size (AWG) or Circular Mills	Torque
4 to 6GA	**100 in-lbs**
1 to 2GA	**125 in-lbs**
1/0 to 2/0GA	**150 in-lbs**
3/0 to 4/0GA	**200 in-lbs**
250 to 350MCM	**250 in-lbs**
500MCM	**300 in-lbs**

INSTALLATION DRAWINGS

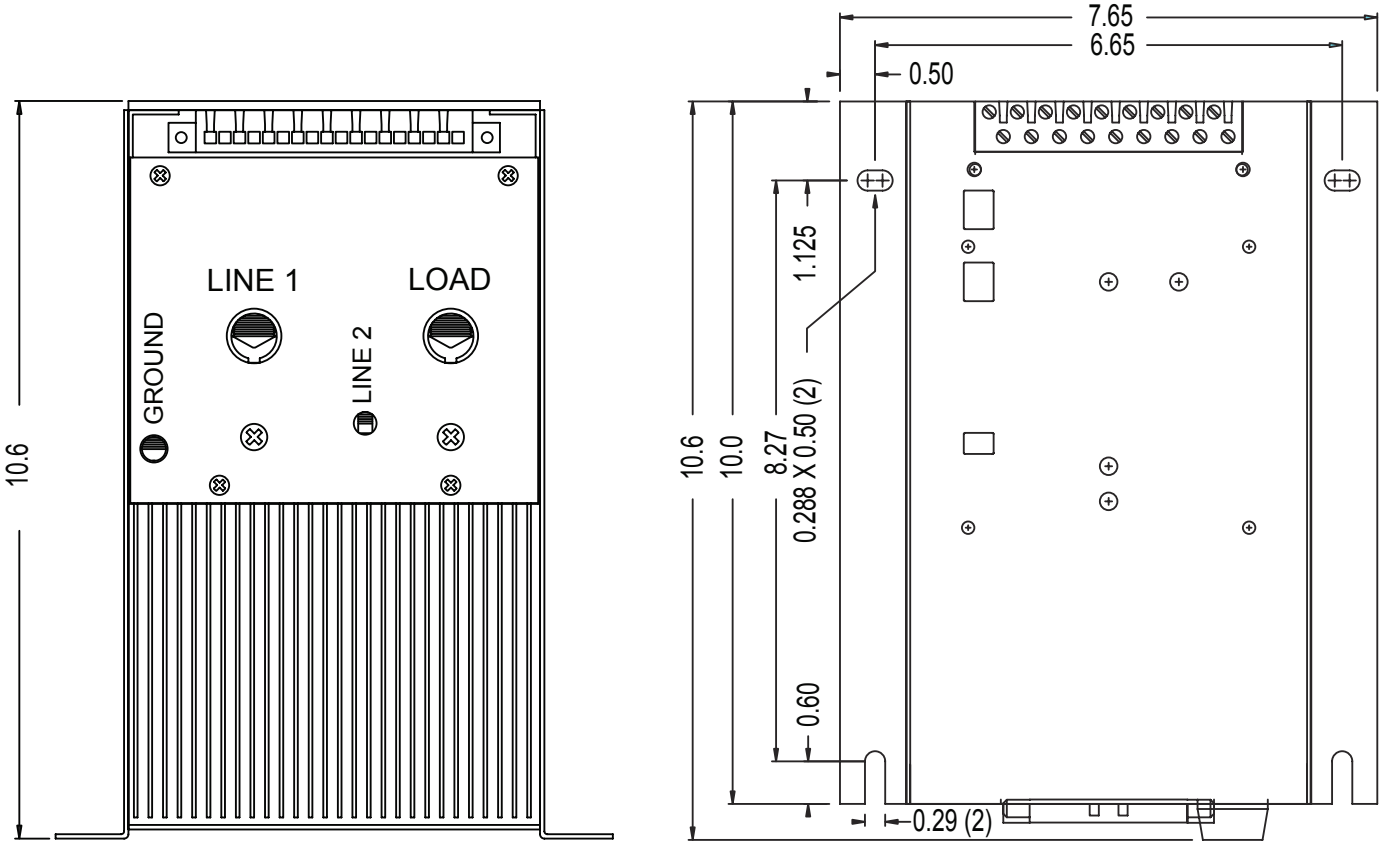


Figure 1. Installation drawing for 50, 80, 120 & 160 Amp units.

NOTE: THE 50 and 80 AMP UNITS ARE NOT FAN COOLED. THEY MUST BE MOUNTED ON A VERTICAL SURFACE WITH THE FINS ORIENTED VERTICALLY SO THAT AIR MAY FLOW FREELY BETWEEN THE FINS.

120 and 160 AMP UNITS ARE FORCED AIR COOLED. THEY MAY BE MOUNTED IN ANY DIRECTION.

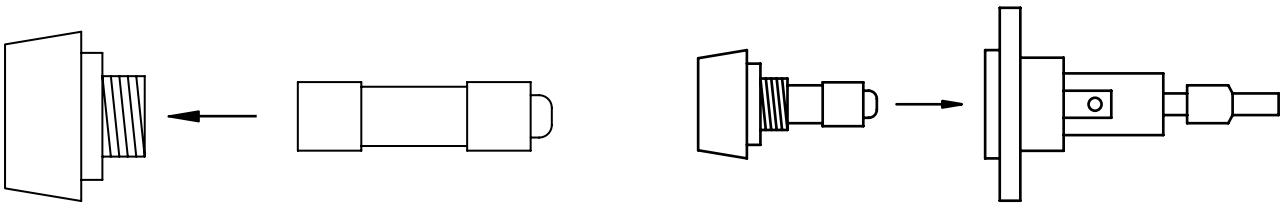


Figure 2.
ORIENTATION OF FUSE IN HOLDER
Fuse makes contact only when correctly installed.
Place flat end of fuse in cap, then insert into holder.

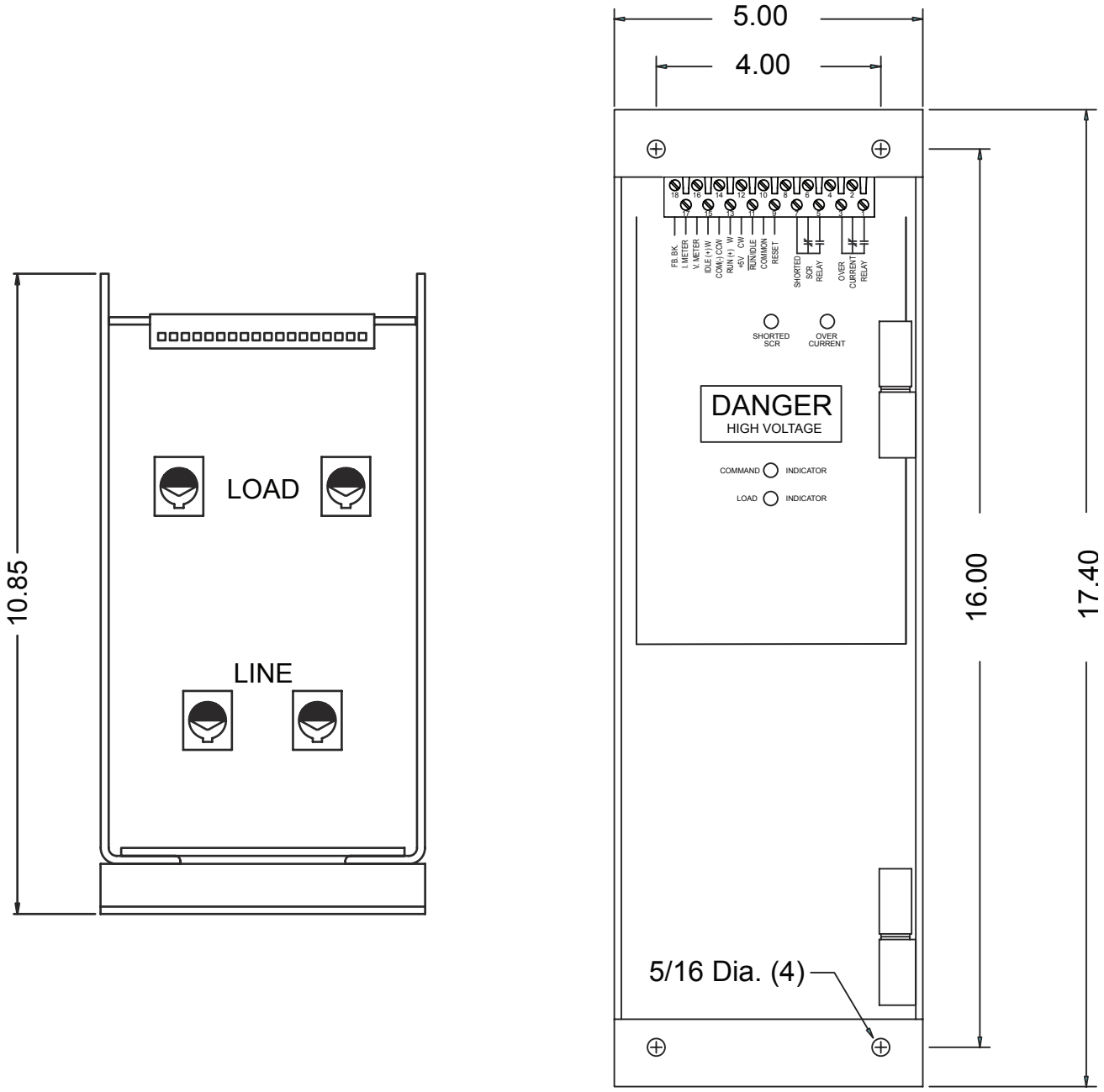


Figure 3. Installation drawing for 200, 250, 300,380 and 425 Amp units.

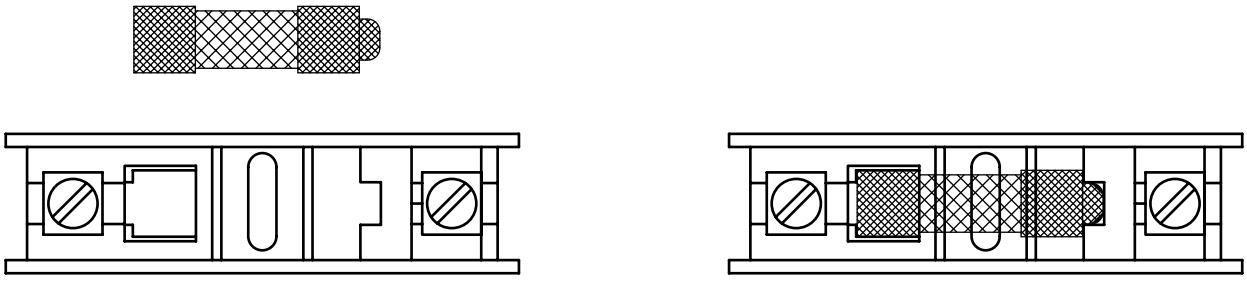
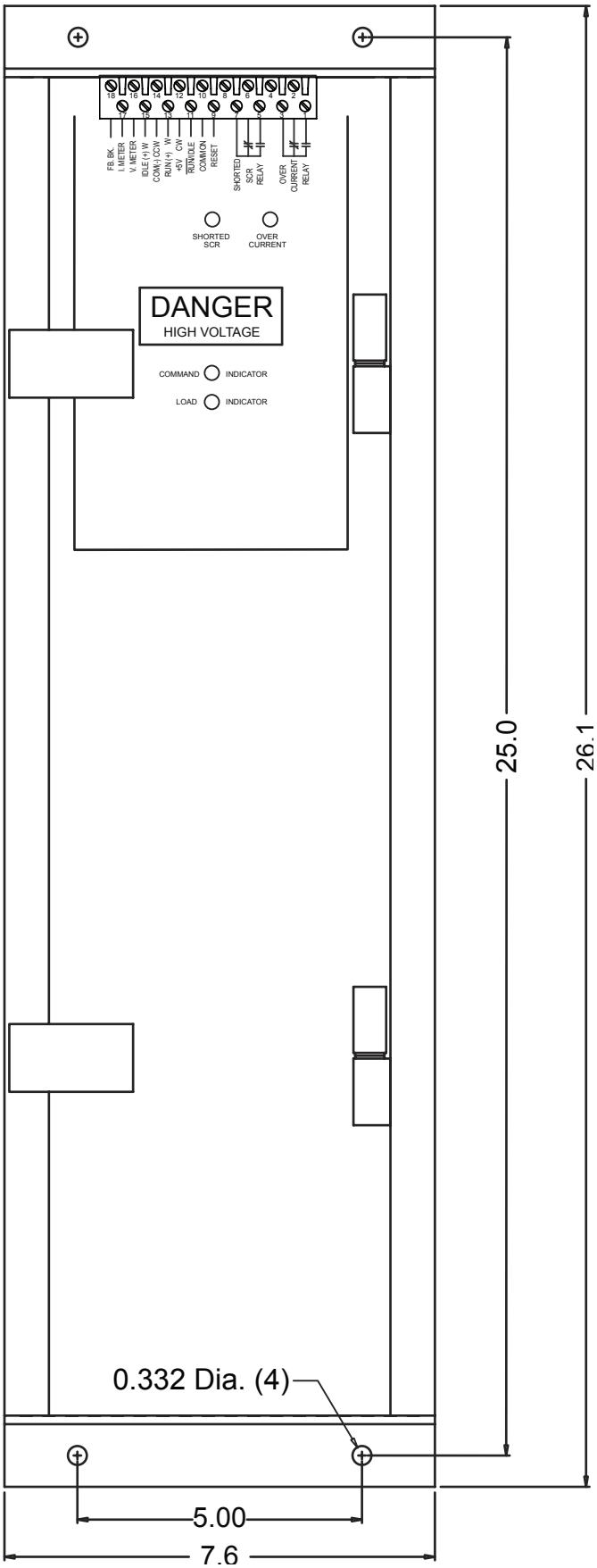


Figure 4.
ORIENTATION OF FUSE IN HOLDER
Fuse makes contact only when correctly installed.

INSTALLATION DRAWINGS (Continued)



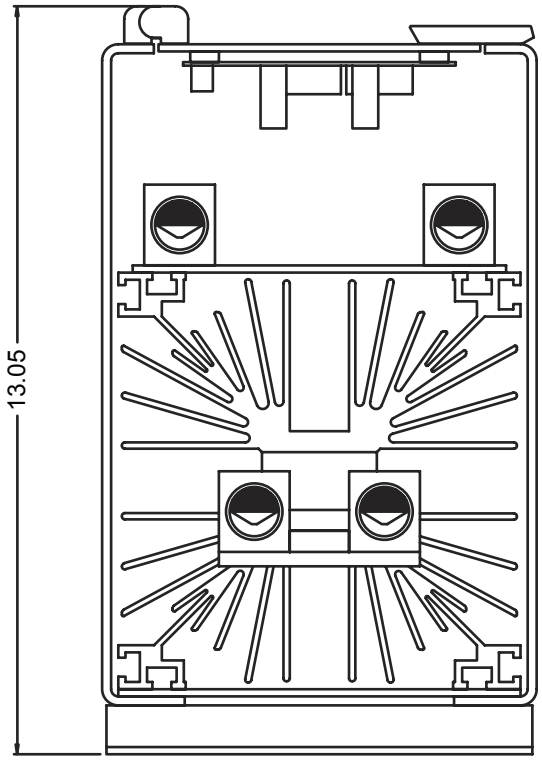


Figure 5. Installation drawing for 500 to 750 Amp units.

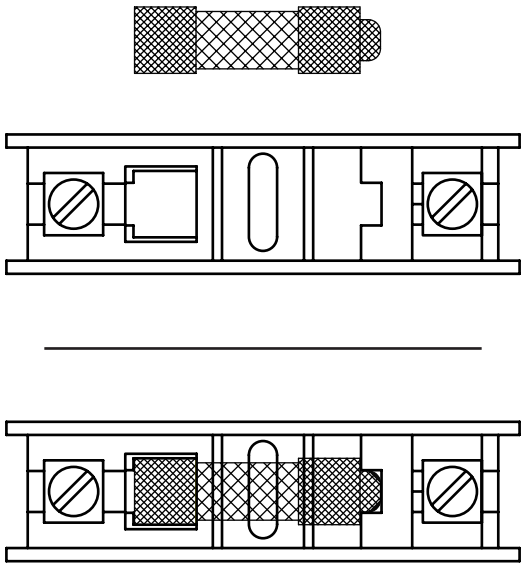


Figure 6.
ORIENTATION OF FUSE IN HOLDER
Fuse makes contact only when correctly installed.

COMMAND CONNECTIONS

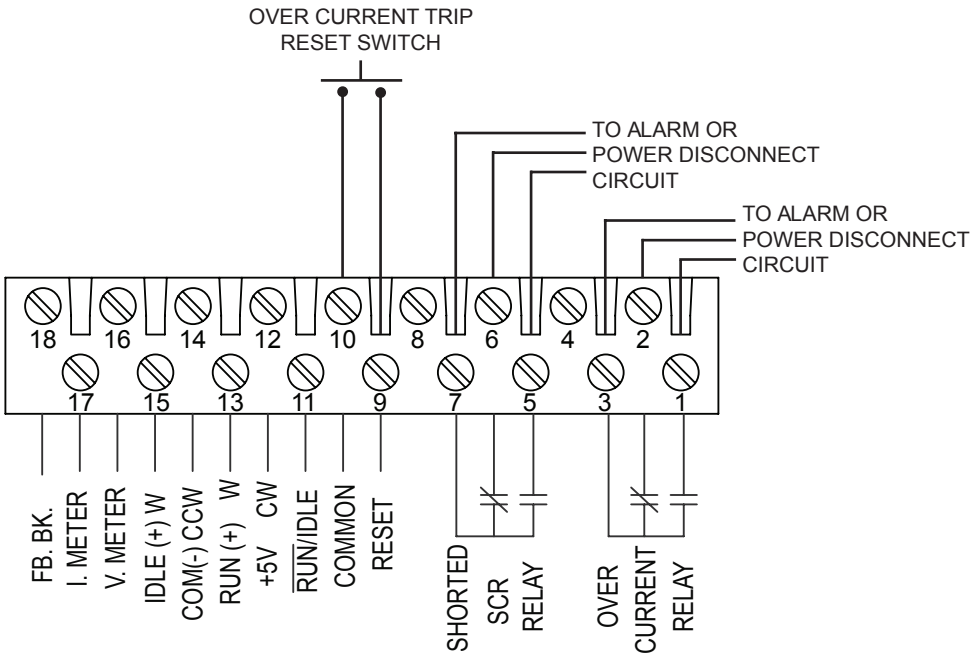


Figure 7. Voltage or current command connections
OVER CURRENT RELAY CONTACTS CHANGE STATE WHEN AN OVERCURRENT CONDITION OCCURS
SHORTED SCR RELAY CONTACTS CHANGE STATE WHEN AN SCR FAILS IN THE SHORTED MODE

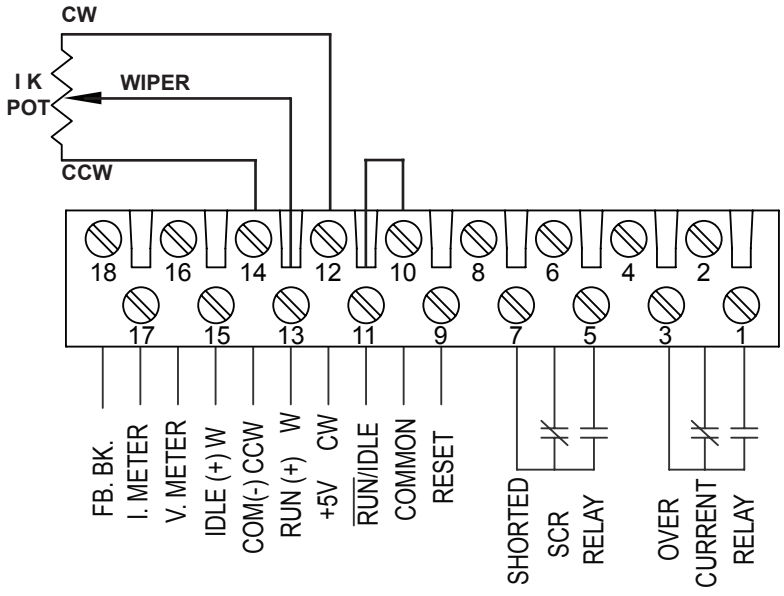


Figure 8. Single potentiometer applied to the run input connections.
(Terminals 10 & 11 must be connected to enable the run input.)
Effective 10/19/2007 the controller will be shipped with shorting jumper on pins 10 & 11.

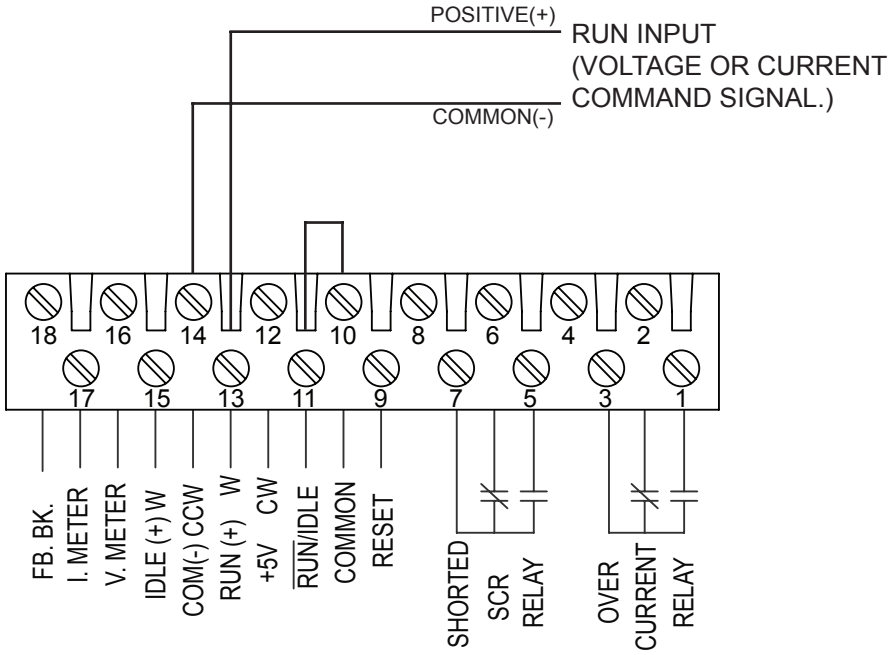


Figure 9. Single voltage or mA current applied to the run input connections
(Terminals 10 & 11 must be connected to enable the run input.)
Effective 10/19/2007 the controller will be shipped with shorting jumper on pins 10 & 11.

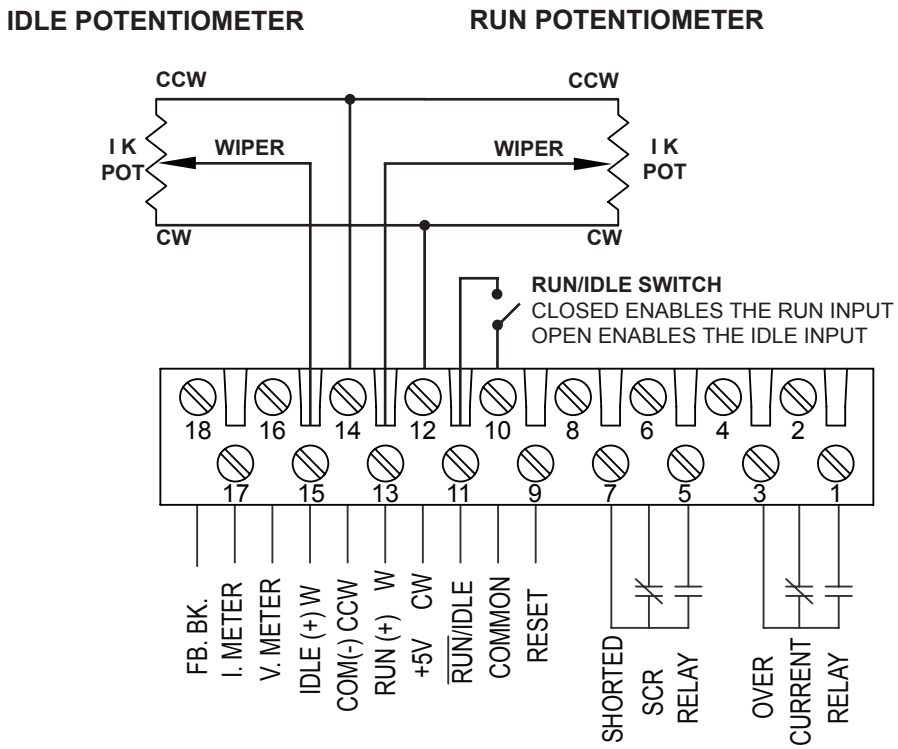


Figure 10. Run and Idle potentiometer connections.

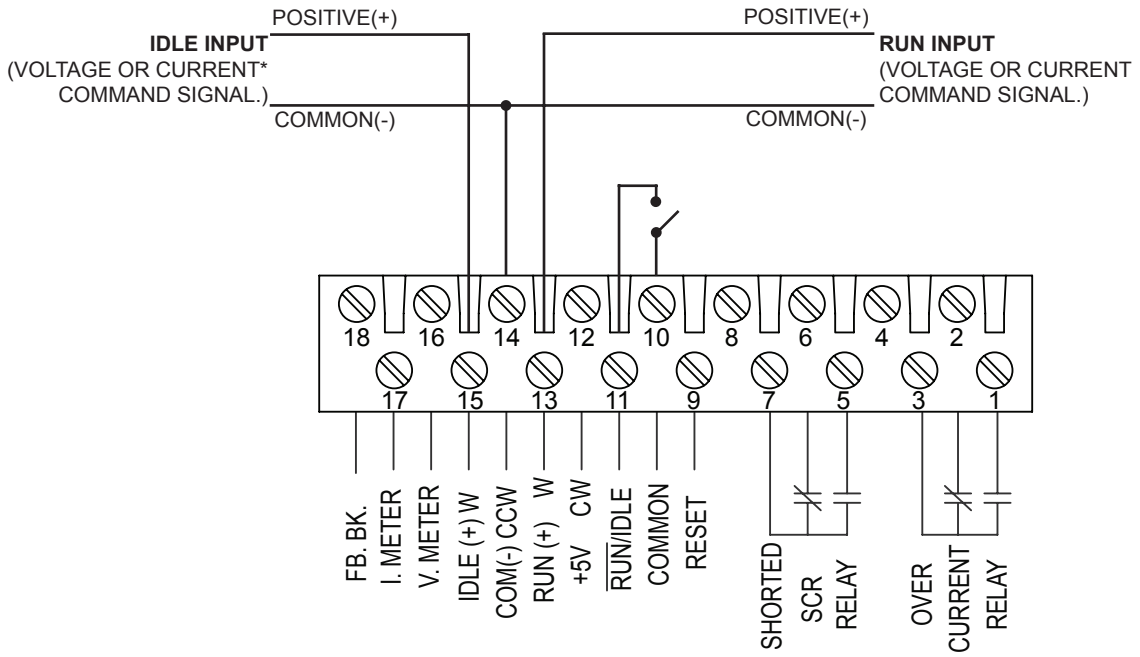


Figure 11. Run and Idle voltage or current connections.
* If it is desired to use a current command in both the Run and Idle command input, the signals must either be common sourcing, or they must be isolated from one another. Contact factory for details.

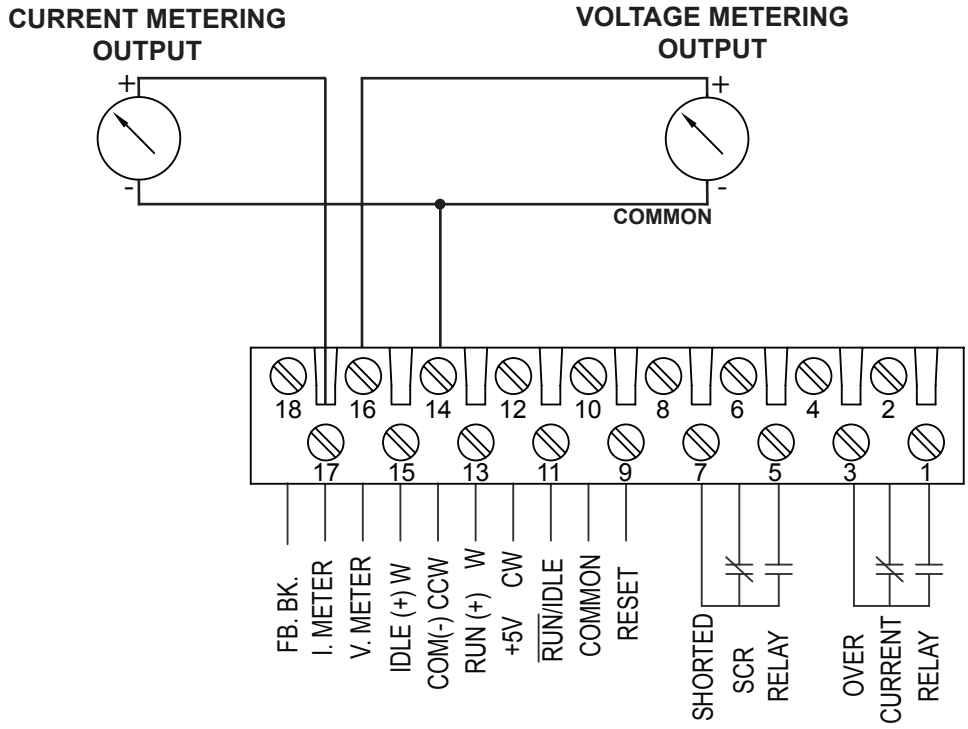


Figure 12. Output metering connections.

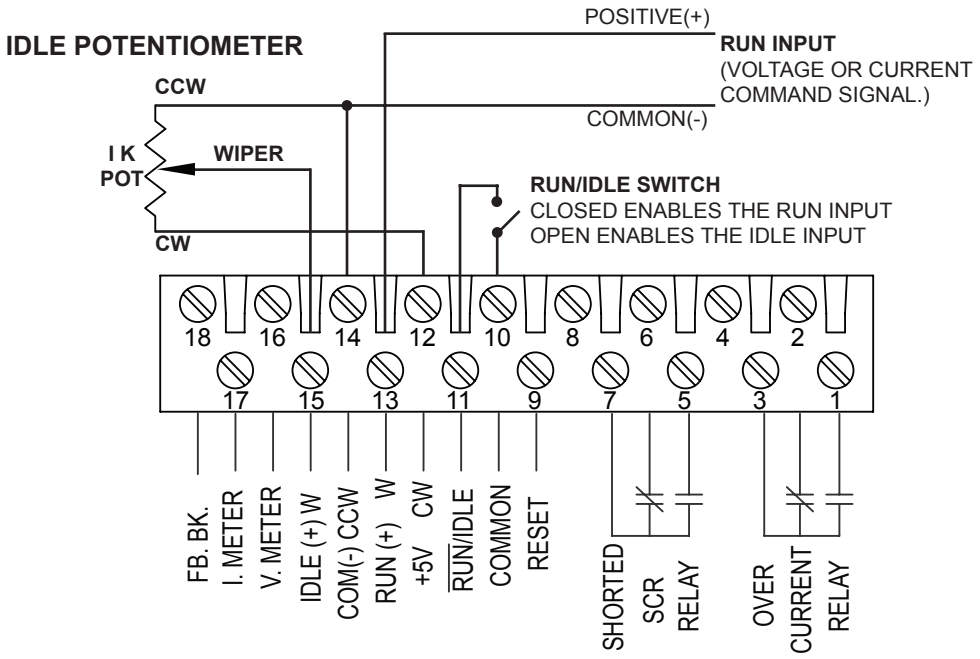


Figure 13. Combination command-signal/potentiomter input connections.
(This is the most common use of a run/idle control.)

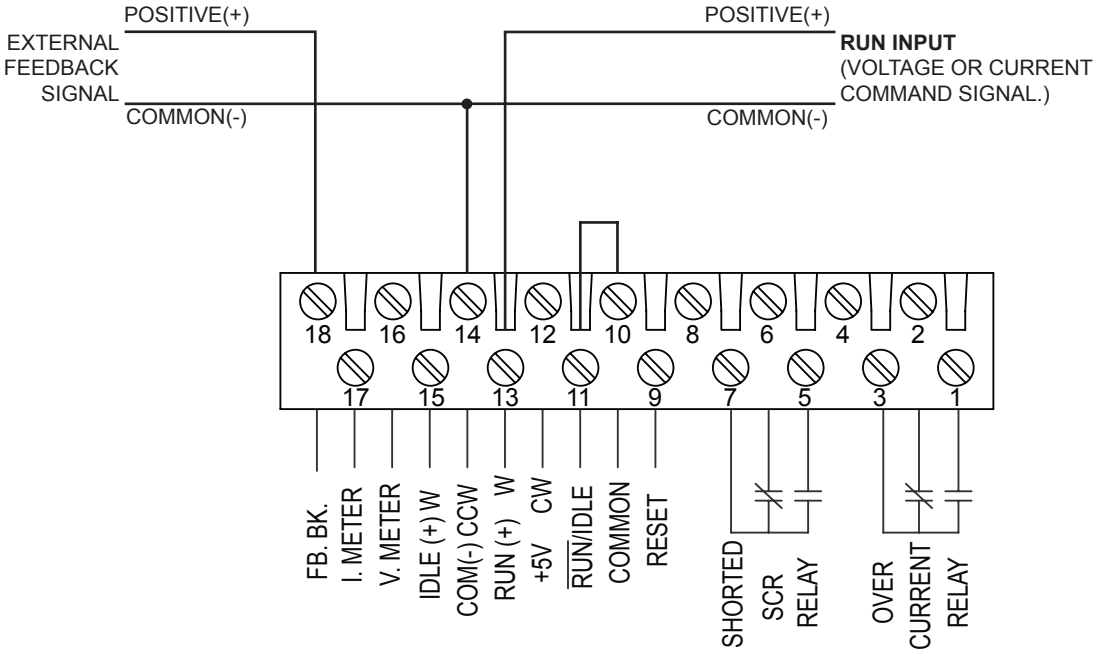


Figure 14. External feedback with signal applied to run input connections.
0 - 5 Vdc or 0 - 50uA external feedback.
(Terminals 10 & 11 must be connected to enable the run input.)
Effective 10/19/2007 the controller will be shipped with shorting jumper on pins 10 & 11.

POWER CONNECTIONS

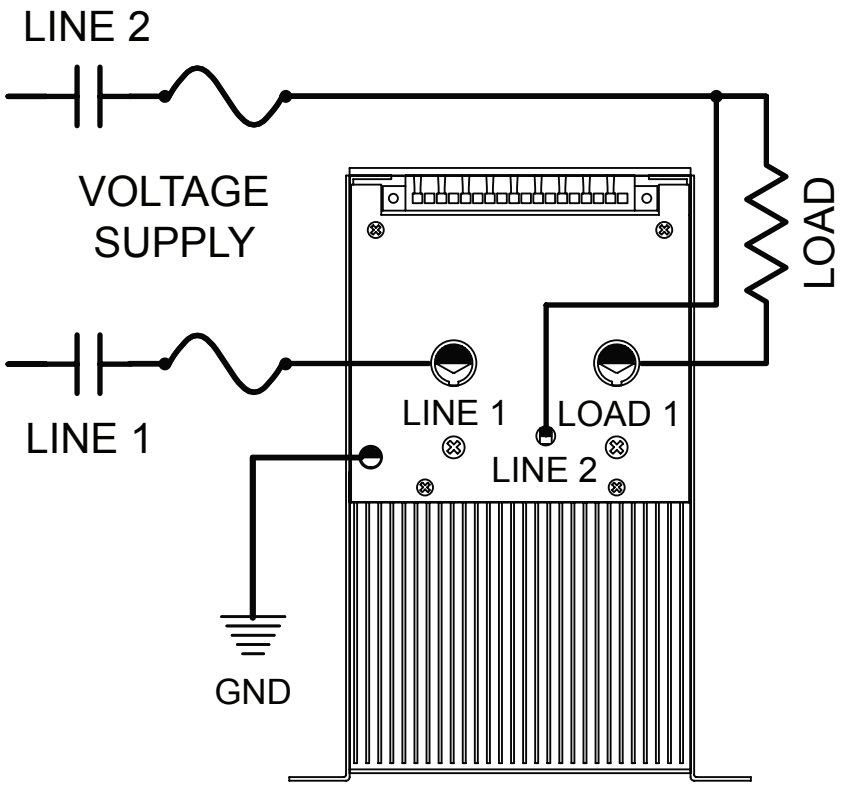


Figure 15. Power Connections.

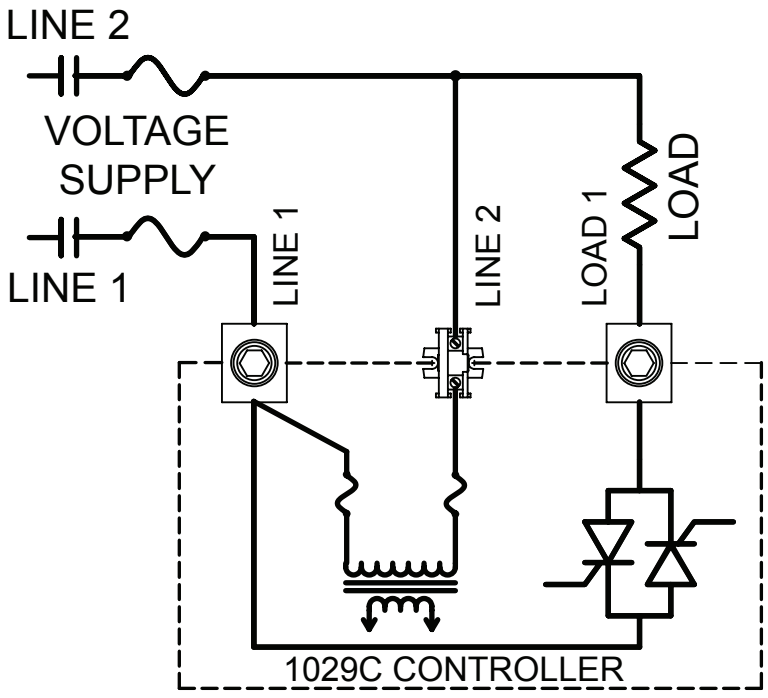


Figure 16. Power Path.

FEEDBACK SELECTION

Connector P2 on the circuit board allows the selection of feedback type. (See Figure 18).

True RMS is the default voltage feedback mode. Average voltage feedback mode may be requested when ordering the controller.

Voltage feedback may be selected by placing the jumper across pins P2-4 and P2-7. (VFB)

Current feedback may be selected by placing the jumper across P2-3 and P2-8. (IFB)

Power feedback, if factory installed, may be selected by placing the jumper across P2-5 and P2-6. (PFB)

External feedback may be connected between terminals P1-14 (Common) and P1-18 (FD. BK.) on the command connector (See Figure 19).

A 0-5Vdc signal may be used for external feedback when the jumper is placed across pins P2-2 and P2-9 (EXT).
A 0-100uA signal may be used for external feedback when the jumper is placed across pins P2-1 and P2-10 (SJ).
Average voltage and True RMS voltage are of the feedforward technique.

START-UP

Determine that the selected transformer tap corresponds to the line voltage.

If the customer wishes to determine that the controller and the command signals are wired and operating correctly before applying power to the load, the following procedure may be followed.

A load capable of drawing at least one amp must be connected for the controller to operate properly.

1. Move the feedback jumper to pins P2-4 & P2-7 to select Voltage FB. (See Figure 18.)

2. Determine that terminals P1-10 & P1-11 are electrically connected. Apply a command signal to the run command signal input.

3. Set the command signal to zero before applying system power. The load voltage should start at zero and increase as the command signal is increased, reaching optimum line output when command signal is maximum.

4. Remove system power from controller. Remove electrical connection from between P1-10 & P1-11. Apply a command signal to the idle command signal input and repeat step 3.

   The load voltage and current may be measured with any meter. However, for accurate RMS voltage measurements use a True RMS responding meter. Use an average responding meter for average voltage measurements.

5. When start-up tests have been completed, move the feedback jumper to select the desired operating feedback.

The controller was calibrated at the factory.
If adjustments appear necessary, see the zero and span adjustment instructions on page 14.

Care is urged whenever working near high voltages, and it is recommended that installation and service be done by a licensed electrician or experienced technician.

ADJUSTMENTS

The I Span and V Span pots (and Power Span and Power Zero pots, when factory installed), are sealed at the factory. They are identified with an X in Figure 17. Under no circumstances should adjustment of these four pots be attempted.
The setting of each of these potentiometers is critical to the proper operation of the controller.

The potentiometers labeled Run Span, Run Zero, Idle Span & Idle Zero have been calibrated at the factory and readjustment should not be necessary.

The zero pots are adjusted to provide zero output when the command signal is at minimum. The span pots are adjusted to provide full output when the command signal is at maximum.

If it is determined that the adjustment should be changed, the following procedure should be followed:

It is assumed that the load is resistive and can draw at least one or more amps.

Run Zero and **Run Span**:
Determine that pin P1-11 (Run/Idle) is electrically connected to pin P1-10 (Common). Make sure that the command signal is connected between the Run input P1-13 (Run/Wiper) and P1-14 (Common).

1. Set the command signal to minimum and adjust the Run zero potentiometer until the output is zero.

2. Set the command signal to maximum and adjust the Run span potentiometer until the output is at the desired maximum value.

3. The span and zero adjustments may interact, making it necessary to repeat steps 1 and 2.

Idle Zero and **Idle Span**:
Remove the electrical connection from between P1-11 (Run/Idle) and P1-10 (Common). Make sure that the command signal is connected between the Idle input P1-15 (Idle/Wiper) and P1-14 (Common). Repeat steps 1,2 and 3 (above) on the idle zero and span potentiometers.

It is important that meters capable of accurately measuring the output of the controller be used.

True RMS meters should be used for accurate measurements of True RMS Voltage, Current or Power (RMS Volts times RMS current into a resistive load).

Average responding meters should be used for measurements of;
Average AC Voltage or DC voltage.

Current Limit:
(The current limit pot is factory set at 105% of rated current unless specified differently by the (**IL**) term in the model Number.)

Proper calibration of the current limit feature requires a True RMS current meter.

If it becomes desirable to reset the current limit level:

1. Rotate the current limit pot fully counter- clockwise. (This is a multiple turn pot.)

2. Carefully increase the command signal to maximum.

3. Slowly rotate the current limit pot in a clockwise direction until the desired load current is reached.

If it is suspected that the current limit adjustment is causing the output of the controller to be lower than desired, rotate the current limit pot clockwise. If the load voltage increases, the current limit adjustment has been controlling the output. Follow the steps above to set current limit to the desired level.

OVER CURRENT TRIP:
This potentiometer has been factory set at 150% of rated frame current. For optimum protection, the customer may wish to reduce the level at which Over Current Trip occurs.

1. Adjust command signal to maximum.

2. Slowly rotate the Over Current Trip pot counterclockwise until the Over current Trip occurs.

3. Rotate the Over Current Trip pot about 1/2 turn clockwise.

4. Reset the Over Current Trip circuit.

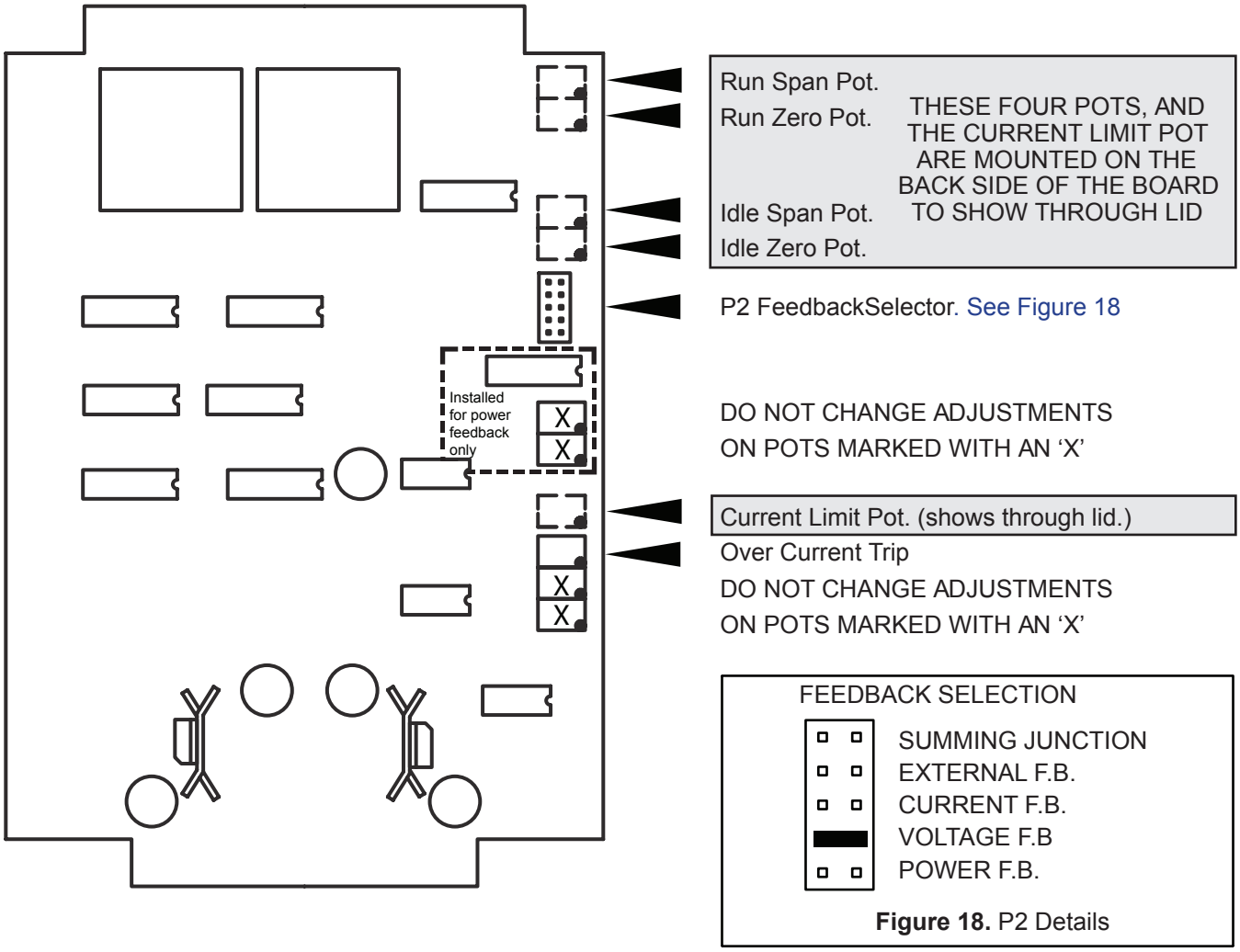


Figure 18. P2 Details

Figure 17. 1029C circuit board showing adjustment locations.

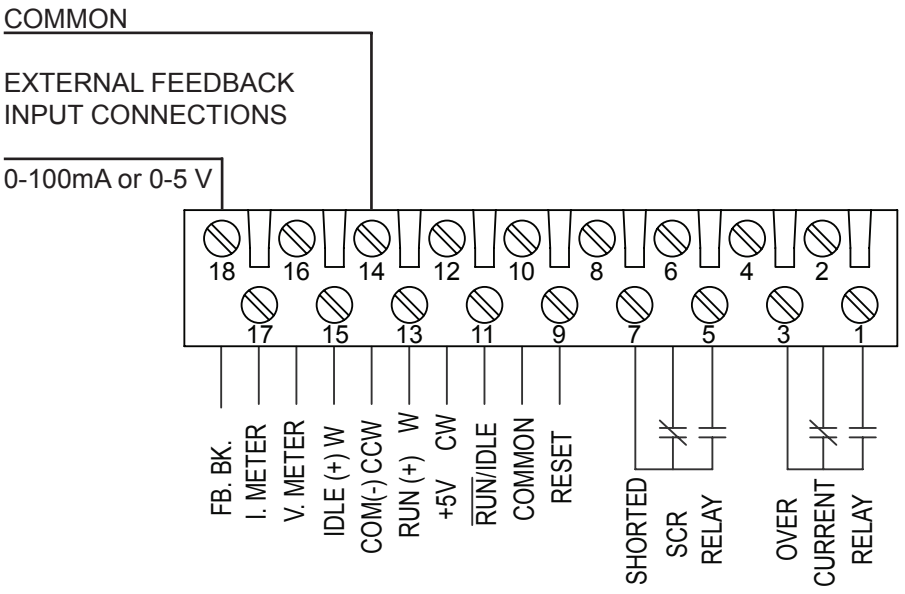


Figure 19. External feedback connections.

TROUBLESHOOTING

CAUTION: HIGH VOLTAGES ARE PRESENT ON THIS CONTROLLER AND ON PORTIONS OF THE PRINTED CIRCUIT BOARD. USE EXTREME CARE TO AVOID ELECTRICAL SHOCK.

Notes: The LED's provide a convenient method of determining the general location of controller problems. The **LOAD** LED indicates that 10% or more of rated load current is present. The intensity of the **LOAD** LED should increase as the command signal is increased. The **COMMAND** LED indicates the presence of gate drive. The **O.C.T.** LED is a fault indicator to warn that an Over Current condition has occurred, the O.C.T. relay is energized and the SCR's are prevented from turning on. The **SHORTED SCR** LED is a fault indicator to warn that one or more SCR's may be shorted.

NO LOAD VOLTAGE:

• Determine that the Command LED lights when the command signal is increased from zero.

If the command LED will not light.

- Determine that the following conditions exist: (Measure voltages at screw terminals to ensure good electrical connections.)
- Determine if **OVER CURRENT TRIP** LED is ON.
- Voltage between COM (Pin 14) and +5CW (Pin 12) must be 5 Volts ±1. If not; Circuit is not powered or command connections are shorting out supply.
- Determine that line voltage exists between Line 1 and Line 2 terminals.
- Determine that fuses on controller are OK.
- Remove connections to CW (terminal 12).

Voltage or potentiometer inputs.

- Determine that voltage from COM (pin 14) to IDLE (W) or RUN (W) changes from 0 to 5 Vdc as command is changed from zero to 100%.

4/20 mA inputs:

- Determine that voltage from COM (pin 14) to IDLE (W) or RUN (W) changes from 1.2 to 6 Vdc as command is changed from 4 to 20 mA.
- Determine that there is no connection between terminals 9 & 10.

If the command LED can be made to light:

• Determine that the load fuses are OK and that the load has continuity. Load continuity (including load fuses can be confirmed by determining that the supply voltage exists between Line 1 and Load 1 terminals when the command signal is zero.

LOAD VOLTAGE WILL NOT GO TO ZERO:
If RMS value of the load voltage is greater than 10 percent of the supply voltage.

- Determine **SHORTED SCR** LED status while varying the command signal.
- With power removed and the load disconnected from terminal Load 1 the resistance between terminals Line 1 and Load 1 should be greater than 100K ohms.
- If the resistance between Line 1 and Load 1 is less than 100K ohms the SCR module has failed.
- If the shorted SCR led is ON & the resistance between Load 1 and Line 1 is greater than 1000 ohms, the failure is likely associated with the circuit board. Determine by removing the circuit board and applying power.
- Determine that the supply to line 2 and the load are connected to the same supply.

If the RMS value of the load voltage is less than 10 percent of the supply voltage.

- Determine that the command signal is correct. Adjust the zero and span potentiometers to achieve the desired output. (Note: The Zero and span potentiometers are factory set. Adjustment should be made with caution.

FULL VOLTAGE CANNOT BE OBTAINED:

- Determine that the control signal is at maximum.
- Determine that the controller is not in current limit Decrease the current limit by rotating the current limit potentiometer counterclocklwise, the controller is in current limit if the load voltage decreases.
- If the problem occurs on initial start up, determine that line 2 and the load are connected to the same supply.

MANUFACTURED BY

CONTROL CONCEPTS
7870 PARK DRIVE, CHANHASSEN, MN 55317
TEL: 952-474-6200 FAX: 952-474-6070
TOLL FREE: 800-765-2799
www.ccipower.com U.S.A

REPLACEMENT PARTS

SCHEMATIC DWG: CCI No. D1000954A

ITS RECOMMENDED THAT THE CONTROLLER AND LOAD BE PROTECTED BY 600 VOLT, CLASS 'T' FUSES:				
TO ORDER A SPARE SCR MODULE:		TO ORDER CLASS 'T' FUSES		
CONTROLLER CURRENT RAING Amps (A)	CONTROL CONCEPTS PART No.	CONTROLLER CURRENT RATING Amps (A)	FUSE SIZE Amps (A)	CONTROL CONCEPTS PART No.
50	SCR/TT91-16	50	60	42110-0460-360
80	SCR/TT91-16	80	100	42110-0460-410
120	SCR/TT105-16	120	150	42110-0460-415
160	SCR/TT132-16	160	200	42110-0460-420
200	SCR/T240-14*	200	250	42110-0460-425
250	SCR/T340-14*	250	300	42110-0460-430
300	SCR/T490-14*	300	350	42110-0460-435
380	SCR/T600-14*	380	450	42110-0460-445
425	SCR/T760-14*	425	500	42110-0460-450
500	SCR/T600-14*	500	600	42110-0460-460
600	SCR/T760-14*	600	700	42110-0460-470
750	SCR/Z1400-14*	750	800	42110-0460-480
CONTACT FACTORY FOR INFORMATION ABOUT 1000 OR 2000 AMP FRAME				

* Because of critical assembly requirements, it is recommended that replacement of SCRs on 200 Amp and larger controllers be done at the factory. If you desire to try it yourself, request a copy of our technical bulletin concerning replacement of SCR's on the 3629 controller.

REPLACEMENT CONTROL TRANSFORMER FUSES			
Frame Size	Location	Fuse Type	CCI Part No.
50 & 80 Amps	F1 & F2	1/4 Amp Class CC TYPE R	42130-0460-2025
120 - 425 Amps	F1 & F2	1/2 Amp Class CC TYPE R	42130-0460-205
500 - 750 Amps	F1	1 Amp Class CC TYPE R	42130-0460-210
500 - 750 Amps	F2	1/2 Amp Class CC TYPE R	42130-0460-205

MODEL NUMBER IDENTIFICATION

1029C-[X]-[XXX]V-[XXX]A-IL[XXX]-R[XXX]-I[XXX]

1029C
The basic model number.

[X] The type of feedback
- A - Specifies average voltage feedback. With average voltage feedback, the controller varies the conduction angle (or ON time) of the SCRs such that the average voltage applied to the load is proportional to the command signal.
- E - Specifies external feedback. The external feedback being proportional to some parameter such as speed, current, etc. that is ultimately being controlled by the action of the controller.
- I - Specifies RMS current feedback. The load current is linearly controlled with respect to the command signal.
- P(XXXAMPS) - The letter P specifies power feedback and therefore the load power is linearly controlled with respect to the command signal. XXX equals amp level for control of power. MAX LOAD POWER = (VOLTS)V x P(AMPS)
- V - Specifies RMS voltage feedback. With RMS voltage feedback, the controller varies the conduction angle (or ON time) of the SCRs such that the RMS voltage applied to the load is proportional to the command signal.

[XXX]V Operating Voltage
120, 208, 240, 277, 380, 415, 480 or 575 Vac

Note: unless otherwise specified, the controller is shipped with a transformer that has primary voltage taps at:
240, 480 or 575 volts, 50/60 Hz.

[XXX]A Operating Current
50, 80, 120, 160, 200, 250, 300, 380, 425, 500, 600 or 750
(consult factory for 1000 & 2000 Amps)

IL[XXX] Current Limiting
Up to 105% of controller rating.

R[XXX] Run Command Signal
0/5Vdc, 4/20mA or Potentiometer

I[XXX] Idle Command Signal
0/5Vdc, 4/20mA or Potentiometer

Example:
1029C-A-480V-80A-IL75-R0/5V-IPOT
Will order a 1029C controller with average voltage feedback, rated @ 480 Volts, 80 Amps, current limit set at 75 Amps, run command signal of 0 to 5Vdc and a potentiometer on the idle command input.

If a "SC(**VVV**) term is included, it implies special calibration, meaning that the controller has been calibrated for a maximum output of **(VVV)** voltage rather than the rated (line) voltage. Contact factory for information.

THEORY OF OPERATION

THE SCR

The heart of the Control Concepts, Inc. power controller is the SCR (silicon controlled rectifier, 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 up to 1600 volts.

In the on state, they can pass several thousand amperes. When a small signal is applied between the gate and cathode terminals (Figure 20), 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, referred to as the holding current.

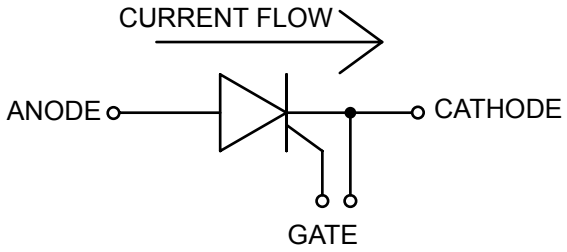


Figure 20. SCR symbol

Because the SCR allows current to flow in only one direction, two SCR's are connected in an inverse parallel (back to back) configuration to control AC current.

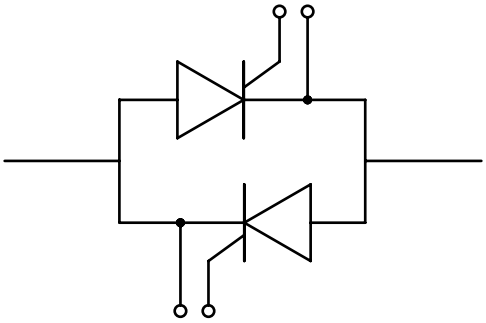


Figure 21. "AC Switch"

PHASE-ANGLE OPERATION

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. (Figure 22).

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 if the load is transformer-coupled, capacitive, inductive or a variable resistance load requiring current limiting.

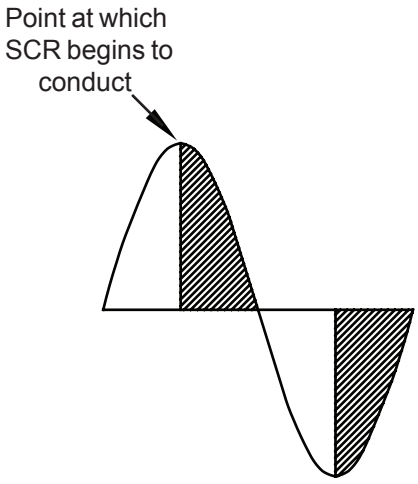


Figure 22. SCR "ON" time, shown by shaded area, is varied to apply the desired load voltage

WARNING: the Control Concepts, Inc, model 1029C power controller uses 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.