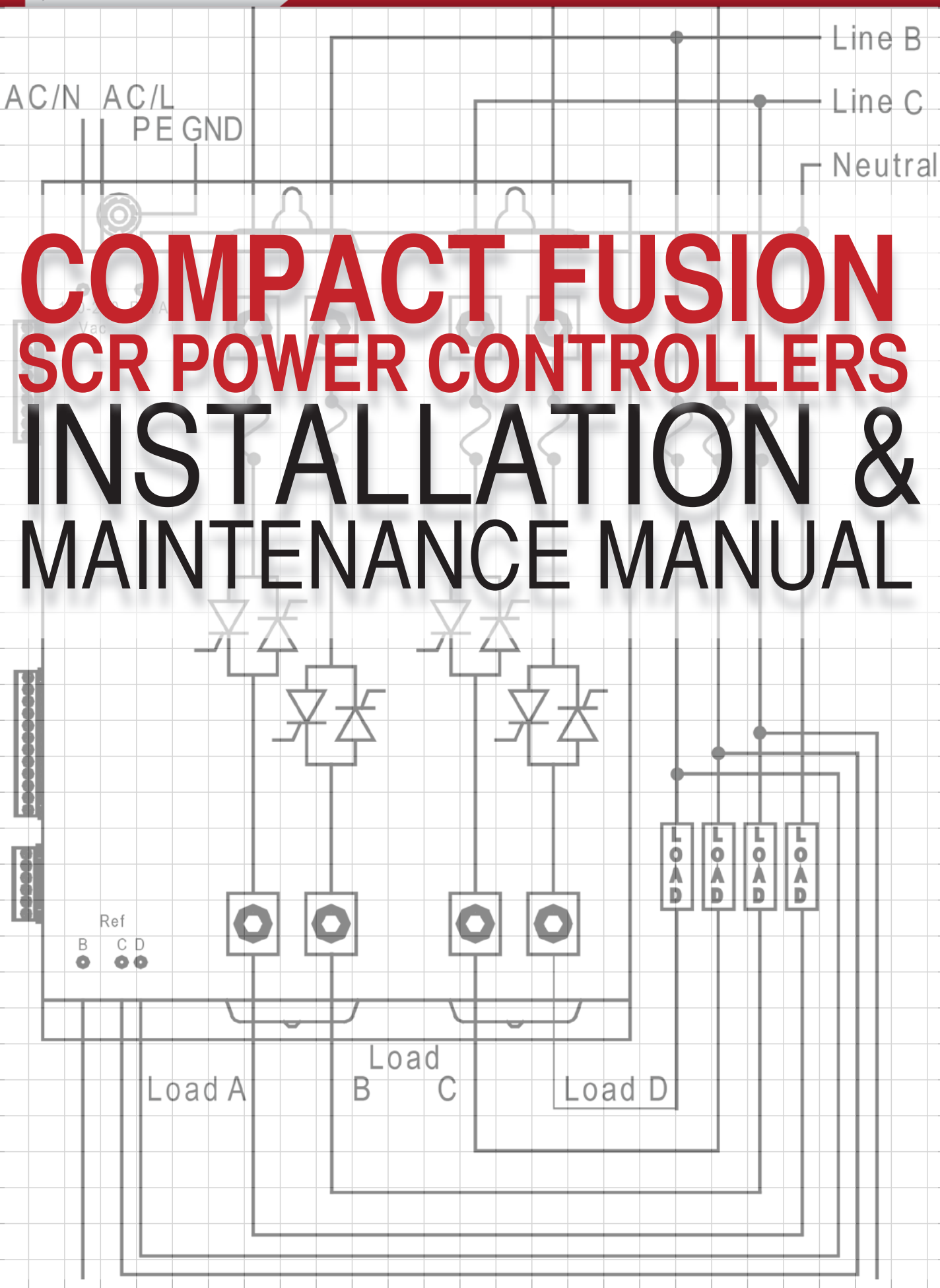
CONTROL CONCEPTS

COMPACT FUSION
SCR POWER CONTROLLERS
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 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.

CONTROL CONCEPTS, INC
18760 LAKE DRIVE EAST
CHANHASSEN, MN 55317
PHONE: (952) 474-6200
TOLL FREE: (800) 765-2799
FAX: (952) 474-6070
www.ccipower.com

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Listed 3L32 - Industrial Control Equipment
100kA Short Circuit Current Rating
File Number E136219

EN60947-4-3
IP 20
See CE Declaration of Conformity

Part 15 Subpart B
Class A Device

See RoHS Certificate of Compliance

DECLARATION OF CONFORMITY

FUSION CF Series SCR Power Controller

Control Concepts, Inc.
18760 Lake Drive East
Chanhassen, MN 55317 USA

Declares that the following product:

Designation:	FUSION CF Series Power Controller
Model Numbers:	Model CF followed by ZC, PA, followed by 1, 2 or 3, followed by 1 through 9 or A through E followed by number or letter, may be followed by numbers and/or letters, may be followed by numbers and/or letters, may be followed by numbers and/or letters.
Classification:	Solid State Power Controller, Class I, Pollution Degree II
Rated Voltage:	24 - 600 Vac
Rated Frequency:	45 - 65 Hz

Meets the essential requirements of the following European Union Directive(s) using the relevant section(s) of the normalized standards and related documents shown:

EN 60947-4-3: 2000 Low-voltage switchgear and controlgear

EMC Directive 2004/108/EC

-EN 61000-6-2: 2005

-EN61000-4-2: 1995 + Amendments A1:1998 + A2: 2001	ESD Immunity
-EN61000-4-3: 2006	Radiated Immunity
-EN61000-4-4: 2004 + Corrigendum 2004	EFT / Burst Immunity
-EN61000-4-5: 2006	Surge Immunity
-EN61000-4-6: 2007	Conducted Immunity
-EN61000-4-8: 1993 + Amendment A1: 2001	Magnetic Field Immunity
-EN61000-4-11 Second Edition: 2004	Voltage Dips & Interruptions
-EN 61000-6-4: 2007	Conducted & Radiated Emissions

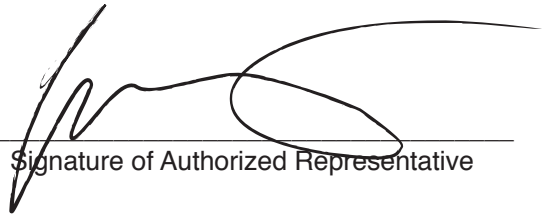
Note 1: All power terminals must be populated as to keep the controller touch safe to comply with EN 60947-4-3.
Note 2: Controller must be mounted in a shielded enclosure to comply with EMC Directive 2004/108/EC.
Note 3: Controller must have appropriate line and control power filter to comply with EN61000-6-2.

Third party conformance testing conducted by TÜV America.

TÜV SÜD America Inc.
Suite 104
1774 Old Highway 8 NW
New Brighton, MN 55112-1891

Name of Authorized Representative: Cory Watkins
Title of Authorized Representative: President

Place of Issue: Chanhassen, Minnesota, USA
Date of Issue: December 2010



Signature of Authorized Representative

12 | 20 | 2010

Date

External EMI filters must be used in conjunction with the FUSION series power controllers to maintain CE immunity* approval. The following filters were used during the immunity testing.

Universal input power:
Schaffner filter
P/N: FN 2030-3-06

Line input power:
Schaffner filter
P/N: FN 3270H-35-33

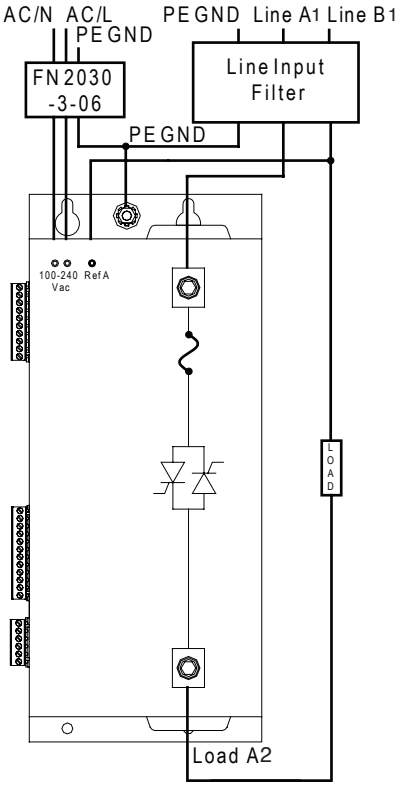
The Schaffner filter for universal input power, or it's equivalent, may be used as listed above. The line input power filter however, will need to be sized accordingly for your load. Please contact Schaffner EMC Inc. for help finding the appropriate filter.

Schaffner EMC Inc.
52 Mayfield Avenue I Edison, New Jersey 08837 / USA
T 1-800-367-5566 I T 732-225-9533 I F 732-225-4789
usasales@schaffner.com I http://www.schaffner.com/us

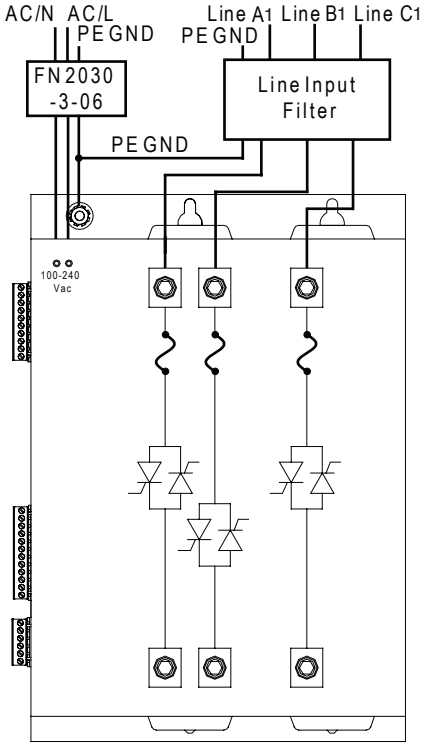
*No filtering is required for emissions.

Wire filters as shown below:

1 Phase Controller



3 Phase Controller



Other wire diagrams are available, for models not listed here, by contacting Control Concepts, Inc.

ATTENTION

This product has been designed for class A equipment. Use of this product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

NOTICE

This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances, in which case the user may be required to take adequate mitigation measures.

PB-FREE/REDUCTION OF HAZARDOUS SUBSTANCE (RoHS)

CERTIFICATE OF COMPLIANCE

RoHS COMPLIANT

Pb Pb-Free

This document certifies that Control Concepts, Inc's products listed in the table are fully RoHS complient as of Nov 13, 2009 in accordance with EU RoHS Directive 2002/95/EC. The products listed in the table have been identified as RoHS compliant do not exceed the maximum limit for the six substances: Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls and Polybrominated diphenyl ether.

PRODUCT FAMILY	PART NUMBERS	DATE ADDED
FUSION	FUSION-□□-□-□□□□-□-□□□□-□□□□	11/13/2009
FUSION CF	CF-□□-□-□□□□-□-□□□□-□□□□	12/20/2010

Authorized Signature
Cory Watkins, President

12 | 20 | 2010
Date Last Updated

CONTROL CONCEPTS, INC.
18760 LAKE DRIVE EAST
CHANHASSEN, MN 55317
(952) 474-6200
1-800-765-2799
FAX (952) 474-6070
www.ccipower.com

1. RECOMMENDED FUSING

Controllers are equipped with fast acting, branch-rated Class T fuse(s). To keep certifications (UL, CE, etc) it is important that blown fuses are replaced with fuses of the same size and type as those originally provided with the controller. The table below shows controller sizes with their installed fuse size. It is also important to use this chart when external fuses are required.

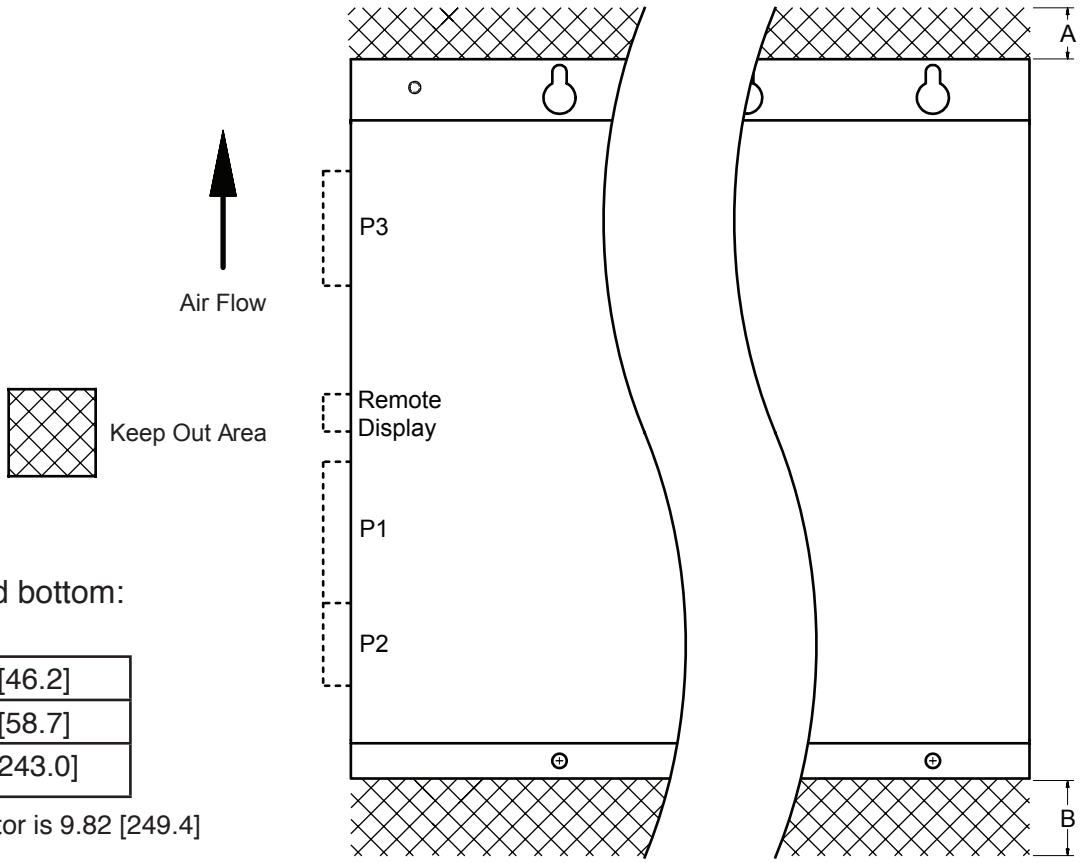
Frame Size	Fuse Size (Amps) 600 V Rated	CCI P/N for Class T
10A	15 Fast Acting T	0042110-0460-315
25A	30 Fast Acting T	0042110-0460-325
50A	60 Fast Acting T	0042110-0460-350
80A	100 Fast Acting T	0042110-0460-410
100A	125 Fast Acting T	0042110-0460-412
125A	150 Fast Acting T	0042110-0460-415
160A	200 Fast Acting T	0042110-0460-420

Control Concepts carries an inventory of fuses and fuse blocks for purchase.

2. INSTALLATION

2.1 Mounting Considerations

Dimensions: Inches [mm]



Keep out area for top and bottom:

A	1.82 [46.2]
B	2.31 [58.7]
Depth*	9.57 [243.0]

*Depth with DeviceNet adaptor is 9.82 [249.4]

Mount 10 and 25 Amp controllers and a 1 zone 50 Amp single phase controller vertically for convection cooling. All other controllers have forced air cooling and may be mounted horizontally or vertically.

The keep out area on the top and bottom must be maintained for air circulation. The top and bottom of the controller must have a minimum of 3.00 [76.2] free from obstructions as measured from fan guards. Dimensions above are measured from the edge of the base plate.

Mounting hardware: 1/4-20 or M6 bolts with flat and lock washers (not provided)

P1, P2 and P3 protrude approximately 0.50 [12.7] from the left side of this figure. When using the remote display, this distance is approximately 2.25 [57.2]. They are required for operation but may be removed for wiring. It is important to leave enough room for the removal of the connectors (approximately 1.00 [25.4] - More if using Remote Display) and wiring considerations.

CAD Blocks are available for download at www.ccipower.com.

2.2 Mounting Dimensions for Single Module Controllers

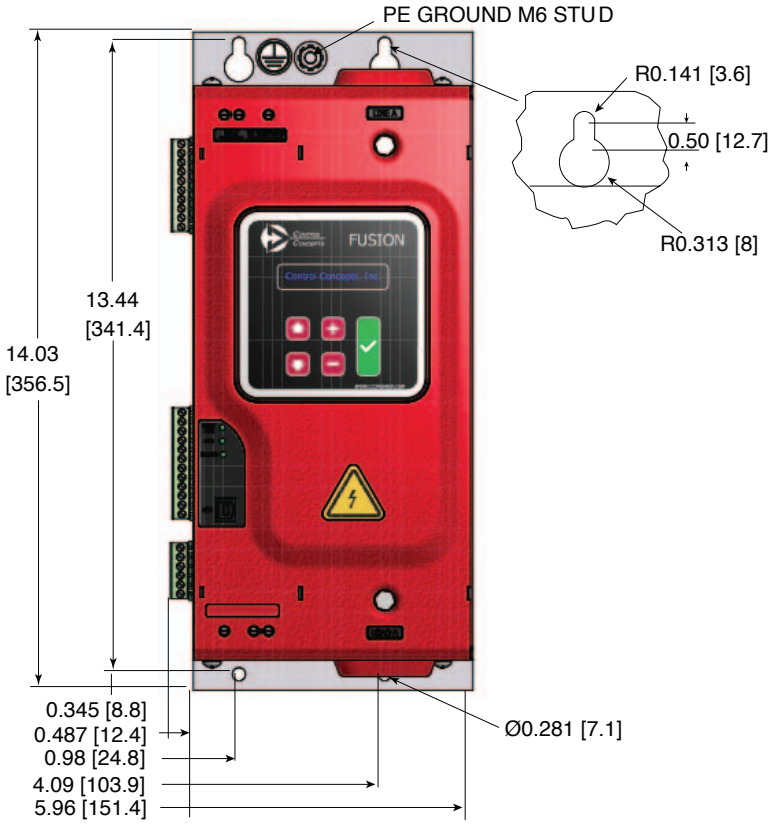
Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
5.96 [151.4]
Depth
9.57 [243.0] *

Amp	Weight (lbs[kg])**
10-50	14.0 - 15.5 [6.4-7.0]
80-125	14.0 - 15.5 [6.4-7.0]
160	15.5 - 17.5 [7.0-7.9]

** Weights are for controller only - Shipping weight will vary

*Depth with DeviceNet adaptor is 9.82 [249.4]



This model includes controllers:

- Single Phase
- Single Phase with Pass Through
- (2x) Single Phase
- Three Phase Two Leg

2.3 Mounting Dimensions for Two Module Controllers

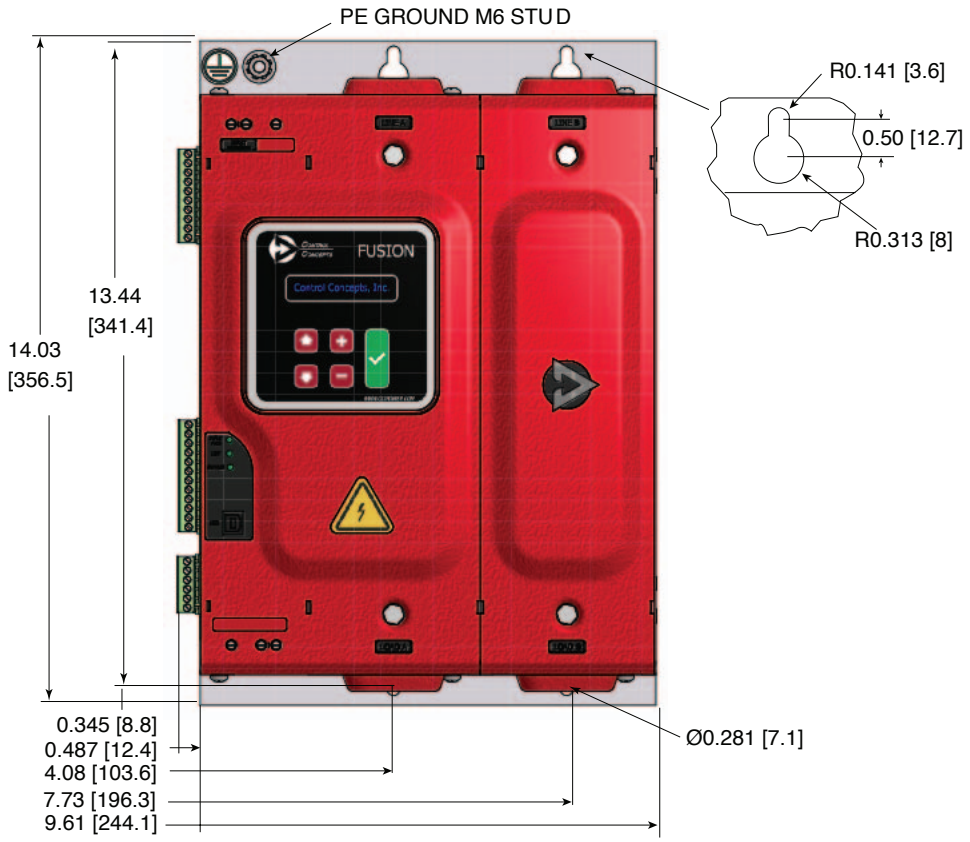
Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
9.61 [244.1]
Depth
9.57 [243.0] *

Amp	Weight (lbs[kg])**
10-50	22.5 - 24.5 [10.2-11.1]
80-125	24.0 - 25.5 [10.8-11.6]
160	26.5 - 28.5 [12.0-12.9]

** Weights are for controller only - Shipping weight will vary

*Depth with DeviceNet adaptor is 9.82 [249.4]



This model includes controllers:

- (2x) Single Phase with Pass Through
- (3x) Single Phase
- (4x) Single Phase
- Three Phase Two Leg with Pass Through
- Three Phase (Delta, Inside Delta, 3 or 4 Wire Wye)

2.4 Remote Display Kit

The remote display kit includes all necessary components (excluding knockout punch) to mount the display to the front of an electrical enclosure. This allows for easy viewing and adjustment of parameters and reduces costs by eliminating the need for external gauges.

The remote display is suitable for use on a flat surface of a type 1 and/or type 12 enclosure. It meets CE and UL requirements. CE testing was conducted with a 25 foot cable from the controller to the display. Contact the factory if you require a length longer than 25 feet.

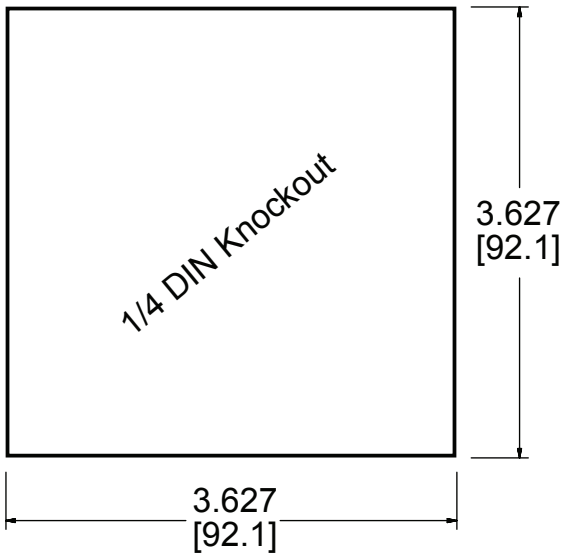
Remote Display Ratings:
IP65 - Totally protected against ingress of dust. Protected against jets of water. Limited ingress permitted.

UL Type 1 - Enclosure constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosure equipment and to provide a degree of protection against falling dirt.

UL Type 12 - Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, against circulating dust, lint, fibers, and filings; against dripping and light splashing of non-corrosive liquids; and against light splashing and consequent seepage of oil and non-corrosive coolants.

2.4.1 Mounting Considerations

Dimensions: Inches [mm]



Must be mounted on enclosure with smooth surface.

Follow the mounting instructions on the following pages for proper installation.

Maximum panel thickness: 0.25 [6.4].

2.4.2 Mounting Instructions

Mounting Kit includes:

(1) Gasket
(1) Ferrite
(1) Display retainer
(4) Screws
(1) 5 or 25 foot shielded cable
(1) Empty Display with CCI logo to replace actual display

STEP 1

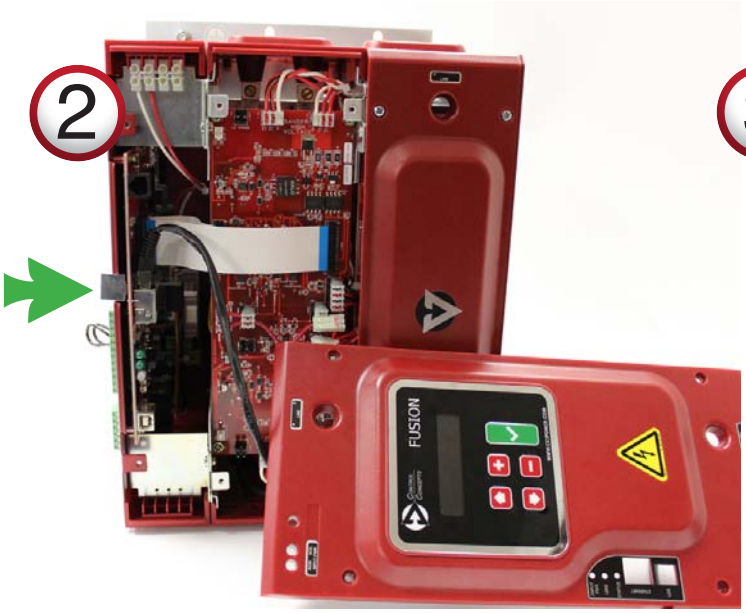
Carefully remove the 4 screws securing the lid.
(See Number 1, right)

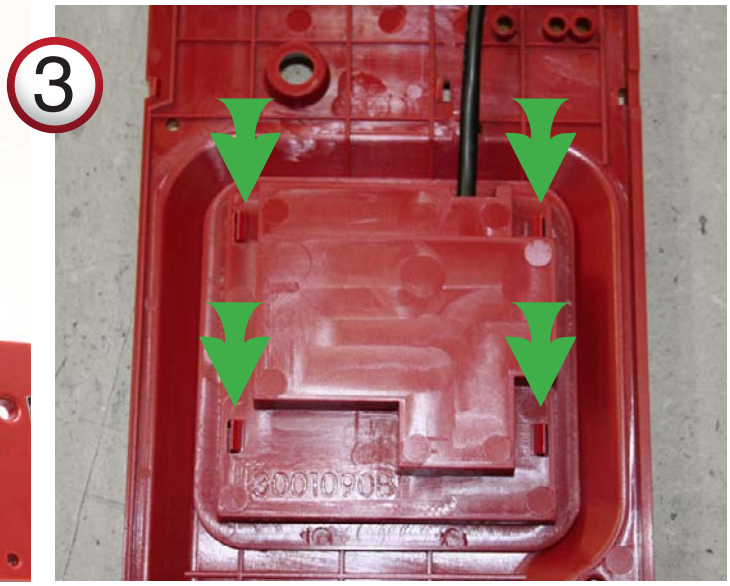
STEP 2

Disconnect the display cable from the controller.
(See Number 2, bottom left)

STEP 3

Remove the display from the lid. The four tabs holding the display into the lid are marked.
(See Number 3 bottom right)



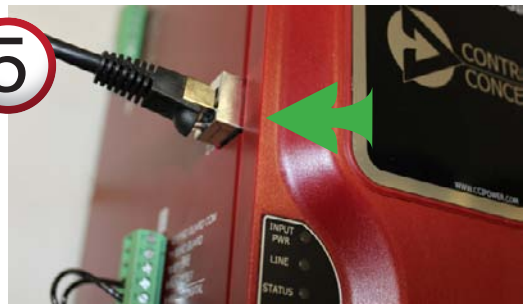


STEP 4

Insert the empty display into the lid and reattach to the controller. (See Number 4, right)

STEP 5

Remove the 1 foot cable from the display. Run one end of the 5 or 25 foot cable to the Remote Display connector on the side of the controller (See Number 5, right)



STEP 6

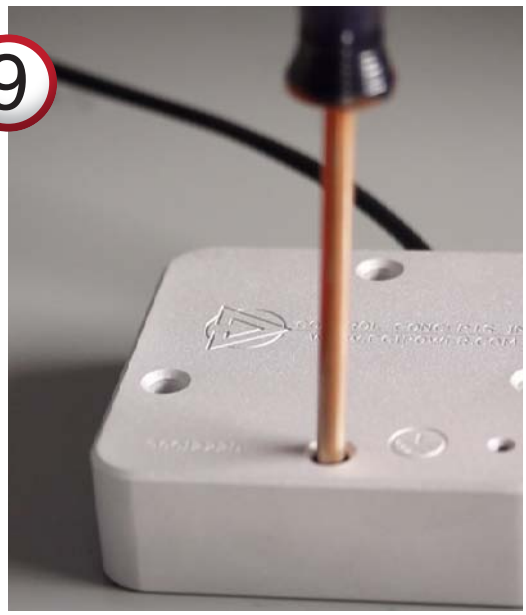
Make a 1/4 DIN (3.627” x 3.627” [92.13mm x 92.13mm]) size hole in the cabinet.

STEP 7

Place the gasket on the back of the display. Make sure the gasket does not overhang the edges of the display. Place the display inside of the 1/4 DIN cutout of the cabinet with the display facing outward.

STEP 8

Attach the other end of the 5 or 25 foot shielded cable to the connector on the display. Place the ferrite as close to the connector as possible. (See Number 8, right)



STEP 9

Attach the display retainer with provided mounting screws. When tightening down the display make sure to apply equal pressure to each screw to ensure the gasket seals properly. When properly installed the gasket shall be compressed 50% on all sides. If the gasket becomes damaged during installation please contact Control Concepts for a replacement.

When the controller is supplied with the Universal input power [100-240 Vac] the display shall now operate the same as when mounted on the controller

3. WIRING

Control Concepts configures and tests each controller before shipping. Once received, the controller is ready to install. The following sections will describe how to properly wire the unit with the recommended fusing.

For line and load connections use copper conductors rated 75°C minimum. In the wiring drawings the wire acceptance is listed with the entry heights. See torque tables for proper tightening.

A ground wire is required for proper operation. Use 10 AWG or larger wire.

Note: Wire controllers to conform with the National Electric Code (NEC) and/or other local wiring codes.

3.1 Torque Specifications

Recommended Tightening Torque For Line/Load Connectors		
Wire Size (AWG)	Screw	Hex Drive
14 - 10	35 IN-LBS	75 IN-LBS
8	40 IN-LBS	75 IN-LBS
6 - 4	45 IN-LBS	110 IN-LBS
2 - 1	50 IN-LBS	150 IN-LBS
1/0 - 2/0	50 IN-LBS	180 IN-LBS
3/0 - 4/0	-	250 IN-LBS
250	-	325 IN-LBS

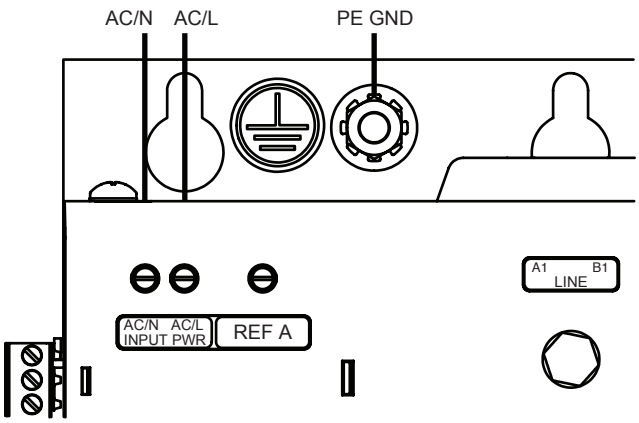
Recommended Tightening Torque For Universal Input 100-240 VAC, 50/60 Hz	
Wire Size (AWG)	Torque
12 - 18 GA	5.0 IN-LBS

Recommended Tightening Torque For Green Connectors	
Wire Size (AWG)	Torque
12 - 26 GA	5.0 IN-LBS

3.2 Universal Input Power

The universal input power may be wired with 12 - 18 AWG wire. The acceptable voltage range is 100 - 240 Vac at 50/60 Hz. This supplies power to the on-board switch mode power supply which provides power to the circuitry and cooling fans.

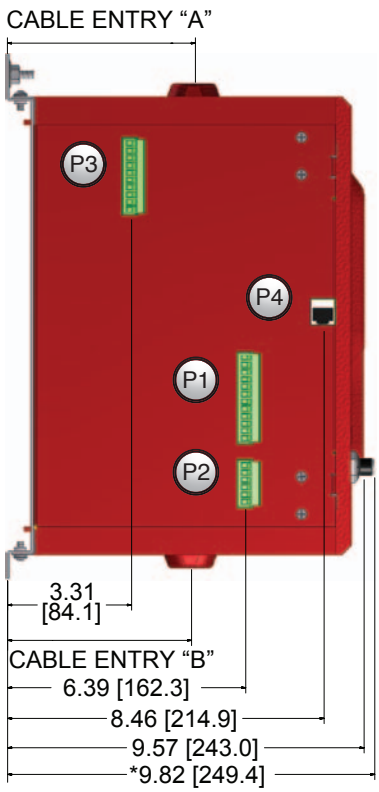
The line is internally fused with a 4 Amp fast blow fuse. If connected line to line, the neutral must also be fused with a 4 Amp fast blow fuse.



Typical Power Consumption @ 120 VAC (Watts)				
	10-25A	**50A**	**80-125A**	**160A**
1Ø - 1 Zone	23.4	23.4	35.4	53.4
1Ø - 2 Zone	28.3	34.3	40.3	58.3
1Ø - 3 Zone	38.3	62.3	62.3	92.3
1Ø - 4 Zone	43.2	67.2	67.2	97.2
1Ø w/ Pass - 1 Zone	23.4	23.4	35.4	53.4
1Ø w/ Pass - 2 Zone	33.4	33.4	57.4	87.4
3Ø - 2 Leg - 1 Zone	28.3	34.3	40.3	58.3
3Ø - 2 Leg w/ Pass	33.4	33.4	57.4	87.4
3Ø	38.3	62.3	62.3	92.3

3.3 AC Cable Entry Heights / Wire Acceptance

Dimensions: Inches [mm]



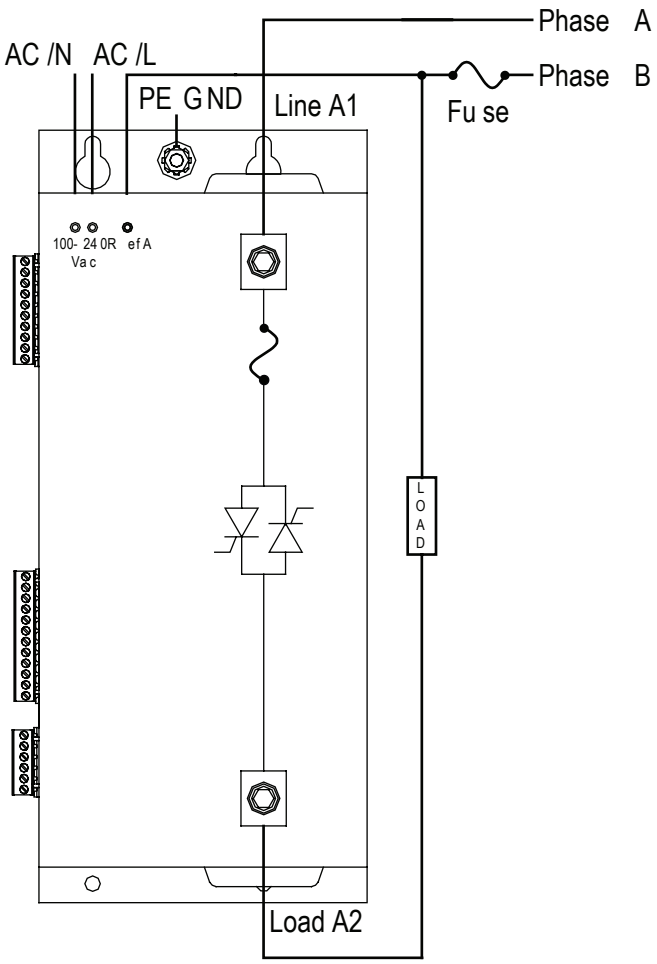
*This is for controllers with DeviceNet only.

	Cable Entry "A" LINE	Cable Entry "B" LOAD
10-50A	4.99 [126.8]	4.91 [124.7]
80A	5.56 [141.3]	4.91 [124.7]
100-160A	5.73 [145.5]	5.73 [145.5]

	LINE & LOAD LUGS	WIRE ACCEPTANCE
10-80A	Screw	14 AWG - 2 AWG
100-160A	5/16" Hex Drive [8]	6 AWG - 250 MCM

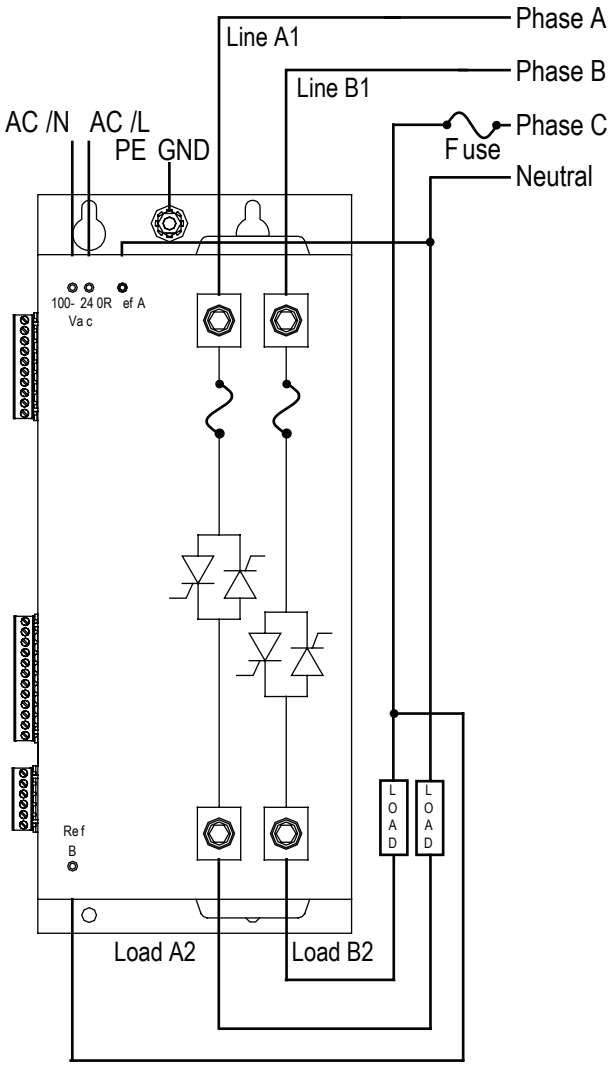
3.4 Line / Load Connections

3.4.1 Single Phase



This figure shows a single phase controller connected Phase A to Phase B. The controller is not phase sensitive and can be connected to any two phases. It can also be connected from Phase to Neutral.

3.4.2 Single Phase, Two Zone



This figure shows a two single phase controllers.

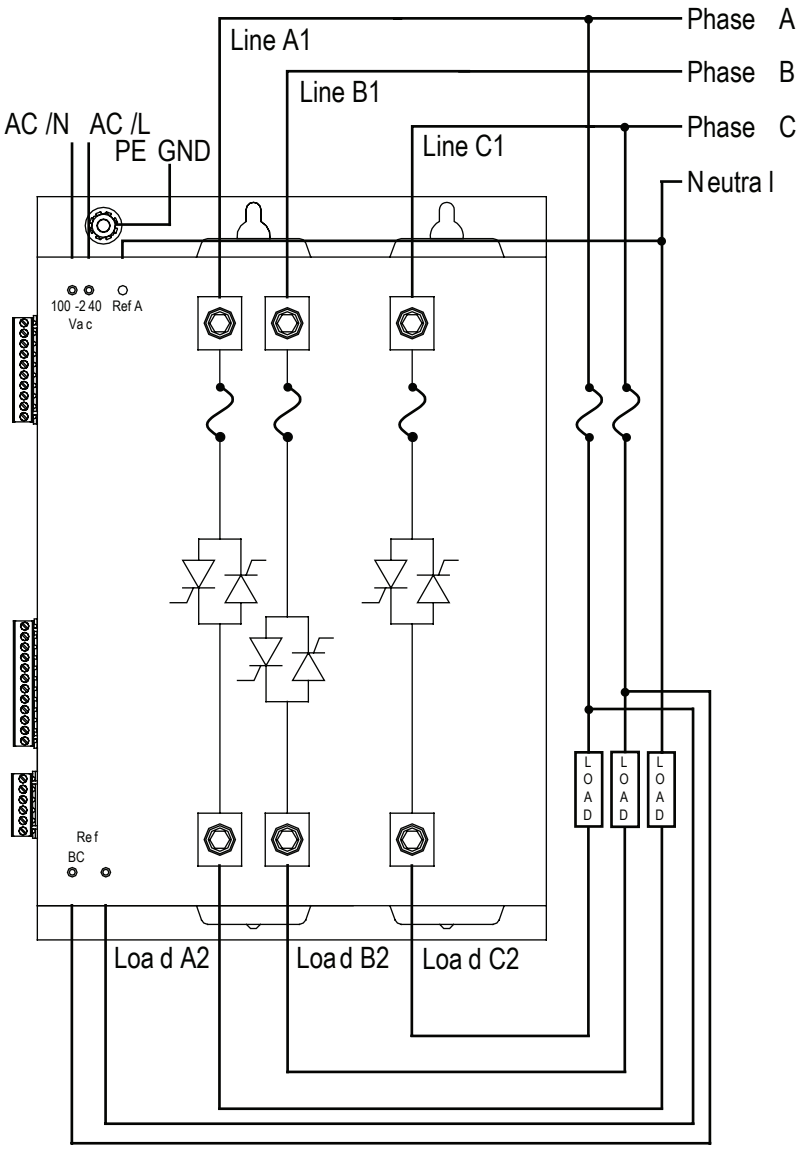
Zone 1 is connected from Phase A to Neutral.

Zone 2 is connected from Phase B to Phase C.

The controller is not phase sensitive and any zone can be connected to any two phases. Any or all zones can be connected from Phase to Neutral.

Note: During operation Zone 1 must have line power “ON” in order for other zones to operate.

3.4.3 Single Phase, Three Zone



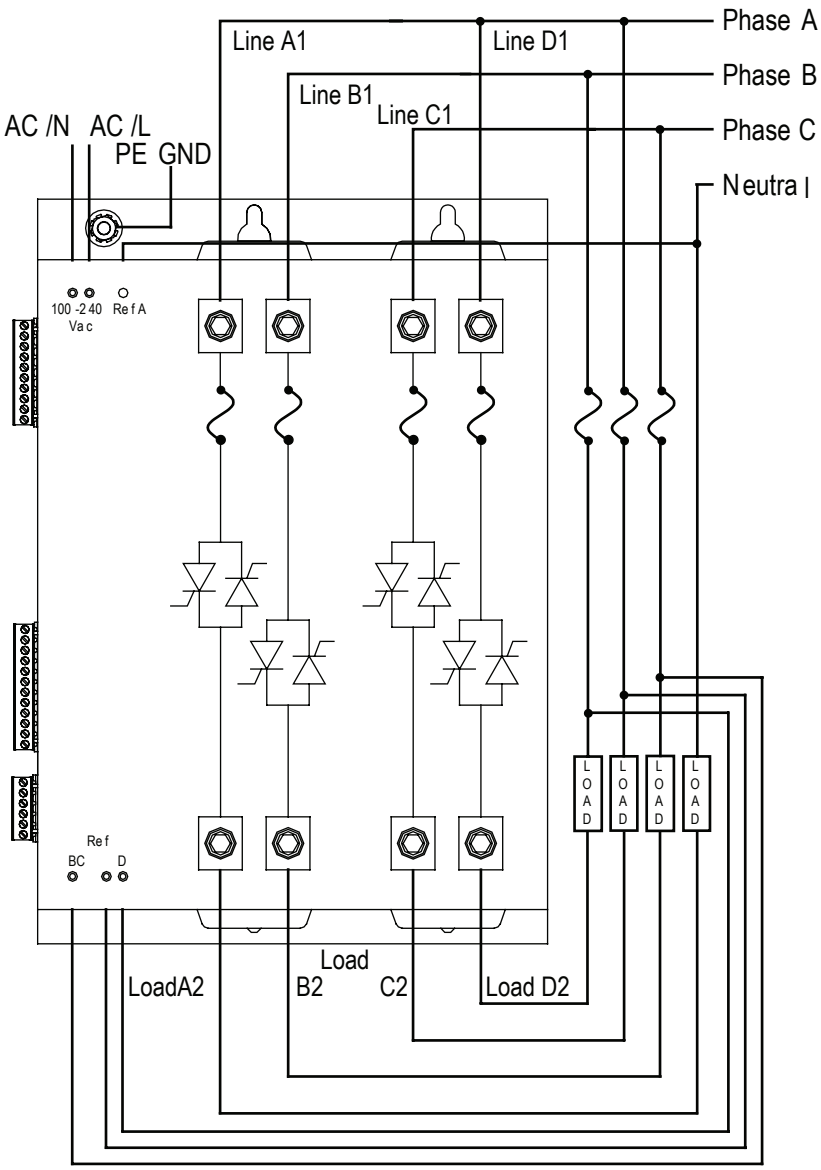
This figure shows a three single phase controllers.

Zone 1 is connected from Phase A to Neutral.
Zone 2 is connected from Phase B to Phase C.
Zone 3 is connected from Phase C to Phase A.

The controller is not phase sensitive and any zone can be connected to any two phases. Any or all zones can be connected from Phase to Neutral.

Note: During operation Zone 1 must have line power “ON” in order for other zones to operate.

3.4.4 Single Phase, Four Zone



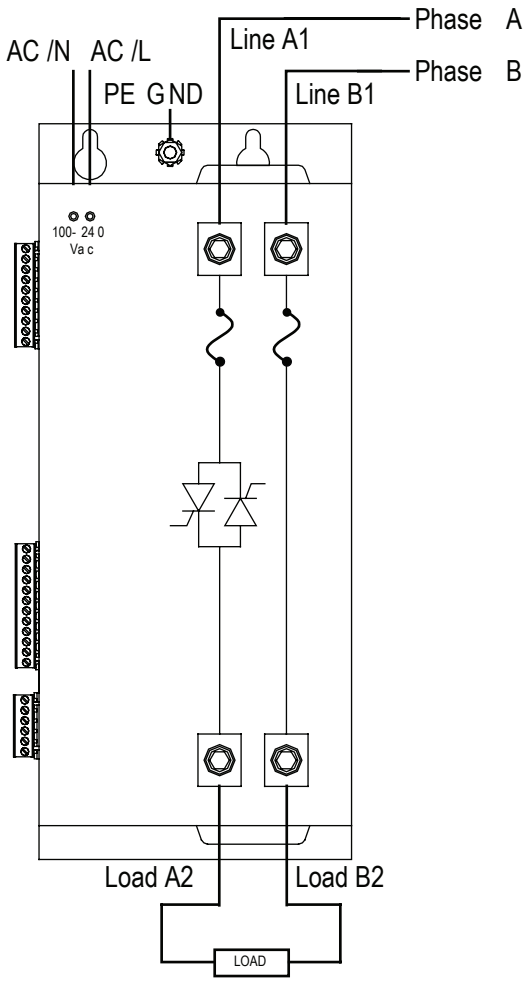
This figure shows a four single phase controllers.

Zone 1 is connected from Phase A to Neutral.
Zone 2 is connected from Phase B to Phase C.
Zone 3 is connected from Phase C to Phase A.
Zone 4 is connected from Phase A to Phase B.

The controller is not phase sensitive and any zone can be connected to any two phases. Any or all zones can be connected from Phase to Neutral.

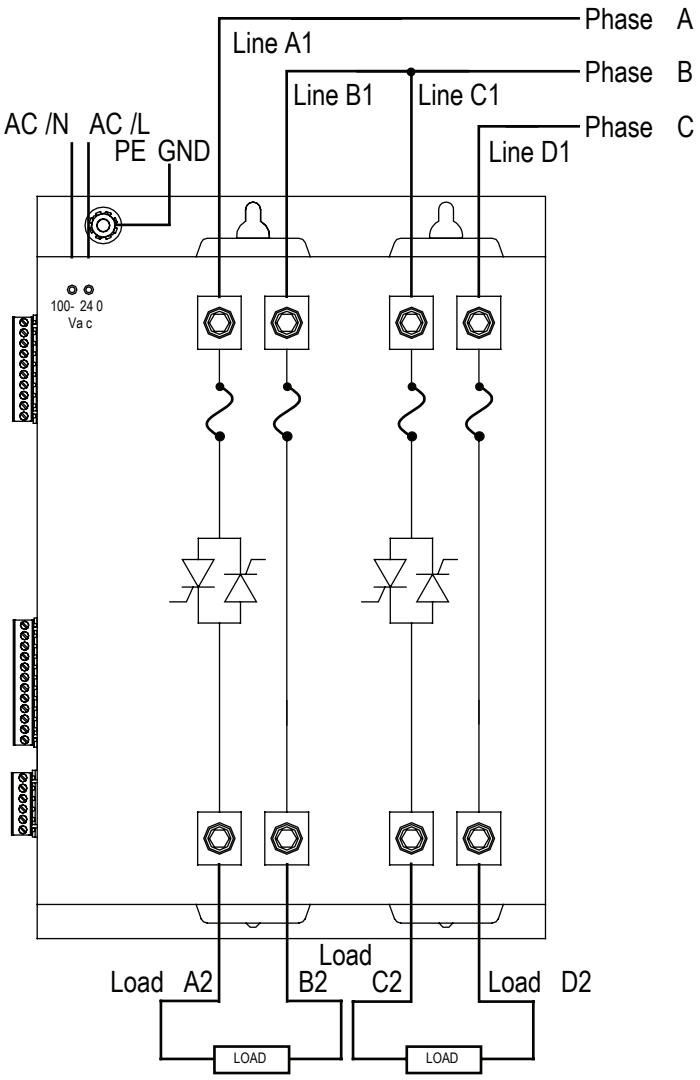
Note: During operation Zone 1 must have line power “ON” in order for other zones to operate.

3.4.5 Single Phase with Pass-Through



This figure shows a single phase controller connected Phase A to Phase B. The controller is not phase sensitive and can be connected to any two phases. It can also be connected from Phase to Neutral.

3.4.6 Single Phase Two Zone with Pass-Through



This figure shows a two single phase controllers.

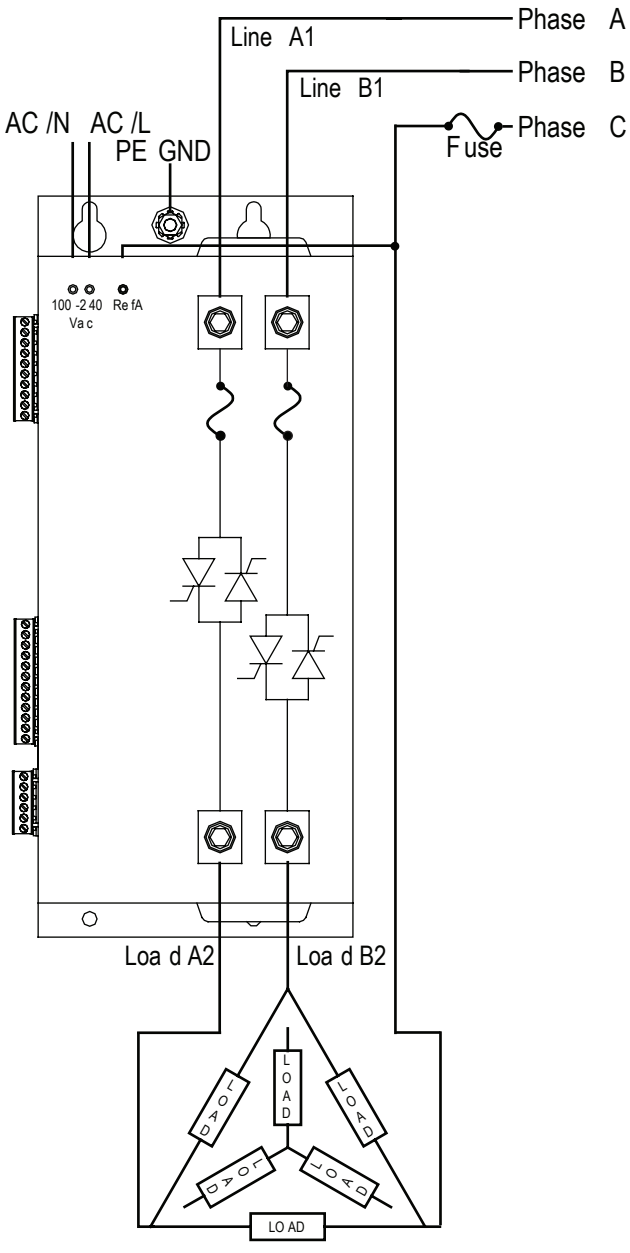
Zone 1 is connected from Phase A to Phase B.

Zone 2 is connected from Phase B to Phase C.

The controller is not phase sensitive and any zone can be connected to any two phases. Any or all zones can be connected from Phase to Neutral.

Note: During operation Zone 1 must have line power “ON” in order for other zones to operate.

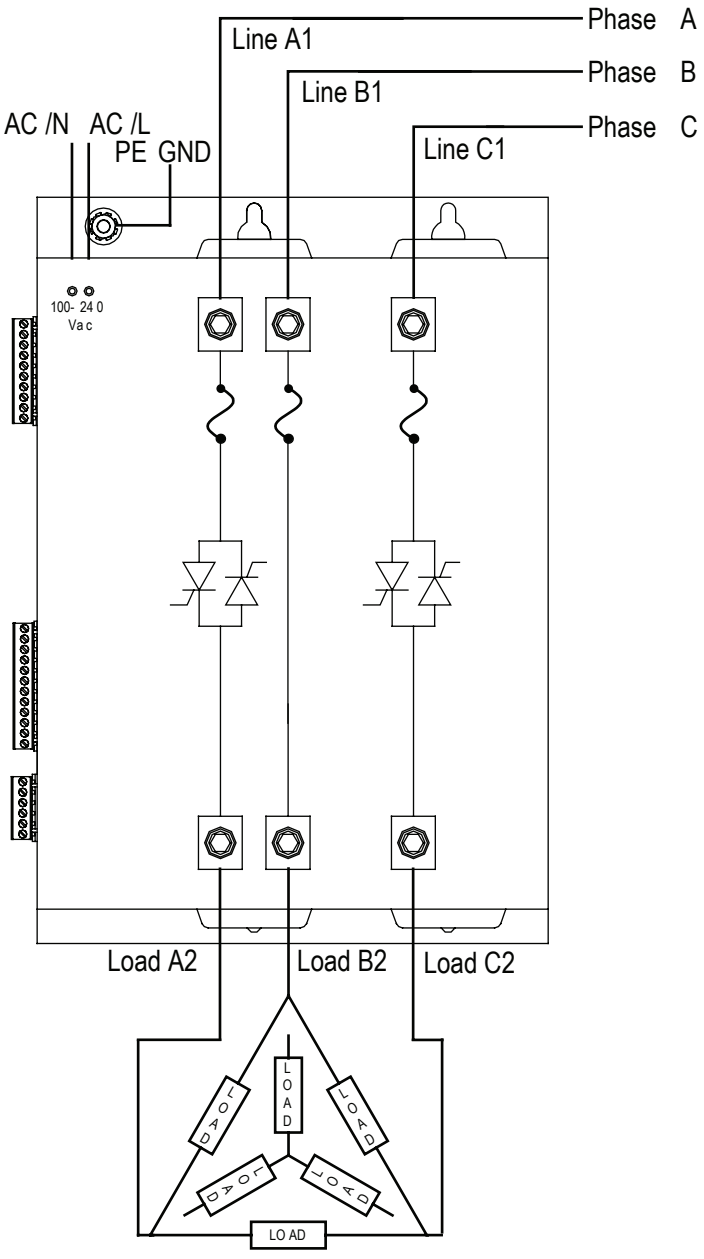
3.4.7 Three Phase - Two Leg



This figure shows a three phase two leg controller connected to either a Delta or 3 Wire Wye load.

Note: An optional current transducer may be ordered for monitoring the current on the third leg that does not run through the controller. Contact Control Concepts for more details.

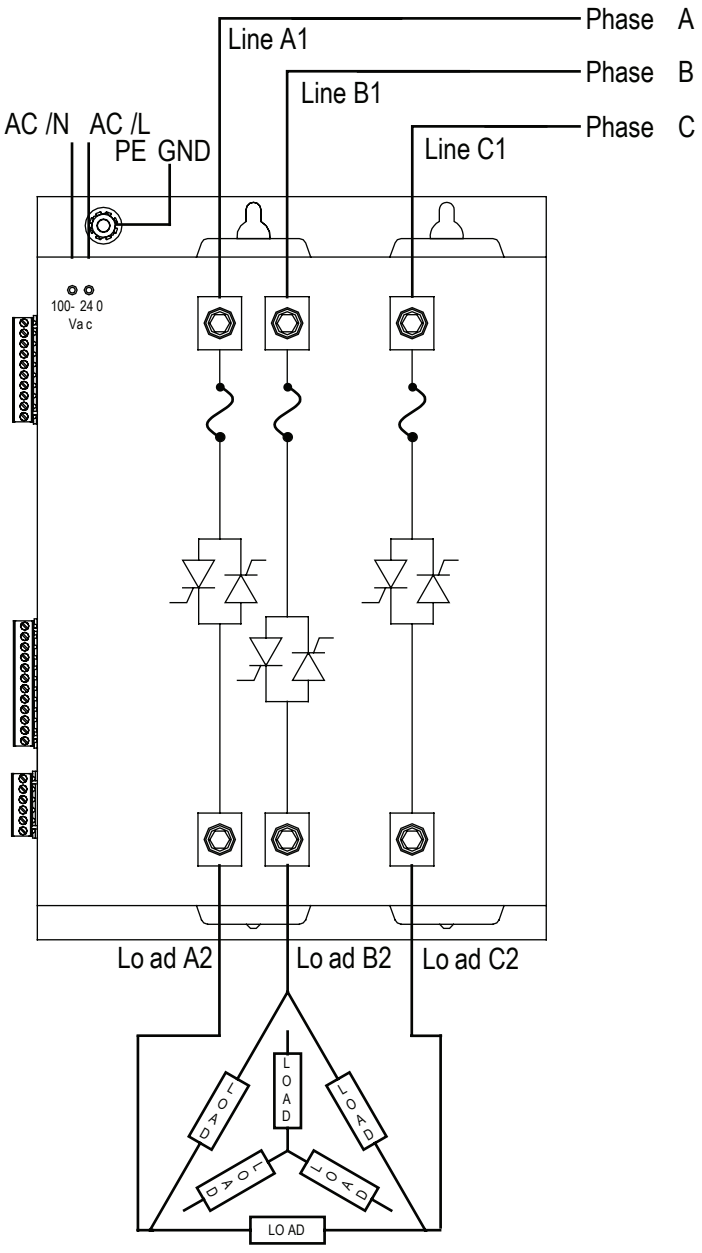
3.4.8 Three Phase - Two Leg, with Pass-Through



Delta or 3 Wire Wye Load

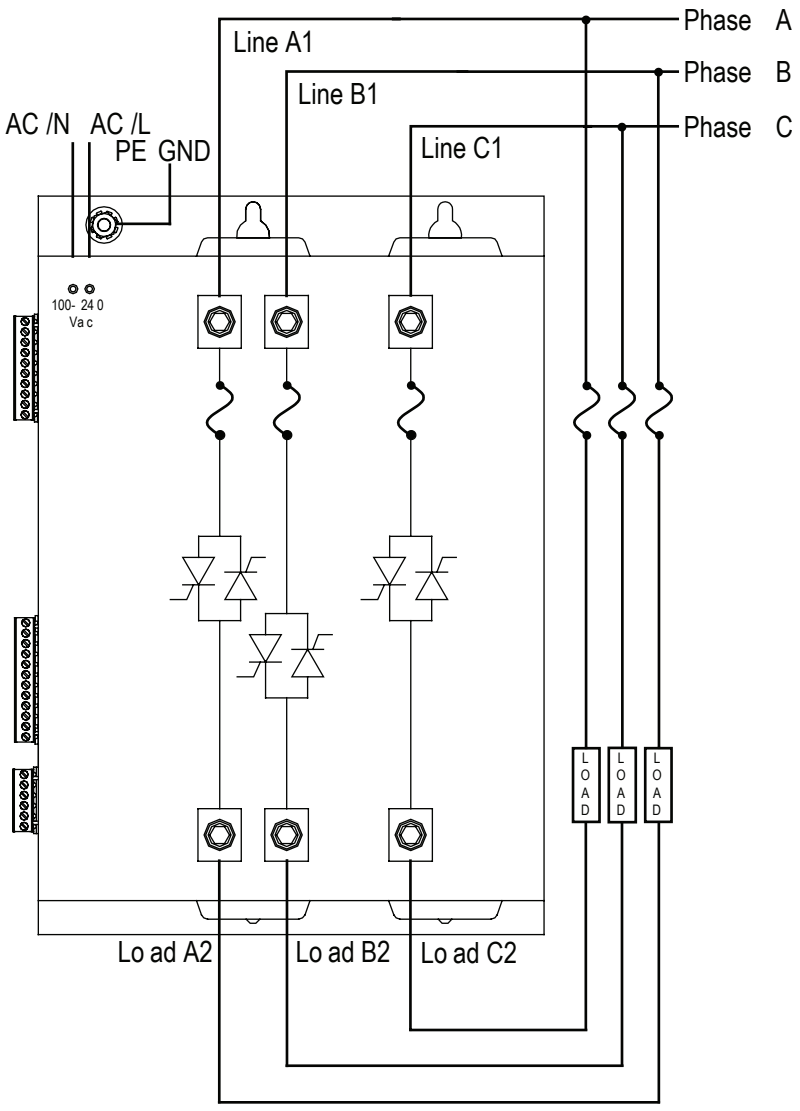
This figure shows a three phase two leg controller connected to either a Delta or 3 Wire Wye load.

3.4.9 Three Phase Three Leg - Delta or Three Wire Wye



This figure shows a three phase three leg controller connected to either a Delta or 3 Wire Wye load.

3.4.10 Three Phase Three Leg - Inside Delta



Due to internal wiring differences of the operation of a Inside Delta load, an additional wire harness must be ordered. If Inside Delta is specified at the time of purchase the controller will ship from the factory wired for Inside Delta operation.

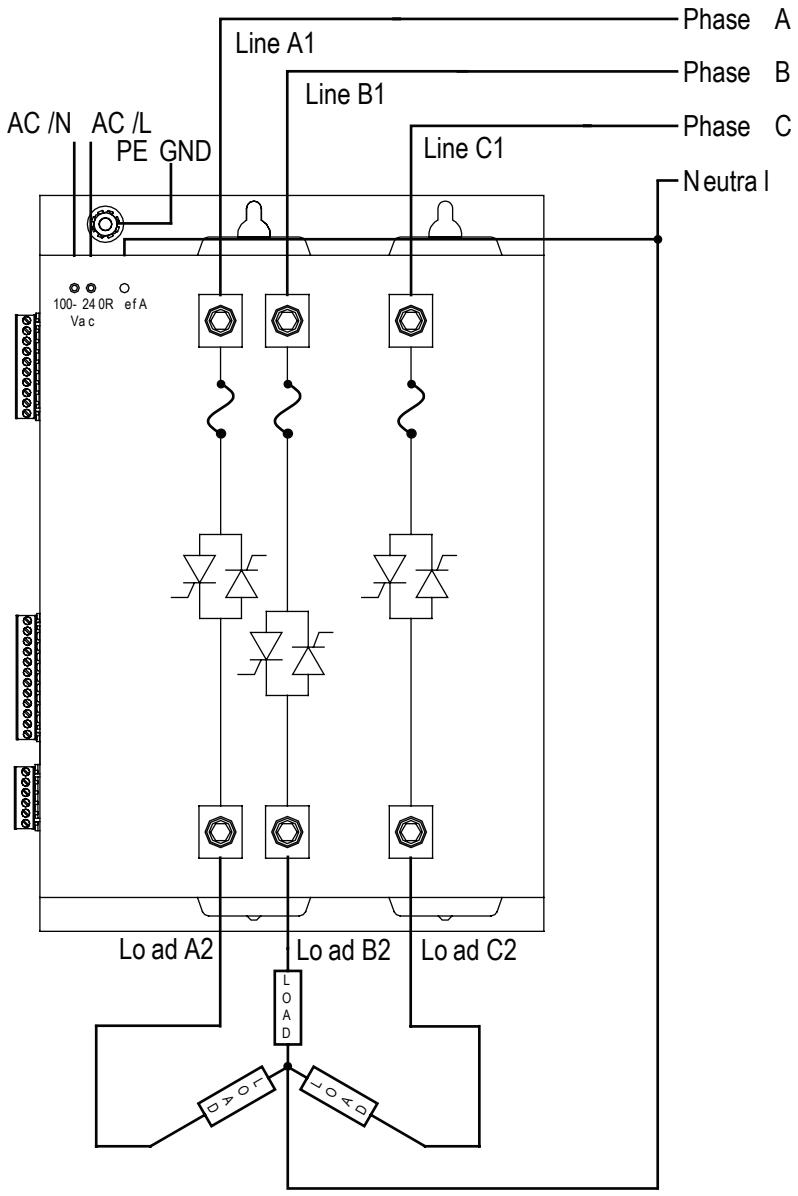
When wiring this controller if must be wired as per the diagram.

Load A must return to Line B.
Load B must return to Line C.
Load C must return to Line A.

There are instructions in Appendix A showing how to change from Inside Delta to a standard configuration (Delta or 3 Wire Wye). Both wire harnesses are necessary to perform this task.

For ordering details see Appendix B in the Operator Manual. The model number configuration data is 0001.

3.4.11 Three Phase, Three Leg - Four Wire Wye



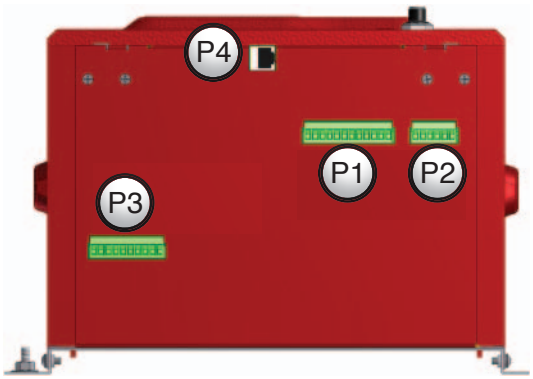
Due to internal wiring differences of the operation of a 4 Wire Wye load, an additional wire harness must be ordered. If 4 Wire Wye is specified at the time of purchase the controller will ship from the factory wired for 4 Wire Wye operation.

The Fusion controllers normally display line and load voltages from Line to Line. When the controller is in 4 Wire Wye operation the line voltages read Line to Line while the load voltages read Line to Neutral.

There are instructions in Appendix B showing how to change from 4 Wire Wye to a standard configuration (Delta or 3 Wire Wye). Both wire harnesses are necessary to perform this task.

For ordering details see Appendix B in the Operator Manual. The model number configuration data is 0002.

3.5 Connectors

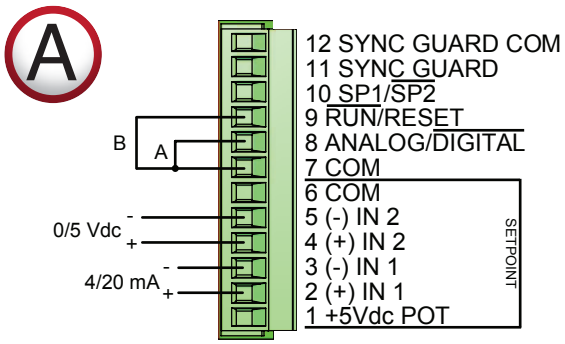


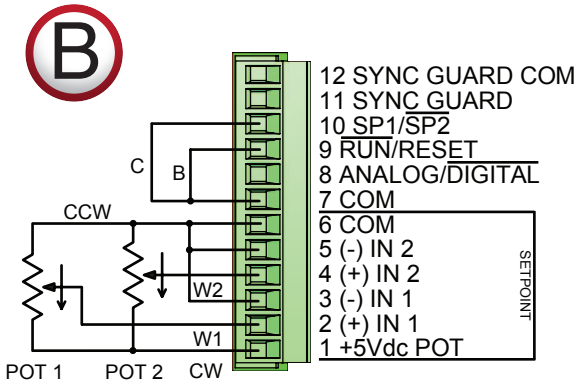
3.5.1 P1-12 Pin Command Connector

Diagram A, pictured right, shows SP1 setpoint with a 4/20 mA command and SP2 setpoint with a 0/5 Vdc command. Connection A puts the controller in a digital setpoint mode. Connection B places the controller in Run mode*.

Diagram B demonstrates how to hook up a potentiometer input into SP1 setpoint and SP2 setpoint. Connection B places the controller in Run mode*. Connection C selects setpoint 2 as the command.

*Run/Reset has selectable open or closed logic to place the controller in Run mode. The default value is closed. With closed logic selected connection B must be connected to place the controller in Run mode. Similarly with open logic selected, remove the connection B to place the controller in Run mode. Open/closed logic can be changed using the FUSION Control Panel software. In the FUSION Control Panel software there is also a digital Run/Reset enable button. To place the controller in a Run state the digital "Enable" button must be checked.



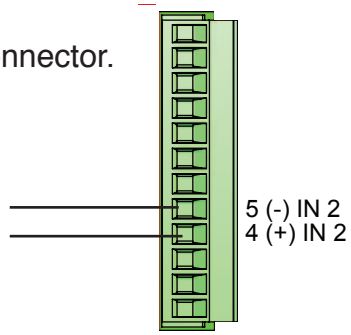


Note: The Compact FUSION power controller has two analog setpoints: SP1 and SP2. On a single zone controller, either can be selected to control this zone.

On a 2 zone controller, SP1 is used to control zone 1 and SP2 is used to control zone 2. On controllers with more than 2 zones, a digital interface must be ordered for communication with all zones.

3.5.2 External Feedback

Connect the external feedback signal to pins 4 and 5 of the P1 (12-pin) connector.



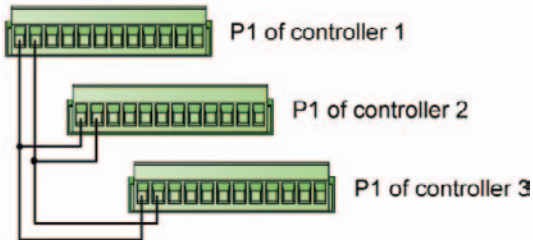
NOTE: Set up the external feedback for the signal being used via the FUSION Control Panel software

3.5.3 SYNC-GUARD™

The purpose of the SYNC-GUARD™ feature is to reduce the possibility of synchronous operation of two or more Zero Cross controllers. An explanation of use can be found in the Operator Manual.

To set up the SYNC-GUARD™ feature, pins 11 and 12 of the P1 connector have to be wired from one controller to another, in parallel, as shown in the image to the right.

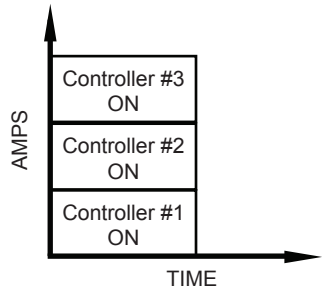
Wiring of controllers for SYNC-GUARD™ feature.



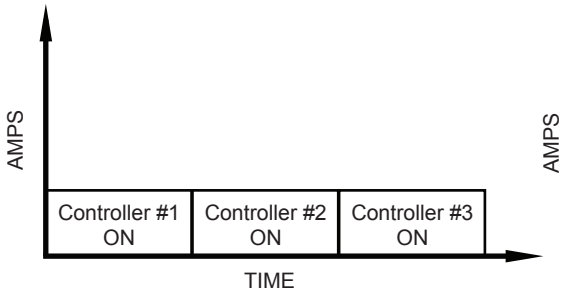
When using this feature, one and only one controller should have the SYNC-GUARD™ resistor enabled via the Fusion Control Panel. See Fusion Control Panel software manual for more details.

The figures below show the total current as a function of time for three controllers, with, and without SYNC-GUARD™ and various load powers. When using the SYNC-GUARD™ feature, the command signals must be isolated from each other.

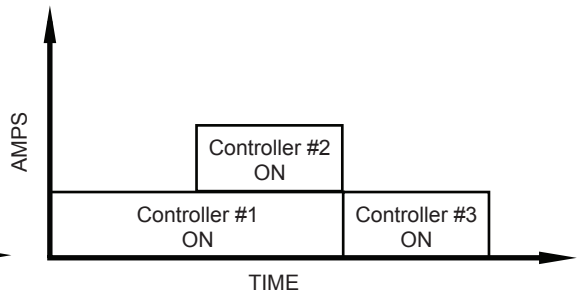
NOTE: A maximum of 10 controllers regardless of the current rating can be connected in this manner.



Three controllers providing 33.3% power each, operating synchronously (without Sync-Guard™).



Three controllers providing 33.3% power each, with Sync-Guard™.



Three controllers with Sync-Guard™, two providing 33.3% power and one providing 66.6% power.

3.5.4 P2 - 6 Pin Relay Connector

Both Relay 1 and Relay 2 can be set up for zero, one, or more alarms using the FUSION Control Panel Software.

The following alarms are available:

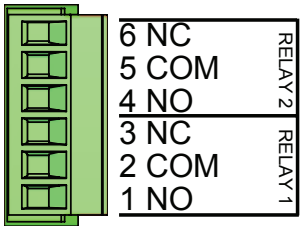
Digital Enable	Voltage Limit	Current Limit	Power Limit
Shorted SCR	Line Phase Loss	Heatsink Warning Temp	Current Trip
Heatsink Over Temp	Processor Error Trap	Communications Error	Memory Error
Watchdog Timeout	PLL Lock Loss	In “Run” State	Run Enable

Both relays can have the same alarm mapped to it.

The default alarms mapped to Relay 1 are Current Trip and Heatsink Over Temp. The default alarms mapped to Relay 2 are Shorted SCR and Heatsink Warning Temp.

There are two Form C contacts with a rated switching current of:

8 A at 250 Vac
5 A at 30 Vdc



3.5.5 P3 - 10 Pin Auxiliary I/O Connector

This connector is only present when the controller is ordered with an Auxiliary I/O card. For more details see the Aux I/O Card section in this manual.

3.5.6 P4 - Remote Display Connector

This connector is for remote mounting the display. For more details see the Remote Display Kit section in this manual.

4. AUX I/O Card (Optional)

The auxiliary I/O expansion card is an optional card that allows the controller to have added features. The standard I/O card comes with (2) digital inputs, (2) digital outputs and (2) analog outputs (retransmits).

The retransmits and digital inputs/outputs are isolated from processor, but not each other.

Analog Retransmit Specifications:
Voltage output: 0-10 Vdc, 20 mA max
Current output: 0-20 mA, 15 Vdc compliance

For selecting voltage or current mode for the retransmits, connecting to the Fusion Control Panel Software is required. See the Fusion Control Panel Software manual for details.

The default settings for both retransmits are 0 - 5 Vdc output.

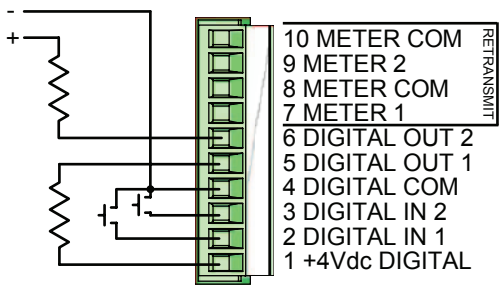
Digital Inputs (x2):
Dry contact 0.4 mA to circuit common
Open collector TTL to circuit common, pull up to 5 Vdc through a 10KΩ resistor

Digital Outputs (x2):
Relay Driver (transistor based)
Open collector (transistor based) 150 mA at up to 48 Vdc (power supplied by customer)
May be powered by unregulated 4 Vdc, 100 mA onboard power supply.

Custom option cards available, please contact factory for custom applications.

4.1 P3 - 10 Pin Aux I/O Connector

Example of possible connections:

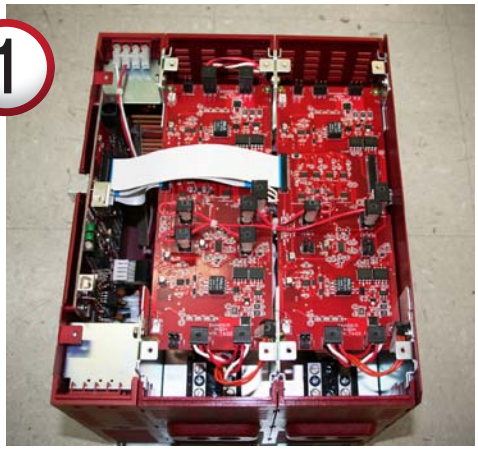


This shows momentary switches for digital inputs 1 & 2. The digital output 1 is driven by the onboard 4 Vdc power supply. The digital output 2 is driven by the customers own supply.

APPENDIX A: Changing from Inside Delta to Delta or 3-Wire Wye Load

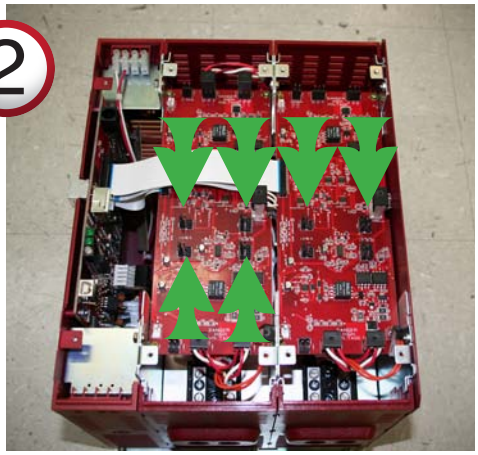
STEP 1

Changing the internal wiring from an Inside Delta to a Delta or 3 Wire Wye load can easily be done in the field. First the line power and the control power **must** be OFF. Use a screw driver to remove all of the lids. There are three boards connected together, a Control board and two Gate Driver boards. It is important to not remove the flat flex (white) cables.



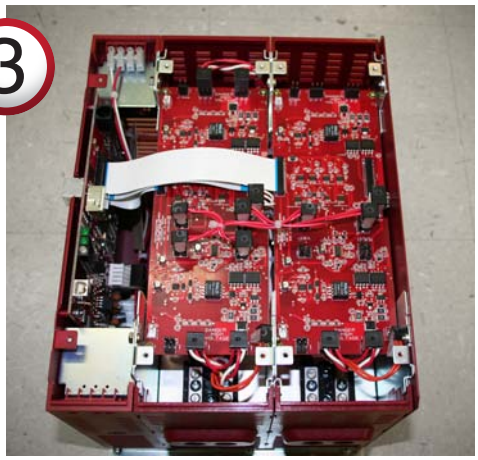
STEP 2

Gently remove the Inside Delta wire harness from the top of Gate Driver boards by simply pulling up on the connectors. Do not pull on wires. Label as inside delta and save the wire harness for future use. Connectors to be removed are marked with green arrows.



STEP 3

The silk screen next to the connectors will read P9 (2 pin), P11 (3 pin), P8 (3 pin) and P10 (3 pin). On one of the boards P8 and P10 will not be populated.



STEP 4

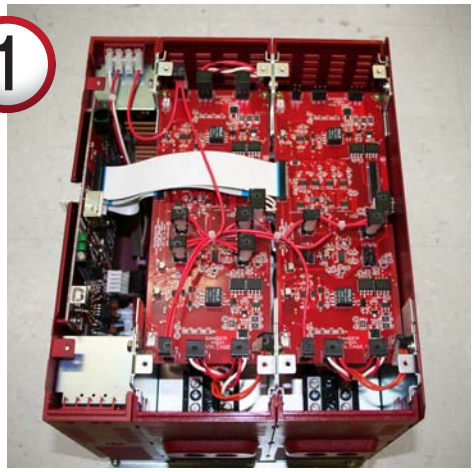
Place the Delta or 3 Wire Wye wire harness on the connectors. Match the 2 pin connectors of the wire harness to the 2 pin connectors of the Gate Driver board. Similarly match the 3 pin connectors together. To wire the load, refer to the Three Phase 3 Leg section of the manual.

NOTE: Delta loads and 3 Wire Wye loads use the same wire harness. After changing wire harness, change the load type in the FUSION Control Panel software.

APPENDIX B: Changing from 4 Wire Wye to Delta or 3-Wire Wye Load

STEP 1

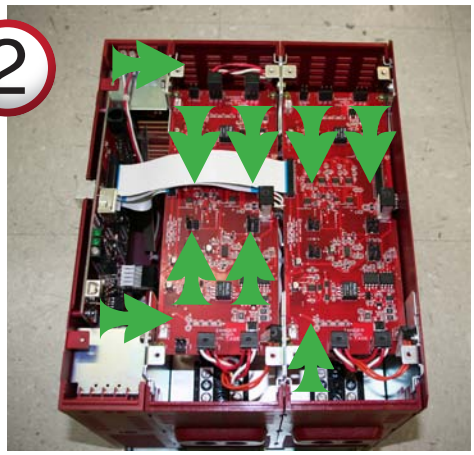
Changing the internal wiring from a 4 Wire Wye to a Delta or 3 Wire Wye load can easily be done in the field. First the line power and the control power **must** be OFF. Use a screw driver to remove all of the lids. There are three boards connected together, a Control board and two Gate Driver boards. It is important to not remove the flat flex (white) cables.



STEP 2

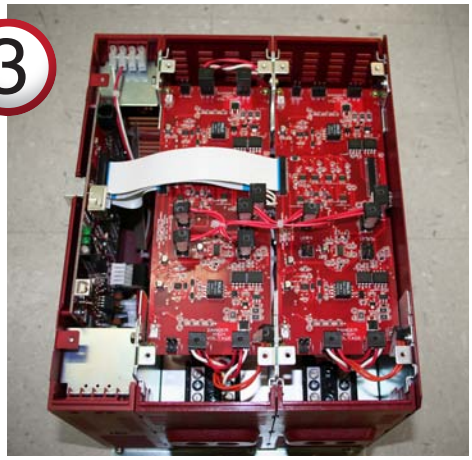
Gently remove the 4 Wire Wye wire harness from the top of Gate Driver boards by simply pulling up on the connectors. **Do not pull on wires.** Label as 4 wire wye and save the wire harness for future use. Connectors to be removed are marked with green arrows. The Ref wire on the terminal block will also need to be disconnected before the wire harness may be removed.

The silk screen next to the connectors will read P3 (2 pin), P16 (2 pin), P9 (2 pin), P11 (3 pin), P8 (3 pin) and P10 (3 pin). On one of the boards P8 and P10 will not be populated.



STEP 3

Place the Delta or 3 Wire Wye wire harness on the connectors. Match the 2 pin connectors of the wire harness to the 2 pin connectors of the Gate Driver board. Similarly match the 3 pin connectors together. To wire the load refer to the Three Phase 3 Leg section of the manual.



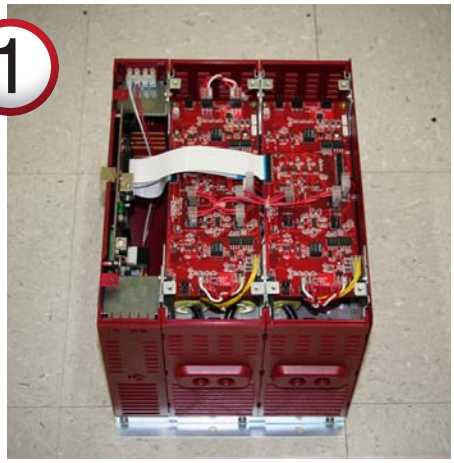
NOTE: Delta loads and 3 Wire Wye loads use the same wire harness. After changing wire harness, change the load type in the FUSION Control Panel software.

APPENDIX C: Fuse Replacement

The following procedure will demonstrate how to replace a fuse on a three phase 80 Amp controller. The same technique can be used to replace a fuse on any type of Compact FUSION controller.

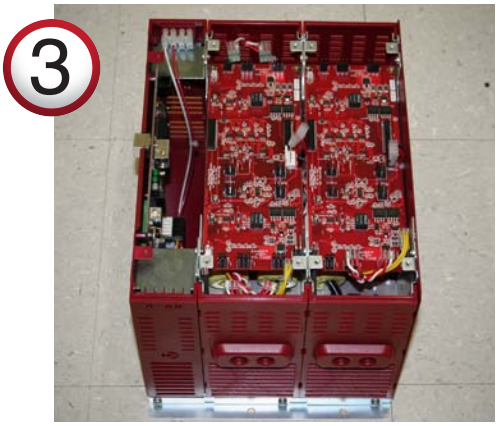
General procedure guidelines:

1. Turn the line and control power OFF.
2. Remove the lids.
3. Remove internal wiring necessary to remove Gate Driver board.
4. Remove screws and Gate Driver board.
5. Replace fuse.
6. Reinstall Gate Driver board.
7. Connect internal wiring.
8. Replace lids.
9. Apply control and line power and verify that the controller does not exhibit a blown fuse indicator.



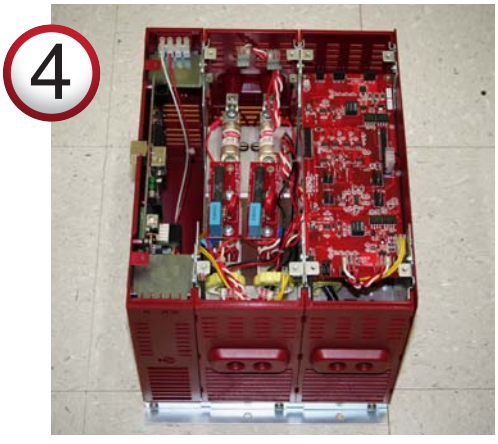
STEP 1

The line power and the control power **must** be OFF before replacing any fuse. Use a screw driver to remove all of the lids. Depending on the type of controller there will be two or three boards connected together, a Control board and one or two Gate Driver boards.



STEP 2

Gently remove all wires from the top of Gate Driver board by simply pulling up on the connectors. **Do not** pull on wires. This may cause damage to the wire harness.



STEP 3

The white flat flex cables (FFC) also need to be removed. There is a key tab that holds the FFC in the connector. The key needs to be pulled towards the cable from both edges of the connector. It can than be gently lifted up and the cable can be easily removed. The key tab stays attached to the connector.

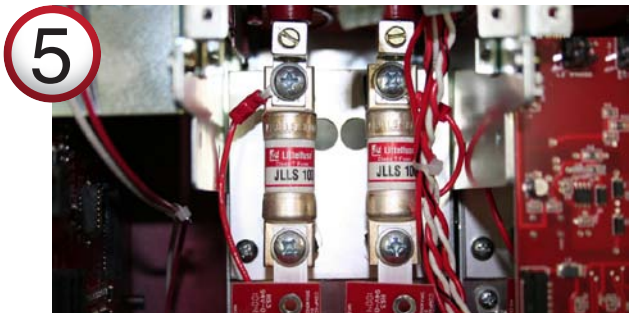
STEP 4

Remove the 4 screws in the corners of the Gate Driver board. Gently lift the board out of the controller.

NOTE: It is recommended that a person be statically grounded when touching any circuit board when it is outside of the controller. Failure to do this may damage the board.

STEP 5

Once the circuit board is removed the fuse can be replaced. In 10 - 50 Amp controllers there are compression fit fuse blocks that hold the fuse. The fuses can be easily replaced by removing the fuse and installing the new one.



For controller sizes 80 - 160 Amps the fuses are held in by screws attached to insulators. Remove the 2 screws holding down the fuse. Make note of the orientation of bus bars, wires and lugs when removing the screws. In the case of a 80 Amp controller, the DVDT board needs to be removed from the SCR in order to remove the bus bar attached to the fuse.

STEP 6

Apply a thin layer of penatrox A (or conductive anti-corrosive grease) to the fuse where it contacts the lug and the bus bar. Replace the fuse and re-attach the Red wire with ring terminal and the lug. Make sure that the lug is as close to the fuse as possible. The lug is should not touch the plastic wire guides. For 80 Amp controllers torque the screws going into the SCR to 44 in/lbs. For all controllers torque the screws, holding the fuse, to 75 in/lbs.

STEP 7

Re-insert the Gate Driver board. Secure the board with the 4 screws that were previously removed. Connect all of the FFCs that were removed, starting with the shortest. If these were removed from the Firing Card make sure to start with the lowest connector, working your way to the top.

STEP 8

Re-insert all of the previously removed wiring to the correct headers. Make sure to connect fan wires if fans are present. The wiring that is the most critical to have correct are the Gate and Cathode leads that are connected to the SCR. The connectors are P1, P2, P14 and P15. Verify that the colors are correct with the following:

P1	Wire Color	P2	Wire Color	P14	Wire Color	P15	Wire Color
G2	White/Yellow	K1 Bus	Red/Black	G2	White/Yellow	K1 Bus	Red/Black
K2 SCR	Red	K1 SCR	Red/Black	K2 SCR	Red	K1 SCR	Red/Black
K2 Bus	Red	G1	White	K2 Bus	Red	G1	White

STEP 9

After verifying that all wiring has been connected correctly, the lids can be re-attached. Apply control and line power to the controller. Verify that the blown fuse indicator is **NOT** present.