

MODEL 1021B

INSTALLATION & MAINTENANCE MANUAL

CONTROL CONCEPTS, INC. 2 YEAR LIMITED WARRANTY

CONTROL CONCEPTS, INC. warrants that the products delivered will be as described in the sales order or contract.

CONTROL CONCEPTS, INC. warrants to the original user that CONTROL CONCEPTS, INC. products will be free from defects in materials and workmanship for a period of two (2) years after the date CONTROL CONCEPTS, INC. ships such products.

If any CONTROL CONCEPTS, INC. product is found to be defective in material or workmanship during the applicable warranty period, CONTROL CONCEPTS, INC.'s entire liability, and purchasers sole and exclusive remedy, shall be the repair or replacement of the defective product at CONTROL CONCEPTS, INC.'s election. CONTROL CONCEPTS, INC. shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or re-installation of any defective product. All shipping and freight costs are the responsibility of the customer. CONTROL CONCEPTS, INC.'s limited warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by CONTROL CONCEPTS, INC., or if the products have been modified or altered without the written consent of CONTROL CONCEPTS, INC., or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to CONTROL CONCEPTS, INC. in writing within the stated warranty period.

CONTROL CONCEPTS, INC.'s limited warranty is made in lieu of, and CONTROL CONCEPTS, INC. disclaims all other warranties, whether expressed or implied, including but not limited to any IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, any implied warranty arising out of a course of dealing or of performance, custom or usage of trade.

CONTROL CONCEPTS, INC. SHALL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, REVENUE OR BUSINESS) OR DAMAGE OR INJURY TO PERSONS OR PROPERTY IN ANY WAY RELATED TO THE MANUFACTURE OR THE USE OF ITS PRODUCTS. The exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict in tort, or any other legal theory, even if CONTROL CONCEPTS, INC. has notice of the possibility of such damages.

By purchasing CONTROL CONCEPTS, INC.'s products, the purchaser agrees to the terms and conditions of this limited warranty.

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

© Copyright 2020, Control Concepts, Inc. Chanhassen, MN 55317

The information and design disclosed herein are the property of Control Concepts, Inc. and may not be used, reproduced or disclosed in any form except as granted in writing by:

CONTROL CONCEPTS, INC
8077 CENTURY BLVD
CHANHASSEN, MN 55317
PHONE: (952) 474-6200
TOLL FREE: (800) 765-2799
FAX: (952) 474-6070
www.cciipower.com

MODEL 1021B TABLE OF CONTENTS

DESCRIPTION	1
THEORY OF OPERATION	1
SYNC-GUARD™	1
INSTALLATION	1
SPECIFICATIONS	2
ELECTRICAL CONNECTIONS	2
COMMAND CONNECTIONS	2
INSTALLATION DRAWINGS	3
INSTALLATION DRAWINGS (Continued)	4
ZERO AND SPAN ADJUSTMENTS	5
SYNC-GUARD™ CONNECTIONS	5
TROUBLE SHOOTING	6
MODEL No. IDENTIFICATION	6
MANUFACTURED BY	6

DESCRIPTION

The model 1021B controller is a single-phase distributive zero-cross SCR controller. Distributive zero-cross control implies that the load voltage is switched on only when the instantaneous value of the sinusoidal supply voltage is zero and that the load power is controlled by varying the number of electrical cycles that power is applied and removed from the load.

The controller is capable of accepting mA command signals, DC voltage signals, or it may be controlled by a potentiometer. Electrical isolation is provided to isolate the command signal from the line and load voltages.

The model 1021B includes a feature called Sync-Guard™ which reduces the possibility of several controllers being on or off at the same time.

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, 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.

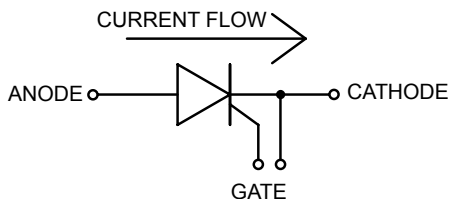


Figure 1. SCR symbol

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

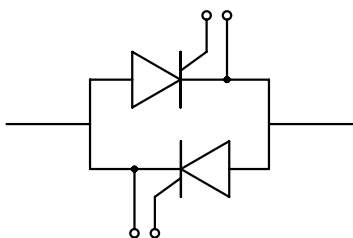


Figure 2. "AC Switch"

ZERO-CROSS OPERATION

In zero-cross control, the load power is turned on or off only when the instantaneous value of the sinusoidal waveform is zero.

Load power is controlled by switching the SCRs "on" for a number of complete electrical cycles, and then "off" for a number of complete electrical cycles. The circuit determines the ON versus the OFF time of the silicon controlled rectifiers (SCRs) such that the load power is linear with the command signal.

The circuit at 50% power will cause the SCRs to be "on" for 3 cycles and "off" for 3 cycles. At higher power levels, the SCRs are ON for more cycles and OFF for 3 cycles. At lower power levels, the SCRs are ON for 3 cycles and OFF for more cycles. The SCRs are turned ON and OFF only at the beginning and end of each electrical cycle.

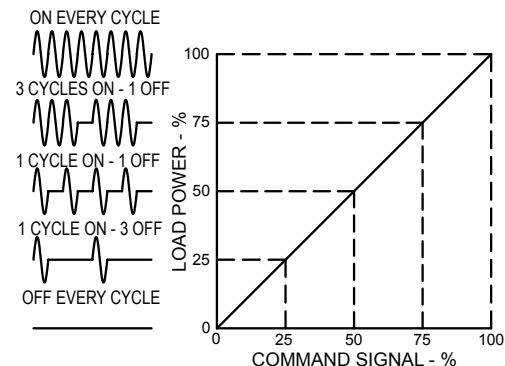


Figure 3. Distributive Control.

SYNC-GUARD™

Sync-Guard™ reduces the possibility of two or more controllers operating synchronously, thereby reducing the possibility of all controllers being on and off simultaneously.

The Sync-Guard™ feature provides a more uniform or continuous power demand and therefore reduces the variations in the supply voltage that can occur when multiple controllers operate synchronously. See page 5 for Sync-Guard™ connections.

INSTALLATION

The controller must be mounted on a vertical surface with the fins oriented vertically such that air will flow over the heat dissipating fins. The plug-in connector may be removed by pulling it straight away from the circuit board.

The 24Vac transformer may be connected to any source of the correct voltage. For the line voltage compensation feature to work properly, the 24Vac transformer must be connected to the same supply used to power the load.

SPECIFICATIONS

CURRENT RATING

The (LOAD CURRENT) term within the model number specifies the maximum continuous RMS current rating at a 55°C maximum ambient temperature.

COMMAND SIGNAL

	Input Resistance
0 to 5Vdc	100 K
0 to 10Vdc	200 K
4/20 mA	300 ohms
Potentiometer	200 K
(1K, 1/2 watt recommended, 20K maximum permissible.)	

ISOLATION

2500V rms input signal to load and line voltages.

CONTROL MODE

Zero-cross, distributive.

LINE VOLTAGE COMPENSATION

The average load voltage remains constant within 2% over line voltage changes of +10% to -15%.

FUSES

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

Control Concepts, Inc. stocks a complete line of Bussmann class "T" fuses for controllers. Contact the factory for price and delivery information.

ELECTRICAL CONNECTIONS

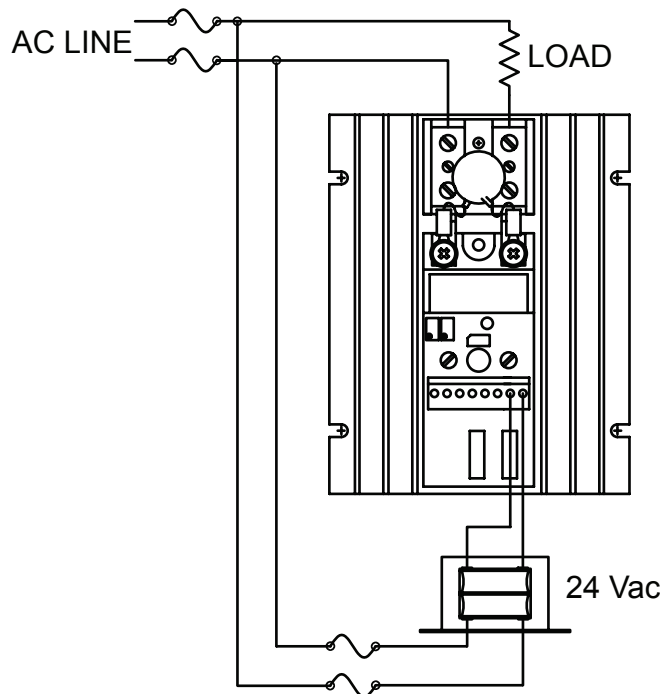


Figure 4. Electrical Hookup.

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

COMMAND CONNECTIONS

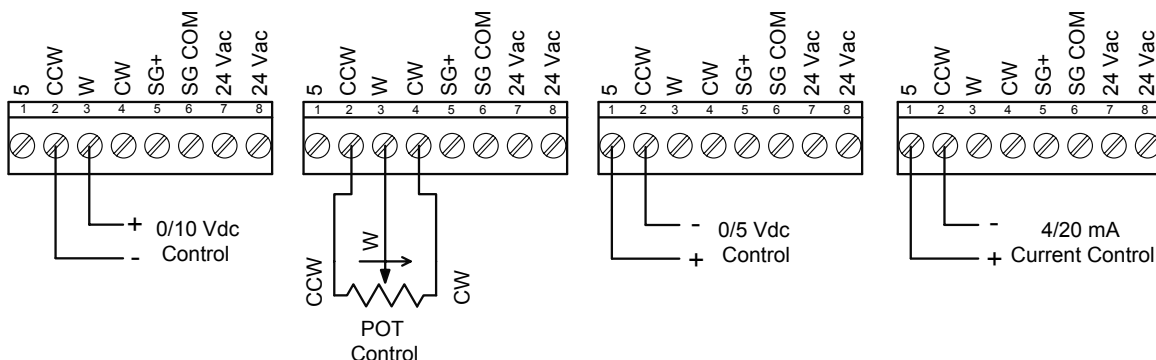


Figure 5. Signal Connections.

INSTALLATION DRAWINGS

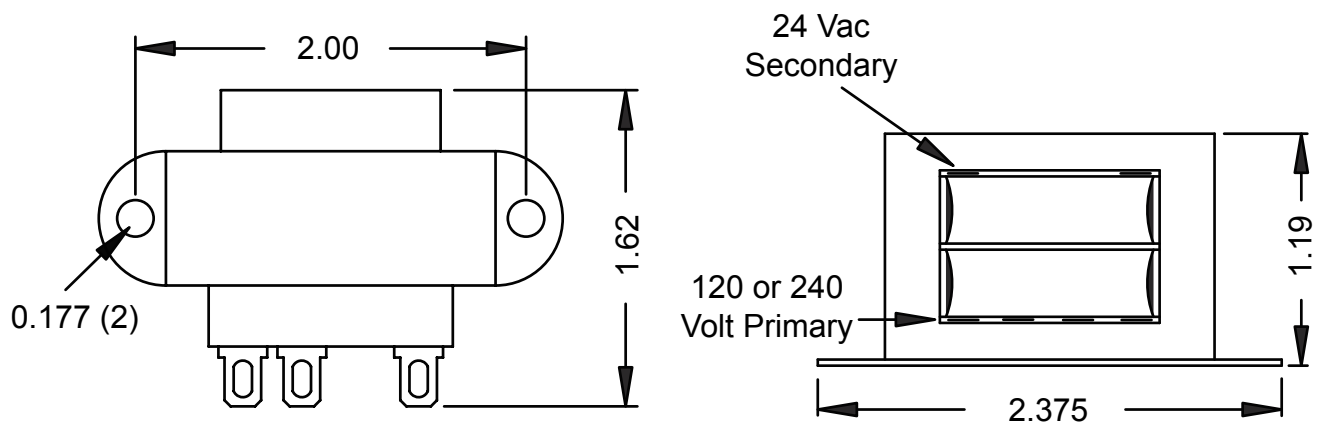


Figure 6. 120/240 Volt Primary Transformer.

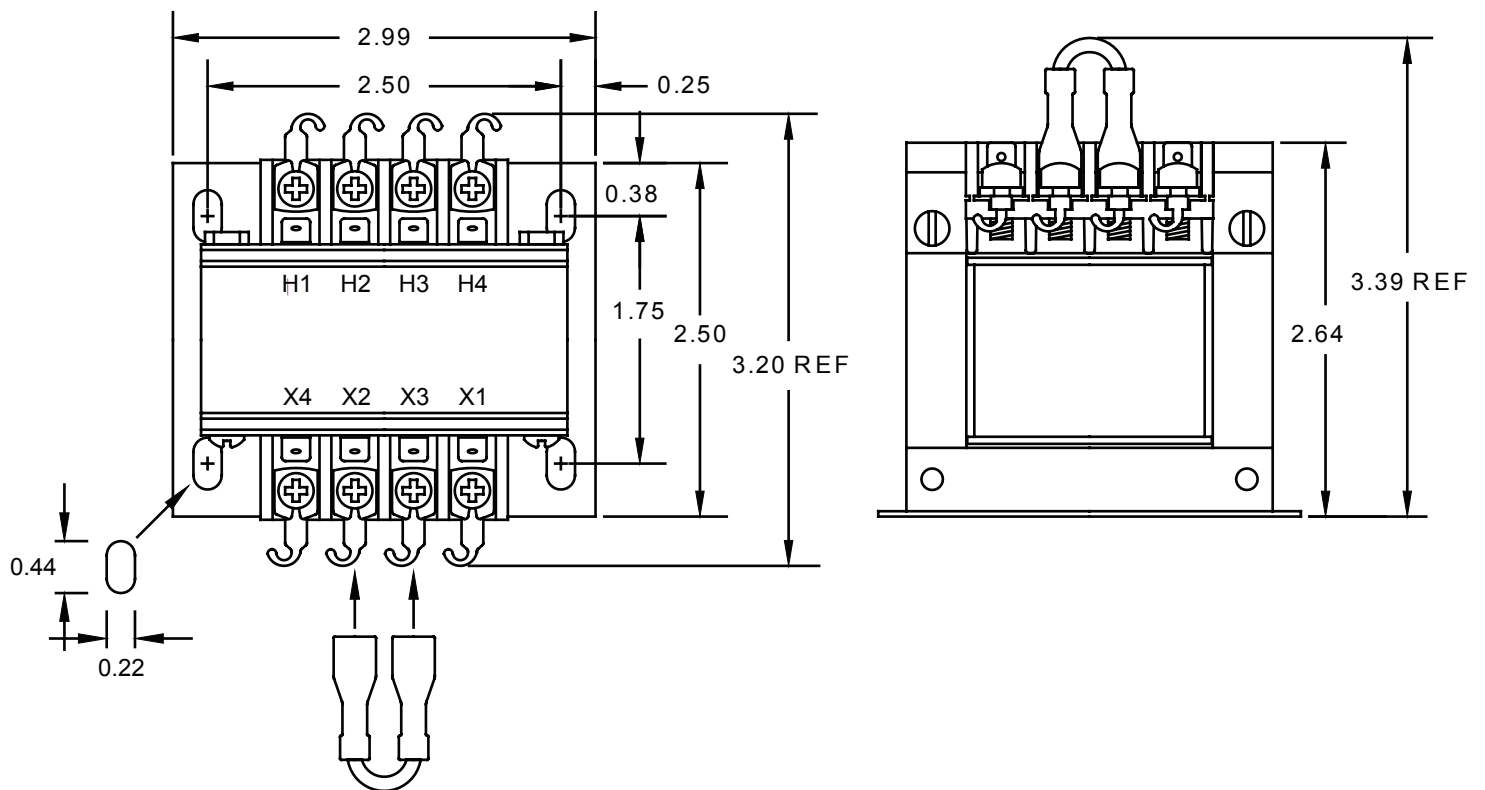


Figure 7. 480 Volt across H1 and H4 of Primary.
Jumper across X2 and X3 to create 24 Vac on Secondary.

INSTALLATION DRAWINGS (Continued)

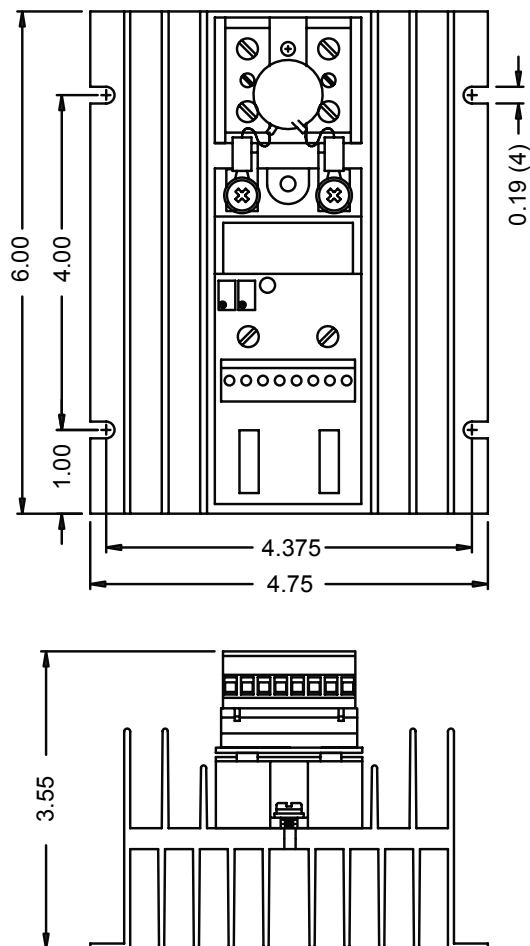


Figure 8. 10,20,30 & 40 Amps.

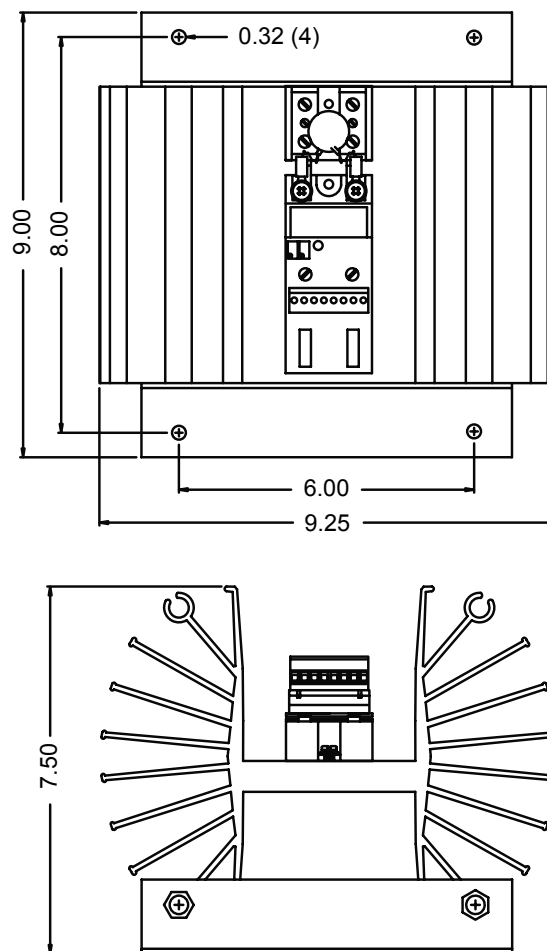


Figure 9. 70 Amps.

RECOMMENDED REPLACEMENT SCR:		RECOMMENDED FUSES (typical) (Alternative fuse size is 125% of max. load current)		
MODEL	ASSY No.*	CCI PART #	BUSSMANN #	CCI FUSE KIT**
1021-12-10	1651-12-10	42110-0460-315	JJS-15	FK\62T15
1021-12-20	1651-12-20	42110-0460-325	JJS-25	FK\62T25
1021-12-30	1651-12-30	42110-0460-335	JJS-35	FK\62T35
1021-12-40	1651-12-40	42110-0460-350	JJS-50	FK\62T50
1021-12-70	1651-12-70	42110-0460-390	JJS-90	FK\62T90
1021-24-10	1651-24-10	42110-0460-315	JJS-15	FK\62T15
1021-24-20	1651-24-20	42110-0460-325	JJS-25	FK\62T25
1021-24-30	1651-24-30	42110-0460-335	JJS-35	FK\62T35
1021-24-40	1651-24-40	42110-0460-350	JJS-50	FK\62T50
1021-24-70	1651-24-70	42110-0460-390	JJS-90	FK\62T90
1021-48-10	1651-48-10	42110-0460-315	JJS-15	FK\62T15
1021-48-20	1651-48-20	42110-0460-325	JJS-25	FK\62T25
1021-48-30	1651-48-30	42110-0460-335	JJS-35	FK\62T35
1021-48-40	1651-48-40	42110-0460-350	JJS-50	FK\62T50
1021-48-70	1651-48-70	42110-0460-390	JJS-90	FK\62T90

*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 fuseblock. CCI recommends fuses rated at 120-125% max load current.

ZERO AND SPAN ADJUSTMENTS

The zero and span adjustments have been factory adjusted to provide zero load voltage when the minimum command signal is applied and to provide rated output voltage to the load when the maximum command signal is applied. Further adjustment of these settings should not be required.

If it is desired to readjust the zero and span settings the following procedures should be followed.

1. Apply minimum command signal and adjust the zero potentiometer until the LED is just off. (Clockwise rotation of both the span and zero potentiometer increase the load voltage)

2. Apply maximum command signal and adjust the span potentiometer until the LED is just full on.

3. It may be necessary to repeat these steps due to interaction that can occur.

The 1021B controller has line voltage compensation. Therefore if the supply voltage is above the nominal rating the controller will supply the nominal rated voltage to the load. For example, if a controller rated for 240 volt operation is supplied from a 260 volt supply and the maximum command signal is applied the controller will supply only 240 volts to the load thereby eliminating the effects of line voltage changes.

SYNC-GUARD™ CONNECTIONS

The two control lines that couple the Sync-Guard™ connections together must be terminated with a 1000 ohm load. This termination resistor is found on the 1021B circuit board and is enabled with a jumper P2. Only one of the circuit boards must have this jumper moved to the "IN" position.

When using Sync-Guard™, pin # 5 from each circuit board must be tied to pin # 5 on the other circuit boards and pin # 6 from each circuit board must be tied to pin # 6 on the other circuit boards. A maximum of 10 boards may be connected together in this manner.

CAUTION! When using the SYNC-GUARD™ feature, the mA control signals must be isolated from each other.

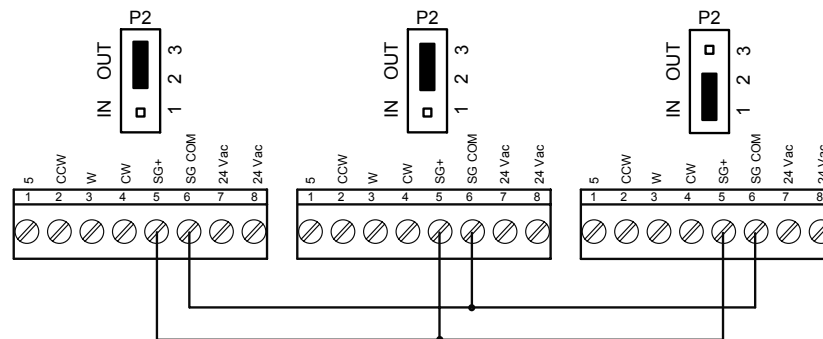


Figure 10. Sync-Guard connections for multiple controllers.

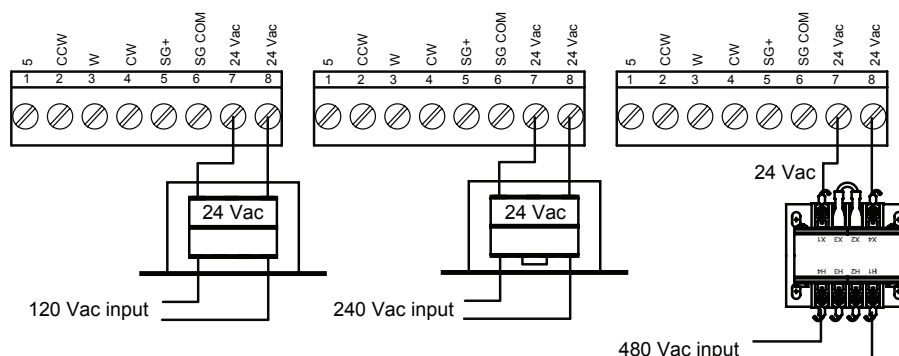


Figure 11. Various 24V power connections. Two fuses are recommended to protect the transformer circuit. See not about primary connecions on page 1.

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 varies in intensity proportional to the command signal and therefore should be proportional to the load voltage.

THE FOLLOWING ARE SYMPTOMS AND POSSIBLE CAUSES:

NO LOAD POWER, LED not ON:

Determine that the command signal is applied to the controller. Determine that 24 volts is applied to the circuit.

NO LOAD POWER, LED intensity can be varied:

Determine that all fuses are "OK". If the voltage across the SCR module is equal to the line voltage the SCR module has probably failed. NOTE: If a replacement SCR module is ordered specify the voltage and current rating of the controller and the serial number of the failed unit.

LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED, LED is ON:

Determine that the command signal can be adjusted to zero. Also remove the green plug-in connector to remove the command signal. If the LED is not off, the circuit card has failed.

LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED, LED is OFF:

Remove the 24Vac plug in connector. If the load still has power the SCR module has probably failed as a short allowing full power at be applied to the load. To determine if the SCR module has shorted remove power and then the line and load connections and measure the resistance across the line and load terminals on the SCR module. If the resistance is less than 10000 ohms the module has failed. NOTE: If a replacement SCR module is ordered specify the voltage and current rating of the controller and the serial number of the failed unit.

MAXIMUM LOAD VOLTAGE CANNOT BE OBTAINED:

Determine that the primary of the circuit transformer is connected to the same supply as the controller and load. Typically this problem is caused by the primary being connected across the load and line connection at the controller.

MODEL No. IDENTIFICATION

1021B-VV-AA-(XX)

VV = Rated voltage: _____

12 = 120Vac

24 = 240Vac

48 = 480Vac

57 = 570Vac

AA = Rated amps: _____

10, 20, 30, 40, or 70 amps

(XX) = Command Signal: _____

0/5 Vdc

0/10 Vdc

4/20 mA

Potentiometer

MANUFACTURED BY



**CONTROL
CONCEPTS**

TEL: (952) 474-6200

(800) 765-2799

FAX: (952) 474-6070

www.ccipower.com

8077 Century Blvd
Chanhassen, MN 55317, USA