CONTROL CONCEPTS INC.

INSTRUCTION MANUAL
MODEL 1029B

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DESCRIPTION:

MODEL COVERED:

This instruction manual covers the model 1029B controller with the following ratings:
CURRENT: 50 AMPS to 1000 Amps.
VOLTAGE: 120 Vac to 575 Vac. @ 50 / 60 Hz.
Other voltage and current ratings may be available, contact factory for information

GENERAL DESCRIPTION:

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

FEATURES:

STATUS INDICATORS:

Command - The intensity of the 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 SCR and load current.

Shorted SCR - When "ON" an SCR has failed in the shorted mode and full power is applied to the load.

Over Current - When "ON" indicates that the SCRs have been locked "OFF" and that the reset switch must be closed or power removed from the input to re-enable the controller.

RUN OR IDLE INPUT SELECTION:

Closure of a remote contact, connected to pins 10 and 11 on the command connector, transfers control from the "IDLE" command input to the "RUN" command input. (See Fig. 9, 10 or 11).
A current or voltage command signal or a potentiometer may be connected to the IDLE command input while another current or voltage command signal or a potentiometer is connected to the RUN command input.
Using this feature provides a convenient means by which the controller output can be operated alternately from either of two process signals.
The feature provides a convenient means to maintain the load at a predetermined level during idle or standby condition.

SOFT START AND MISSING CYCLE DETECTION:

On initiation of power, or if the supply power is momentarily interrupted for 1/2 cycle or more, the load voltage is set to zero and increased to the desired value at a rate equal to a time constant of approximately 0.2 seconds. This feature allows adequate time for variable resistance loads T-3 lamps to stabilize and prevents saturation of transformers used to couple power between the controller and the load.

CHOICE OF FEED BACK:

The feed back choices are: Voltage, Current, External or Power (if Power feedback circuitry is installed at factory).

Voltage is True RMS unless the Average voltage option was installed at the factory. (True RMS or Average Voltage use a feedforward technique.)

Current feedback may be selected by moving a jumper on P2.

External choices are 0-5 Vdc or 0-100 uA applied to terminals P1-14(com) and P1-18 (input).

Power may be selected if the Power option was installed at the factory.

OUTPUT METERING:

Current: A filtered 0 to 5Vdc (5mA max. load) output signal, proportional to the value of the load current.

Voltage: A filtered 0 to 5Vdc (5mA max load) output signal, proportional to the estimated value of the load voltage.

Note: If *average voltage* feedforward technique is installed, the voltage metering output will be proportional to the estimated Average value of the load voltage.

SHORTED SCR DETECTION:

In the event an SCR fails by shorting, the **Shorted SCR** LED will light and a relay with form C contacts rated for 5 amps at 120Vac is energized. These contacts may be used to activate an alarm or remove system power. Connections to these contacts are available on the command connector. (Fig. 6, Pg. 8)

FEATURES: cont.

CURRENT LIMITING:

Prevents the load current from exceeding the rating of the SCRs and prevents excessive load current from occurring when variable impedance loads are used. A potentiometer on the printed circuit board allows adjustment of the current limiting setting from 20% to 105% of the controller's rating. The CURRENT LIMIT potentiometer is factory set at 105% of the rated current unless otherwise requested.

OVERCURRENT TRIP:

If the SCR current exceeds a preset value of approximately one and one half times the rated current, the SCRs will be latched off, the OVER CURRENT LED will light and a relay with form C contacts rated for 5 amps at 120Vac will be energized. These contacts may be used to activate an alarm or cause system power to be removed. Connections to these contacts are on the command connector. (Fig. 7, Pg. 12)

RESET SWITCH:

Momentary closure of a remote reset switch (Fig. 7, Pg. 12) or a momentary interruption of the AC supply will reset the over current relay and allow the controller to reapply power to the load. Closure of the reset switch during normal operation prevents the SCRs from operating but does not cause the over current relay to energize. The reset switch may be used as an ON-OFF switch.

THEORY OF OPERATION

THE SCR

The heart of the SCR 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 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 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.

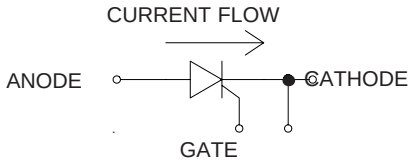


Figure 1. SCR SYMBOL

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

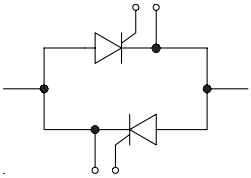


Figure 2. "AC SWITCH "

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 3a & b). 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 or inductive.

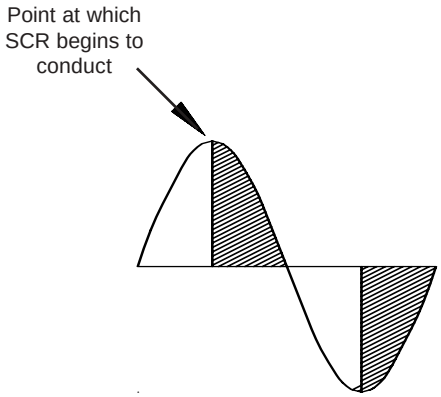


Figure 3. SCR "ON" time, shown by shaded area, is varied to achieve the desired load voltage.

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:	SCR phase-angle control of the voltage applied to a single phase load.
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:	Signal: Input Impedance: 1/5mA 1200 ohms 4/20mA 300 ohms 0-5Vdc 100K ohms Potentiometer 100K ohms (1K, 1/4watt pot recommended for optimum linearity, up to 20K permissible) The potentiometer is excited by 5Vdc, supplied by the circuit. **Other ranges are available. Check with factory for special applications.**
IDLE COMMAND SIGNAL:	Signal: Input Impedance: 1/5mA 1200 ohms 4/20mA 300 ohms 0-5Vdc 100K ohms Potentiometer 100K ohms (1K, 1/4 watt pot recommended for optimum linearity, up to 20K permissible) The potentiometer is excited by 5Vdc, supplied by the circuit. **Other ranges are available. Check with factory for special applications.**
RUN/IDLE CONTROL:	Control of the output can be switched between the idle command signal and the run command signal by a remote single pole single throw switch.
OPERATING VOLTAGE:	208, 240, 380, 480 or 575Vac +10 -15% 50/60 Hertz Other voltages available - consult factory.
ENVIRONMENT:	Operating temperature 0 to 55ºC (32 to 132ºF) Storage temperature: -40 to 80ºC (-4 to 176ºF) Humidity: 0 to 95%, non-condensing
SCR RATINGS:	Peak forward and reverse voltage: 1600 volts

SPECIFICATIONS:

OVER CURRENT TRIP INDICATOR:	An LED indicates if the over current limit has occured.
LOAD CURRENT INDICATOR:	An LED indicates when current is applied to the load.
COMMAND INDICATOR:	An LED indicates when the SCRs are turned on.
SHORTED SCR INDICATOR:	An LED indicates if either SCR is shorted.
SCR SURGE CURRENT RATINGS :	(peak one cycle non-repetitive I_{TSM} @ 125°C) Controller Rating Surge Current Rating 50, 100 & 150 Amp: 1,750 Amps Peak 200 Amp: 4,500 Amps Peak 250 Amp: 5,200 Amps Peak 300 Amp: 5,200 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 1000 Amp: 20,000 Amps Peak
ELECTRICAL CONNECTIONS:	Aluminum compression lugs for line and load connections are provided for use with either aluminum or copper wire from 500 MCM to No. 6 ga.
ELECTRICAL ISOLATION:	Heatsink to supply and load voltage: - 2500 Volts Peak.
ZERO AND SPAN:	Command signal to supply and load voltage: - 1500 Volts Peak.
CURRENT LIMITING:	Potentiometers on the circuit board allow zero and span adjustments of ± 25% of span for run and idle. A potentiometer on the circuit board allows adjustment of the current limiting 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 0 to 5Vdc signal proportional to the percentage of load voltage output. (True RMS or Average depending on type of feedback.)
CURRENT METER OUTPUT:	A filtered 0 to 5Vdc signal proportional to the true RMS current.

SPECIFICATIONS:

GATE DRIVE:	An optical coupled current source of 250mA with a maximum compliance of 20 volts provides the gate drives to the SCRs. Duration or "back porch" is approximately 1.4 milliseconds (60 electrical degrees).
CONTROL RANGE:	0 to 98% of supply voltage.
VOLTAGE COMPENSATION:	The load power remains constant independant of supply voltage changes within + 10%, -15% 50/60 Hz.
WEIGHT:	50 & 100 Amp controllers 13 pounds 150 Amp controllers 15 Pounds 225 to 425 Amp controllers 25 Pounds 500 to 1000 Amp controllers 40 Pounds
POWER DISSIPATION:	1.5 Watts per amp of load current.
INTERNAL FEEDBACK:	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 at any time.
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.
LINEARITY:	The controlled variable is linear within 2% of Span with respect to the command signal.
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. SCRs are protected from voltage transients by a Metal Oxide varistor.

WARNING: the Control Concepts, Inc, model 1029B 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.

INSTALLATION:

TRANSFORMER TAP:

Prior to mounting the controller, place the spade terminal on the transformer tap that corresponds with the supply voltage to be used.

MOUNTING and LOCATION:

The 50 and 100 amp controller must be mounted on a vertical surface with the heat dissipating fins oriented so that air may flow vertically over them. All other controllers are forced air cooled and may be mounted in any direction.

COMMAND:

The 1029B has two command inputs, 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.

Note: Terminal 13 (run input) is the normally active input. To use alternate terminal 15 (idle input), the jumper between terminals 10 & 11 must be disconnected.
See figures 9 & 10 on page 10.

Potentiometer:

A 1000 ohm to 20,000 ohm potentiometer, 1/4 watt or higher, may be used to adjust the load voltage. A 1000 ohm potentiometer provides the maximum linearity. Connect terminal 12 to the clockwise end of the potentiometer, terminal 13 (run) or terminal 15 (idle) to the potentiometer wiper, and terminal 14 (common) to the counterclockwise end of the potentiometer.

Current:

The positive current connection is to terminal 13 (run) or 15 (idle). The negative or return current connection is to terminal 14 (common).

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) and the negative or common signal to terminal 14 (common) (See fig. 10, Pg 10). Higher DC voltages may be used by placing an external resistor in series with terminal 13 such that the maximum voltage between terminals 13 and 14 (or 14 and 15), is 5 volts.

OVER CURRENT TRIP RELAY:

Connections to the form C contacts of the over current relay are as shown on the cover of the controller and in Figure 6, on page 8. The contacts are rated for 5 Amps at 120 Vac and are intended for activating an alarm and/or removing power from the system.

OVER CURRENT 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.

SHORTED SCR RELAY:

Connections to the 5 Amp 120 Vac form C contacts are shown on the cover of the controller and in fig. 6, on page 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.

RUN/IDLE:

A remote switch can be used, as shown on page 10, to cause the controller to be controlled by either the run or idle inputs. Connecting terminal 10 to terminal 11 causes the run input to be in control. Opening the connection between terminal 10 and terminal 11 causes the idle input to be in control.

POWER CONNECTIONS:

Figures 15 & 16 on page 13 shows the electrical connections. The line and load connectors are rated for wire sizes from #6 to 500 MCM. The recommended torques as a function of wire size are:

RECOMMENDED TIGHTENING TORQUE FOR THE LINE AND LOAD CONNECTORS:

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

ADJUSTMENTS:

The I Span and V Span pots (and Power Span and Zero pots, when factory installed), are sealed at the factory. They are identified with an X in Figure 4.
Under no circumstances should the adjustment of these four pots be tampered with. The setting of these potentiometers is critical to the proper operation of the controller.

The potentiometers labeled *RUN ZERO & SPAN*, and *IDLE ZERO & SPAN* have been calibrated at the factory for proper operation.
The zero potentiometer adjusts the controller to provide the desired minimum output when the command signal is at minimum.
The span potentiometer adjusts the controller to provide the desired maximum output when the command signal is at maximum.
If adjustment becomes necessary, the following procedure must be followed.
It is assumed that the load is resistive will draw at least one amp.

To adjust the RUN Zero and Span:
Short pin P1-11 (Run/Idle) to pin P1-10 (Common).
Make sure that the command signal is connected to 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.

To adjust the IDLE Zero and Span:
Remove the Short between P1-11 (Run/Idle) and P1-10 (Common).
Make sure that the command signal is connected to the Idle input P1-15 (Idle/Wiper) and P1-14 (Common).
Repeat steps 1,2 and 3 above.

It is important that equipment 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 A.C. Voltage, or DC voltage.

To adjust the Current Limit:
(Current limit is factory set at 105% unless specified differently by the (**IL**) term in the model number.)
Clockwise rotation of the Current limit potentiometer raises the point at which the load current is affected.
Note: Loads whose variable resistance increases slowly, may cause the current limiting feature to limit the output of the controller. This would appear as though the span is not adjusted properly.
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 1 turn clockwise. If the load current increases, the current limit adjustment is controlling the output.

To adjust the Over Current Trip:
(Factory set at 150% of rated current) Clockwise rotation raises the point at which the over current trip activates the Over Current Trip LED and relay. When necessary, this potentiometer may be adjusted to suit the requirements of the application. The range of adjustment is approximately 50% to 200% of rated current.

FEEDBACK SELECTION:

Connector P2 on the circuit board allows the selection of feedback type. (See Figure 5 on Page 8).
Unless Average Voltage was installed by request, True RMS Voltage is the default voltage selection.
Average voltage and True RMS voltage are of the feedforward technique.
Voltage is selected when the jumper is placed on pins P2-4 and P2-7.

Current feedback may be selected by placing the jumper on P2-3 and P2-8.

Power feedback, if factory installed, may be selected by placing the jumper on P2-5 and P2-6.

External feedback may be connected between terminals P1-14 and P1-18 on the command connector (See Figure 6).
A 0-5Vdc signal may be used for external feedback when the jumper is placed on pins P2-2 and P2-9.
A 0-100uA signal may be used for external feedback when the jumper is placed on pins P2-1 and P2-10.

INSTALLATION:

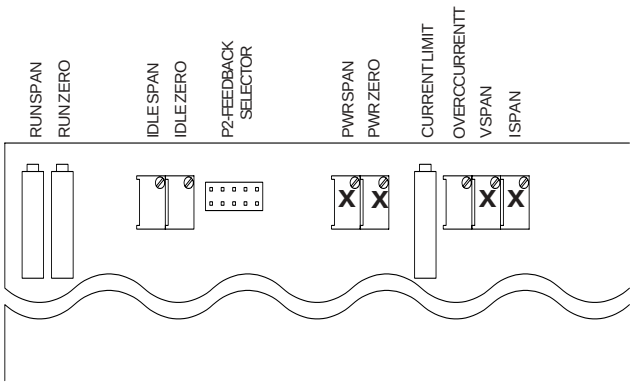


Figure 4. 1029B Circuit Board Adjustments.
Under no circumstances should any attempt be made to adjust the pots marked with an X

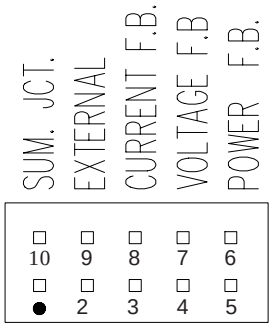


Figure 5. P2 Detail

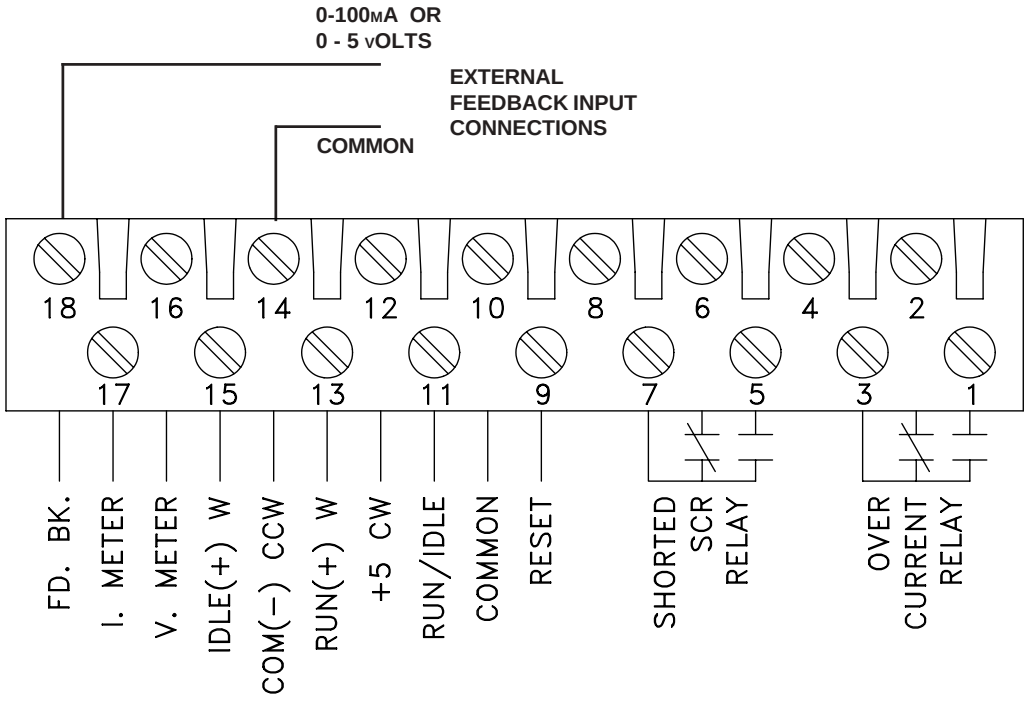


Fig. 6. External feedback connections.

INSTALLATION CONNECTIONS:

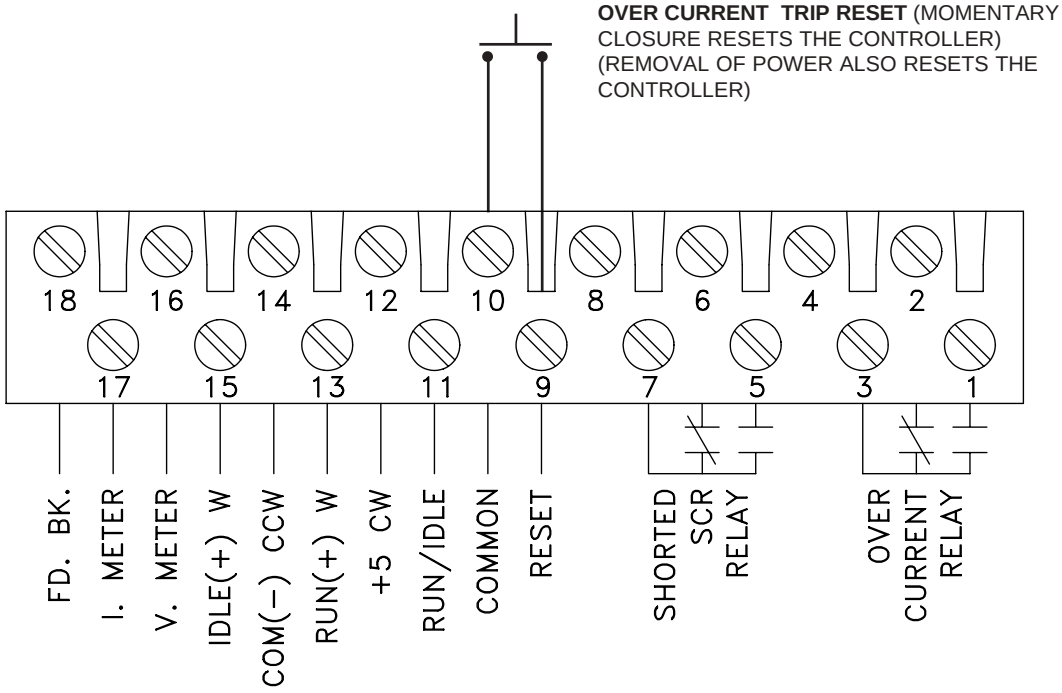


Figure 7. Shorted SCR, Over current relay and reset switch connections.

RELAY CONTACTS CHANGE STATE WHEN AN OVERCURRENT CONDITION OCCURS OR IF AN SCR FAILS IN THE SHORTED MODE.

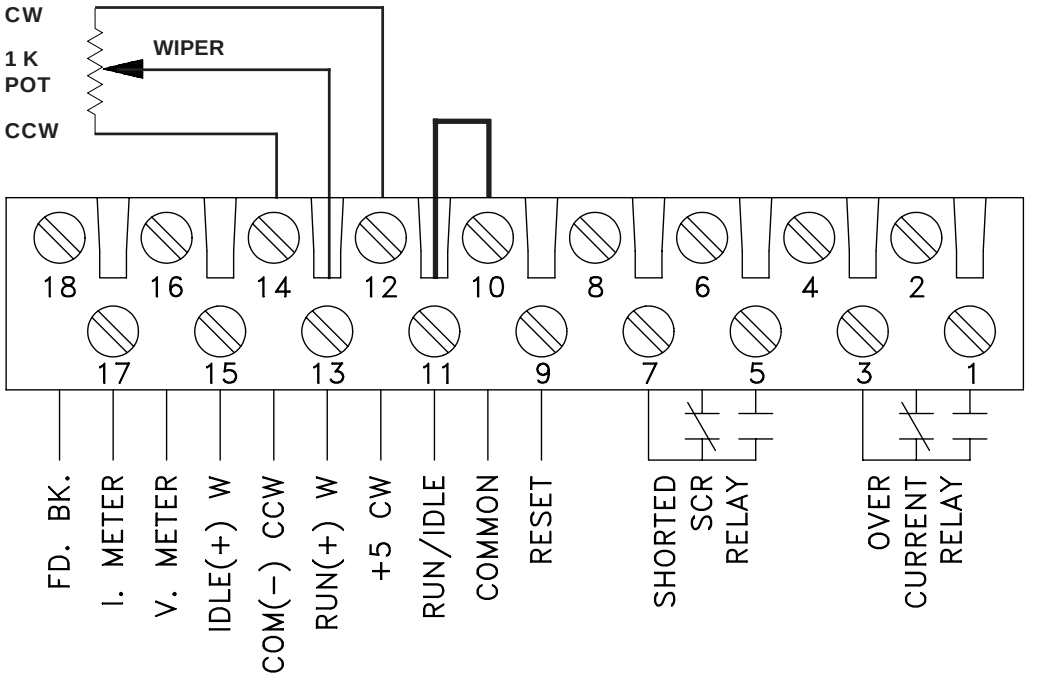


Figure 8. Single potentiometer connections.
(Terminals 10 & 11 must be connected.)

INSTALLATION CONNECTIONS: (CONT.)

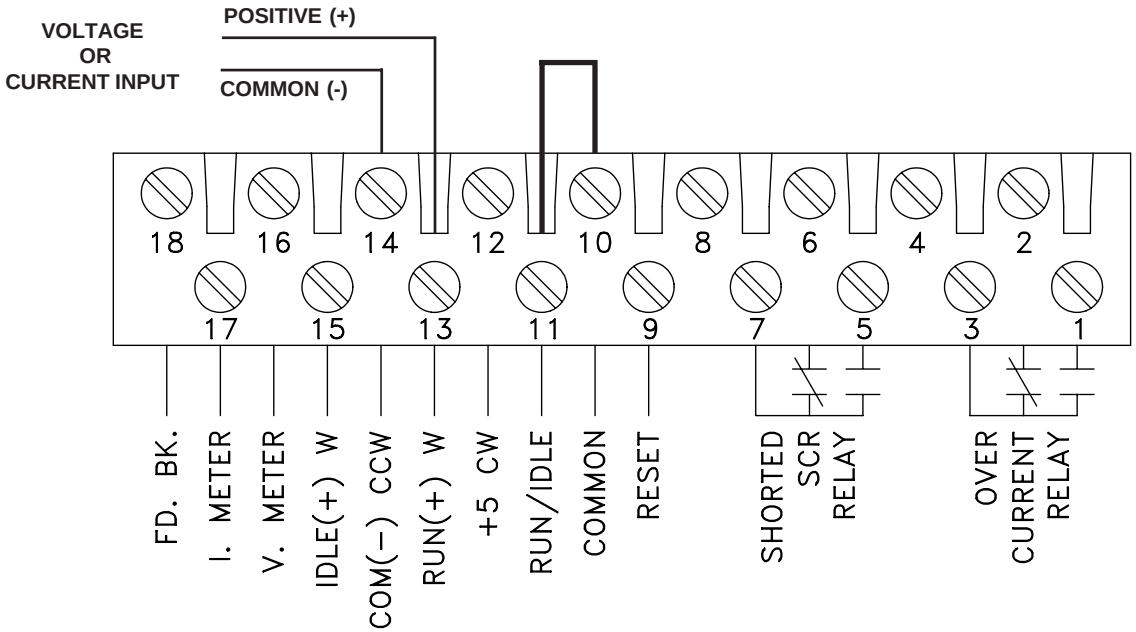


Figure 9. Single voltage or mA current connections.
(Terminals 10 & 11 must be connected.)

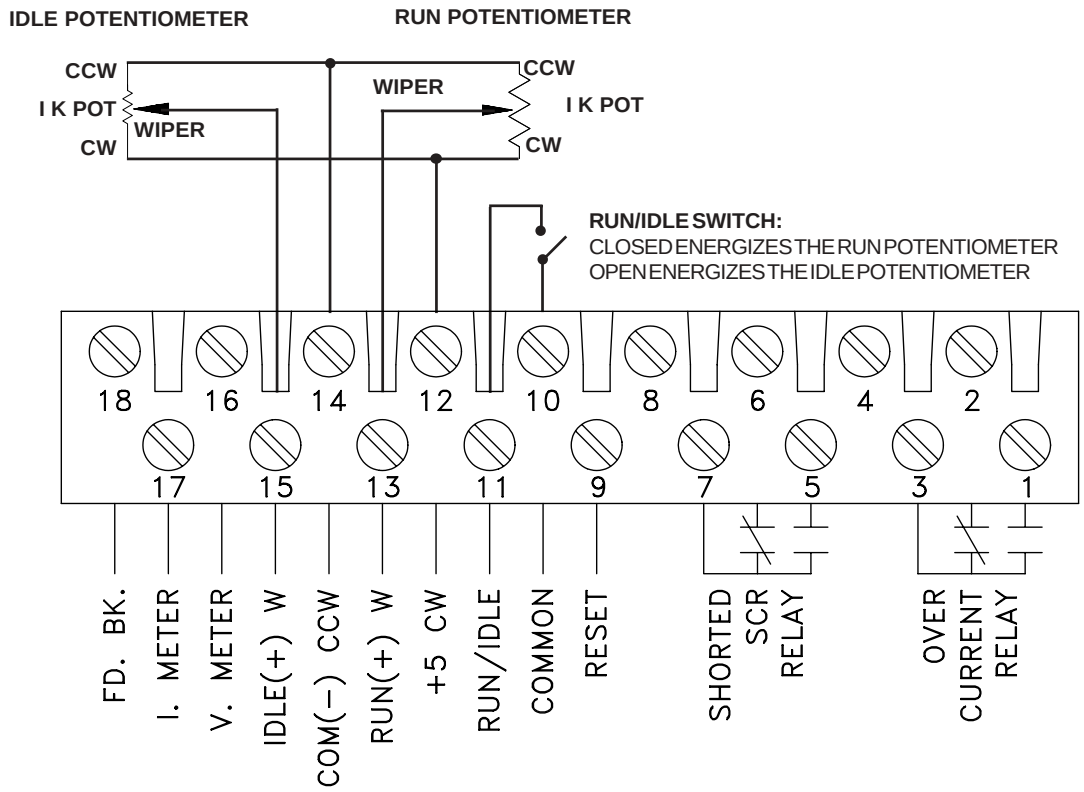


Figure 10. Run and Idle potentiometer connections

INSTALLATION CONNECTIONS: (CONT.)

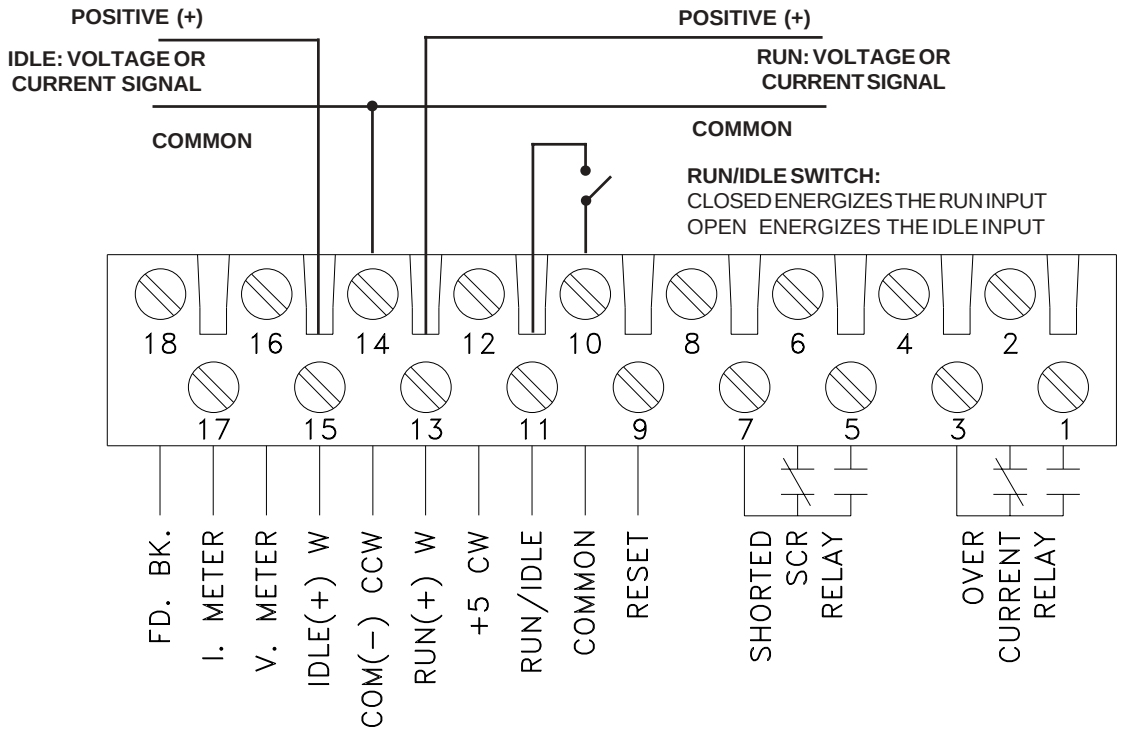


Figure 11. Run and Idle voltage or current connections

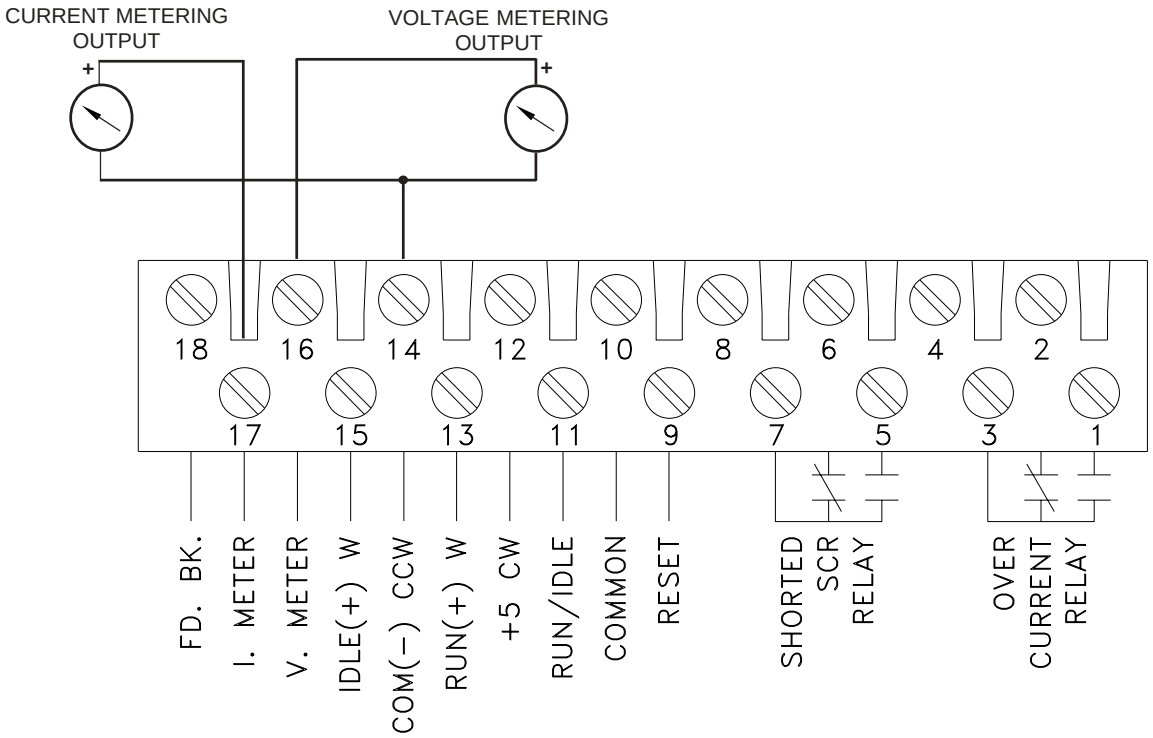


Figure 12. Output metering connections

INSTALLATION CONNECTIONS:

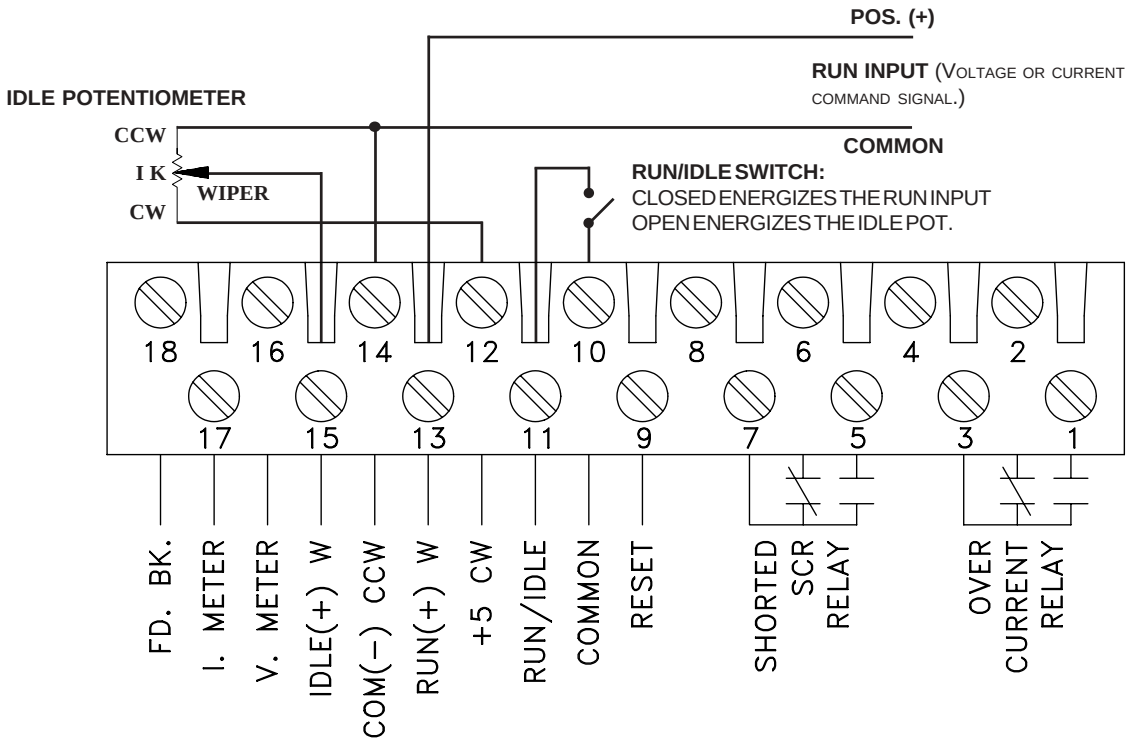


Figure 13. - Combination command-signal/potentiometer input connections

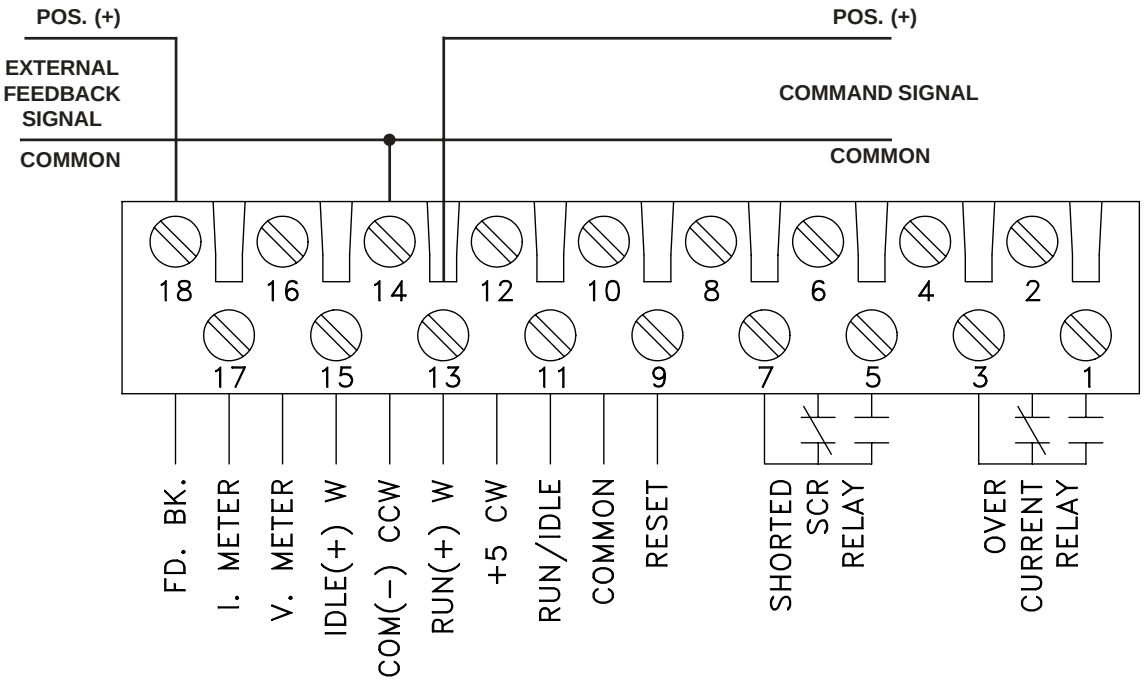


Figure 14. Feedback and signal connections
0 TO 5Vdc or 0 to 100uA external feedback

MODEL No IDENTIFICATION:

1029B-(FB)-(VOLTS)V-(AMPS)A-IL(AMPS)-R(CS)-I(CS)

The characteristics of the 1029B SCR power controller are defined by the terms in the model number as follows:

1029B The model 1029B specifies a single phase, phase-angle SCR firing circuit featuring: current limit, over current trip, shorted SCR detection and electrical isolation of the command signal from the line and load voltages.

-(FB) (A, V, E, I or P[XXXAMPS])

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.

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.

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)

-(VOLTS)V - Specifies the supply voltage the controller has been calibrated to operate at. Note: the standard controller has voltage taps on the transformer for operation at 240, 480 or 575 volts, 50/60 hertz.

-(AMPS)A - Specifies the continuous RMS current rating.

-IL(AMPS) - Specifies the current limit in Amps.

-R(CS) - Specifies the run command signal. **R**0/5V, **R**4/20mA or **R**POT

-I(CS) - Specifies the idle command signal. **I**0/5V, **I**4/20mA or **I**POT.

Specify special command signals: **I**1.2/6Vdc, etc.

For example:

1029B-A-480V-100A-IL75-R0/5V-IPOT

Will order a 1029B controller with average voltage feedback, rated @ 480 Volts, 100 Amps, current limit set at 75 Amps, run command signal of 0 to 5Vdc and a potentiometer option on the idle command input.

POWER CONNECTIONS

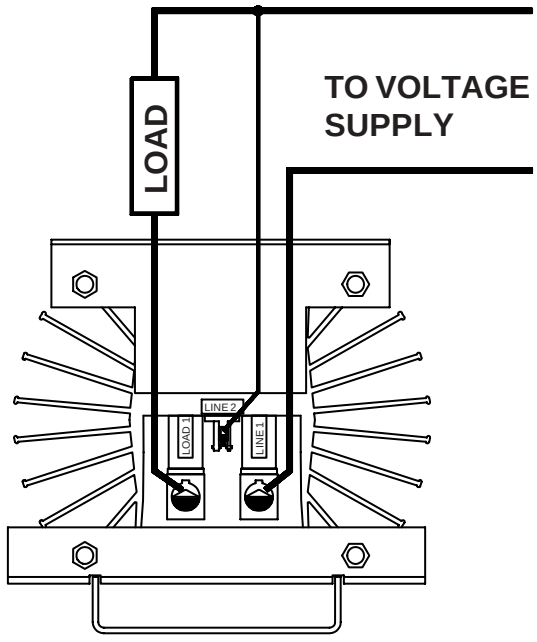


Figure 15. Power connections

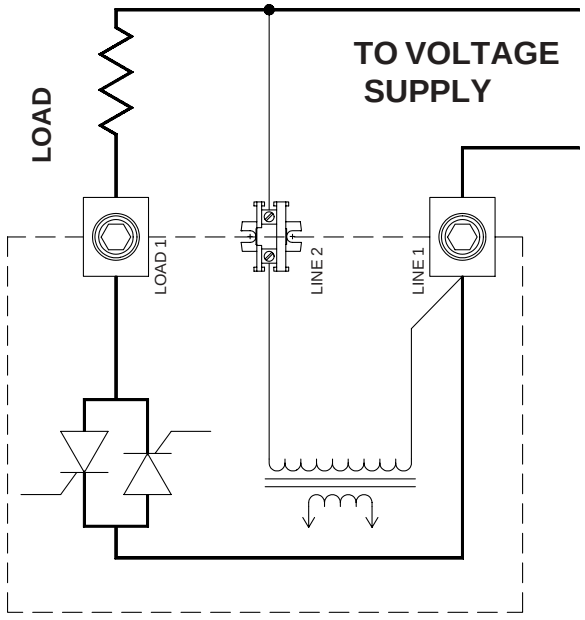
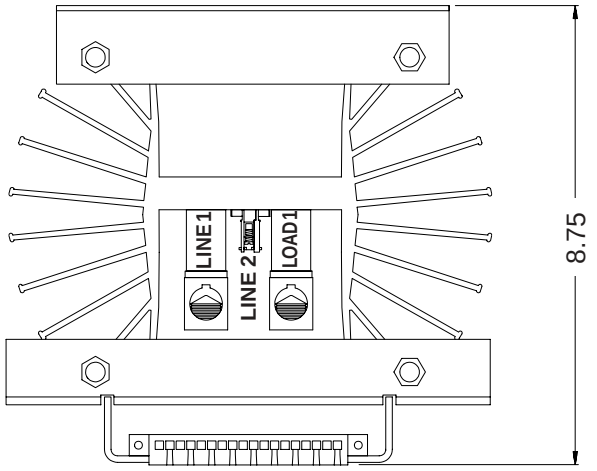


Figure 16. Power path

INSTALLATION DIMENSIONS:



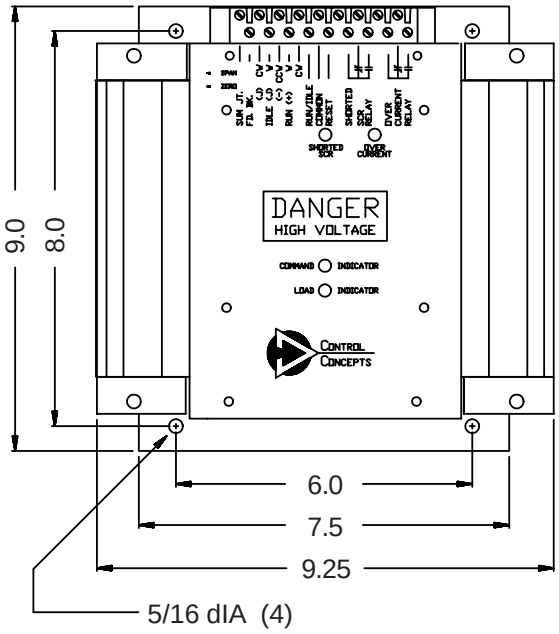
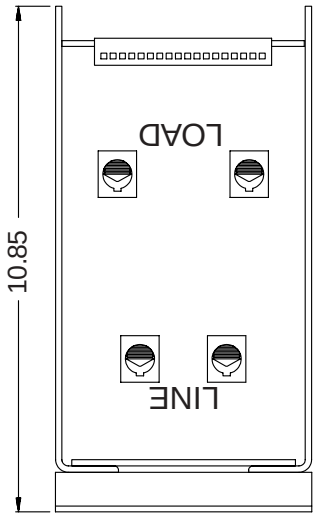


Fig. 17. - Installation dimensions
50, 100 & 150 Amp

150 Amp controller has a fan. (not shown)
Length becomes 9.25 inches



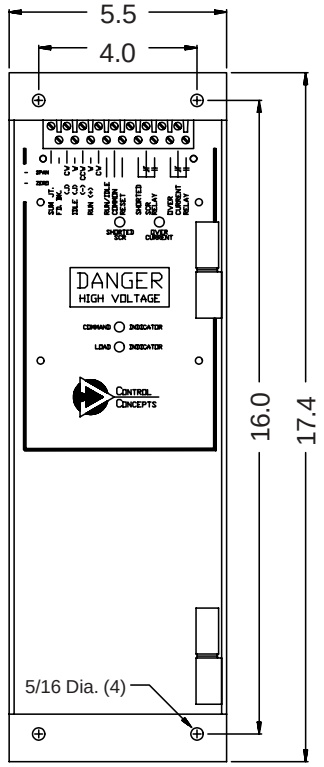


Fig. 18. - Installation dimensions
200, 250, 300, 380 & 425 Amp

INSTALLATION DIMENSIONS:

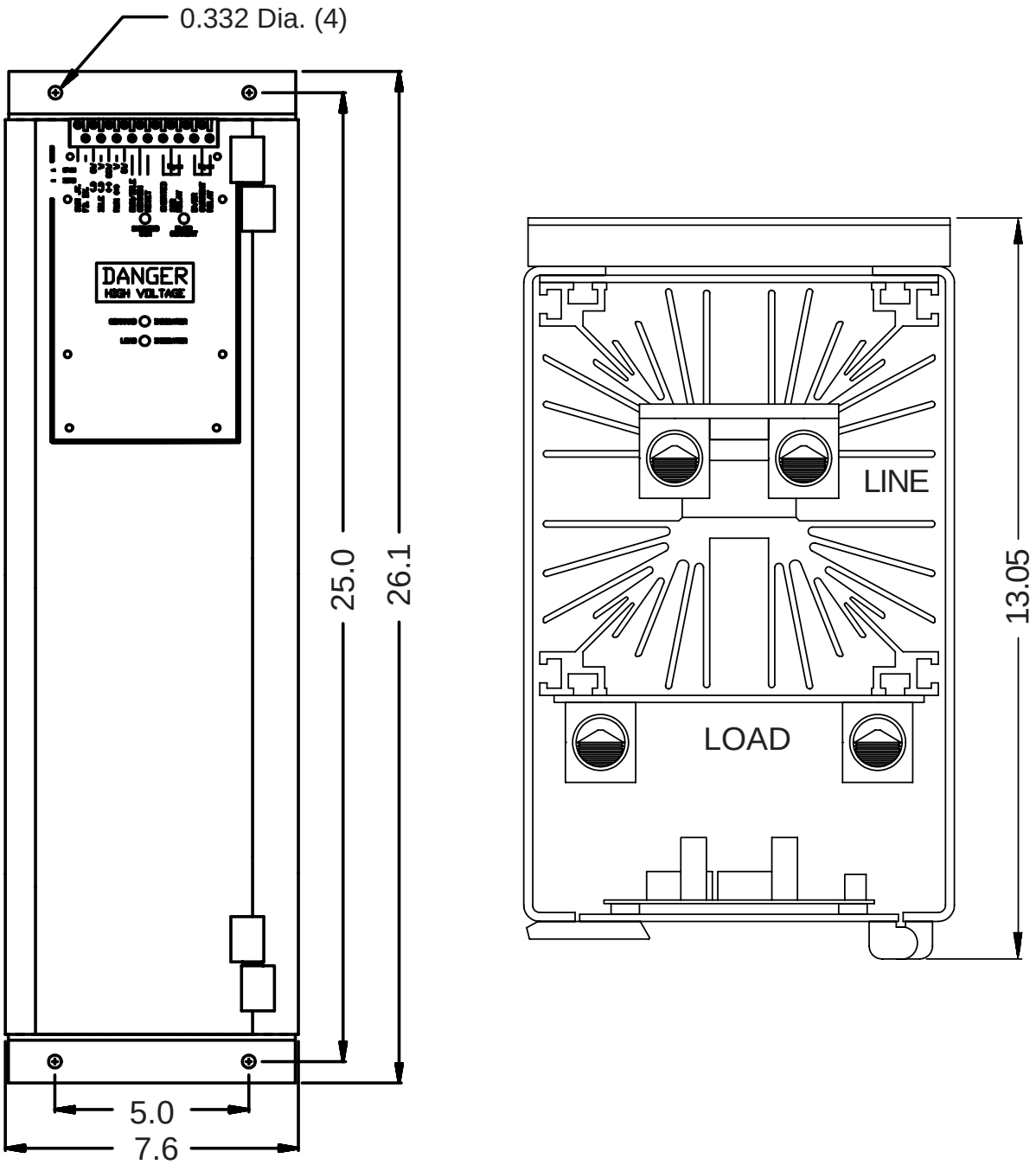


Fig. 19. - Installation dimensions
500, 600, 750 and 1000 Amp Controllers

START-UP:

Apply a command signal to the run command signal input, making sure that terminals P1-10 & P1-11 are tied together. The load should be capable of drawing at least one amp for the controller to operate properly.

Move the feedback jumper to pins P2-4 & P2-7 to select Voltage FB.

Set the command signal to zero and apply system power. The load voltage should start at zero and increase as the command signal is increased reaching desired maximum output when command signal is maximum. The controller is calibrated at the factory, but if adjustments appear necessary, see the zero and span adjustment instructions on page 7.

Remove short from P1-10 & P1-11, apply command signal to idle input and repeat above procedure.

Move jumper back to desired feedback selection.

The load voltage and current may be measured with any meter. However, accurate RMS voltage measurements can only be made with a True RMS responding meter and accurate average voltage measurements can only be made with an average responding meter.

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

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.

TROUBLE SHOOTING:

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 indicator LED's provide a convenient method of determining the general location of controller problems.

The LOAD LED lites when 10% or more of rated load current is present. LOAD LED intensity should increase as the command signal is increased.

The COMMAND LED indicates the operation of a large part of the circuitry. The intensity of the command indicator should be proportional to the command signal.

The OCT LED is a fault indicator to warn that an Over Current Trip has occurred.

The SSCR LED is a fault indicator to warn that one or more SCR's may be shorted.

NO LOAD VOLTAGE

See wiring diagrams on page 16.

Determine that the supply voltage is present.

Determine that the command signal is applied to the selected input (run or idle) and is wired correctly.

Check the load circuit for open wires, bad connections or blown fuses.

As a last resort, try substituting another circuit board of the same kind.

Check the over current relay for latched condition. Remove power momentarily or close reset contacts to unlatch the over current circuit.

If there is a command signal present and the command indicator is not working, the trouble is likely on the circuit board. Replace the circuit board.

No load voltage with normal operation of the COMMAND LED indicates possible failure of the optical coupler or the SCR driver. Try substituting another circuit board.

LOAD VOLTAGE WILL NOT GO TO ZERO

Determine that the command signal is at it's minimum setting in both the run and idle mode.

If the load voltage is within 2 or 3 volts of desired minimum, see the adjustment information on page 7.

If the shorted SCR indicator is on, an SCR has failed.

If the load voltage will not go to zero with the circuit board removed from the controller, an SCR has failed.

If the load voltage does go to zero with the circuit board removed, replace the circuit board..

FULL VOLTAGE CANNOT BE OBTAINED

Determine that supply voltage is sufficient.

Determine that the control signal is at maximum.

If control signal is present on run or idle input, determine that the correct input is selected. (P1-11)

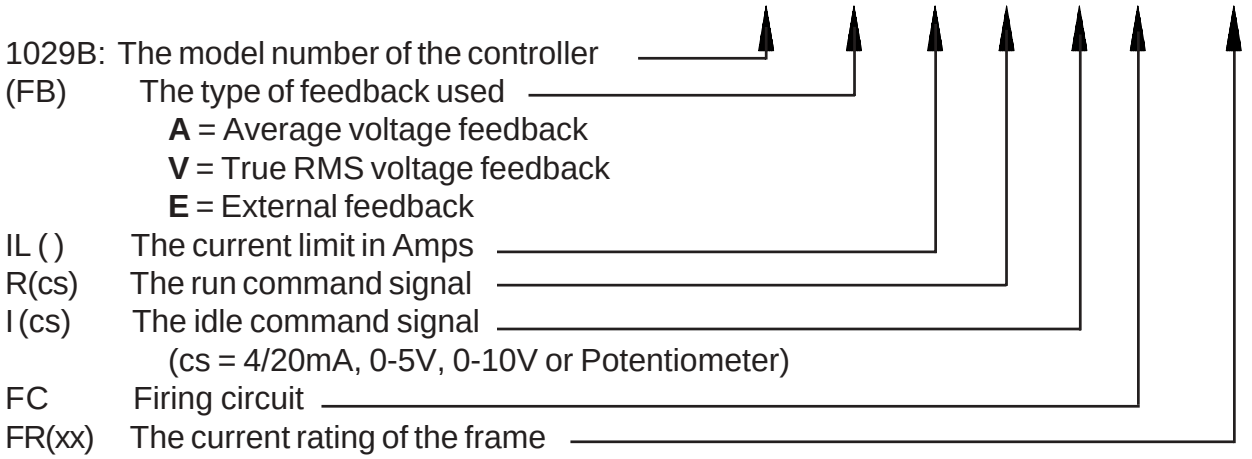
If the load voltage is within 2 or 3 volts of desired maximum, you may be able to adjust the correct (run or idle) span potentiometer for maximum load voltage with a maximum command signal. (See procedure on page 7.)

If external feedback is selected, move the jumper from pins P2-1 & P2-10 to pins P2-4 & p2-7. If the load voltage goes to maximum, the external feedback signal must be adjusted for proper range.

If the maximum obtainable load voltage is approximately 70% of the supply, the problem is likely a circuit board failure.

RECOMMENDED SPARE PARTS:

TO ORDER A SPARE FIRING CIRCUIT: 1029B-(FB)-IL()-R(cs)-I(cs)-FC-FR(xx)



1029B: The model number of the controller
(FB) The type of feedback used
- **A** = Average voltage feedback
- **V** = True RMS voltage feedback
- **E** = External feedback

IL ( ) The current limit in Amps
R(cs) The run command signal
I (cs) The idle command signal
(cs = 4/20mA, 0-5V, 0-10V or Potentiometer)
FC Firing circuit
FR(xx) The current rating of the frame
(xx) = **50, 100, 150, 200, 250, 300, 380, 425, 500, 600, 750 or 1000**

1029B-V-IL100-R4/20mA-IPot-FC-FR100
would be the correct number to order a firing circuit with True RMS voltage feedback, calibrated for 100A limit with a 4/20mA run signal and a potentiometer idle signal, to be used on a 100 amp frame. Call 1 (952) 474-6200 for help.

TO ORDER A SPARE SCR MODULE:

CONTROLLER CURRENT RATING:	ORDER CONTROL CONCEPTS PART No.
50 A	28325-0395-516
100 A	28325-0395-516
150 A	28325-0395-516
200 A	28000-0424-516
250 A	28000-0434-516
300 A	28000-0449-516
380 A	28011-0460-516
425 A	28011-0476-516
500 A	28011-0460-516
600 A	28011-0476-516
750 A	28013-0514-516
1000 A	28013-0514-516

IT IS RECOMMENDED THAT THE CONTROLLER AND THE LOAD BE PROTECTED BY FUSES AS FOLLOWS:

CONTROLLER CURRENT RATING:	RECOMMENDED BUSS CLASS T FUSE: JJS -	CCI PART NUMBER:
50 Amps	60 Amps	42110-0460-360
100 "	125 "	42110-0460-412
150 "	175 "	42110-0460-417
200 "	250 "	*42110-0460-425
250 "	300 "	42110-0460-430
300 "	350 "	42110-0460-435
380 "	450 "	42110-0460-445
425 "	500 "	42110-0460-450
500 "	600 "	*42110-0460-460
600 "	700 "	*42110-0460-470
750 "	800 "	*42110-0460-480

REFERENCE DWGs:

CCI No. D1000589B - SCHEMATIC

* not normally stocked at Control Concepts, Inc. Contact factory for other components as desired. Control Concepts stocks controller replacement parts. Above 750 Amps use a semiconductor fuse.