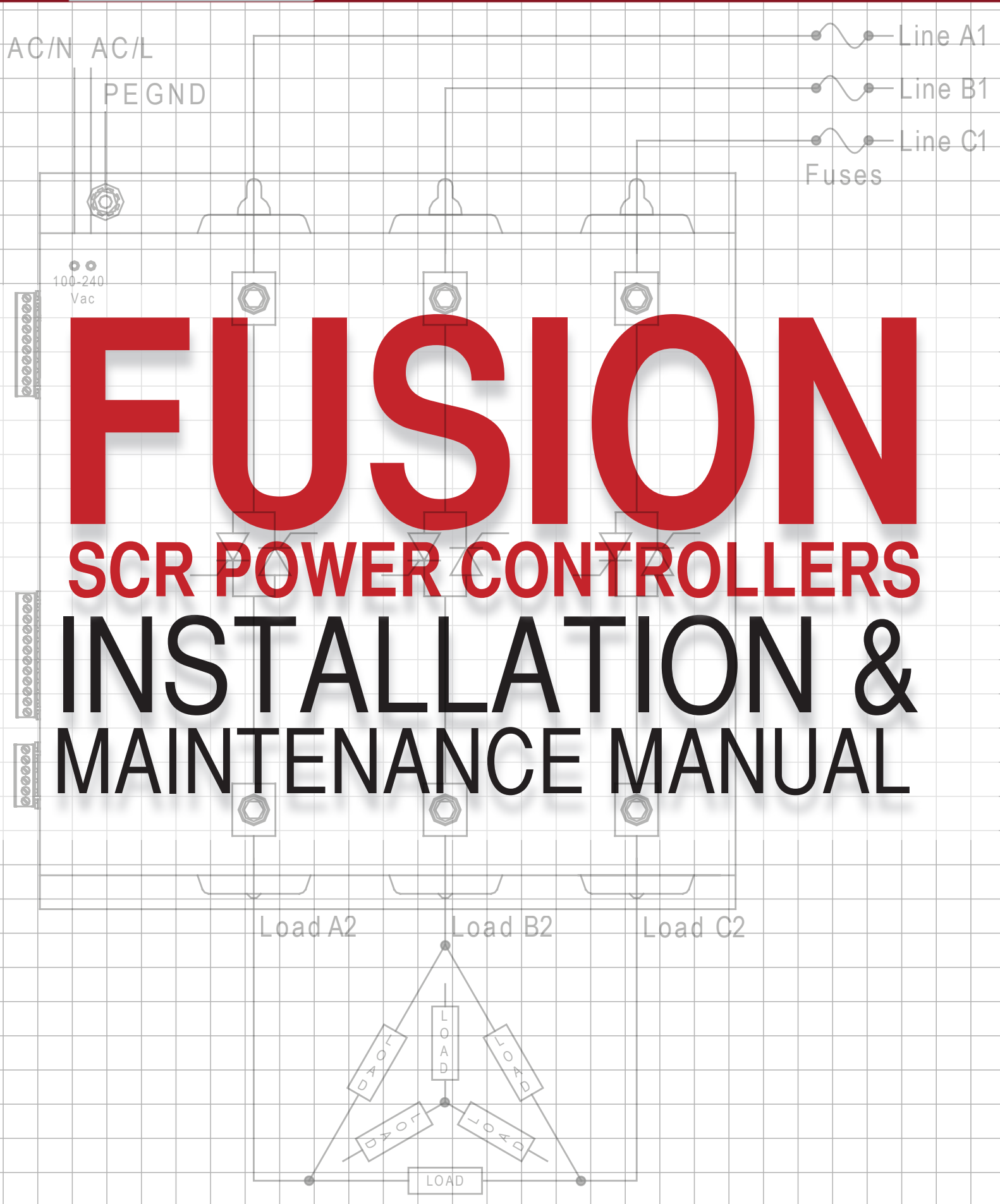
CONTROL CONCEPTS



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

TABLE OF CONTENTS

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

*On select models with appropriate fusing.

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 Series SCR Power Controller

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

Declares that the following product:

Designation:	FUSION Series Power Controller
Model Numbers:	Model Fusion followed by ZC, PA or DC, followed by 1, 2 or 3, followed by 1 through 9 or A through E, followed by O, S or E, may be followed by numbers and/or letters, may be followed by numbers and/or letters, may be followed by NS, 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: November 2009

Signature of Authorized Representative

11/13/09
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

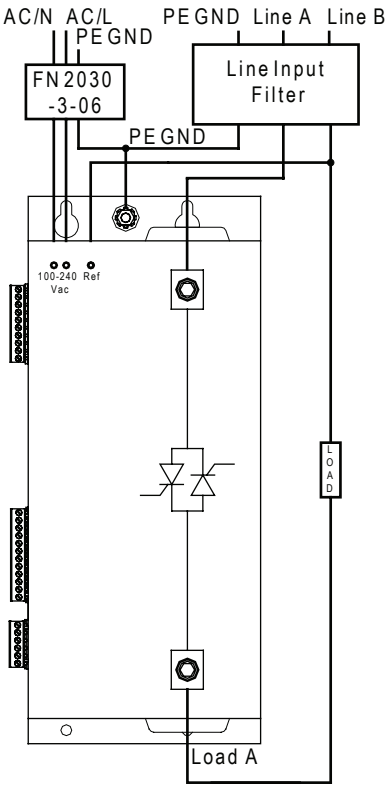
The Schaffner filter for universal input power, or it's equivalent, may be used as listed above. The line input power filter however, will need to be sized accordingly for your load. Please contact Schaffner EMC Inc. for help finding the appropriate filter.

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

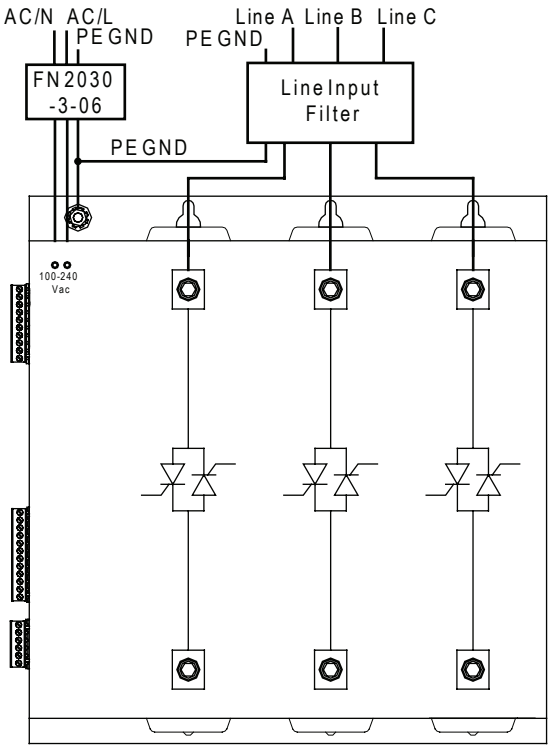
*No filtering is required for emissions.

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

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
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(952) 474-6200
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FAX (952) 474-6070
www.ccipower.com

1. RECOMMENDED FUSING

It is recommended that the controller be protected by fast acting class 'J,' fast acting 'L' or 'T' fuse(s). Branch rated fuses are required to meet Short Circuit Current Rating (SCCR) requirements. The table below shows the controller size with the recommended fuse size.

	Frame Size			Fuse Size (Amps) 600 V Rated	CCI P/N for Class T
	1Ø OR 3Ø AC	1Ø DC	3Ø DC		
1	50A	45A DC	60A DC	60 Fast Acting J or T	0042110-0460-360
2	80A	-	-	100 Fast Acting J or T	0042110-0460-410
3	100A	90A DC	120A DC	125 Fast Acting J or T	0042110-0460-412
4	130A	-	-	175 Fast Acting J or T	0042110-0460-417
5	160A	145A DC	195A DC	200 Fast Acting J or T	0042110-0460-420
6	200A	-	-	250 Fast Acting J or T	0042110-0460-425
7	240A	220A DC	290A DC	300 Fast Acting J or T	0042110-0460-430
8	320A	-	-	400 Fast Acting J or T	0042110-0460-440
9	400A	360A DC	490A DC	500 Fast Acting J or T	0042110-0460-450
A	500A	-	-	600 Fast Acting J or T	0042110-0460-460
B	650A	-	-	800 Fast Acting J or T	0042110-0460-480*
C	800A	720 A DC	975A DC	1000 Fast Acting L or T	0042110-0460-510*
D	1000A	-	-	1200 Fast Acting L or T	0042110-0460-512*
E	1200A	1080A DC	1400A DC	1500 Fast Acting L	0042270-0460-515 (Fast Acting L)

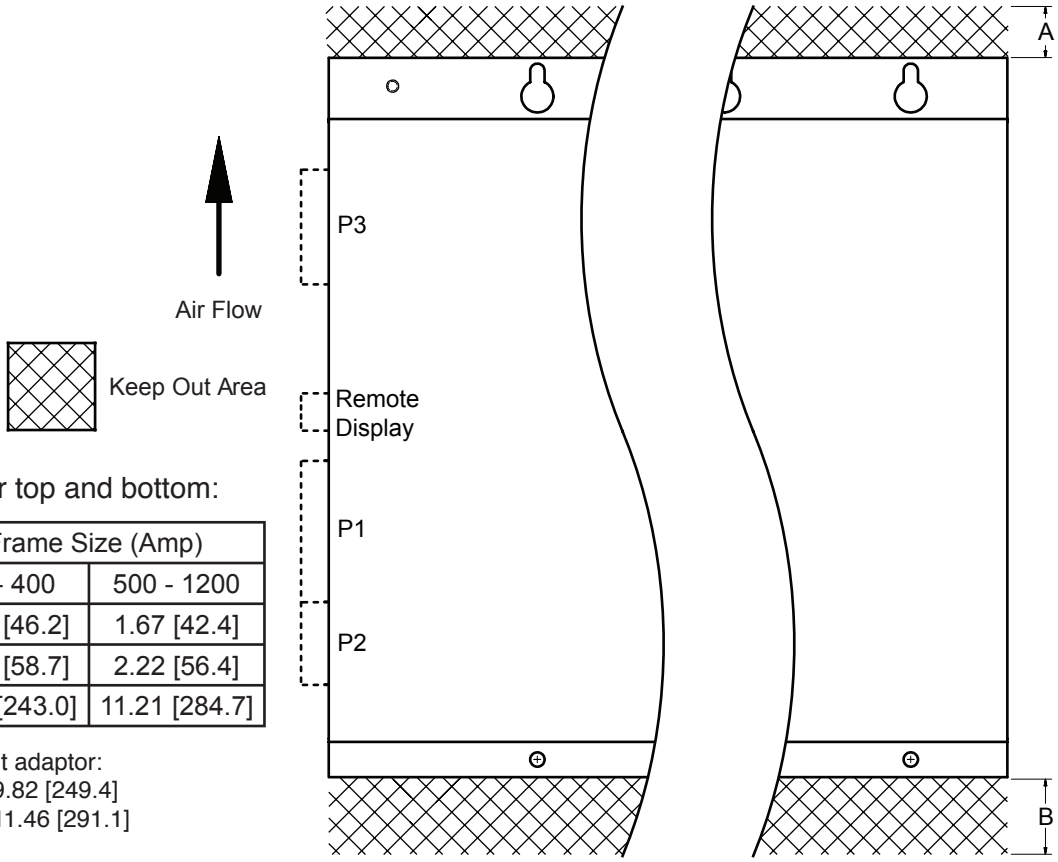
* UL listed but not CSA approved. Contact Control Concepts for information on CSA approved fusing.

Control Concepts carries an inventory of branch-rated fuses and fuse blocks for customers to purchase.

2. INSTALLATION

2.1 Mounting Considerations for All AC Controllers

Dimensions: Inches [mm]



Keep out area for top and bottom:

	Frame Size (Amp)	
	50 - 400	500 - 1200
A	1.82 [46.2]	1.67 [42.4]
B	2.31 [58.7]	2.22 [56.4]
Depth*	9.57 [243.0]	11.21 [284.7]

* Depth with DeviceNet adaptor:
50-400 Amp - 9.82 [249.4]
500-1200 Amp - 11.46 [291.1]

Mount 50 Amp controllers vertical 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 is 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 base plate.

Mounting hardware: (Not included)	50 - 400 Amp	1/4-20 or M6 bolts with flat and lock washers
	500 - 1200 Amp	5/16 or M8 bolts with flat and lock washers

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.

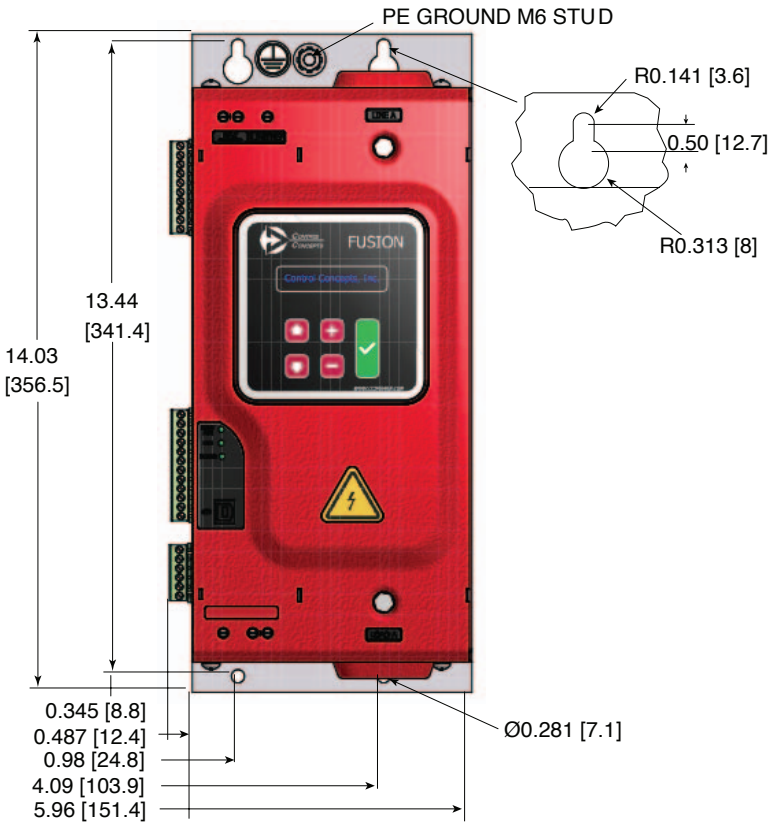
CAD Blocks are available for download at www.ccipower.com.

2.1.1 Single Phase One Zone (50-400 Amps)

Dimensions: Inches [mm]

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

Amp	Weight (lbs[kg])
50	14 [6.4]
80	14 [6.4]
100	14 [6.4]
130	15 [6.8]
160	15 [6.8]
200	15 [6.8]
240	15 [6.8]
320	17 [7.7]
400	17 [7.7]

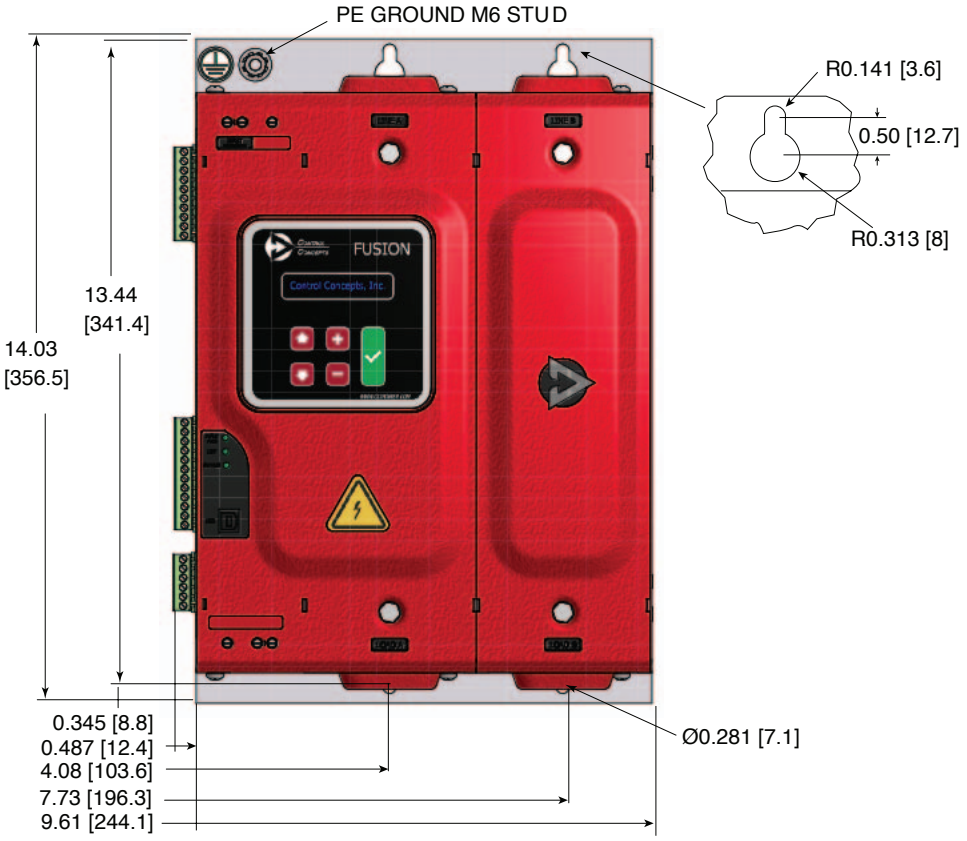


2.1.2 Single Phase, Two Zone (50-400 Amps)
Three Phase - Two Leg (50-400 Amps)

Dimensions: Inches [mm]

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

Amp	Weight (lbs[kg])
50	22.5 [10.2]
80	23 [10.4]
100	23 [10.4]
130	24 [10.9]
160	24 [10.9]
200	24 [10.9]
240	24 [10.9]
320	28 [12.7]
400	28.5 [13.0]

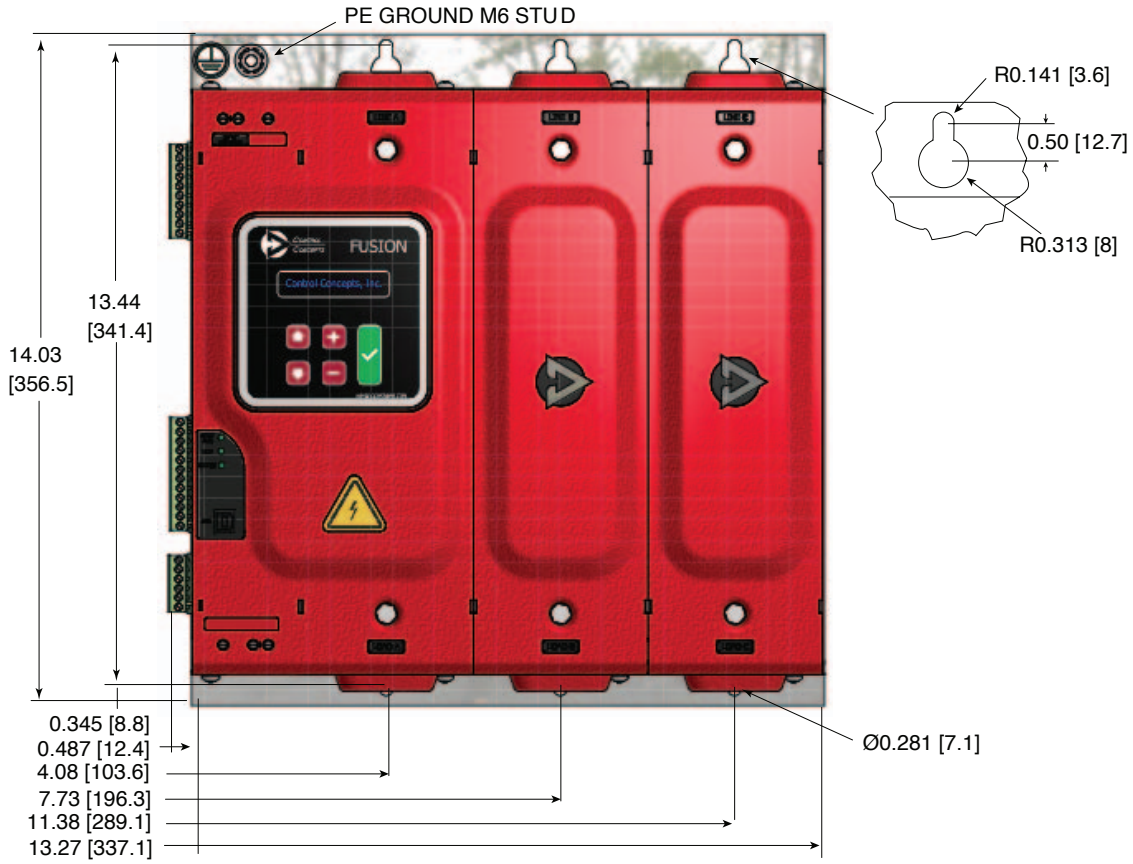


2.1.3 Single Phase, Three Zone (50-400 Amps)
Three Phase - Three Leg (50-400 Amps)

Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
13.27 [337.1]
Depth
9.57 [243.0]

Amp	Weight (lbs[kg])
50	31 [14.1]
80	32 [14.5]
100	32 [14.5]
130	33 [15.0]
160	33 [15.0]
200	33 [15.0]
240	33 [15.0]
320	39 [17.7]
400	40 [18.1]

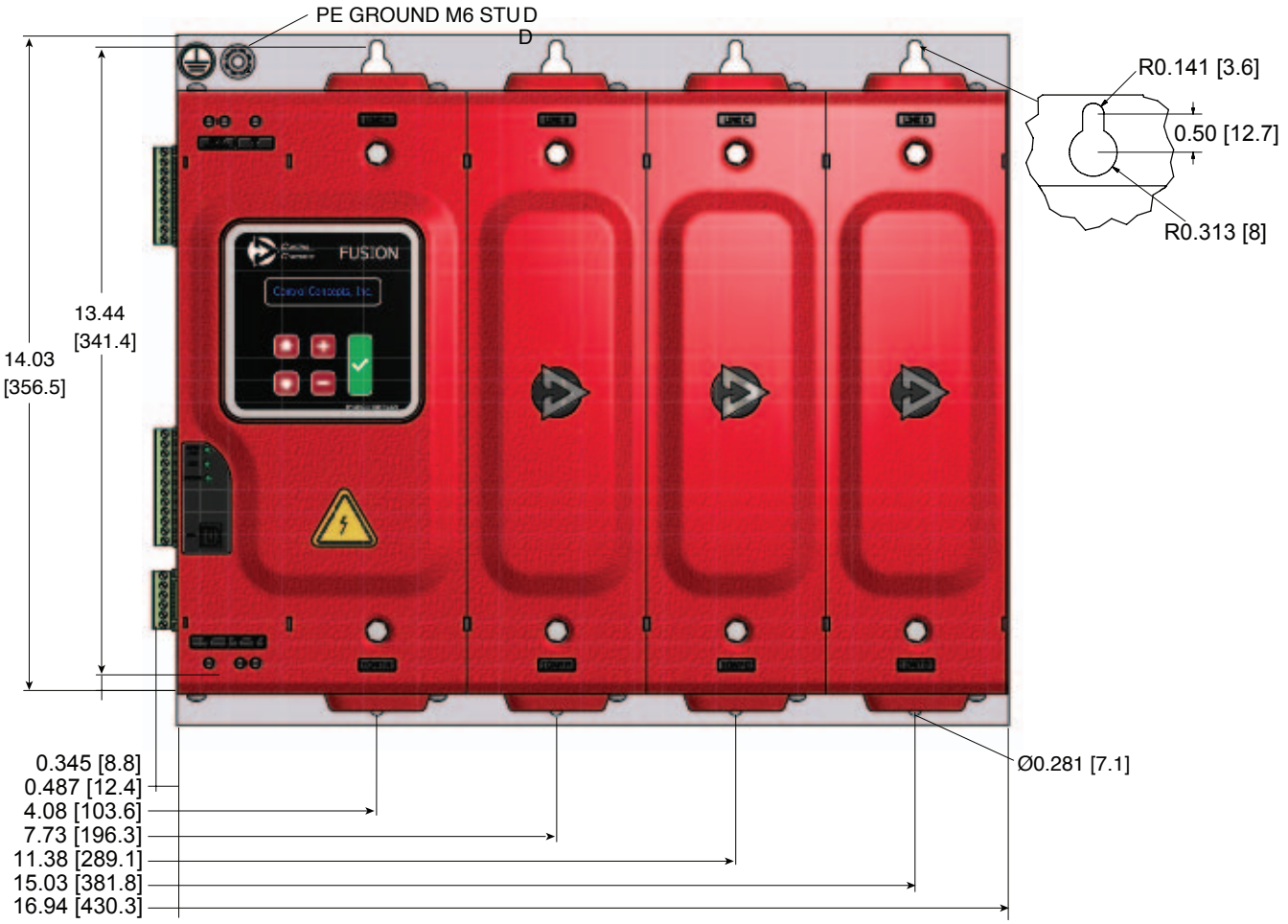


2.1.4 Single Phase, Four Zone (50-400 Amps)

Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
16.94 [430.3]
Depth
9.57 [243.0]

Amp	Weight (lbs[kg])
50	40 [18.1]
80	41 [18.6]
100	41 [18.6]
130	42 [19.1]
160	42 [19.1]
200	42 [19.1]
240	42 [19.1]
320	50 [22.7]
400	52 [23.6]

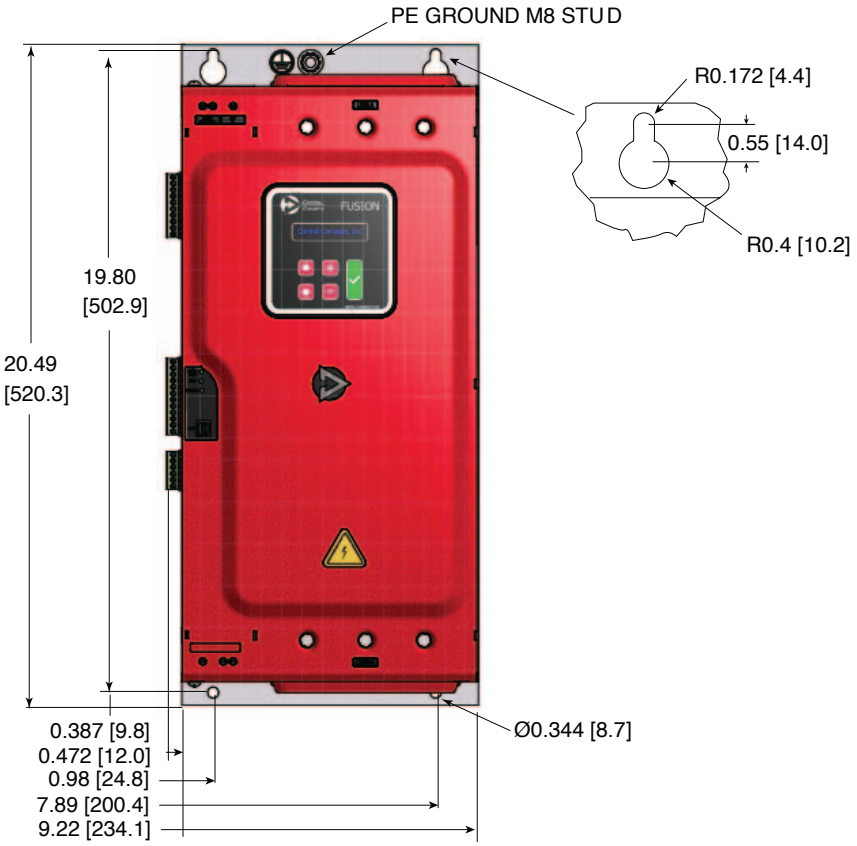


2.1.5 Single Phase, One Zone (500-1200 Amps)

Dimensions: Inches [mm]

Height
20.49 [520.3]
Width
9.22 [134.1]
Depth
11.21 [284.7]

Amp	Weight (lbs[kg])
500	38 [17.2]
650	38 [17.2]
800	38 [17.2]
1000	50 [22.7]
1200	50 [22.7]

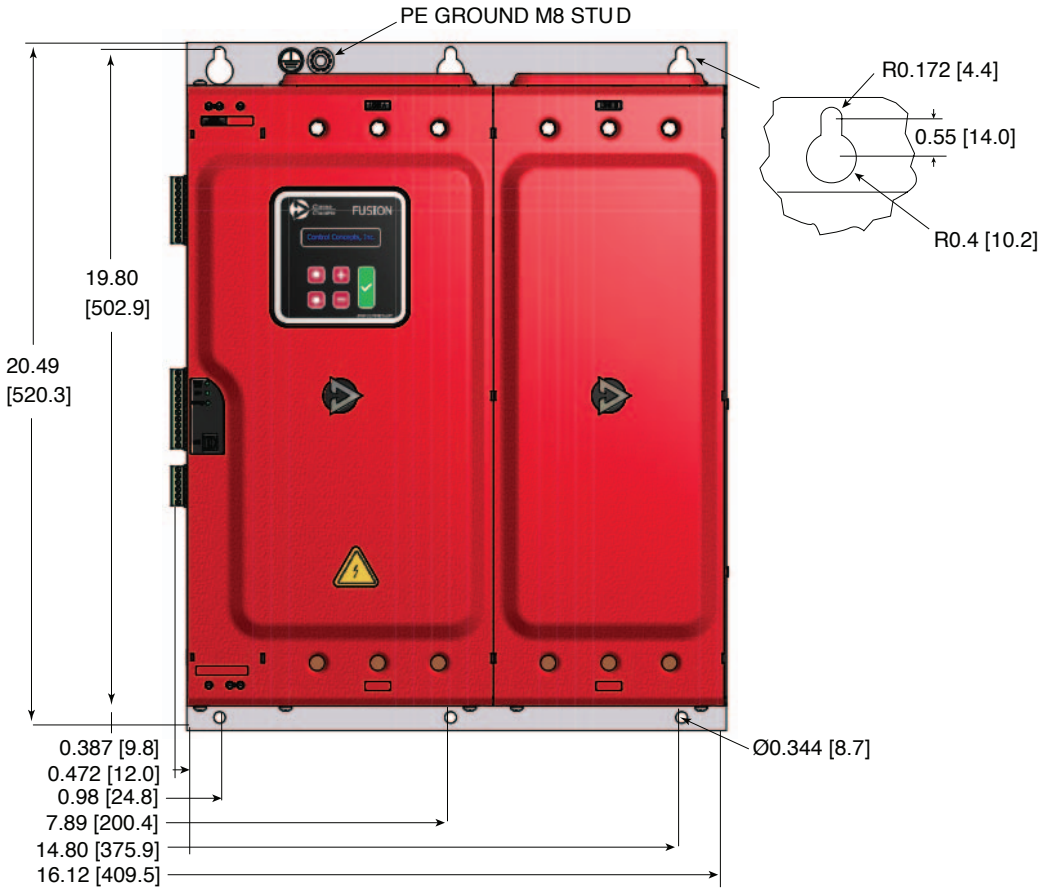


2.1.6 Single Phase Two Zone (500-1200 Amps)
Three Phase - Two Leg (500-1200 Amps)

Dimensions: Inches [mm]

Height
20.49 [520.3]
Width
16.12 [409.5]
Depth
11.21 [284.7]

Amp	Weight (lbs[kg])
500	67 [30.4]
650	67 [30.4]
800	67 [30.4]
1000	93 [42.2]
1200	93 [42.2]

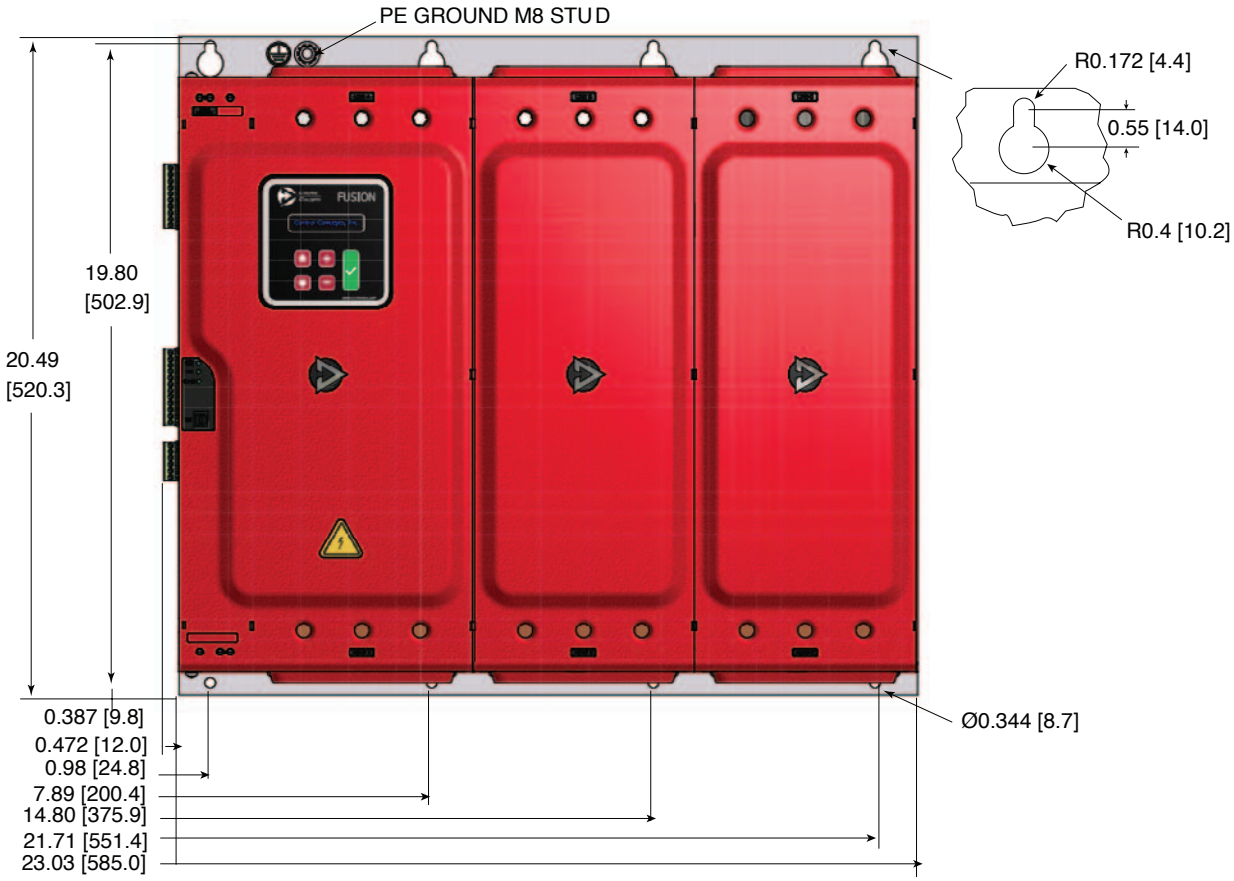


2.1.7 Single Phase Three Zone (500-1200 Amps)
Three Phase - Three Leg (500-1200 Amps)

Dimensions: Inches [mm]

Height
20.49 [520.3]
Width
23.03 [585.0]
Depth
11.21 [284.7]

Amp	Weight (lbs[kg])
500	95 [43.1]
650	95 [43.1]
800	95 [43.1]
1000	135 [61.2]
1200	135 [61.2]

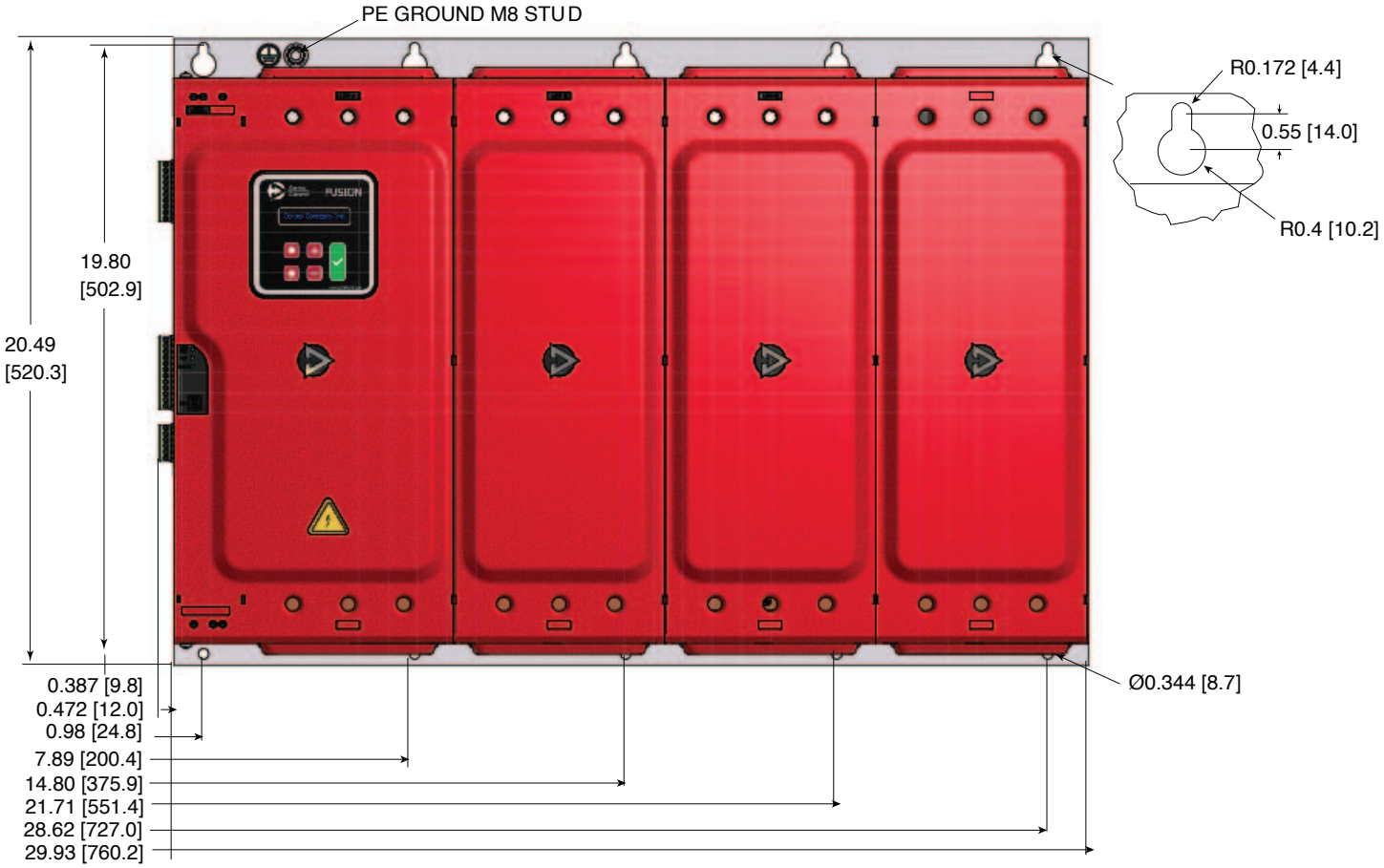


2.1.8 Single Phase, Four Zone (500-1200 Amps)

Dimensions: Inches [mm]

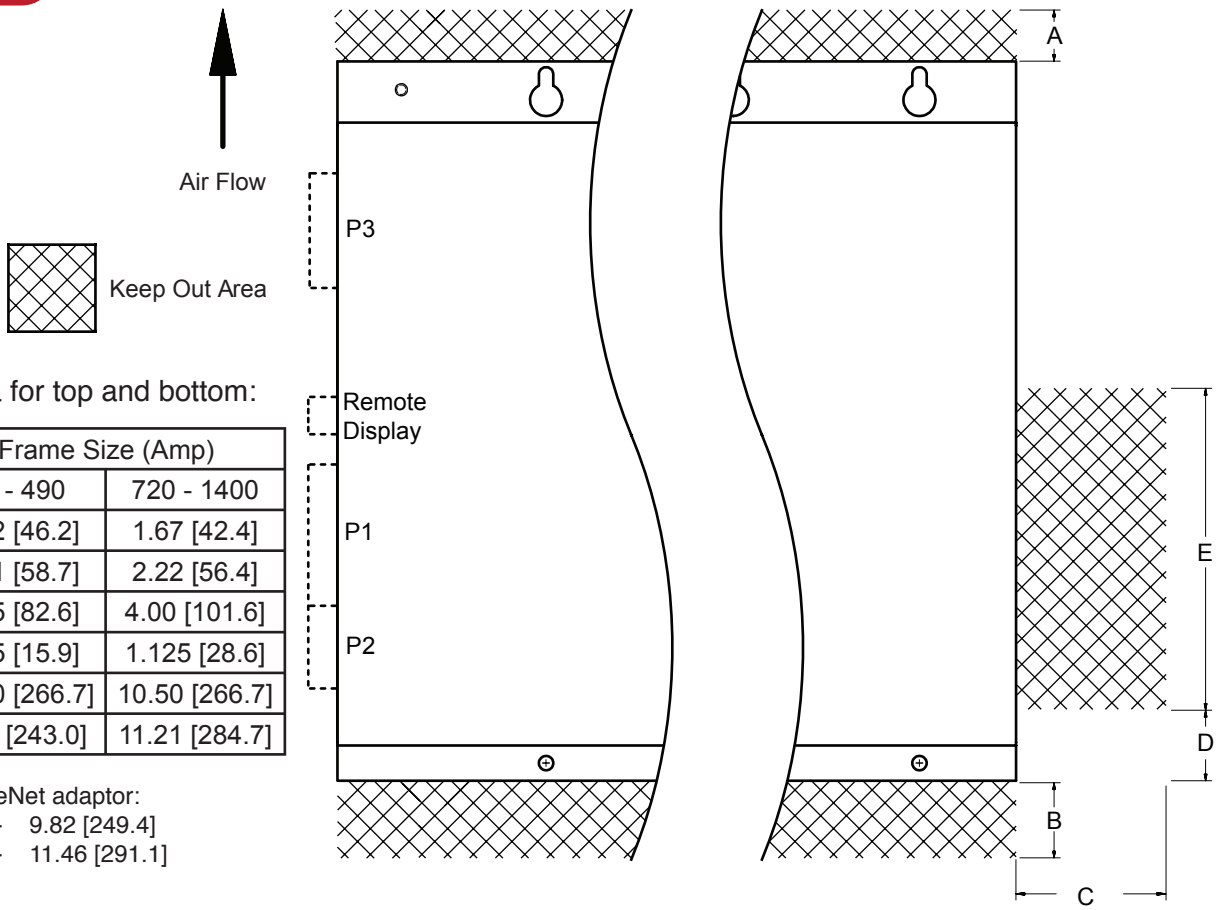
Height
20.49 [520.3]
Width
29.93 [760.2]
Depth
11.21 [284.77]

Amp	Weight (lbs[kg])
500	124 [56.2]
650	124 [56.2]
800	124 [56.2]
1000	177 [80.3]
1200	177 [80.3]



2.2 Mounting Considerations for All DC Controllers

Dimensions: Inches [mm]



Keep out area for top and bottom:

	Frame Size (Amp)	
	45 - 490	720 - 1400
A	1.82 [46.2]	1.67 [42.4]
B	2.31 [58.7]	2.22 [56.4]
C	3.25 [82.6]	4.00 [101.6]
D	.625 [15.9]	1.125 [28.6]
E	10.50 [266.7]	10.50 [266.7]
Depth*	9.57 [243.0]	11.21 [284.7]

* Depth with DeviceNet adaptor:
50-400 Amp - 9.82 [249.4]
500-1200 Amp - 11.46 [291.1]

Mount 45 & 60 Amp controllers vertical for convection cooling. All other controllers have forced air cooling and may be mounted horizontal or vertical.

The keep out area on the top and bottom is 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 from edge of base plate. The area to the right side is for the DC bus bars. The load connections are made from the right side of this area.

Mounting hardware:	45 - 490 Amp	1/4-20 or M6 bolts with flat and lock washers
(Not included)	720 - 1400 Amp	5/16 or M8 bolts with flat and lock washers

P1, P2 and P3 protrude approximately .5 [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.

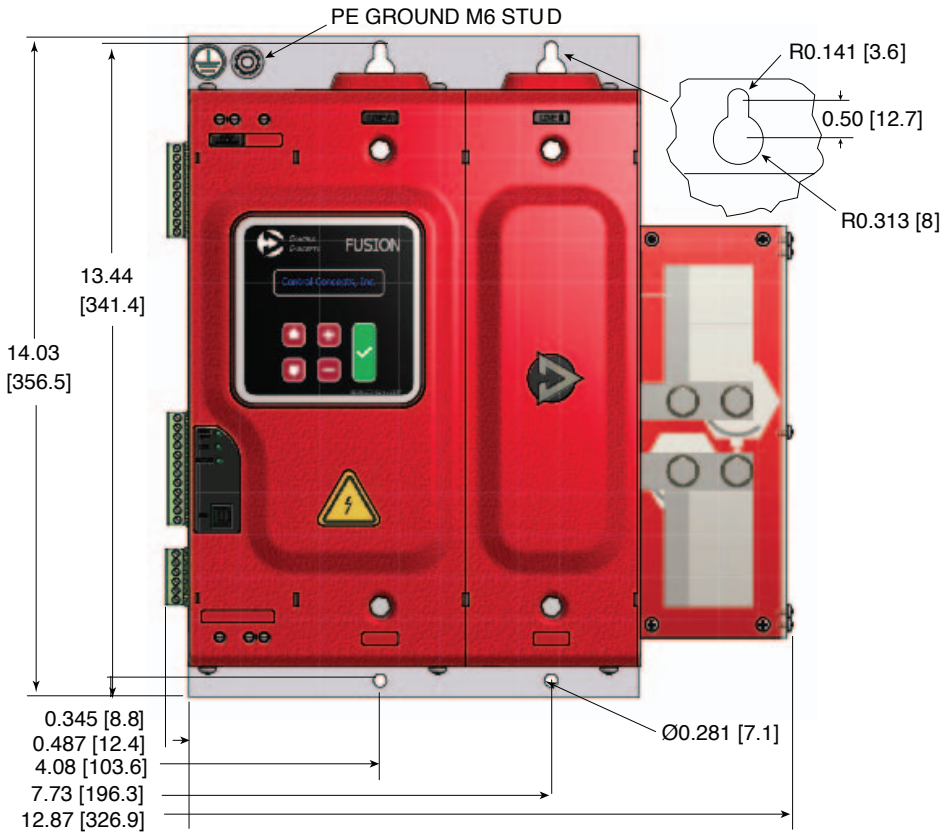
CAD Blocks are available for download at www.ccipower.com.

2.2.1 Single Phase (45 - 360 Amps) DC

Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
12.87 [326.9]
Depth
9.57 [243.0]

Amp	Weight (lbs[kg])
45	24 [10.9]
90	24 [10.9]
145	25 [11.3]
220	25 [11.3]
360	30 [13.6]

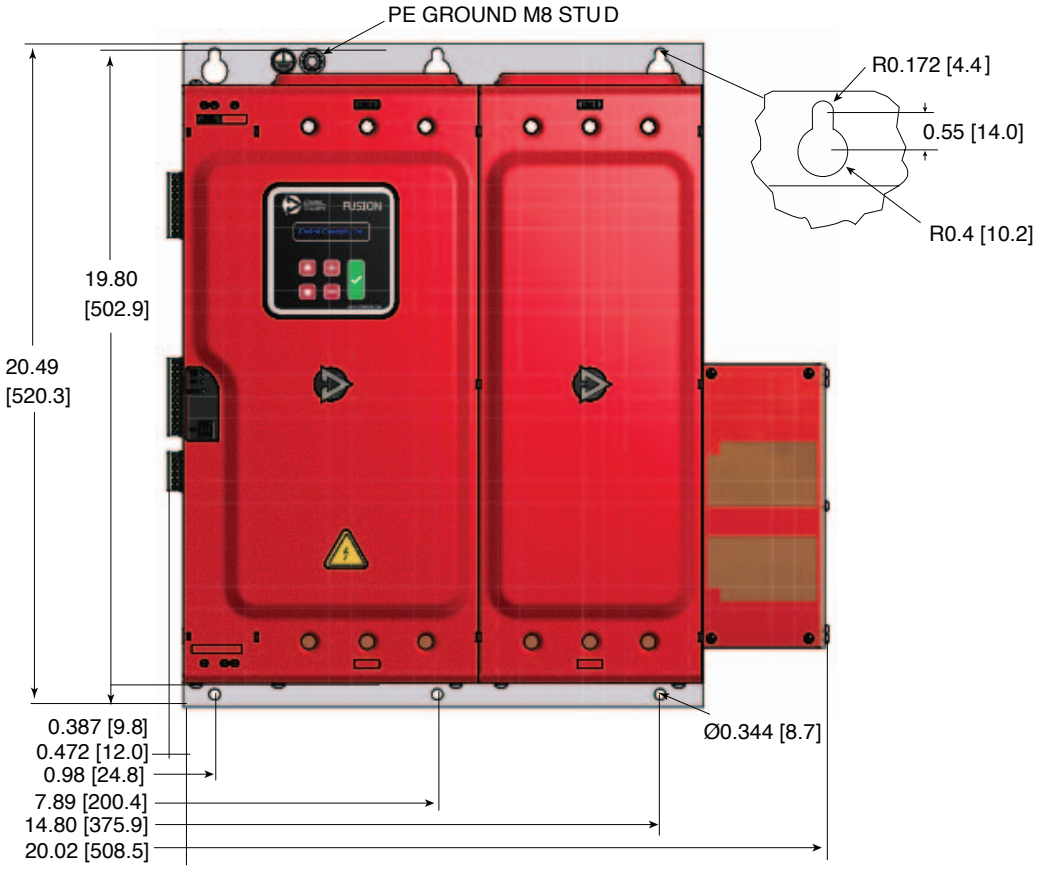


2.2.2 Single Phase (720 - 1080 Amps) DC

Dimensions: Inches [mm]

Height
20.49 [520.3]
Width
20.02 [508.5]
Depth
11.21 [284.7]

Amp	Weight (lbs[kg])
720	68 [30.8]
1080	93 [42.2]

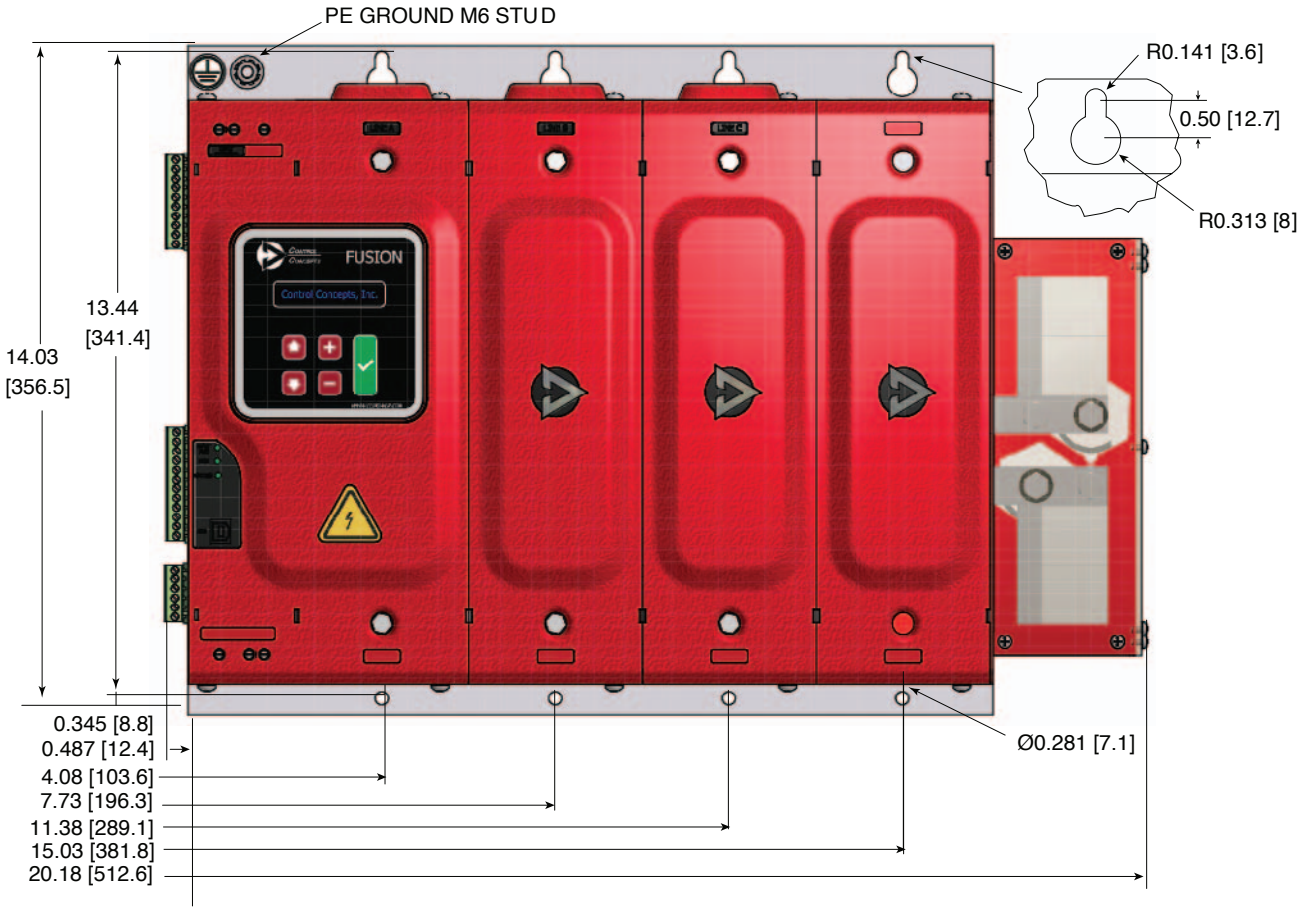


2.2.3 Three Phase (60 - 490 Amps) DC

Dimensions: Inches [mm]

Height
14.03 [356.5]
Width
20.18 [512.6]
Depth
9.57 [243.0]

Amp	Weight (lbs[kg])
60	39 [17.7]
120	40 [18.1]
195	42 [19.1]
290	42 [19.1]
490	51 [23.1]

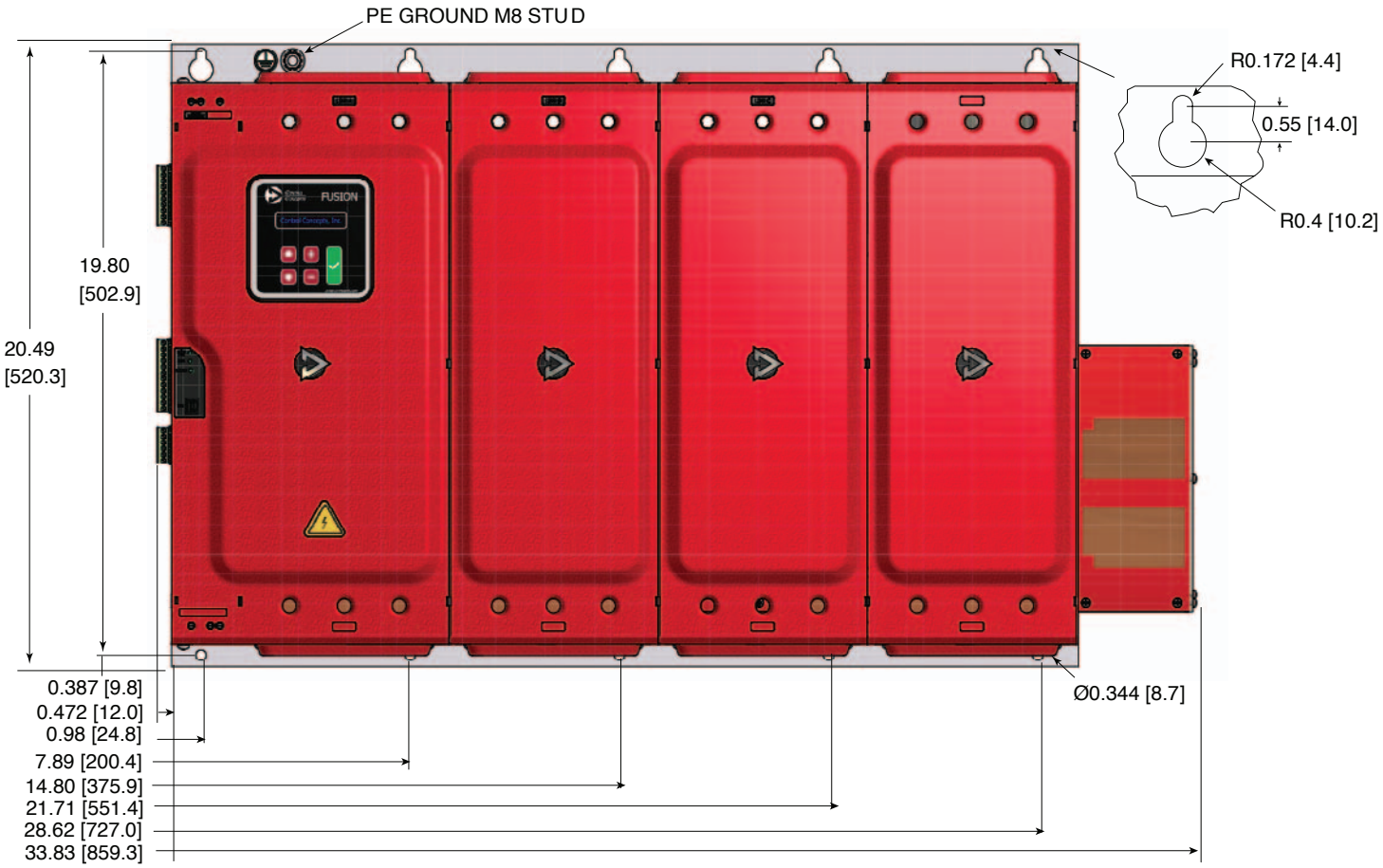


2.2.4 Three Phase (975-1400 Amps) DC

Dimensions: Inches [mm]

Height
20.49 [520.3]
Width
33.83 [859.3]
Depth
11.21 [284.7]

Amp	Weight (lbs[kg])
975	122 [55.3]
1400	150 [68.0]



2.3 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.

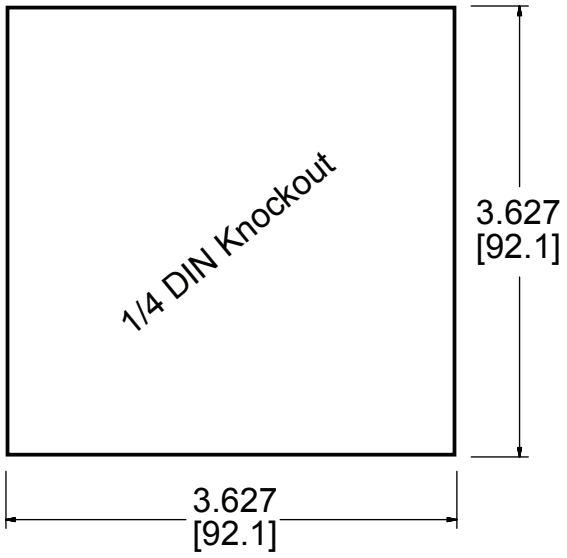
Remote Display Ratings:
IP65 - Totally protected against ingress of dust. Protected against jets of water. Limited ingress permitted.

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.

2.3.1 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].

2.3.2 Mounting Instructions

Mounting Kit includes:

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

STEP 1

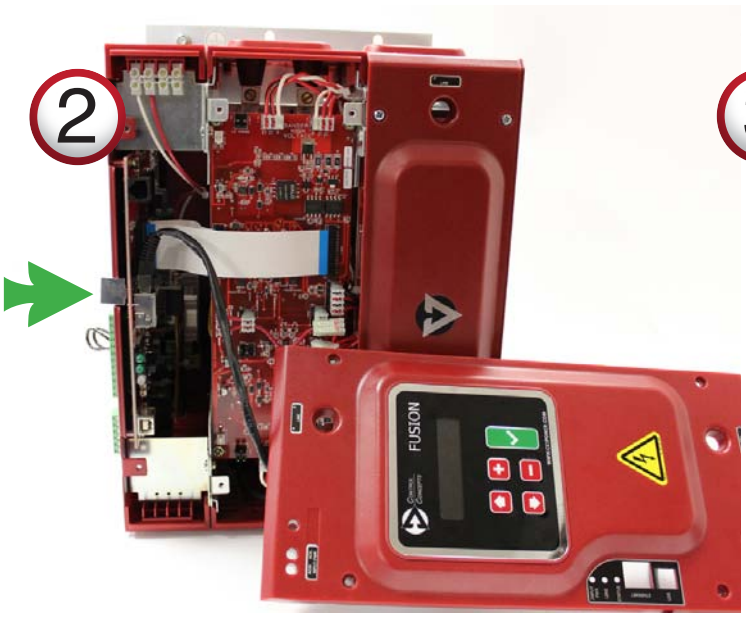
Carefully remove the 4 screws securing the lid.
(See Number 1, right)

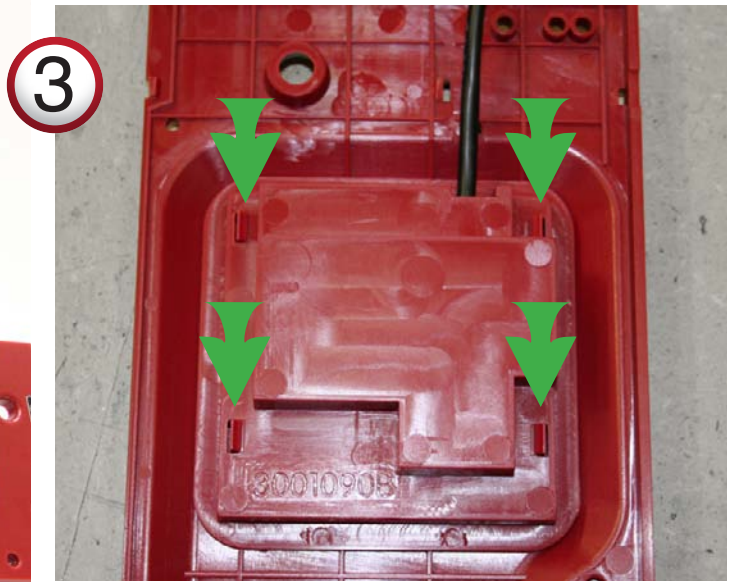
STEP 2

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)



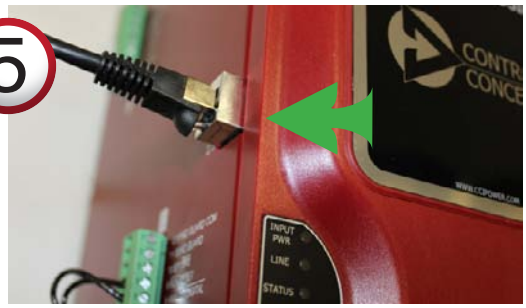


STEP 4

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.

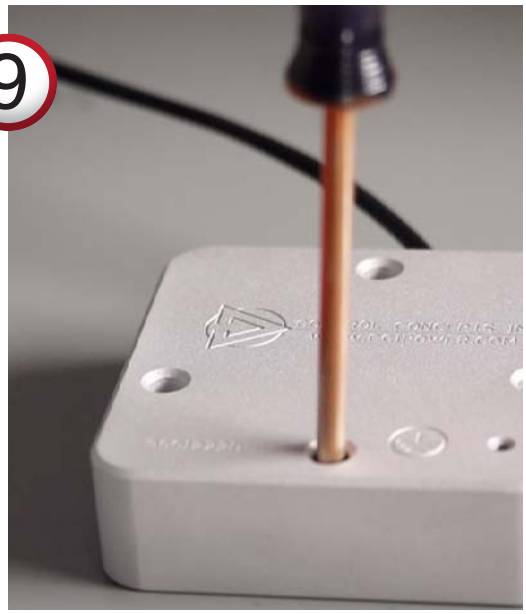
STEP 8

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

For controllers 240 Amps and Less.

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 - 350	-	325 IN-LBS

For controllers 320 Amps and More.

Recommended Tightening Torque For Line/Load Connectors		
2 Conductors Per Terminal		
Wire Size (AWG)	Screw	Hex Drive
1/0 - 250	-	611 IN-LBS
1 Conductor Per Terminal		
Wire Size (AWG)	Screw	Hex Drive
350 - 750	-	611 IN-LBS

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

3.2 Universal Input Power

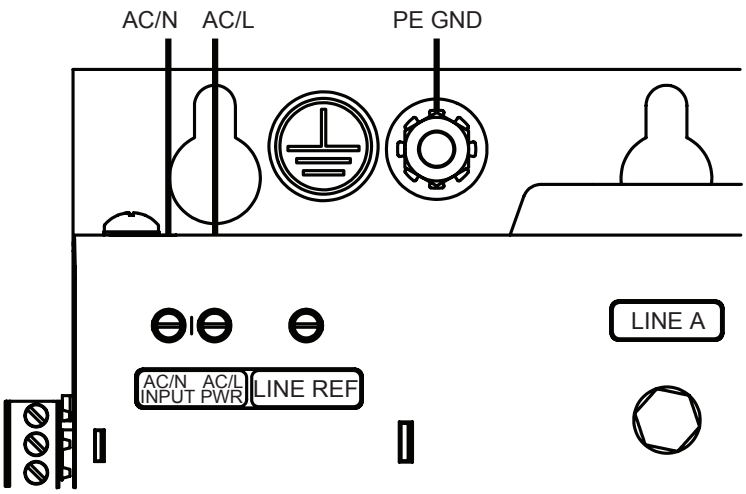
The universal input power may be wired with 12 - 18 AWG wire. The acceptable voltage range is 100-240 Vac at 50/60 Hz.

This supplies power to the on-board switch mode power supplies which provides power to the circuitry and cooling fans.

For 50 - 490 Amp AC and DC controllers, 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.

For 500 - 1200 Amp 1Ø AC controllers, the line is internally fused with a 3.15 Amp time delay fuse. If connected line to line, the neutral must also be fused with a 3.15 Amp time delay fuse.

For 500 - 1400 Amp 3Ø AC, 1Ø and 3Ø DC controllers the line is internally fused with a 3.15 Amp and a 6.3 Amp time delay fuses. If connected line to line, the neutral must also be fused with a 10 Amp time delay fuse.

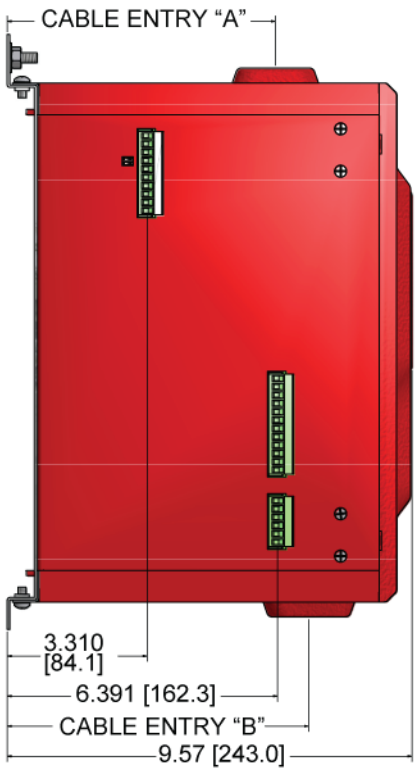


Typical Power Consumption @ 120 VAC (Watts)				
	50A	**80-320A**	**400A**	**500-1200A**
1Ø - 1 Zone	21.4	32.2	43.0	53.4
1Ø - 2 Zone	25.3	46.9	68.5	89.4
1Ø - 3 Zone	29.3	61.7	94.1	125.4
1Ø - 4 Zone	33.2	76.4	119.6	161.4
3Ø - 2 Leg	35.3	46.9	68.5	89.4
3Ø - 3 Leg	29.3	61.7	94.1	125.4
	45-60A	90-290A	360-490A	720-1400A
1Ø DC	25.3	46.9	68.5	89.4
3Ø DC	29.3	72.5	104.9	156

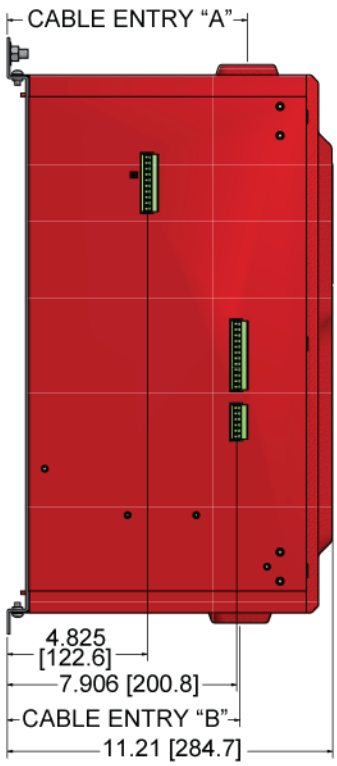
3.3 AC Cable Entry Heights / Wire Acceptance

Dimensions: Inches [mm]

50 - 400



500 - 1200



	Cable Entry "A" LINE	Cable Entry "B" LOAD
50-100	5.689 [144.5]	5.689 [144.5]
130-240	6.008 [152.6]	6.008 [152.6]
320-400	6.342 [161.1]	7.129 [181.1]

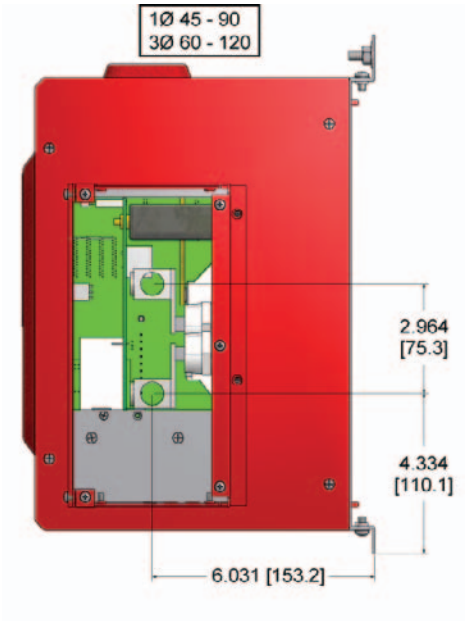
	Cable Entry "A" LINE	Cable Entry "B" LOAD
500-800	7.668 [194.8]	7.668 [194.8]
1000-1200	8.258 [209.8]	8.008 [203.4]

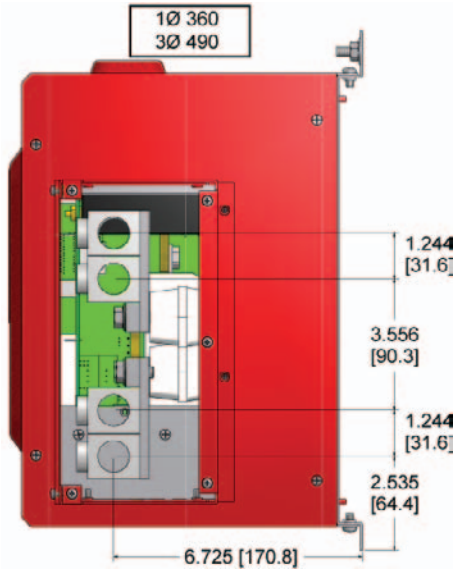
	LUGS		WIRE ACCEPTANCE PER LUG
	Qty	Size	
50-100	1	Screw	14 - 1/0
130-240	1	3/8" Hex Drive [9]	6 - 350 MCM
320-400	1	3/8" Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM

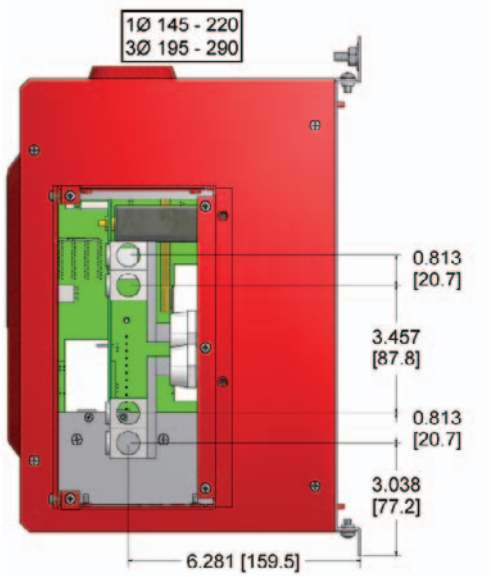
	LUGS		WIRE ACCEPTANCE PER LUG
	Qty	Size	
500-800	2	3/8" Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM
1000-1200	3	3/8" Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM

3.4 DC Cable Entry Heights / Wire Acceptance

3.4.1 Single Phase (45 - 360 Amps) DC
Three Phase (60 - 490 Amps) DC

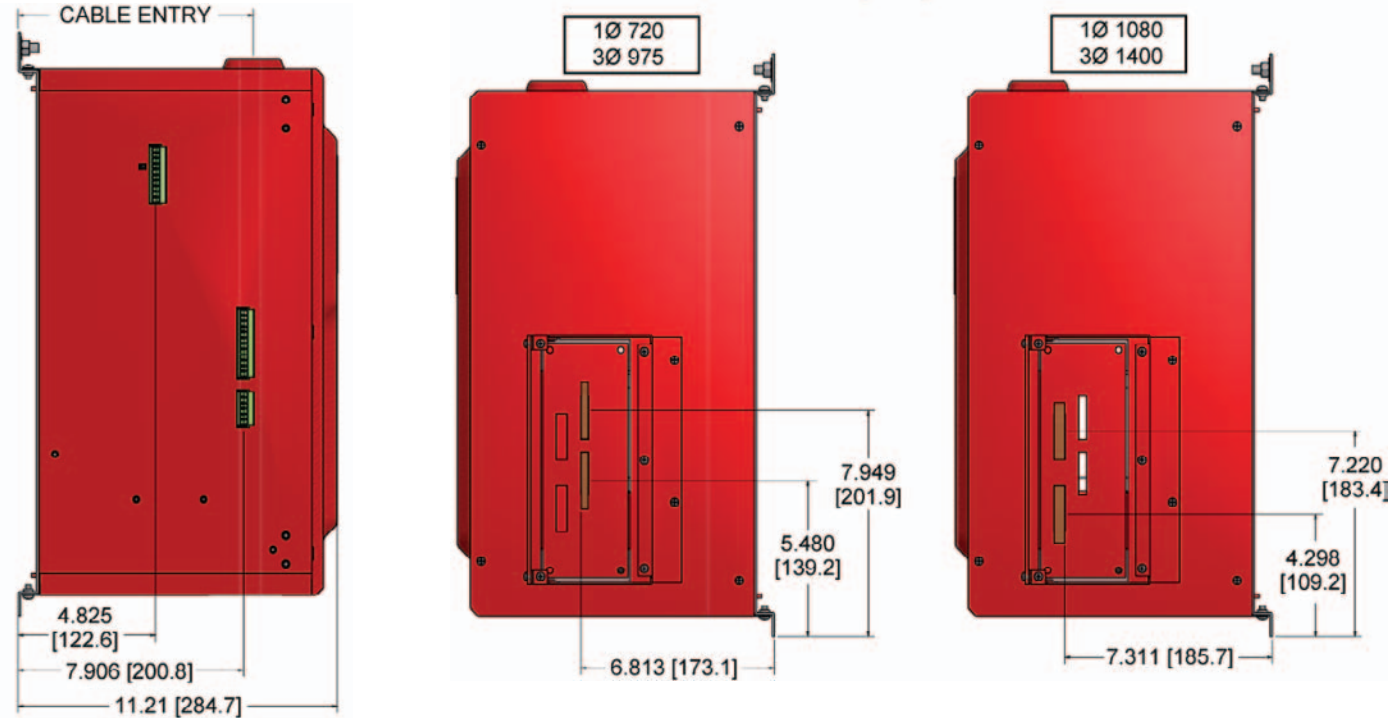






	LINE				LOAD		
	Cable Entry	LUGS		WIRE ACCEPTANCE PER LUG	LUGS		WIRE ACCEPTANCE PER LUG
		Qty	Size		Qty	Size	
1Ø 45 - 90 3Ø 60 - 120	5.689 [144.5]	1	Screw	14 - 1/0	1	5/16” Hex Drive [8]	6 - 250 MCM
1Ø 145 - 220 3Ø 195 - 290	6.008 [152.6]	1	3/8” Hex Drive [9]	6 - 350 MCM	2	5/16” Hex Drive [8]	6 - 250 MCM
1Ø 360 3Ø 490	6.342 [161.1]	1	3/8” Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM	2	3/8” Hex Drive [9]	1/0 - 500 MCM

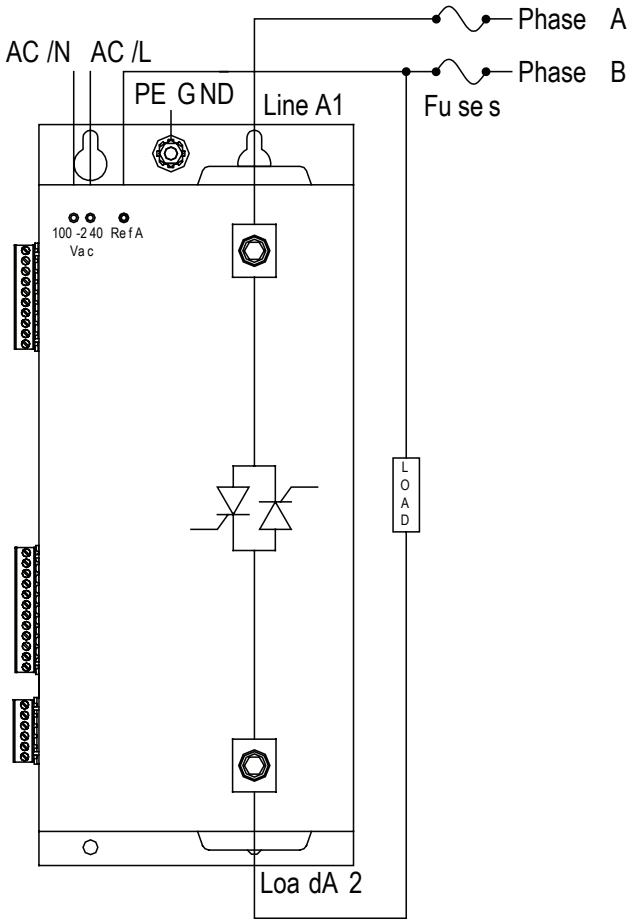
3.4.2 Single Phase (720 - 1080 Amps) DC
Three Phase (975 - 1400 Amps) DC



	LINE				LOAD	
	Cable Entry	LUGS		WIRE ACCEPTANCE PER LUG	LUGS	WIRE ACCEPTANCE PER LUG
		Qty	Size			
1Ø 720 3Ø 975	7.668 [194.8]	2	3/8” Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM	NA	NA
1Ø 1080 3Ø 1400	8.258 [209.8]	3	3/8” Hex Drive [10]	(2) 1/0 - 250 MCM or (1) 350 - 750 MCM	NA	NA

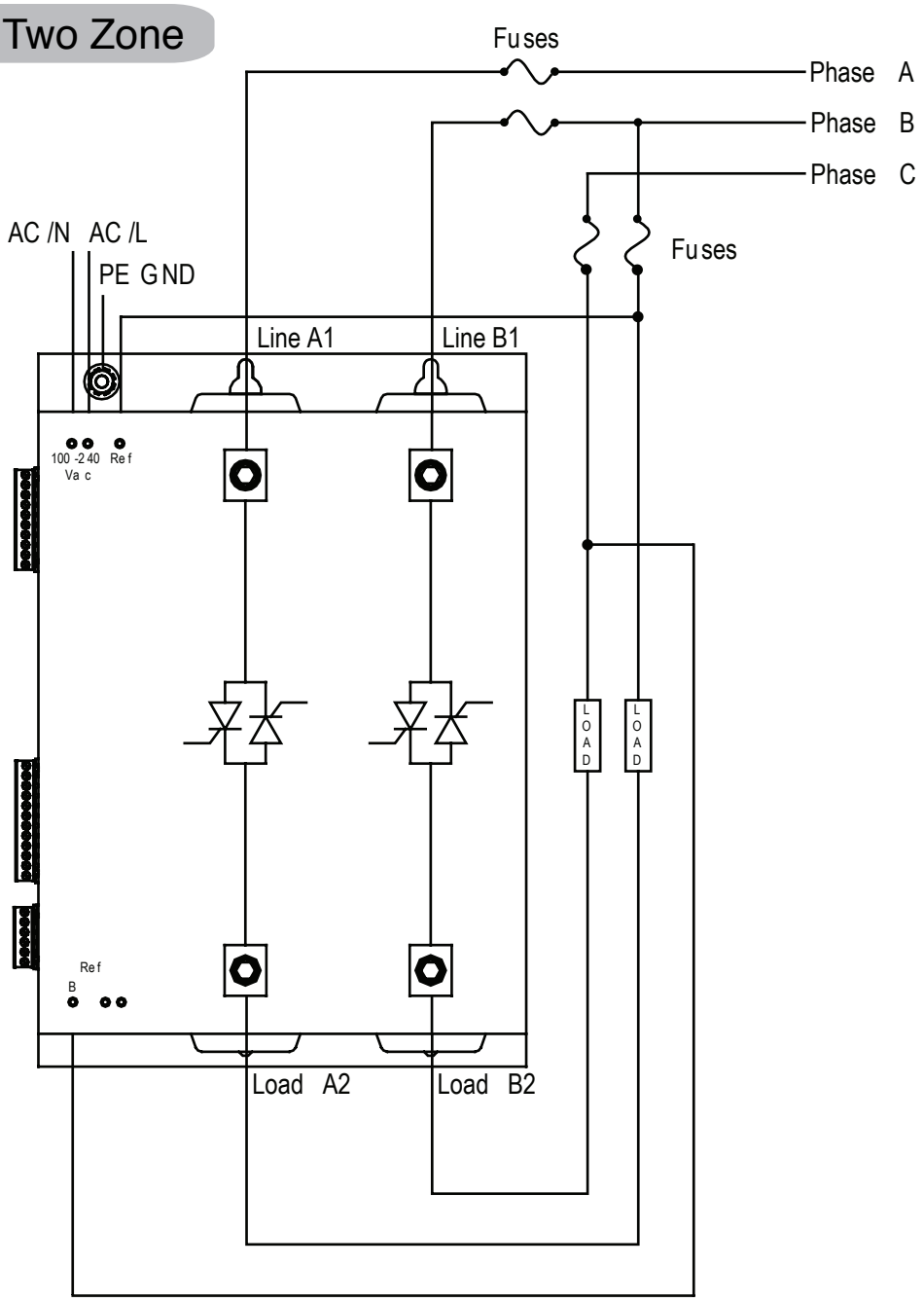
3.5 AC Line / Load Connections

3.5.1 Single Phase, One Zone



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.

3.5.2 Single Phase, Two Zone



This figure shows a two single phase controllers.

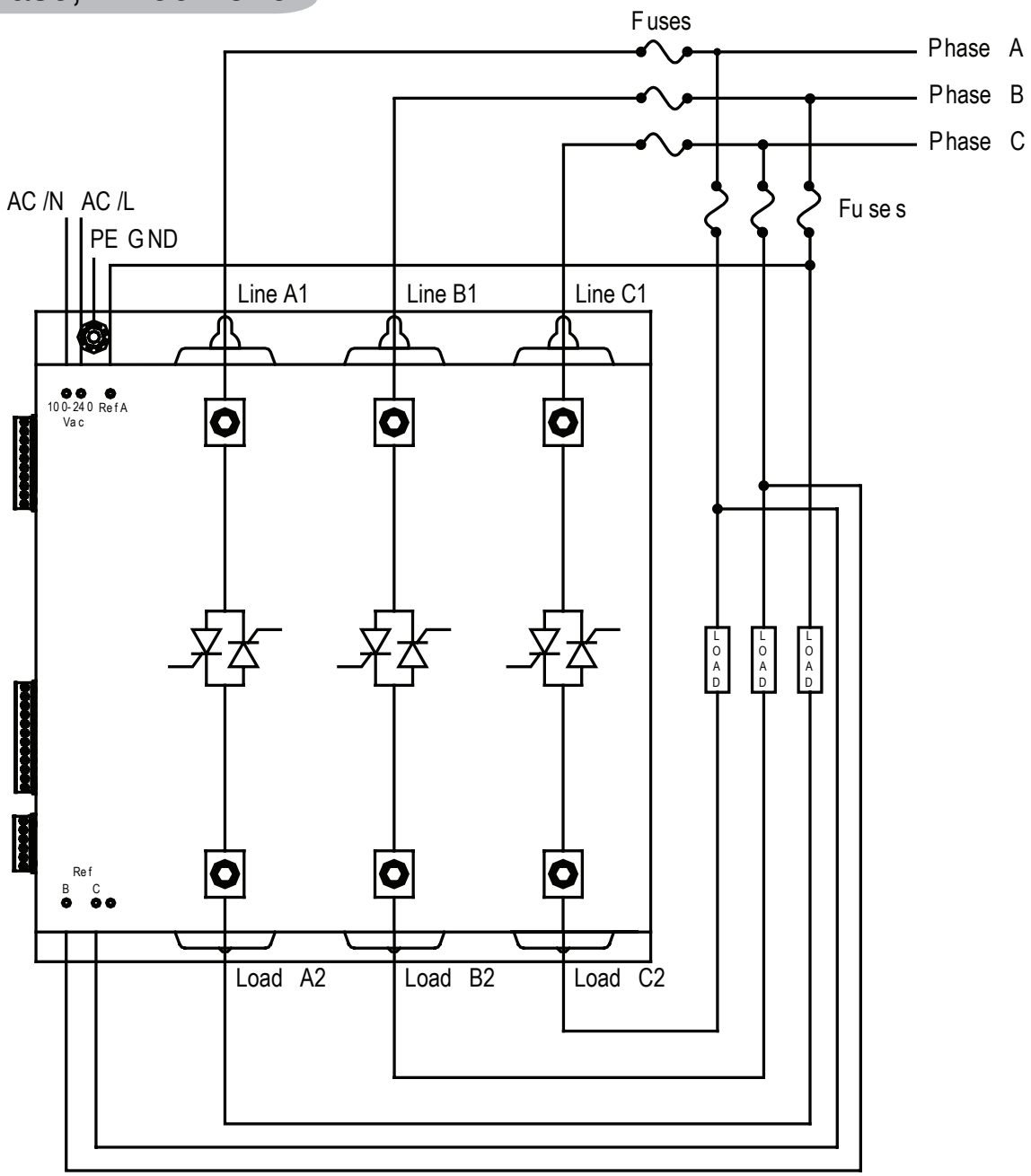
Zone 1 is connected from Phase A to Phase B.

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.

3.5.3 Single Phase, Three Zone



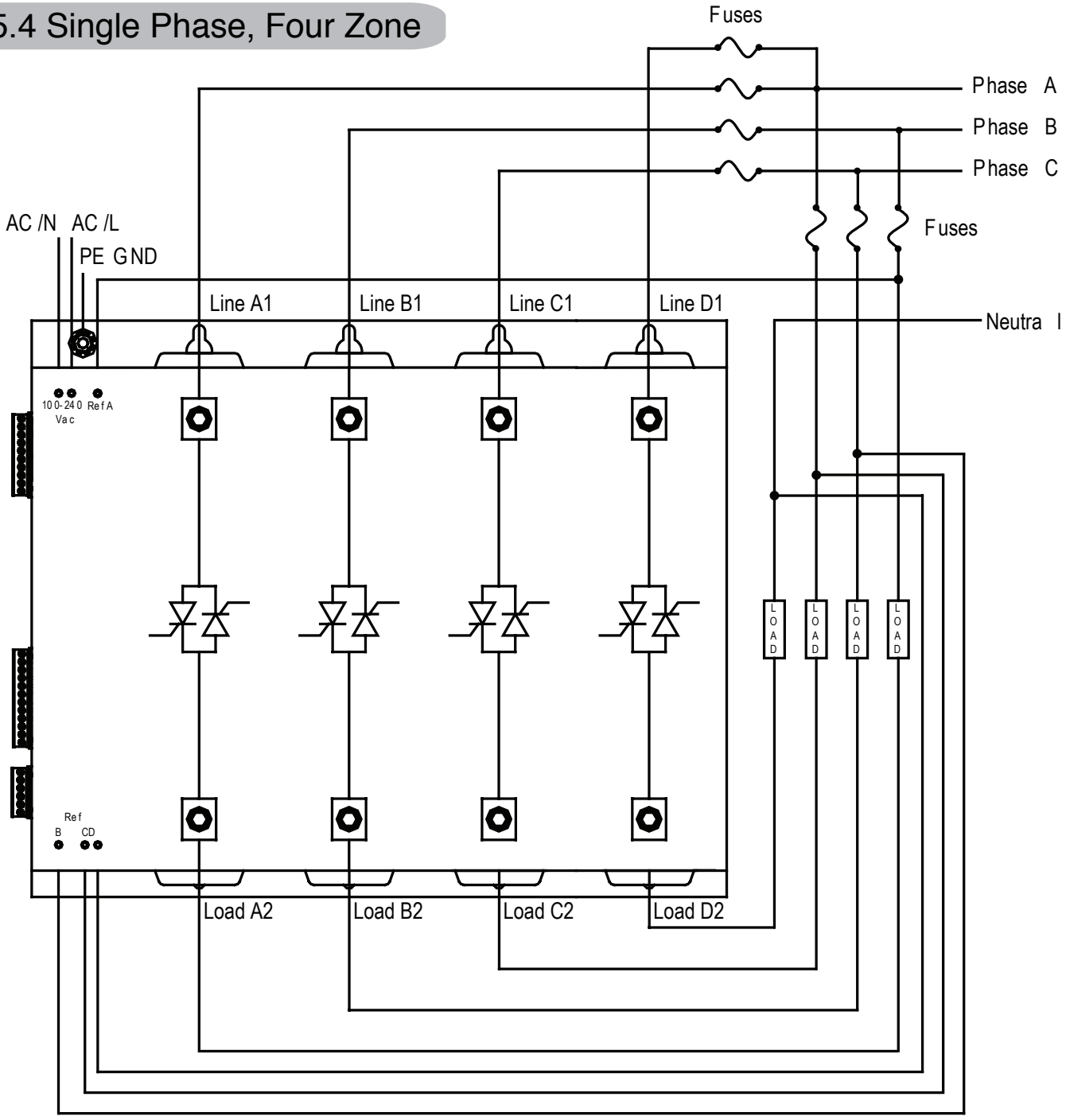
This figure shows a three single phase controllers.

Zone 1 is connected from Phase A to Phase B.
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.

3.5.4 Single Phase, Four Zone



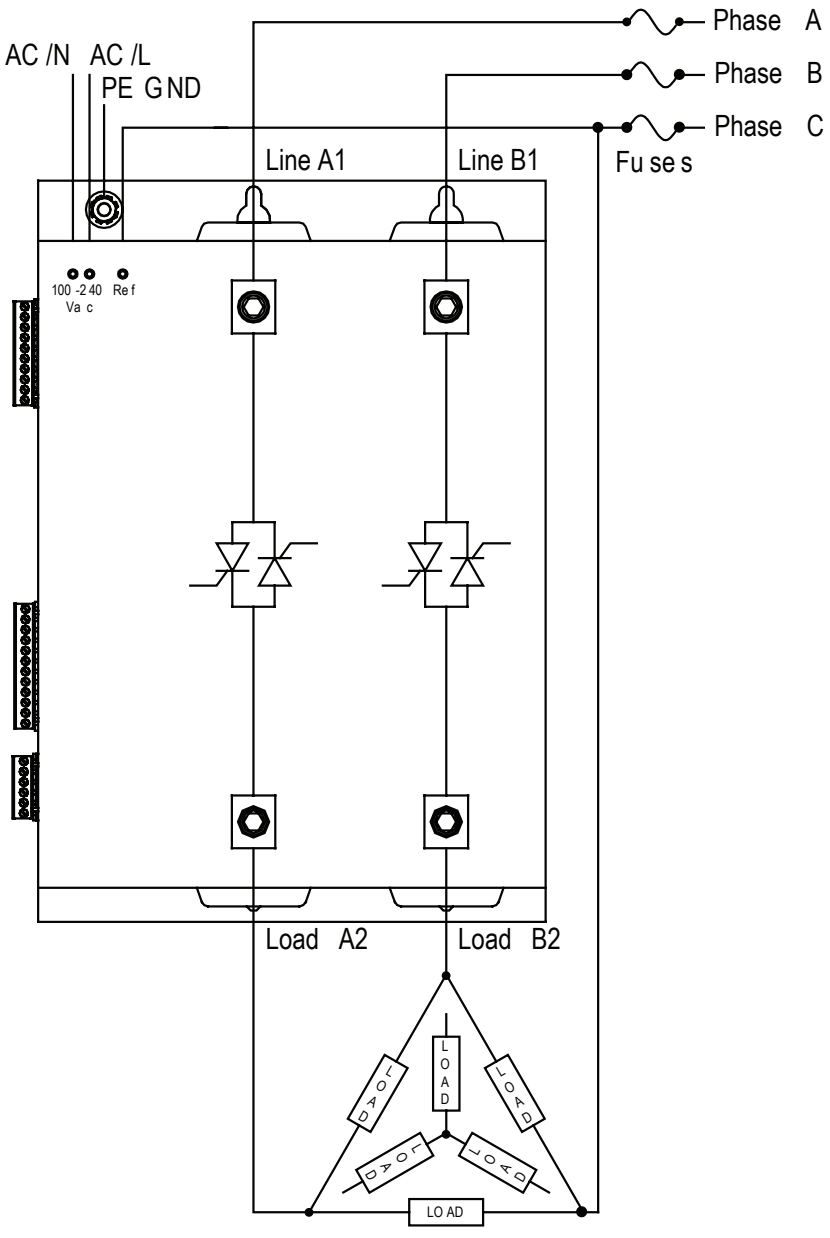
This figure shows a four single phase controllers.

Zone 1 is connected from Phase A to Phase B.
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 Neutral.

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.

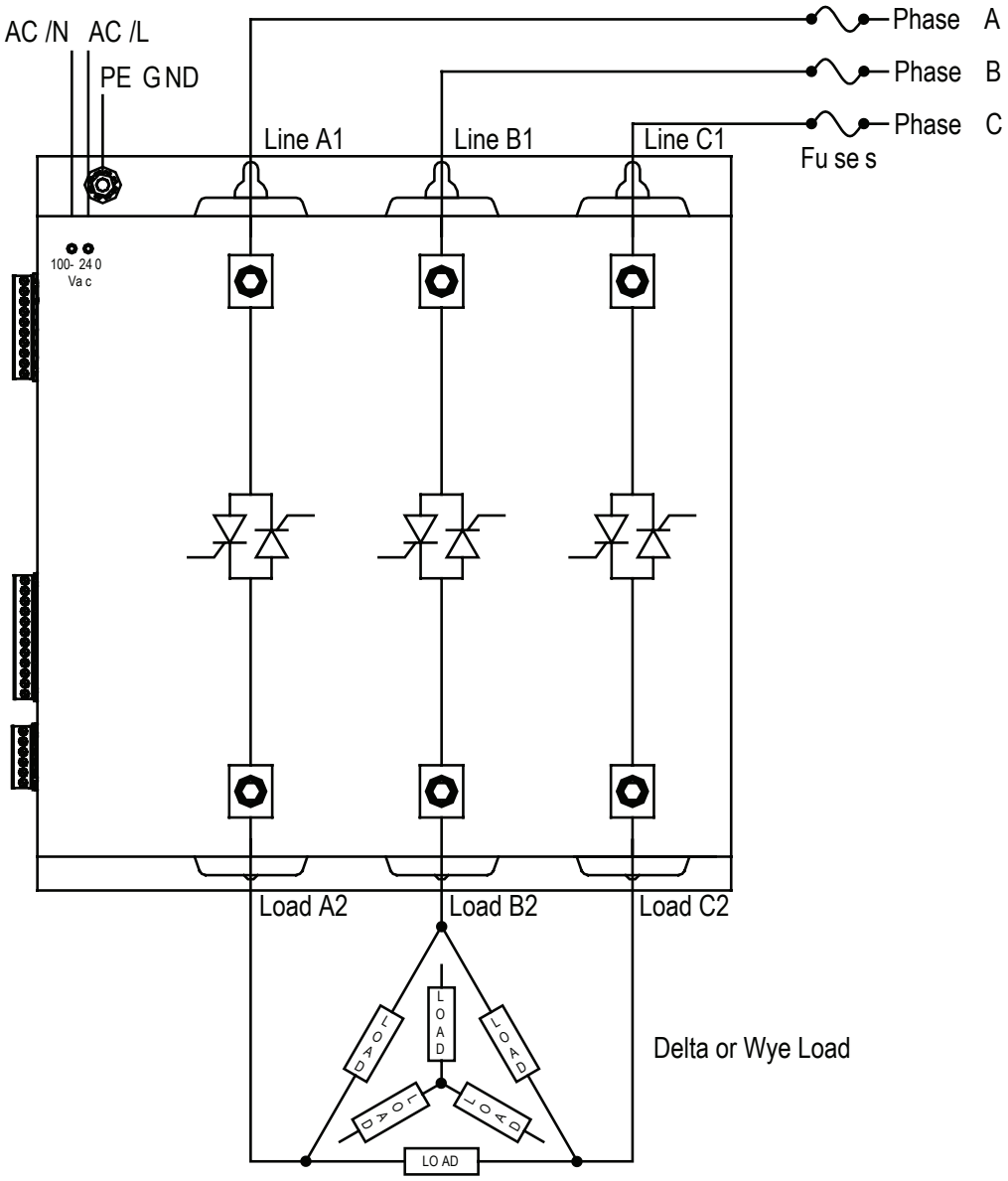
3.5.5 Three Phase - Two Leg



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

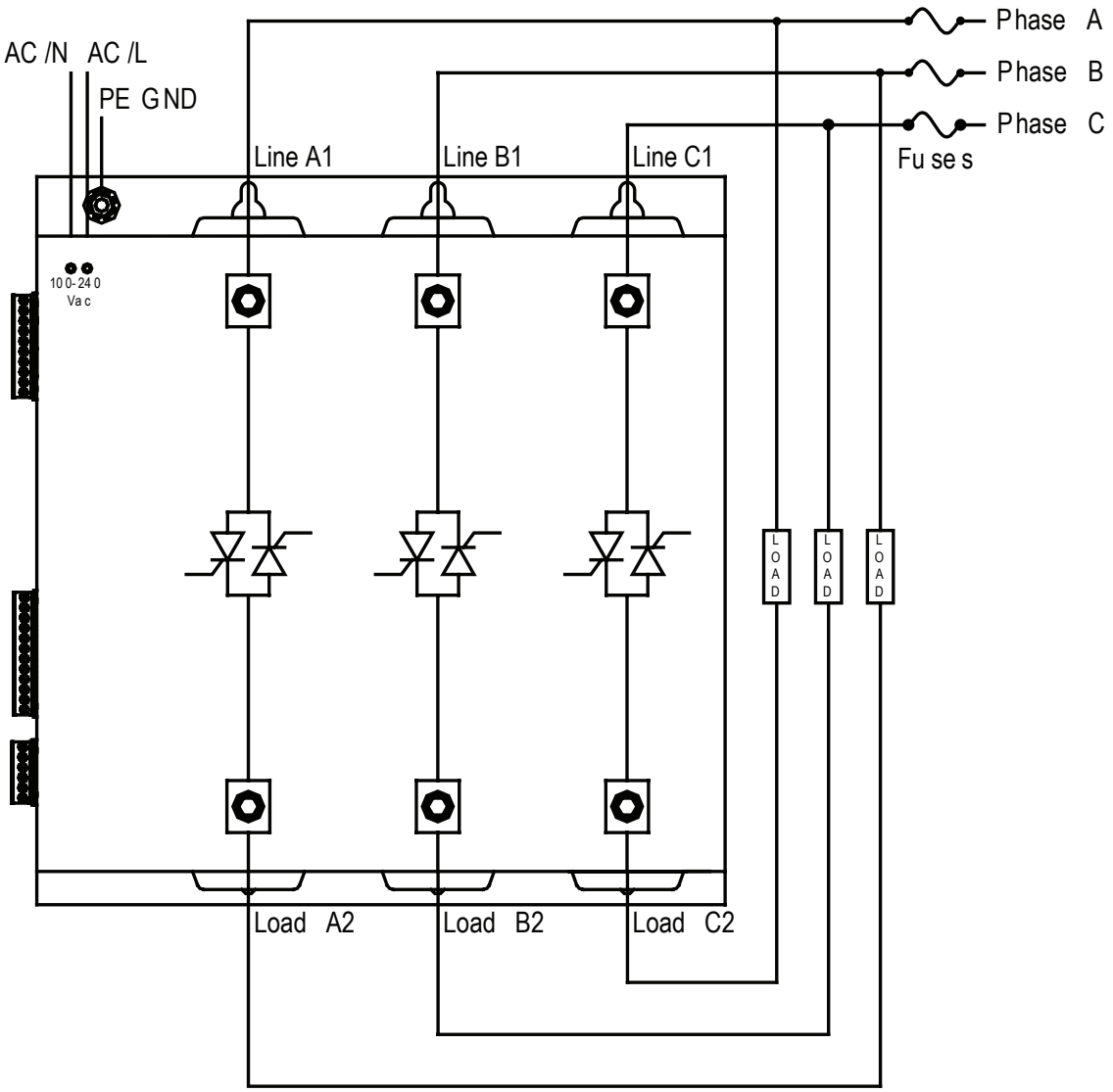
Note: An optional current transducer may be ordered for monitoring the current on the third leg that does not run through the controller. Contact Control Concepts for more details.

3.5.6 Three Phase - Three Leg - Delta or Three Wire Wye

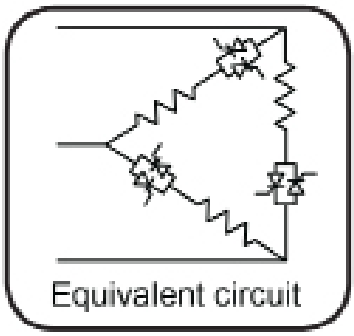


This figure shows a three phase three leg controller connected to either a Delta or 3 Wire Wye load.

3.5.7 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.



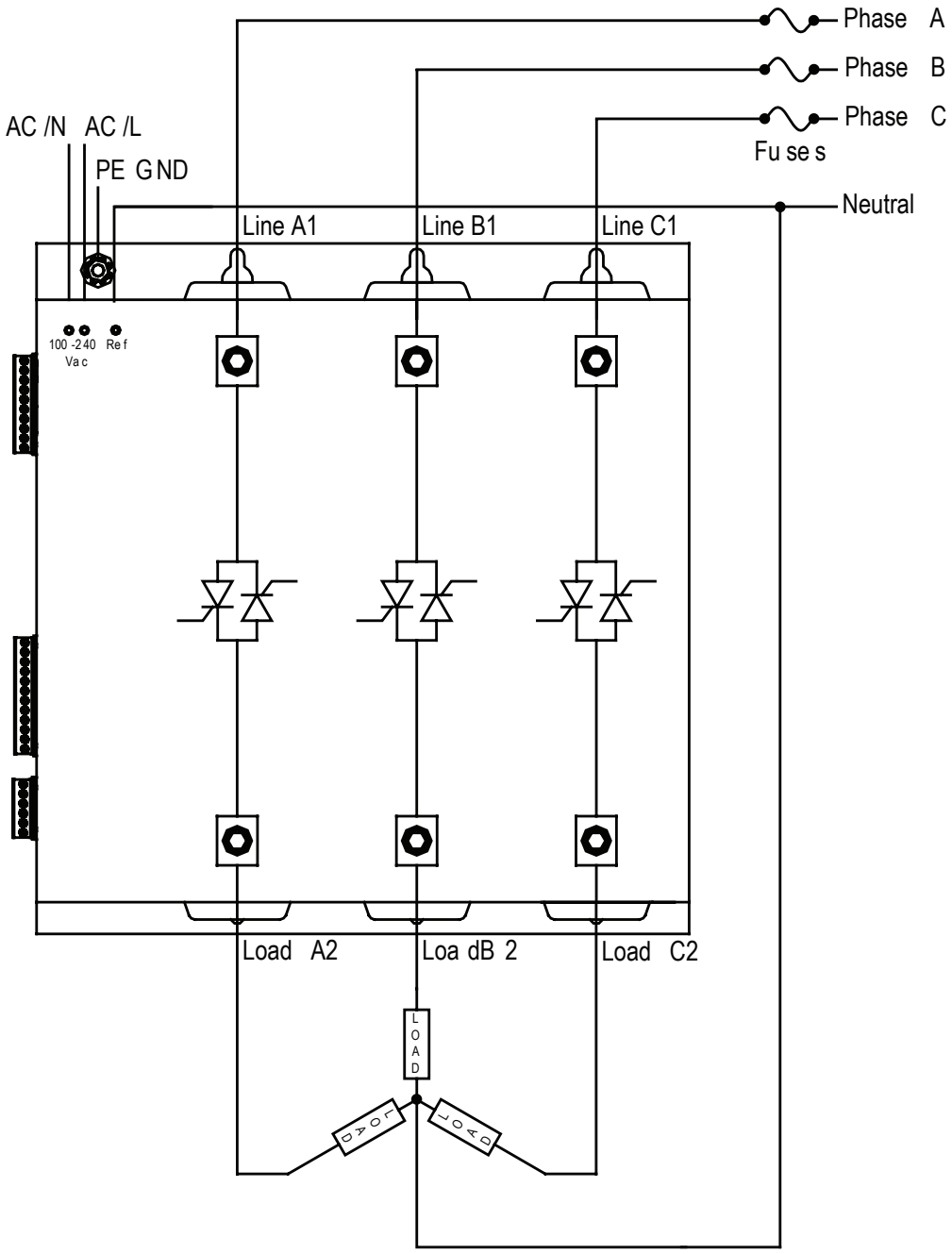
When wiring this controller if must be wired as per the diagram.

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.

3.5.8 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.

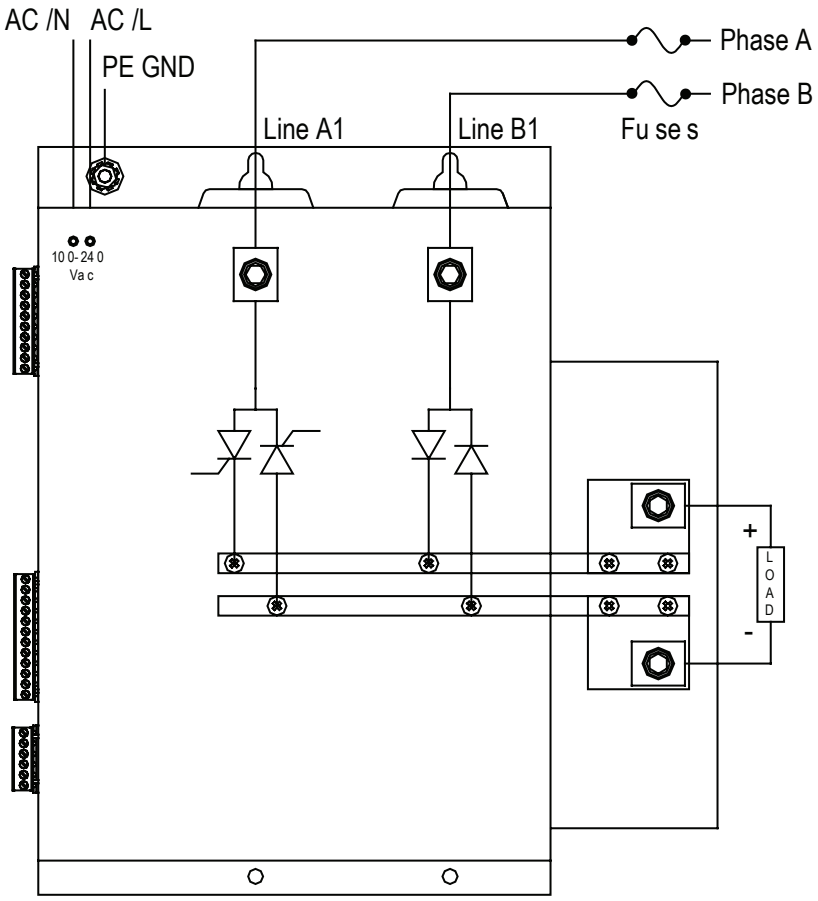
The Fusion controllers normally display line and load voltages from Line to Line. When the controller is in 4 Wire Wye operation the line voltages read Line to Line while the load voltages read Line to Neutral.

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.

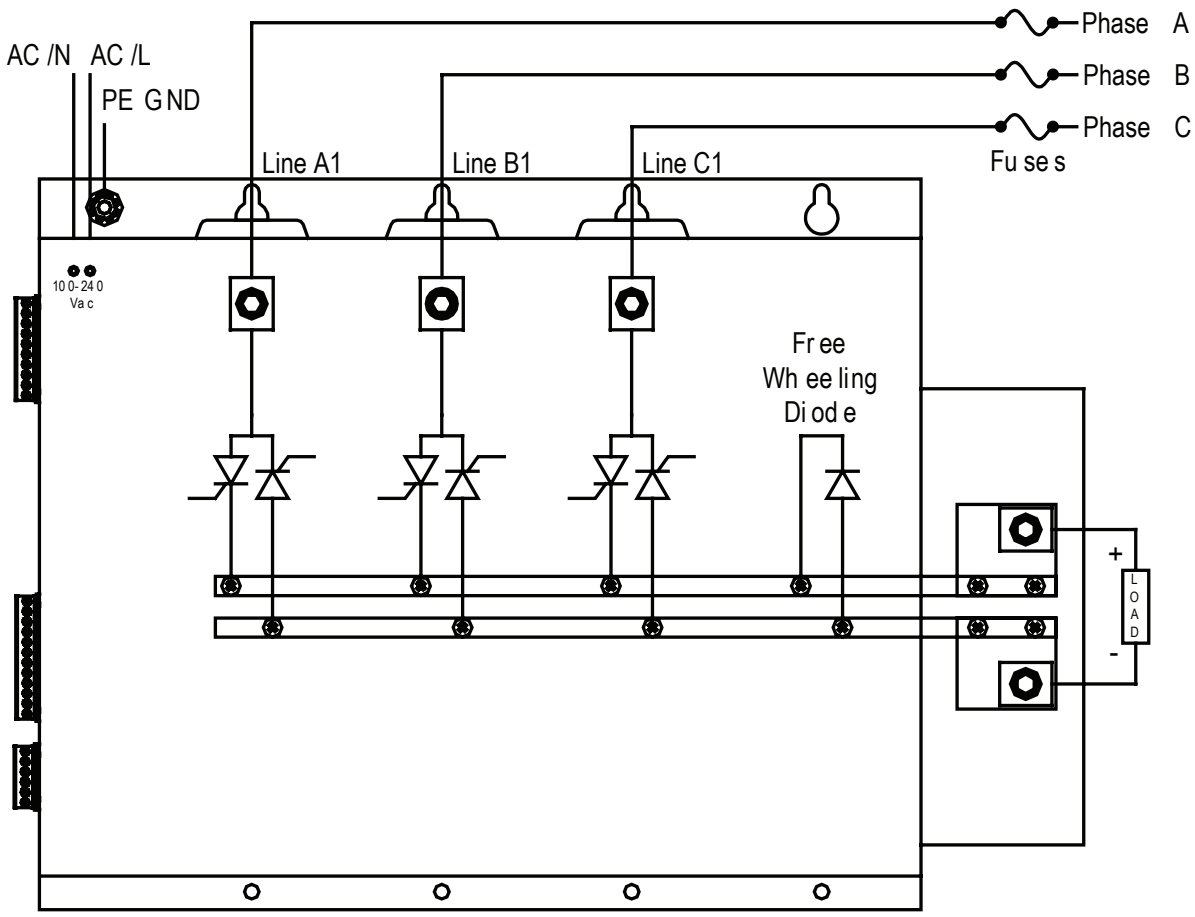
3.6 DC Line / Load Connections

3.6.1 Single Phase - DC



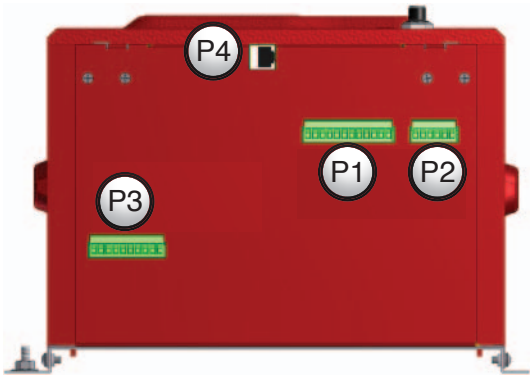
This shows a single phase DC controller connected to a DC load.

3.6.2 Three Phase - DC



This shows a three phase DC controller connected to a DC load.

3.7 Connectors

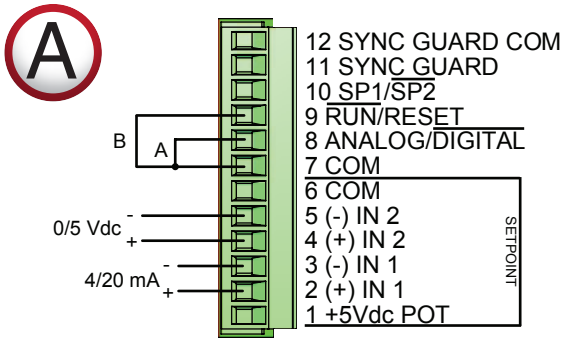


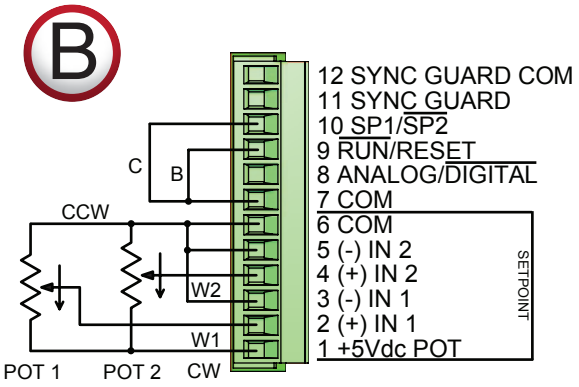
3.7.1 P1-12 Pin Command Connector

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.



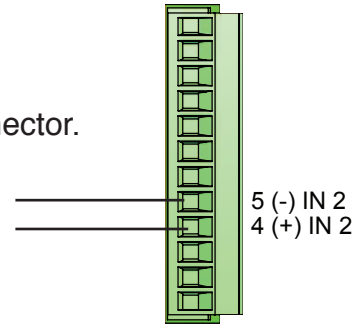


Note: The FUSION power controller has two analog setpoints: SP1 and SP2. On a single zone controller, either can be selected to control this zone. On a 2 zone controller, SP1 is used to control zone 1 and SP2 is used to control zone 2. On controllers with more than 2 zones, a digital interface must be ordered for communication with all zones.

3.6.2 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

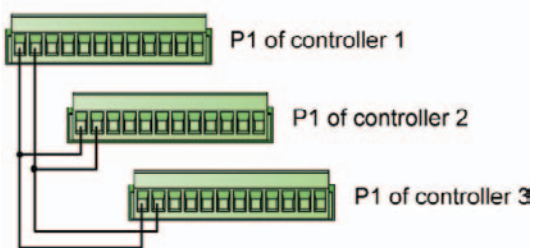


3.7.4 SYNC-GUARD™

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.

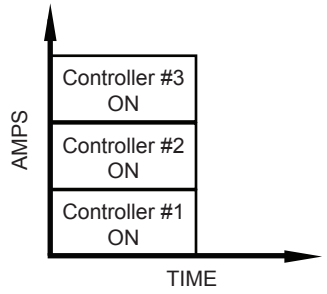
Wiring of controllers for SYNC-GUARD™ feature.



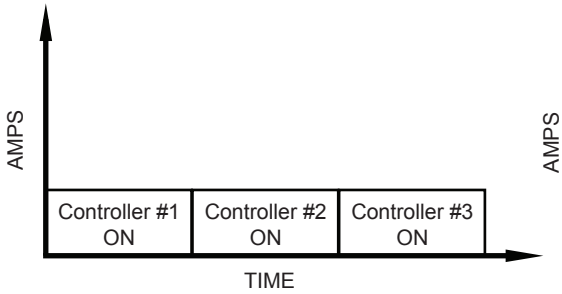
When using this feature, one and only one controller should have the SYNC-GUARD™ resistor enabled via the Fusion Control Panel. See Fusion Control Panel software manual for more details.

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.

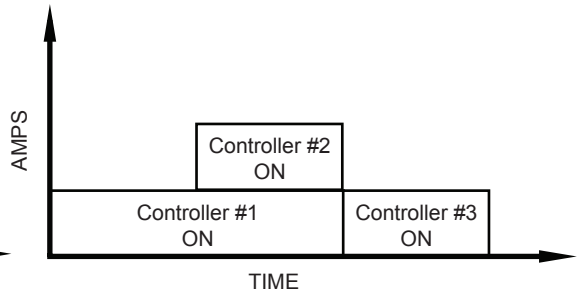
NOTE: A maximum of 10 controllers regardless of the current rating can be connected in this manner.



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



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

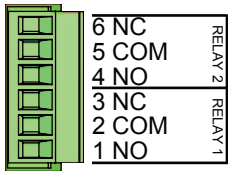


Three controllers with Sync-Guard™, two providing 33.3% power and one providing 66.6% power.

3.7.3 P2 - 6 Pin Command Connector

There are two Form C contacts with a rated switching current of 8 A at 250 Vac and 5 A at 30 Vdc

Both Relay 1 and Relay 2 can be set up for zero, one or more alarms using the FUSION Control Panel Software. Both relays can have the same alarms. By default, Current Trip and Heatsink Over Temp are mapped to Relay 1, and Shorted SCR and Heatsink Warning Temp are mapped to Relay 2



The following alarms are available:

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.	Low Output	Digital Enable	In “Run” State
Run Enable			

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 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.

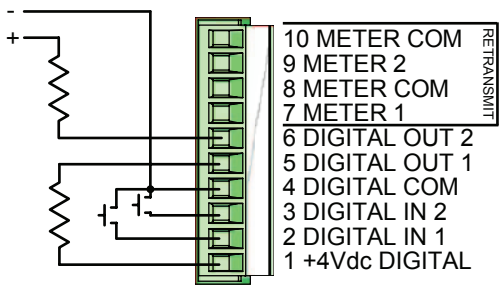
Digital Inputs (x2):
Dry contact 0.4 mA to circuit common
Open collector TTL to circuit common, pull up to 5 Vdc through a 10KΩ resistor

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

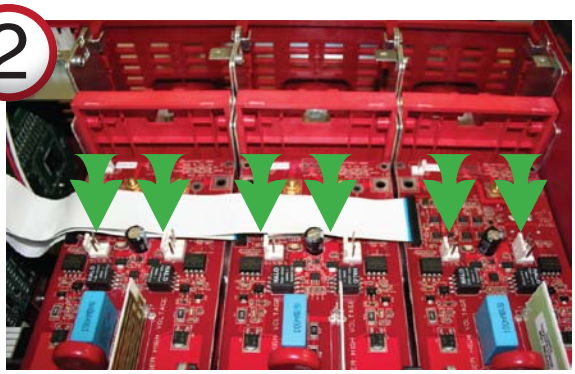
The internal wiring from an Inside Delta to a Delta or 3 Wire Wye load can be easily done in the field. First the line power and the control power must be OFF. Use a screw driver to remove all of the lids. There are four boards connected together, a Control board and three Gate Driver boards. It is important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

1

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. Save the wire harness for future use. Connectors to be removed are marked with green arrows.

2



For 50-400 Amp models the silk screen next to the connectors will read P4 (2 pin) & P7 (3 pin). For 500-1200 Amp models the silk screen will read P6 (2 pin) & P7 (3 pin).

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. The wires closest to the flat flex cables will be red/black. To wire the load refer to the Three Phase - Three Leg section of this manual.

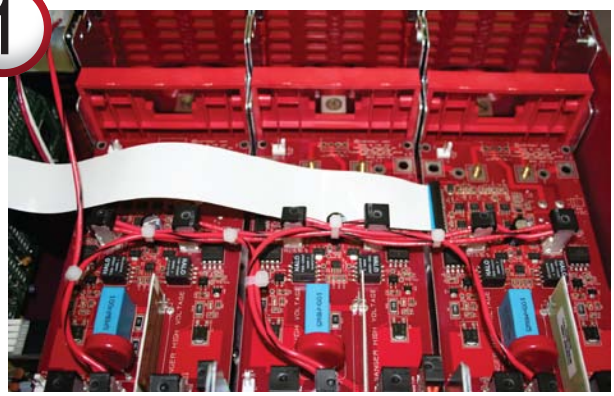
3

NOTE: Delta loads and 3 Wire Wye loads use the same wire harness. After changing wire harness, change the Three Phase Load Config (SP 80) in the FUSION control panel software.

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

STEP 1

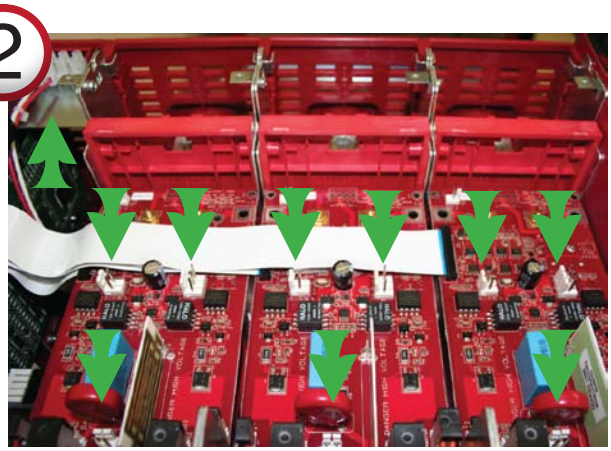
The internal wiring from a 4 Wire Wye to a Delta or 3 Wire Wye load can be easily done in the field. First the line power and the control power must be OFF. Use a screw driver to remove all of the lids. There are four boards connected together, a Control board and three Gate Driver boards. It is important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



STEP 2

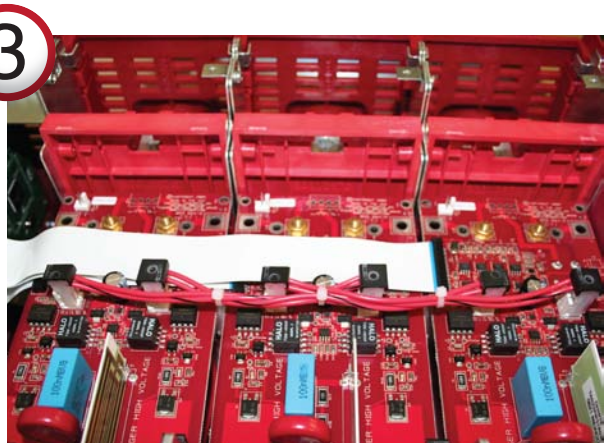
Gently remove the 4 Wire Wye wire harness from the top of Gate Driver boards by simply pulling up on the connectors. Do not pull on wires. Save the wire harness for future use. Connectors to be removed are marked with green arrows. The Ref wire on the terminal block will also need to be disconnected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

For 50-400 Amp models the silk screen next to the connectors will read P4 (2 pin) & P7 (3 pin). For 500-1200 Amp models the silk screen will read P6 (2 pin) & P7 (3 pin).



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. The wires closest to the flat flex cables will be red/black. To wire the load refer to the Three Phase - Three Leg section of the manual.



NOTE: Delta loads and 3 Wire Wye loads use the same wire harness. After changing wire harness, change the Three Phase Load Config (SP 80) in the FUSION control panel software.