CONTROL CONCEPTS

MODEL 3020
INSTALLATION & MAINTENANCE MANUAL

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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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DESCRIPTION

The model 3020 controls the electrical power applied to a three-phase load, proportional to a 4/20 mA command signal, by zero-cross operation of a pair of SCR modules. The controller is available with current ratings from 10 to 70 amps and voltage ratings from 120 to 480 Vac.

Two SCR's (Silicon Controlled Rectifiers) are contained in each module, in an inverse parallel configuration, facilitating the control of AC Voltages. The command signal input terminals are electrically isolated from the line and load voltages and all are electrically isolated from the heat sink.

The circuit card, which is powered from the 4/20 mA signal, controls the ON and OFF time of the SCR's, causing the load power to be directly proportional to the command signal.

SPECIFICATIONS

CONTROL MODE	Three-phase zero-cross, distributive control.
COMMAND SIGNAL	4/20 mA, 7 volt maximum; voltage drop at 20 mA input. Impedance equivalent to 350 ohms.
CONTROL RANGE	0 to 97 % of line voltage.
LINEARITY	Average load power is linear within 1% of the command signal.
ZERO AND SPAN ADJUSTMENTS	User adjustable over range of +/- 20% of span.
ISOLATION	Dielectric strength input/line & load voltage/heat sink 2500 V (RMS). Insulation resistance input/line & load voltage/heat sink 10^10 ohms. Maximum capacitance input to output is 8 pF.
COOLING	Convection.
MOUNTING	Must be mounted on vertical surface with fins vertical. Units may be mounted adjacent to each other. Heat sink is electrically isolated.
LINE VOLTAGE	120, 240, 480, 575 Vac +10%, -50% 50/60 Hz
DIAGNOSTIC INDICATOR	An LED turns ON whenever the solid state relay is ON. Feature provides a quick and safe means to check controller operation.
PHYSICAL	Weight: 10 - 40 Amp; 6 lbs, includes base plate & transformer 70 Amp; 12 lbs Dimensions: Refer to installation drawings.
ENVIRONMENT	Operating: 0 to 55º C (32 to 131º F) Storage: -40 to 80º C (-40 to 176º F) Humidity: 0 to 95 % Non-condensing.
DV/DT & TRANSIENT VOLTAGE	200 Volts/us minimum. A DV/DT snubber and a metal oxide varistor (MOV) are provided to protect against high frequency transients (DV/DT) and voltage spikes.
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 JJS fuses. Control Concepts, Inc. maintains an inventory of fuses and fuse holders for your convenience. See Recommended Spare Parts section.

SPECIFICATIONS (Continued)

CURRENT CAPACITY				TOTAL LOAD (KW)				
Continuous RMS rating	RMS 1 Second	Peak 1 cycle (Non-Repetitive	I²t rating	120 Vac	240 Vac	277 Vac	480 Vac	575 Vac
10	22	140	81	2.08	4.16	4.80	8.31	9.96
20	44	250	260	4.16	8.31	9.60	16.63	19.92
30	80	625	1620	6.24	12.47	14.39	29.94	29.98
40	150	1000	4150	8.31	16.63	19.19	33.26	39.84
70	150	1000	4150	14.55	29.10	33.58	58.26	69.72

INSTALLATION

The model 3020 controller must be mounted on a vertical surface with the heat radiating fins aligned vertically. It should be protected from dirt and dust and located in an environment that will not exceed 55º C.

The wiring to the controller must be installed according to prevailing electrical codes. The supply and load terminals will accept up to # 2 wire. Use a maximum of 50 inch pounds of torque on these terminals.

The terminals for the command control signal are on a plug-in connector and will accept wire up to # 18. The connector can be removed by pulling it straight away from the circuit card.

NOTE: It is recommended that the controller and the load be protected with fast acting class “T” fuses like those recommended in the specification portion of this instruction manual.

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**

RECOMMENDED TIGHTENING TORQUE FOR GREEN CONNECTOR: 	
WIRE SIZE (AWG)	TORQUE
12 TO 26GA	**5.0 IN-LBS**

INSTALLATION DRAWINGS

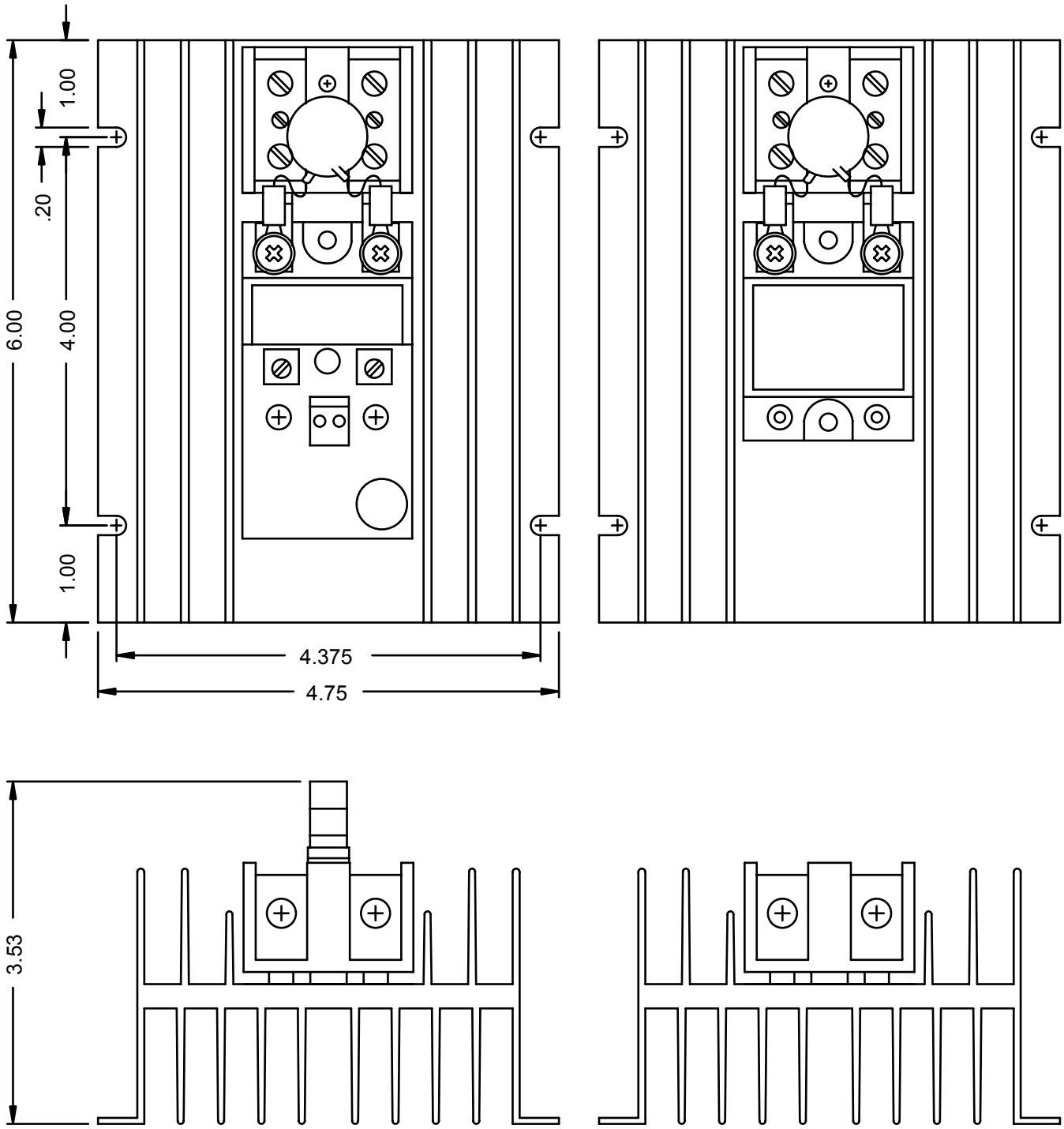

Figure 1. Model 3020 - 10, 20, 30 & 40 Amps
(Both assemblies required for two leg control)

INSTALLATION DRAWINGS (Continued)

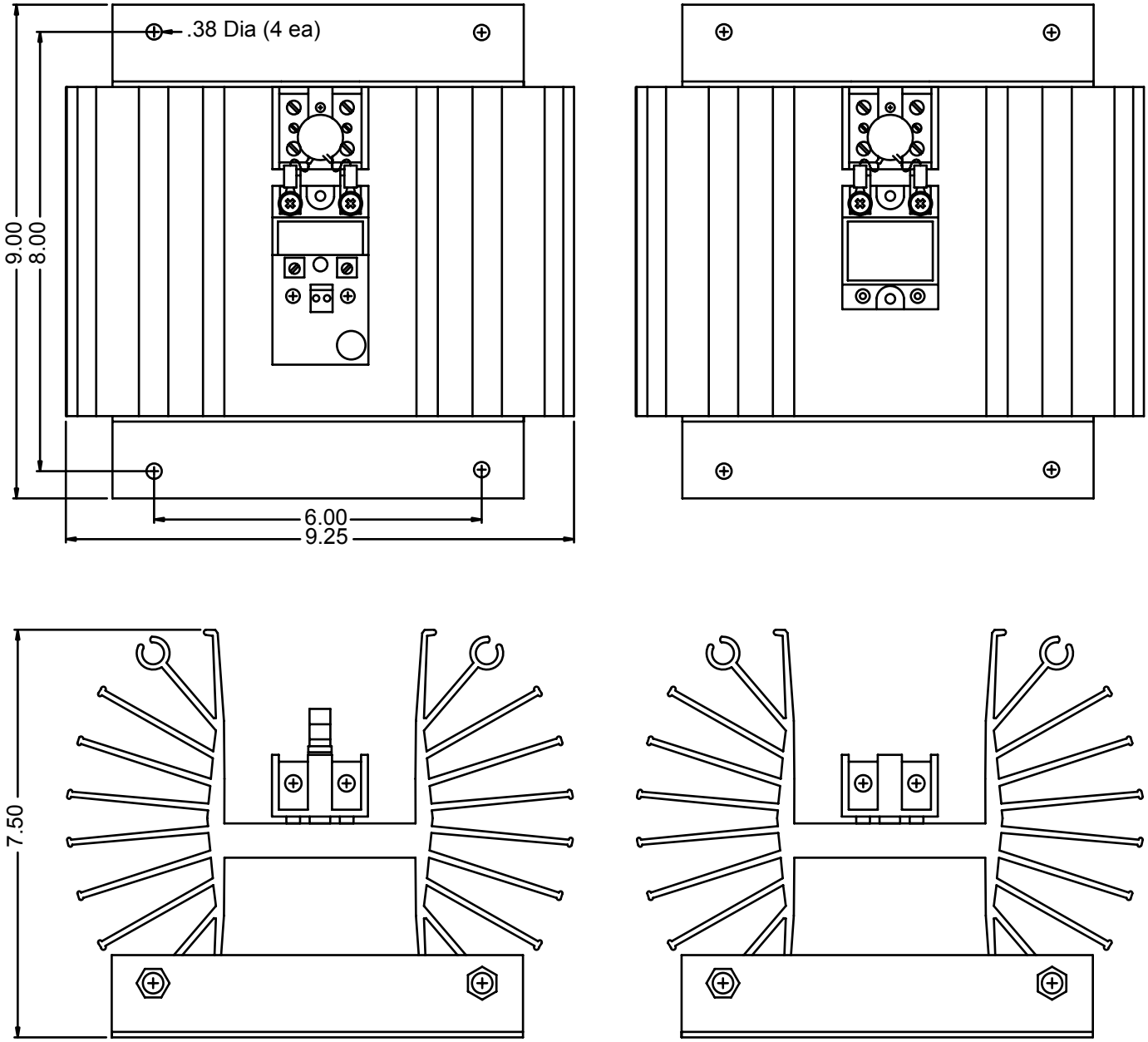

Figure 2. Model 3020 - 70 Amps
(Both assemblies required for two leg control)

ELECTRICAL CONNECTIONS

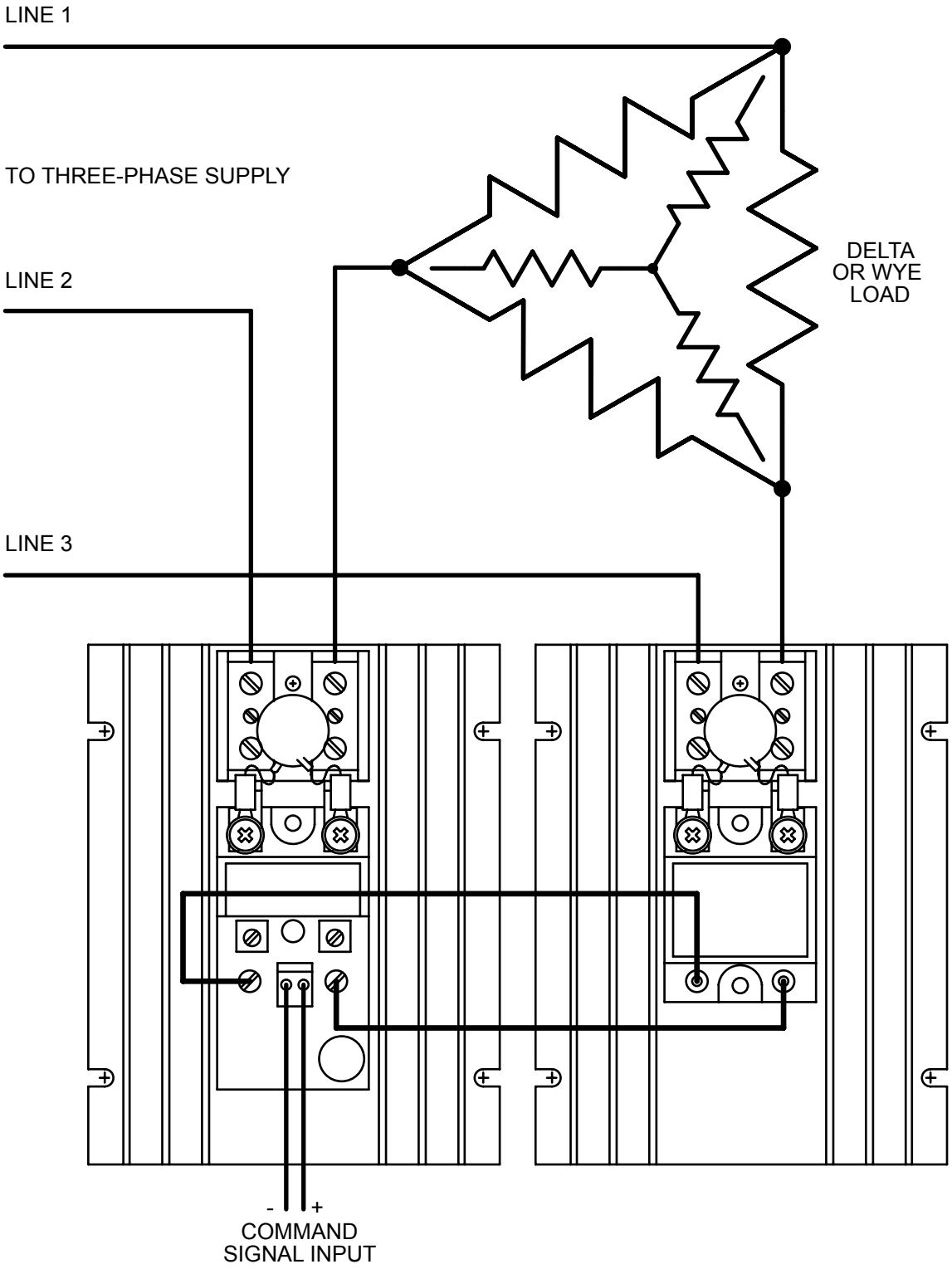

Figure 3. Model 3020, Electrical connections.

THEORY OF OPERATION

The model 3020 is a zero-cross distributive controller. “Zero-cross” implies that load power can be turned ON or OFF only at the beginning or end of each electrical half cycle when the instantaneous value of the applied voltage is zero. Distributive control provides rapid ON-OFF cycling of the load power and combines various cycling rates to obtain the desired load power with infinite resolution. At 50% power the 3020 controller is ON for 3 electrical cycles and OFF for 3 electrical cycles.

At lower power levels load power is applied for 3 cycles and the number of OFF cycles is increased. At power levels above 50% power is OFF for 3 cycles and the number of ON cycles is increased. For example, at 75% power the controller is ON for 9 cycles and OFF for 3 cycles. At 60% power the controller is ON for 4 cycles, OFF for 3 cycles then ON for 5 cycles followed by 3 OFF cycles, providing 9 ON cycles out of a total of 15 cycles.

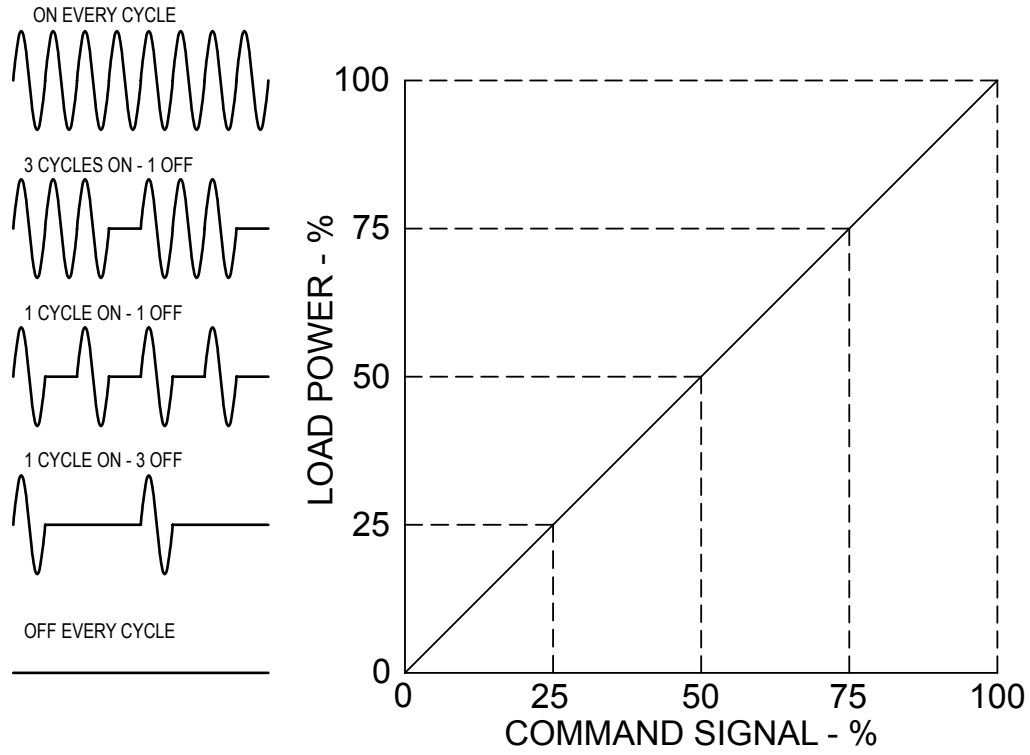

Figure 4. Zero-cross distributive control.

RECOMMENDED SPARE PARTS

RECOMMENDED REPLACEMENT SCR		RECOMMENDED FUSES (typical) (Alternative fuse size is 125% of maximum load current.)		
Model	Assembly Part No.*	CCI Part #	Bussmann	CCI Fusekit**
3020-12-10	1651-12-10	42110-0460-315	JJS-15	FK\63T15
3020-12-20	1651-12-20	42110-0460-325	JJS-25	FK\63T25
3020-12-30	1651-12-30	42110-0460-335	JJS-35	FK\63T35
3020-12-40	1651-12-40	42110-0460-350	JJS-50	FK\63T50
3020-12-70	1651-12-70	42110-0460-390	JJS-90	FK\63T90
3020-24-10	1651-24-10	42110-0460-315	JJS-15	FK\63T15
3020-24-20	1651-24-20	42110-0460-325	JJS-25	FK\63T25
3020-24-30	1651-24-30	42110-0460-335	JJS-35	FK\63T35
3020-24-40	1651-24-40	42110-0460-350	JJS-50	FK\63T50
3020-24-70	1651-24-70	42110-0460-390	JJS-90	FK\63T90
3020-48-10	1651-48-10	42110-0460-315	JJS-15	FK\63T15
3020-48-20	1651-48-20	42110-0460-325	JJS-25	FK\63T25
3020-48-30	1651-48-30	42110-0460-335	JJS-35	FK\63T35
3020-48-40	1651-48-40	42110-0460-350	JJS-50	FK\63T50
3020-48-70	1651-48-70	42110-0460-390	JJS-90	FK\63T90

*The assembly includes one SCR relay, one thermal conductive pad, one MOV and an instruction sheet.
**The fuse kit includes two fuses of appropriate rating for the frame size, and a fuse block. CCI recommends fuses rated at 120-125% max load current.

MODEL No. IDENTIFICATION

3020 - VV - AA

Basic model number

Voltage Rating
- 12 = 120 Vac
- 24 = 240 Vac
- 48 = 480 Vac
- (+10%, -50%)

Current Rating
- 10, 20, 30, 40 & 70 Amps. RMS

NOTE: Adding " -SC(XXX)" to the end of the part number implies that the controller has been modified to have a different input command.

For example:
3020 - 24 - 30 - SC 12/20mA
This implies a model 3020 with a line voltage of 240 Vac at 30 Amps RMS and operates with a 12 - 20 mA control signal.

ADJUSTMENTS

The zero and span potentiometers are factory set, and generally do not require further adjustment.
If adjustments become necessary, the following procedure should be followed.
If you are using RMS feedback, you must use a true RMS meter for these measurements.

1. Set the command signal to minimum and adjust the zero potentiometer until the output is zero. If this pot is set incorrectly, the output of the controller may not be linear with respect to the command signal, or, the controller may be unable to shut off completely.
2. Set the command signal to maximum and adjust the span potentiometer until the output is at the desired maximum value. If this pot is set incorrectly, the output of the controller may not be linear with respect to the command signal, or, the controller may be unable to reach full output.
3. The span and zero adjustments may interact, therefore it may be necessary to repeat steps 1 and 2.

Unless another command signal range has been specified, the zero and span potentiometers will be factory adjusted so that when 4 mA or less is applied, the controller will be OFF. When signal is 20 mA is applied, the controller will be ON continuously. When the command signals are greater than 4 mA but less than 20 mA, the LED will blink.

TROUBLE SHOOTING

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 should be ON whenever the SCR Module is ON and therefore whenever power is being applied to the load.

THE FOLLOWING ARE SYMPTOMS AND POSSIBLE CAUSES:

LED IS OFF AND NO LOAD POWER CAN BE OBTAINED:
Determine that the output of the process controller is connected correctly and the signal is greater than 4mA. The voltage across the input should be approaching 6Vdc. If the voltage is correct, the circuit has probably failed.

LED IS OFF BUT POWER IS APPLIED TO THE LOAD:
Determine if the SCR module has failed as a short and therefore allows power to be continuously applied to the load.

LED IS ON BUT NO LOAD POWER CAN BE OBTAINED:
Determine that power has been applied and that all fuses are OK. If the SCR module is not ON, the supply voltage will exist across the line and load terminals of the SCR module. If a fuse has opened, determine the cause prior to replacing the fuse and applying power.

MANUFACTURED BY

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