

PowerLogic™

AccuSine EVC+

Installation Manual

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Safety Information

Important information



Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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Chapter 1 Safety Precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462, or applicable local standards.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Do not exceed the device's ratings for maximum limits.
- Ground equipment using the ground connecting point provided before turning on any power supplying this device.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- After removing power, wait for 15 minutes to allow the capacitors to discharge prior to opening the doors or removing covers.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Carefully inspect the interior for tools left behind before closing and sealing the door.
- Verify the rating of the neutral conductor for each unit in the system is greater than the neutral current limit setting.

Failure to follow these instructions will result in death or serious injury.

WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords at first use to help prevent unauthorized access to device settings and information.
- Disable unused ports/services and default accounts, where possible, to minimize pathways for malicious attacks.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cyber security best practices (for example, least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, interruption of services, or unintended operation.
- Restrict unit access to authorized personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Chapter 2 Introduction

EVC+

Electronic VAR control (EVC) are static power electronic products that employ digital logic and IGBT semiconductors to synthesize a current waveform that is injected into the electrical network to cancel load induced poor displacement power factor (DPF), phase current unbalance, and flicker. DPF correction can be provided for either leading (capacitive) or lagging (inductive) loads that cause poor DPF. Mains current balancing is achieved by measuring the negative sequence current present and injecting the inverse negative sequence currents to balance the current for the network. Flicker control is provided by rapid detection and injection of reactive current (VARs) to prevent the reactive current from over loading the network that causes rapid voltage deviations identified as flicker.

EVC also have the ability to monitor the network voltage on which they are connected and determine the proper amount of VARs to either raise the network voltage or lower it. EVC will inject leading VARs to raise the voltage and lagging VARs to lower the voltage. Entry of appropriate parameters will keep the network within its stated voltage tolerance level.

Additionally, EVC+ has the ability to cancel harmonic currents caused by nonlinear loads in a similar operating model to AHF to a limited capacity, focusing on dominant lower order harmonic frequencies 5th, 7th, 11th, and 13th. By injecting the synthesized current, network harmonic currents are greatly mitigated, thus reducing the heating effects of harmonic current and reducing voltage distortion.

Chapter 3 Receiving, Handling, and Storing

Receiving

Inspect the EVC+ for any damage as soon as it is received. Transfer of the equipment to a carrier at any manufacturing plant or other shipping point constitutes delivery to the purchaser. Title and all risk of loss or damage in transit shall pass to the purchaser at that time, regardless of freight payment.

Inspection

- Check that all packages and/or crates have been delivered and that the equipment has not been damaged in transit.
- In the event of damaged or missing items, contact the carrier immediately. Check with them for time limits for filing claims and any documentation required such as a Bill of Lading number, etc.
- Goods, whether sent freight pre-paid or not, are shipped at the consignee's risk.
- Damaged or missing items are the responsibility of the carrier and must be reported.
- Check that the information shown on the equipment nameplates corresponds with the order specifications.
- The packaging material should be replaced to protect the unit until installation has begun.

Handling

WARNING

HAZARD OF PERSONAL INJURY

- Use proper lifting equipment such as an overhead crane to handle the EVC+.
- Do not lay the equipment on its front.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Make sure that the proper equipment such as an overhead crane is available at the installation site to handle the EVC+. This equipment will help avoid injury to personnel and damage to the EVC+.

Verify the lifting capacity of the equipment being used to handle the EVC+ in accordance with the shipping weight of each shipping section.

NOTICE

RISK OF EQUIPMENT DAMAGE

For UL Type 1 models, use lifting eye-bolts provided on the unit to remove it from the shipping crate. Do not lift the unit by its ends.

Failure to follow this instruction can result in equipment damage.

Storing

If the EVC+ is not to be installed when unpacked, it should be stored indoors in a clean, dry place. The storage temperature must be between -20 °C (-4 °F) and 60 °C (140 °F) with a maximum relative humidity of 85%, non-condensing, and a maximum dewpoint of 37 °C. It is preferable to store the unit in its original shipping container to protect the unit from potential damage.

Chapter 4 Installation

This chapter provides the information required to properly install the EVC+ and associated equipment for proper operation and performance. Frequently, commissioning difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. Read and understand all instructions in this manual prior to installation.

Correct installation of the EVC+ is essential for proper operation of all components. Study the associated instruction books and all drawings carefully.

The location chosen for installation should provide working clearances complying with the appropriate section of the National Electrical Code® (NEC®), the Canadian Electrical Code (CEC), or applicable local standards.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462, or applicable local standards.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Do not exceed the device's ratings for maximum limits.
- Ground equipment using the ground connecting point provided before turning on any power supplying this device.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Do not stand on any part of the EVC+.
- After removing power, wait for 15 minutes to allow the capacitors to discharge prior to opening the doors or removing covers.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Carefully inspect the interior for tools left behind before closing and sealing the door.

Failure to follow these instructions will result in death or serious injury.

The following is a summary of the steps for installation covered in this chapter:

1. Make sure that the line voltage is compatible with the voltage rating of the EVC+.
2. Make sure that the foundation is prepared for the EVC+.
3. Make sure that environmental requirements are satisfied.
4. Refer to the dimensional drawings for the EVC+ to be installed.
5. Mount the unit in the desired location.

6. Make the electrical connections.
7. Make the CT to CT board connection.
8. Set up parallel communication if applicable.
9. Make the control wiring connections, but do not energize the EVC+ yet.

NOTE: Commissioning and energizing the EVC+ requires specialized knowledge. Pre-commissioning procedures are covered in “Pre-Commissioning” on page 47. Commissioning procedures are covered in the User Manual. Commission the EVC+ and energize it only if you are qualified to do so.

Foundation Preparation

The mounting location must be able to support the weight of the unit without sagging.

Installation

For optimum performance in harmonic mitigation mode, adhere to the following recommendations:

- All harmonic generating loads must have a minimum 3% line reactor or 3% DC choke installed.
- Notch depth: 20%, Notch area (AN): 22,800 V μ s @ 400 V as per IEEE 519-2014, Annex C.
- No capacitors downstream of the Main CTs.

NOTICE

RISK OF EQUIPMENT DAMAGE

Adhere to DC choke, SCR based rectifier, and capacitor placement requirements.

Failure to follow this instruction can result in equipment damage.

If these recommendations are not followed, the target harmonic level may not be met and equipment damage can occur.

Environmental Requirements

The EVC+ units are designed for indoor use only. They require unrestricted exchange of environmental air to the inside of the enclosure for proper cooling. Make sure that the environment meets pollution degree 2, it does not contain conductive particles, significant amounts of dust, or corrosive or otherwise harmful gases. Normally only non-conductive pollution occurs. Temporary conductivity caused by condensation is to be expected.

NOTICE

RISK OF EQUIPMENT DAMAGE

Ensure that the installation location satisfies environmental requirements.

Failure to follow this instruction can result in equipment damage.

If environmental requirements are not adhered to, malfunction and possible destruction of the EVC+ may occur.

The EVC+ generates significant heat during operation. For cooling system design, a 2 kW heat load should be used per unit installed. Make sure that the room where the EVC+ is mounted has adequate ventilation. Maintain ambient temperature between 0 °C (32 °F) and 45 °C (113 °F) with a maximum relative humidity of 95%, non-condensing, and a maximum dewpoint of 37 °C.

The operating temperatures are maximum and minimum levels the unit is designed to operate within. Operating above or below these levels will result in the unit either shutting down or reduced performance. The upper or lower limit should not be used as ideal room temperature levels. System reliability and product life expectancy will improve if temperature levels are maintained between 20 °C (68 °F) and 30 °C (86 °F).

Physical Description

Physical Description

EVC+	Kvar Rating		Mounting Style	Cable Entry	Weight (kg)	Air Flow (m³/h)	Exterior Dimensions H x W x D (mm)
IP00	75	100	Vertical	Bottom	95	912	1260 x 440 x 264
IP20	75	100	Wall	Bottom	95	912	1260 x 440 x 280
UL Type 1	75	100	Wall	Bottom	106	912	1740 x 440 x 280
IP21	75	100	Wall	Bottom	159	912	1684 x 542 x 375
IP31/UL Type 2	75	100	Wall	Bottom	159	912	1684 x 542 x 375

NOTE: Mass information is approximate and subject to change without notice.

Physical Installation

The EVC+ can be provided as a Wall Mount IP20 and UL Type 1, Rack Mount IP20 or Open/IP00 chassis unit.

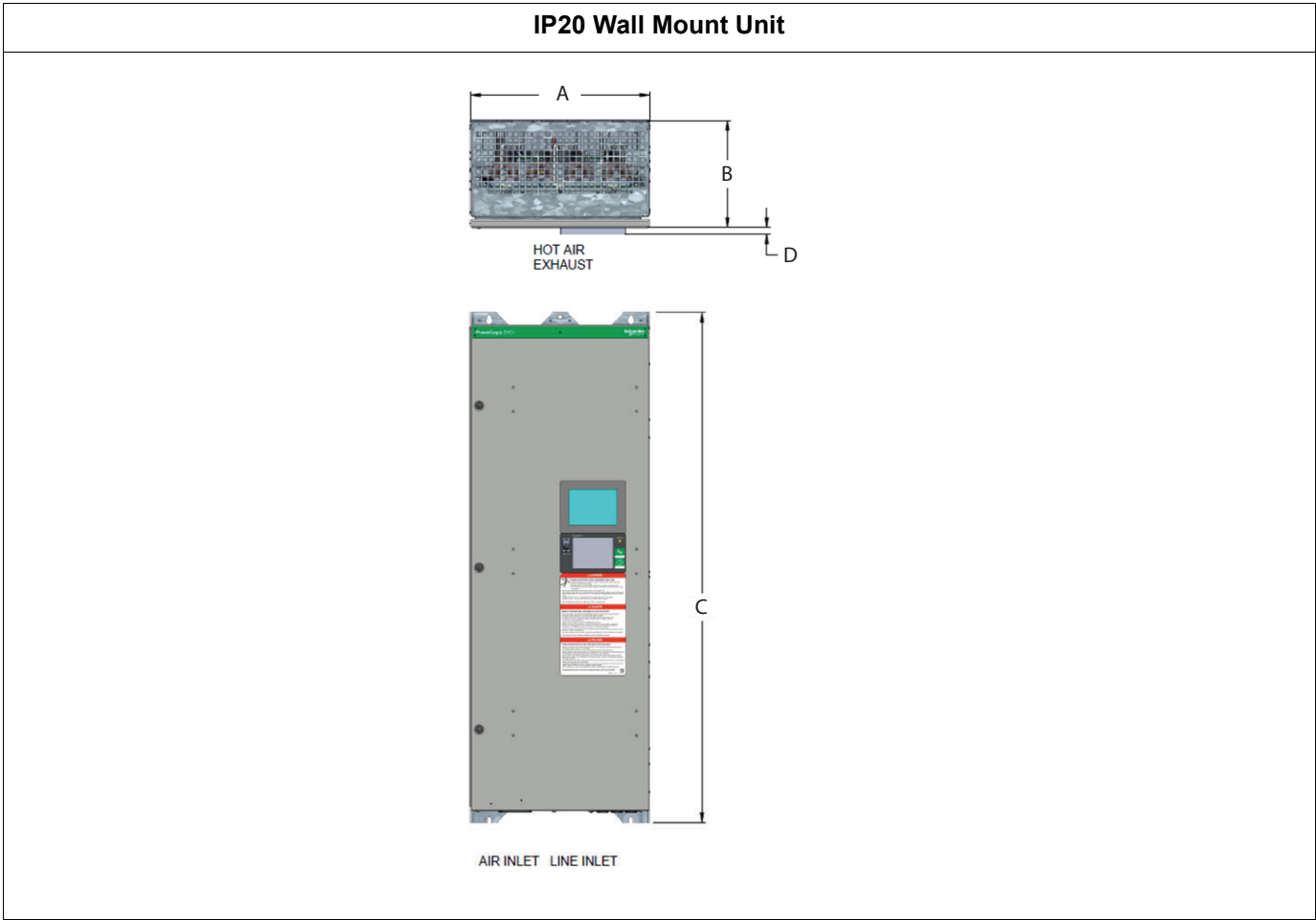
Physical Installation

Enclosure Type	IP00	IP20	UL1	IP31	UL2	IP21
Enclosure provided	No	Yes	Yes	Yes	Yes	Yes
Standard Compliance: UL 508	Yes	No	Yes	Yes	Yes	Yes
Standard Compliance: IEC 60529	Yes	Yes	Yes	Yes	Yes	Yes
Unrestricted air exchange, protection against contact with enclosed parts, protection against limited amount of falling dirt.	No	Yes	Yes	Yes	Yes	Yes
Protection against foreign bodies with diameter listed	No	Yes > 12.5 mm	Yes > 12.5 mm	Yes > 2.5 mm	Yes > 2.5 mm	Yes > 2.5 mm
Protection against touch	No	Yes	Yes	Yes	Yes	Yes
Protection against dust	No	No	No	No	No	No
Protection against dripping water and external condensation of non-corrosive liquids	No	No	No	Yes	Yes	Yes
Protection against water from all directions	No	No	No	No	No	No

NOTE: This list indicates minimum requirements. Complete description of the requirements are provided in the standards referenced in this list.

Dimensional Drawings

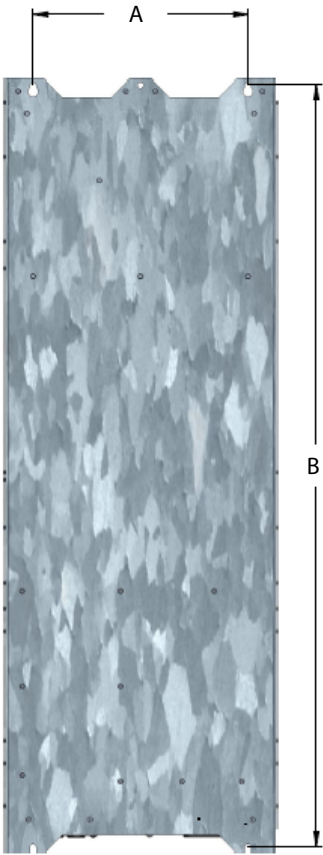
Refer to the drawings on the following pages for dimensions of the EVC+ to be installed.



Dimension	mm	Inches
A	440	17 3/8
B	264	10 3/8
C	1260	49 5/8
D	16	5/8

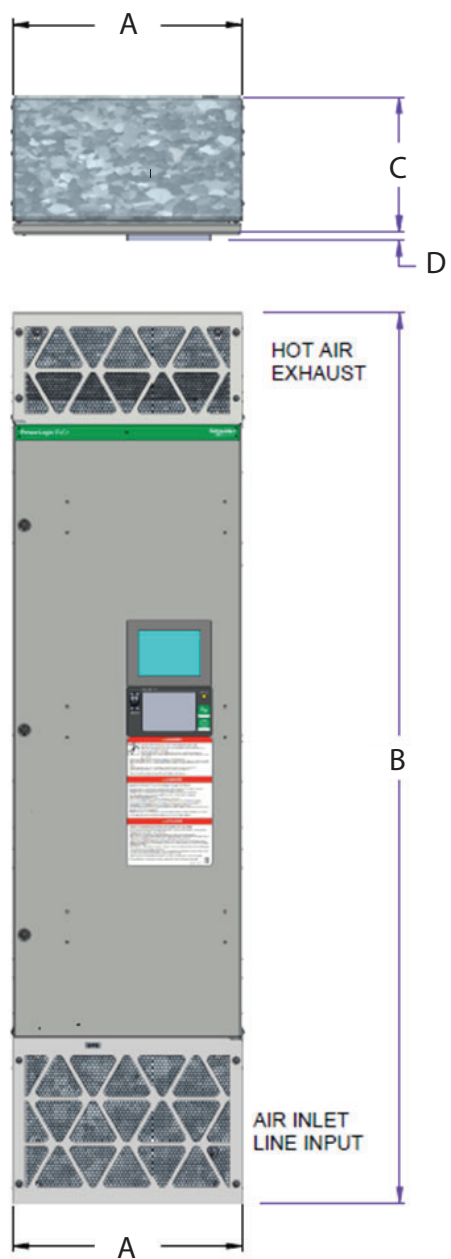
200 mm (7 7/8 inches) Clearance top and bottom
No side clearance required

IP20 Wall Mount Hole Dimensions



Dimension	mm	Inches
A	350	13 3/4
B	1240	48 7/8

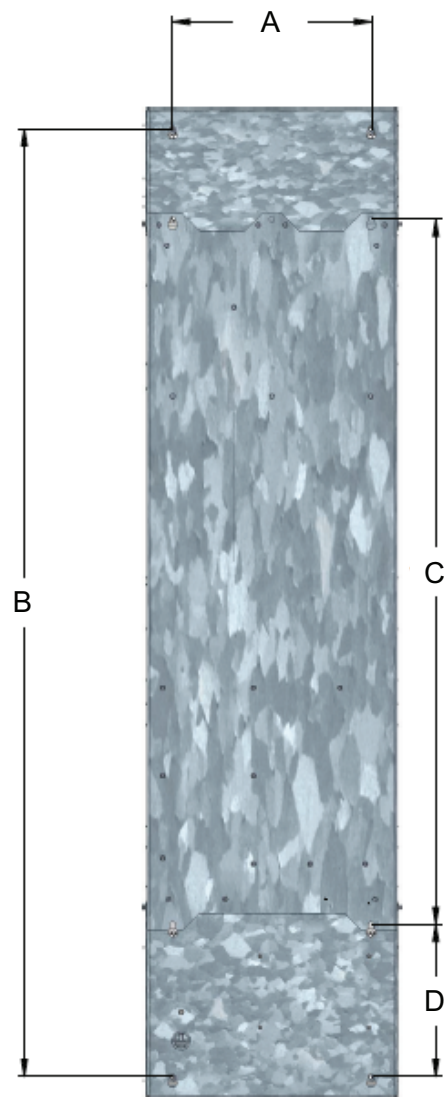
UL Type 1 Wall Mount Dimensions



Dimension	mm	Inches
A	445	17 1/2
B	1739	68 1/2
C	262	10 3/8
D	18	3/4

No clearances required

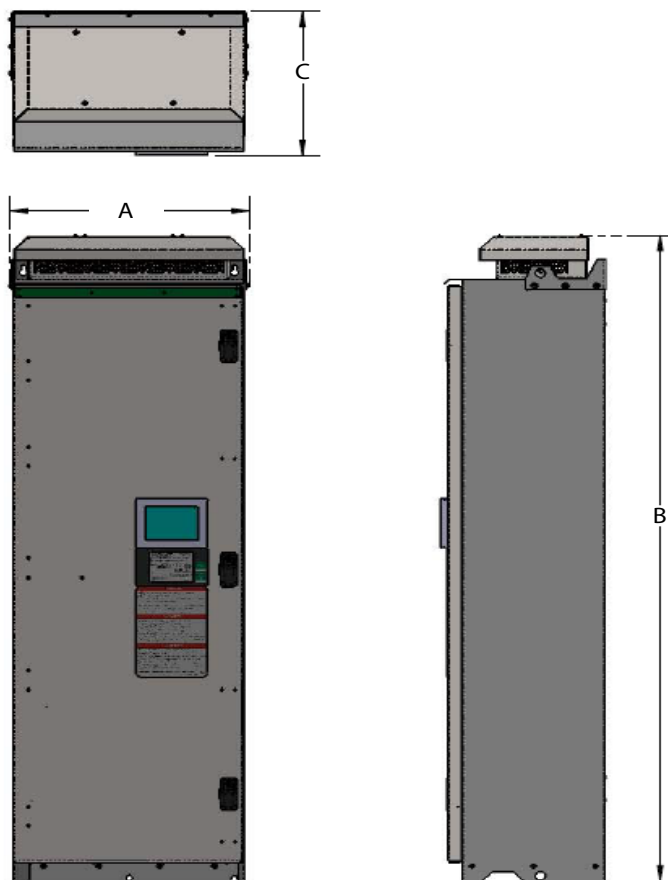
UL Type 1 Mounting Hole Location



Dimension	mm	Inches
A	350	13 3/4
B	1667	65 5/8
C	1240	48 7/8
D	268	10 5/8

When installing the unit in locations that experience vibration or that require additional mounting holes, it is recommended to use the chassis mounting hole. See page 22.

IP31 & UL2 Wall Mount

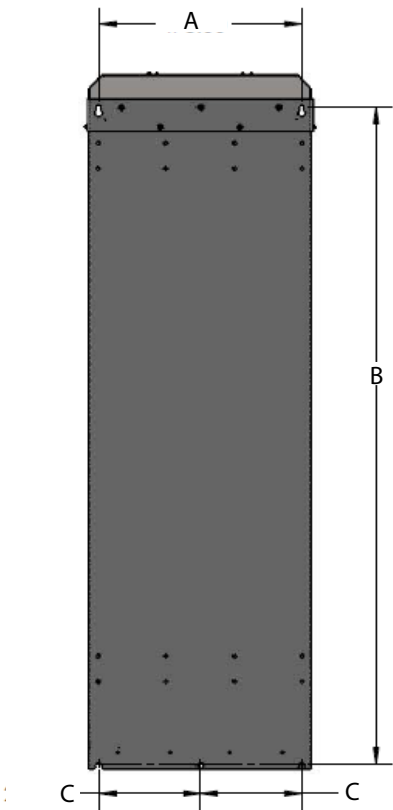


Dimension	mm	Inches
A	542	21 3/8
B	1685	66 3/8
C	375.5	14 3/4

200 mm (7 7/8 inches) bottom clearance required

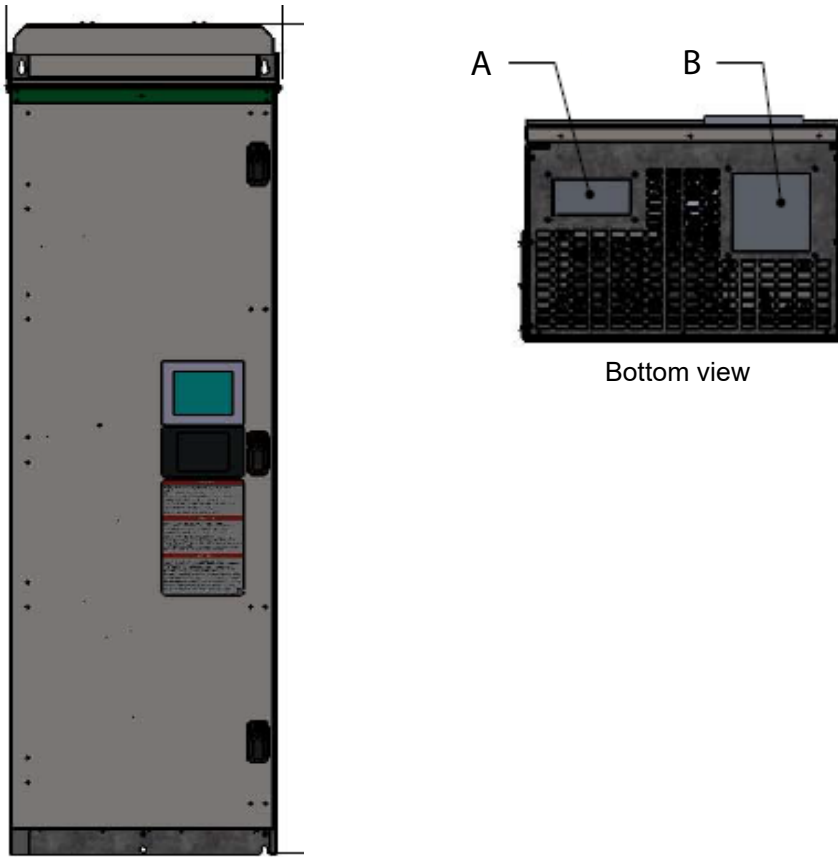
No top or side clearance requirement

IP31 & UL2 Wall Mount Hole Dimensions



Dimension	mm	Inches
A	478.5	17 7/8
B	1593	62 3/4
C	239.25	9 1/2

IP31 & UL2 Wall Mount Unit



Dimension	mm	Inches
A	60 X 100	2 ¼ X 4
B	100 X 100	4 X 4

The bottom of the unit has two aluminium gland plates. The 100 mm (4") x 100 mm (4") plate (B above) is for AC power and ground cable entry. The 60 mm (2 ¼") x 100 mm (4") plate (A above) is for CT and communications wiring. Remove both gland plates and punch holes to the appropriate size for the application.

Electrical Connection

Line Voltage

EVC+ has an input voltage range between 208...480 V.

Circuit Breaker and Manual Disconnect Selection

A dedicated over-current protection device, circuit breaker, or fuse disconnect is required for this product. The over-current protection device must be rated for at least 125% of the unit rating.

EVC+	Voltage (V)	Breaker Rating (A)
75 kVAR	208–415	150
	440–480	120
100 kVAR	208–415	200
	440–480	150

The inrush current does not exceed the unit rating. Circuit breaker settings such as Long Time Pickup, Long Time Delay, and Short Time Pickup can be set for minimum inrush current.

It is recommended that the over-current protection device and associated unit have labels applied for identification purposes.

Residual Current Device

Direct current can be introduced in the protective ground conductor of the AccuSine. If a Residual Current Device (RCD/GFCI) or a Residual Current Monitor (RCM) is used for additional protection against direct or indirect contact, the following specific types must be used:

- RCD/GFCI Type B only
- Time Delay setting at 100 mS or greater.
- In parallel systems provide one RCD/GFCI per unit.
- RCM must be approved for use with frequency inverters and is sensitive to all types of current.

NOTICE

INAPPROPRIATE TRIPPING OF PROTECTION DEVICE

Adhere to RCD/GFCI or RCM requirements.

Failure to follow this instruction can result in a reduction in performance of the EVC+.

Due to high leakage current in standard operation, it is recommended to choose at least a 500 mA device. If the installation requires a residual current device less than 500 mA, the IT/BP switch must be opened (see Chapter 6 for IT/BP operation).

Power and Ground Cable Selection and Connections

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- The unit must be properly grounded before power is applied.
- Ground equipment using the ground connecting point provided.

Failure to follow these instructions will result in death or serious injury.

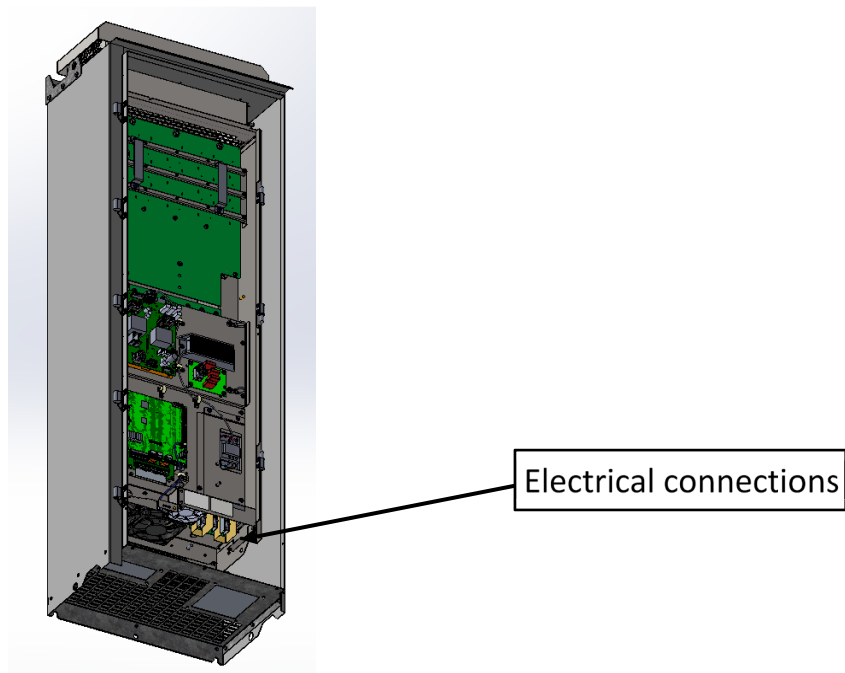
All power cables must comply with all national and local electrical code. The outside diameter of the power and PE cables cannot exceed 19 mm. Installation of parallel power cabling is not supported.

When used as a harmonic current compensation device, the EVC+ produces currents at frequencies that are multiples of the AC line fundamental frequency. Power cables as well as input disconnect devices should be rated at 125% of the EVC+ rated current. This helps avoid excessive heating from any skin effect resistance increase at these higher frequencies.

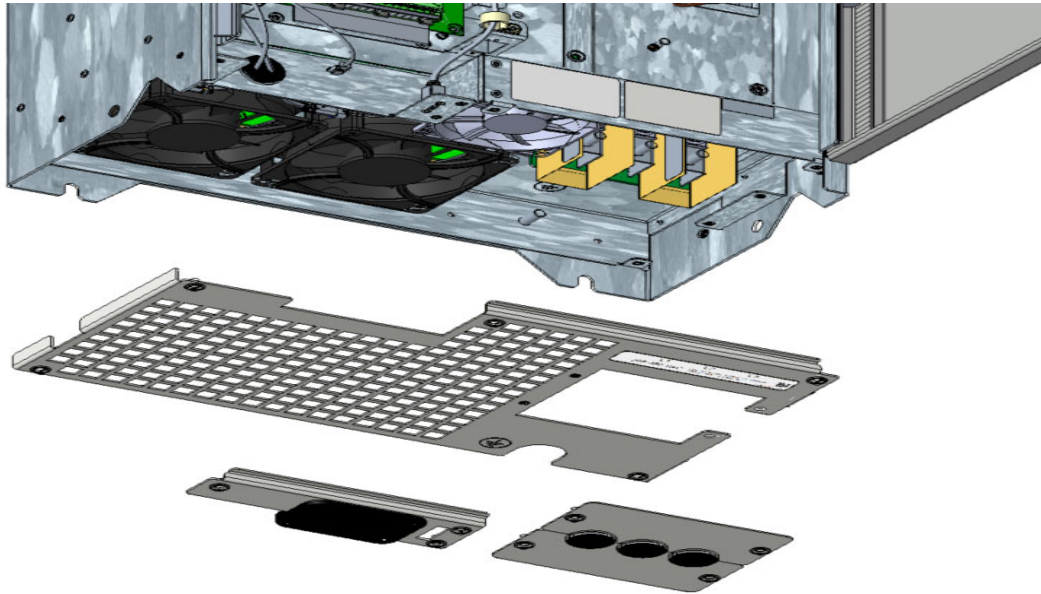
NOTE: Check national and local codes and regulations to make sure of the compliance.

To access the electric connection, open the outer door and interior chassis door.

Electrical Connections



IP20 Electrical Connection Access



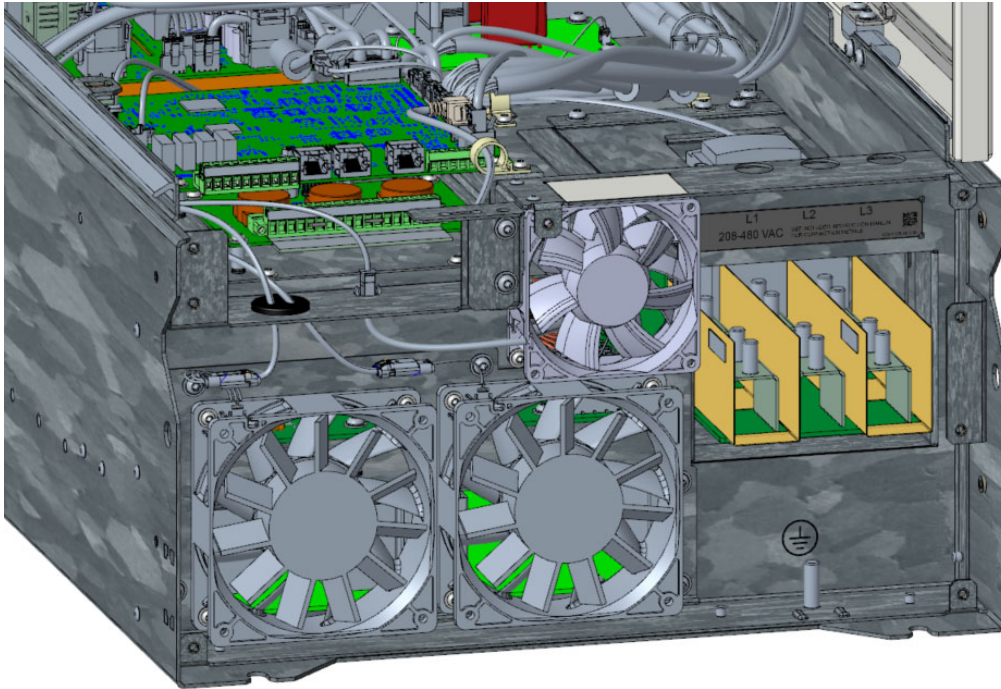
Follow the procedure to access the electrical connections.

- Open front door.
- At the bottom of the unit, air inlet, remove access panes.
- Using a T30 driver open the service door.
- At the bottom of the unit using a T25 driver remove the air intake grill and power cable cover.
- Using a punch or similar, create a hole in the grommet just large enough to allow the line, ground and neutral (if required) wires to pass through the grommet.
- Pass one cable through each of the grommets.
- Connect an appropriate one-hole crimp lug on the end of each wire for an 8 mm stud.
- Reinstall the power cable cover using the T25 hardware. Make sure that the grommets are properly seated.

Access the line input remove the air inlet grill and on the front cover. Punch a hole in the air inlet box to allow for power cables. An additional hole will be required for CT wiring and communications wiring. Be sure to thoroughly remove any metallic shaving from the air inlet box prior to energizing the unit.

UL 1 Electrical Connection Access

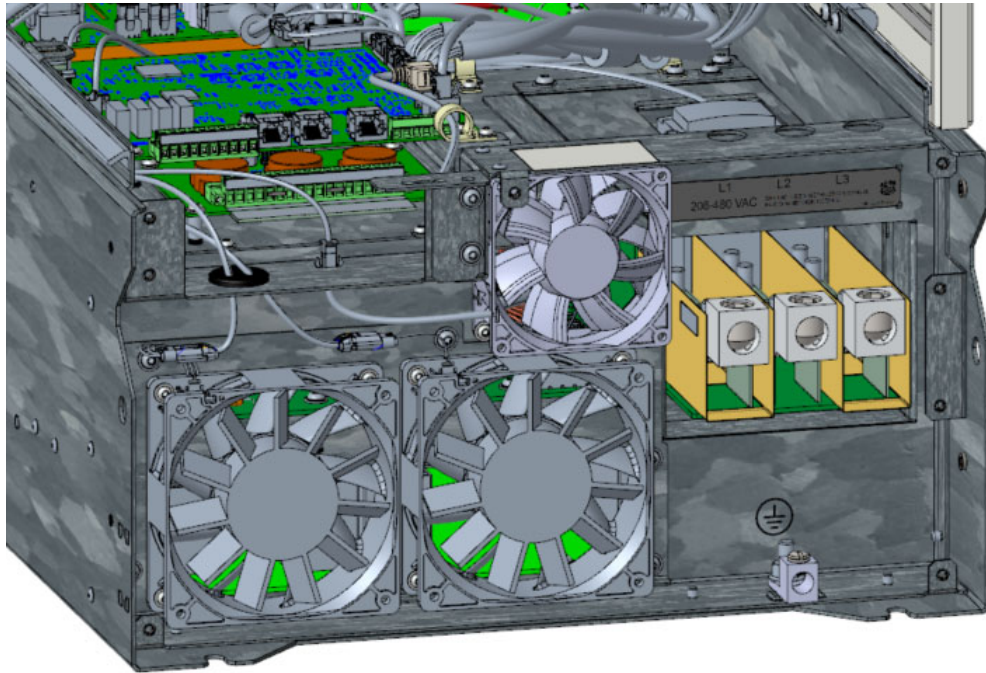


IP20 and IP31 Electrical Connection Access

8 mm Studs are used for the line and ground connections.

Stud size M8

Torque value 18.2 Nm (161 in-lb)

UL1 and UL2 Electrical Connection Access**Phase Lugs**

- Wire Range - 10 mm² – 70 mm² (6 AWG – 3/0)
- Torque - 22.6 Nm (200 in-lbs)

Ground Lug

- Wire Range - 1.5 mm² – 50 mm² (14 – 1/0 AWG)
- Torque - Torque 5.7 Nm (50 in-lbs)

Box lugs are rated for both copper and aluminum wiring.

Current Transformers

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.

Failure to follow these instructions will result in death or serious injury.

Make sure that CT secondary current is not present when wiring the CT secondary connections. The shorting jumpers must be installed at the X1 to X2 OUT of each CT channel on the CT board unless you are connecting an additional Primary parallel unit. Refer to “Source Side CT Position Diagram” on page 35.

General CT Information

The CT must be orientated properly during installation. The orientation is specified in the drawings with an arrow indicating the direction or polarity of the CT. Most CT manufacturers will indicate orientation with a label indicating H1 on one side of the CT or a dot. There can also be a label indicating H2 and/or an arrow on the CT. The H1 side of the CT should always be closest to the power source. If the CT has an orientation arrow, it should point from the source towards the load. See the installation instructions for the specific CTs being installed.

A shorting terminal block or shorting switch with galvanic isolation to the EVC+ for the CT secondary is required. Insert an interposing terminal block in a separate enclosure with the ability to short the secondary wiring of the CT. This provides the ability to short the CT without entering the EVC+ enclosure (which otherwise would require a power shutdown). Shorting terminal blocks are available in the catalog.

CT location is defined in relationship to the EVC+ system. CT location on the “Source Side” indicates that the CTs are physically located upstream of the EVC+. The CTs will measure the improvement to the current as a result of the EVC+ operating. A CT location on the “Load Side” indicates that the CTs are downstream of the EVC+. The CTs will monitor the Load current provided by both the source and EVC+ currents.

Two CTs are required to be installed, one on L1 phase and one on L2 phase of the conductors powering the loads to be compensated by the EVC+ system. If there are any line-to-neutral connected loads downstream of the EVC+ system's main CTs, a third CT is required on L3 phase.

NOTICE

MEASUREMENT ERRORS

CTs must be physically separated from any perpendicular conductor by at least 25 mm (1 inch) for every 1000 A of current flowing through the perpendicular conductor.

Failure to follow this instruction can result in a reduction in performance of the EVC+.

If this practice is not followed, the magnetic field produced by the current flowing on the perpendicular conductor will cause CT measurement errors.

Minimum CT Requirements

The EVC+ uses a minimum of two external current transformers (CTs) to measure load current waveforms. Standard CTs rated for 50/60 Hz or 400 Hz with Type 1 accuracy rating, with a 5 A or 1 A secondary are acceptable. The largest primary rating for the CT is 10,000 A. Any splicing to the CT leads needs to be done with crimp style connectors or soldered.

The CT should be mounted on phases L1 and L2 with the orientation arrow pointing toward the load. Systems that are using two CTs can have the CTs installed on L1 and L3 or L2 and L3 if necessary. If L1 and L3 or, L2 and L3 CT configurations are used, this information must be provided to the qualified person commissioning the unit. Three external CTs are required if line-to-neutral connected loads are present.

NOTICE

REDUCED PERFORMANCE

CT wiring must be routed separately from power cables.

Failure to follow this instruction can result in a reduction in performance.

CT wiring must be routed directly from the conduit entry-plate to the terminal block of the CT board.

CT must be selected for:

- 5 A or 1 A secondary
- 250 to 10,000 primary rating
- 50/60 Hz or 400 Hz Rated
- Type 1 accuracy
- The CT primary current rating must exceed the maximum load current where they are installed;
- The maximum burden (in VA) on the CT is formed by the CT wiring and total EVC+ burden. This is equal to 1.0 VA for CTs with a 5 A secondary rating or 0.04 VA for CTs with a 1 A secondary rating.
- The maximum wire size of the CT secondary is 2.5 mm²/ 12 AWG. Consult the CT manufacturer for secondary wiring recommendations. See "Maximum Wire Length" tables on page 34.

CT secondary wiring must be either twisted and/or shielded pairs.

Do not connect the EVC+ CT to any other loads. Use a separate current transformer if additional uses are required.

Any splicing to the CT leads needs to be done with crimp style connectors or soldered.

X2 of each CT installed must be grounded as close to the CT as possible.

A single EVC+, not operating in parallel, can have the CTs installed either on the source side or load side of the EVC+. Parallel systems must have the main CTs installed on the source side of the EVC+ system.

CT to CT Board Connection

The CT connection is made behind the small customer access panel at the bottom of the EVC+ chassis. Remove the customer access panel. The CT board is located behind and slightly below the control board. This is the location where the EVC+ CT secondary wiring must be terminated. Remove the clear plastic safety cover to access the CT board.

Typically, L1 CT will be connected to CH1 IN. There are two X1 and X2 IN terminals. The second set of IN terminals can be used to connect additional CTs that may be required for site specific conditions. X1 and X2 OUT are used for parallel EVC+ systems.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The factory provided shorting jumpers must be installed at the OUT of the CT board of the last unit with CT secondary wiring connected.

Failure to follow these instructions will result in death or serious injury.

NOTICE

CIRCULATING CURRENTS

When using shielded CT secondary wire, only ground the shield at one end of the cable.

Failure to follow this instruction can result in a reduction in performance.

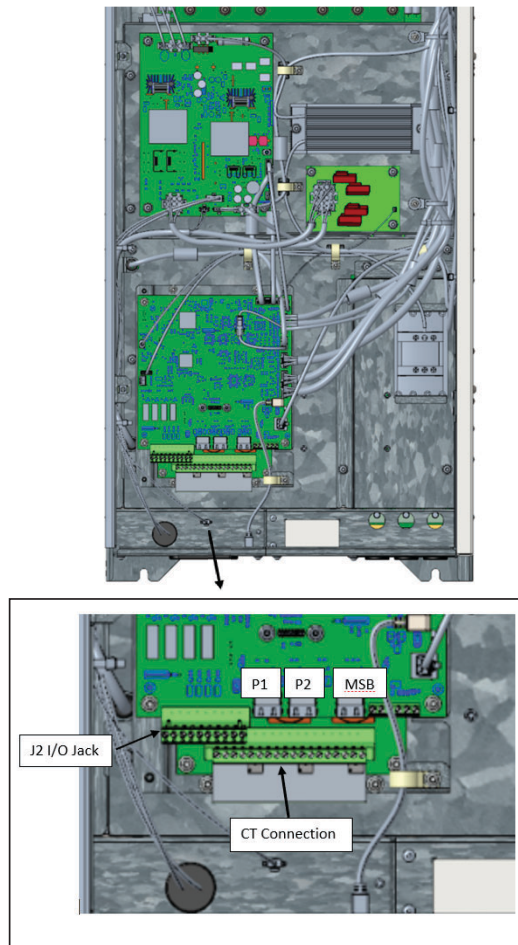
NOTICE

INACCURATE FILTER OPERATION

Do not allow the conductor on which the CT is mounted to become lodged in the joint area of a split-core CT.

Failure to follow this instruction can result in inaccurate filter operation.

Control Board and CT Board Details



The terminal block on the CT board can accept wire sizes of up to 2.5 mm^2 (12 AWG) wire and has a torque specification of $1 \text{ N}\cdot\text{m}$ (9 lb-in).

Maximum Wire Length

5 A Secondary Maximum Wire Length

Maximum wire length between Unit and CT in Meters							
Wire Size		1.5 mm ²			2.5 mm ²		
Number of Connected Units		1	2	3	1	2	3
CT Burden Rating	5 VA	5.9	4.4	2.9	10.1	7.6	5.1
	15 VA	20.6	19.1	17.6	35.4	32.9	30.4
	25 VA	35.3	33.8	32.4	60.8	58.2	55.7
	30 VA	42.5	41	39.5	73	70.5	68
	35 VA	50	48.5	47	86	83.5	81
	45 VA	64.5	63	61.5	111	108.5	106

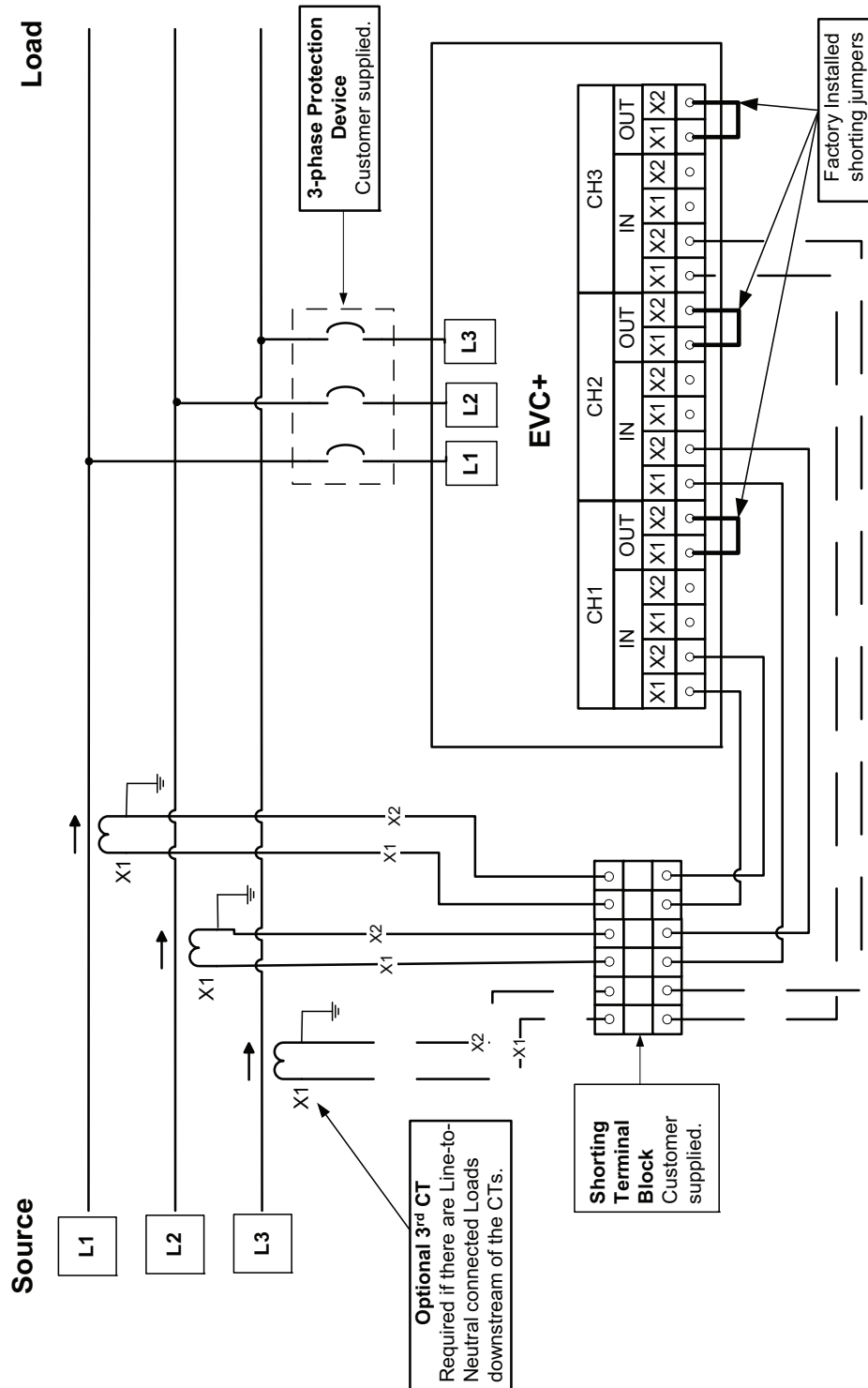
Maximum wire length between Unit to CT in Feet							
Wire Size		14AWG			12AWG		
Number of Connected Units		1	2	3	1	2	3
CT Burden Rating	5 VA	31.5	23.5	15.5	50	37.5	25
	15 VA	110.5	102.5	94.5	176	163.5	150.9
	25 VA	189.5	181.5	173.5	301.5	289	276.5
	30 VA	229	221	213	364.5	352	339.5
	35 VA	268.5	260.5	235	427.5	415	402.5
	45 VA	347.5	339.5	332	553.5	540.5	528

1 Amp Secondary Maximum Wire Length

Maximum wire length between Unit and CT in Meters							
Wire Size		1.5mm ²			2.5mm ²		
Number of Connected Units		1	2	3	1	2	3
CT Burden Rating	5 VA	182	180.5	179	313.5	311	308.5
	15 VA	550	548.5	547	946.5	944	941.5
	25 VA	917.5	916	914.5	1579	1577	1574
	30 VA	1101	1100	1098	1896	1893	1891
	35 VA	1285	1283	1282	2212	2210	2207
	45 VA	1652	1651	1650	2845	2843	2840

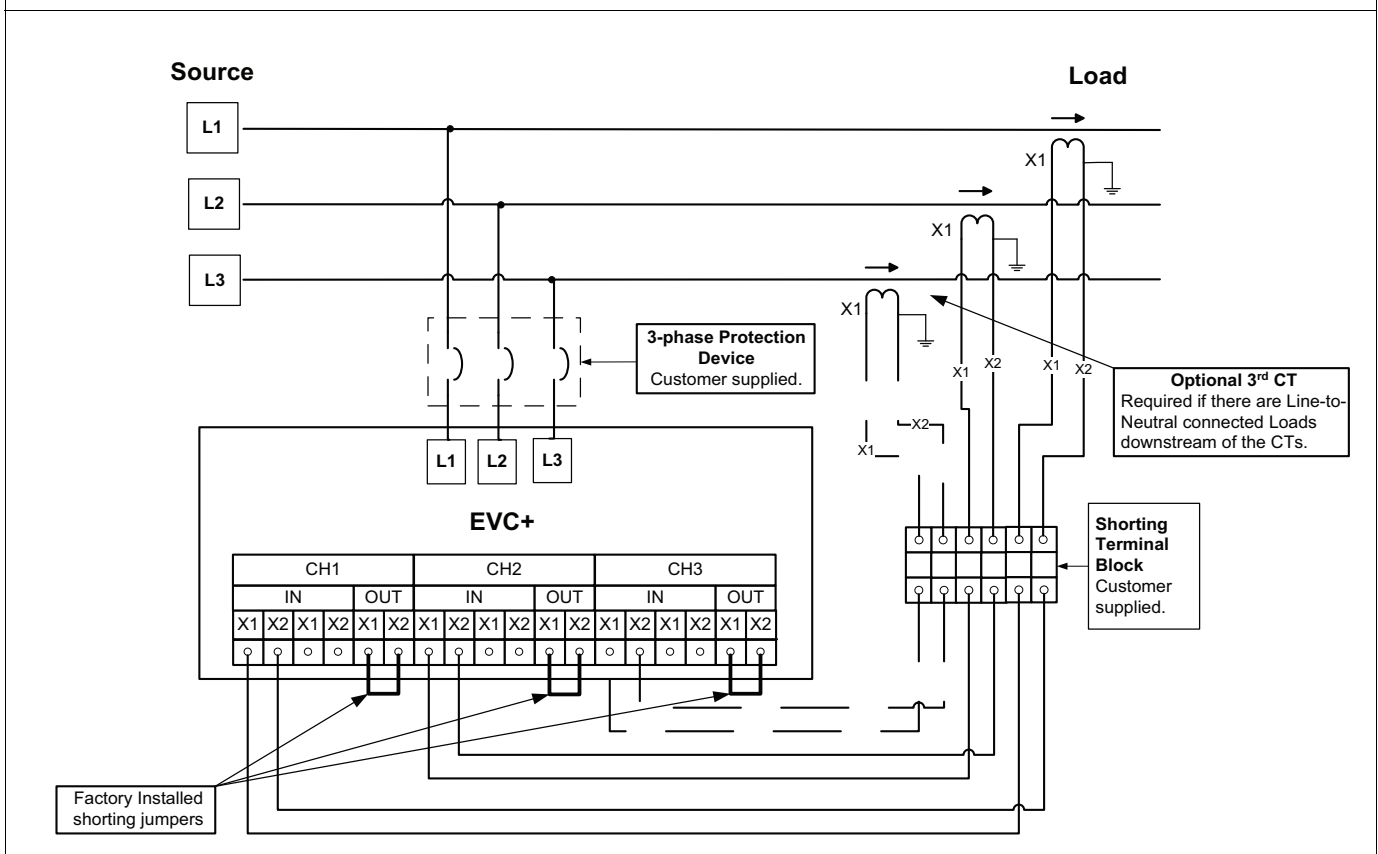
Maximum wire length between Unit to CT in Feet							
Wire Size		14AWG			12AWG		
Number of Connected Units		1	2	3	1	2	3
CT Burden Rating	5 VA	980	972	964	1559	1547	1534
	15 VA	2956	2948	2940	4704	4691	4679
	25 VA	4932	4924	4917	7849	7836	7823
	30 VA	5920	5913	5905	9421	9408	7823
	35 VA	6909	6901	6893	10993	10981	10968
	45 VA	8885	8877	8869	14138	14125	14113

Source Side CT Position Diagram
(CT's installed on the "Source Side" or upstream of the EVC+)



NOTE: The factory installed shorting jumpers must be installed.

Load Side CT Position Diagram



NOTE: The factory installed shorting jumpers must be installed.

Parallel System

Up to 10 EVC+ can be installed in parallel. If more than 10 units in parallel are required, contact the local sales representative for assistance prior to installation.

CT Installation Parallel Units

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

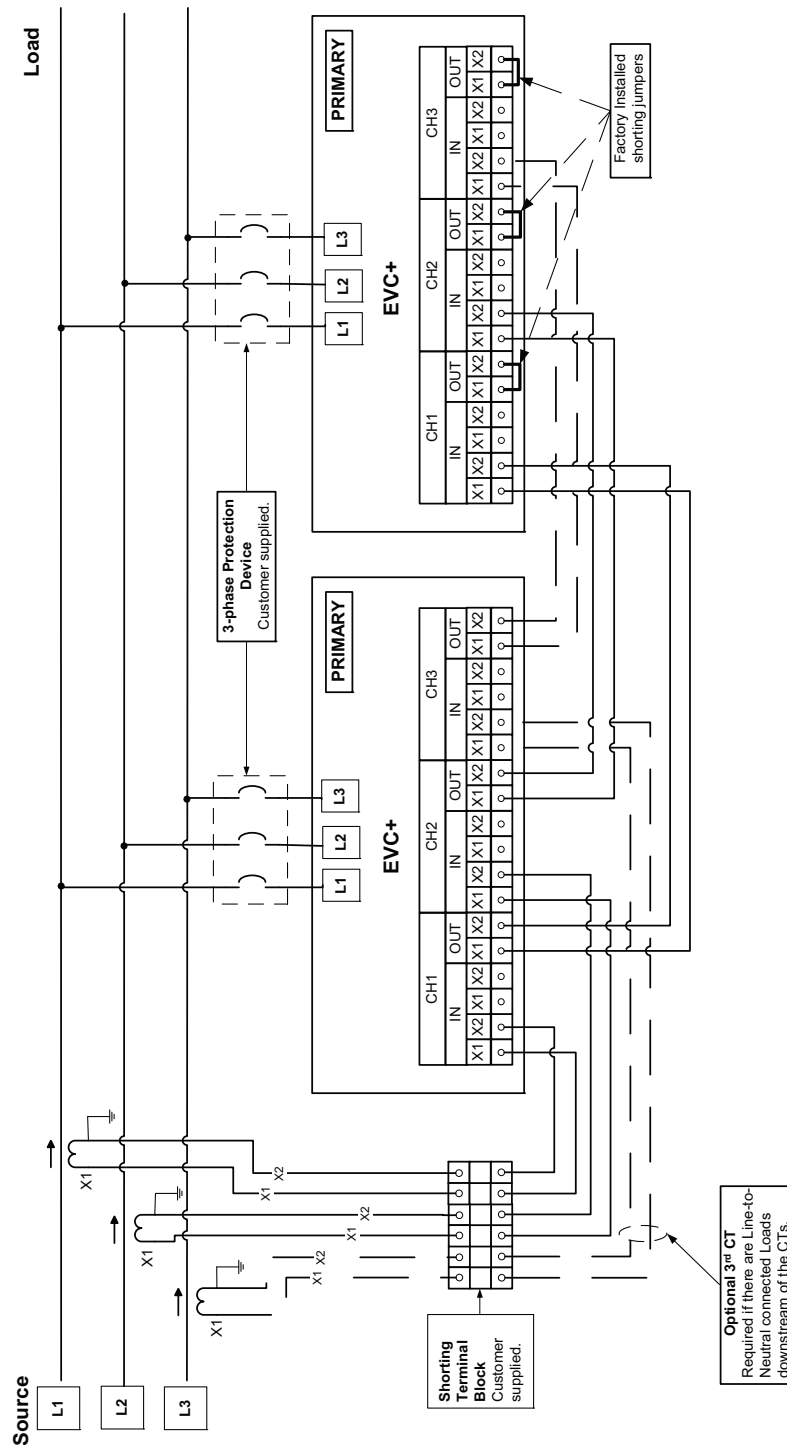
The factory provided shorting jumpers must be installed at the OUT of the CT board of the last unit with CT secondary wiring connected.

Failure to follow these instructions will result in death or serious injury.

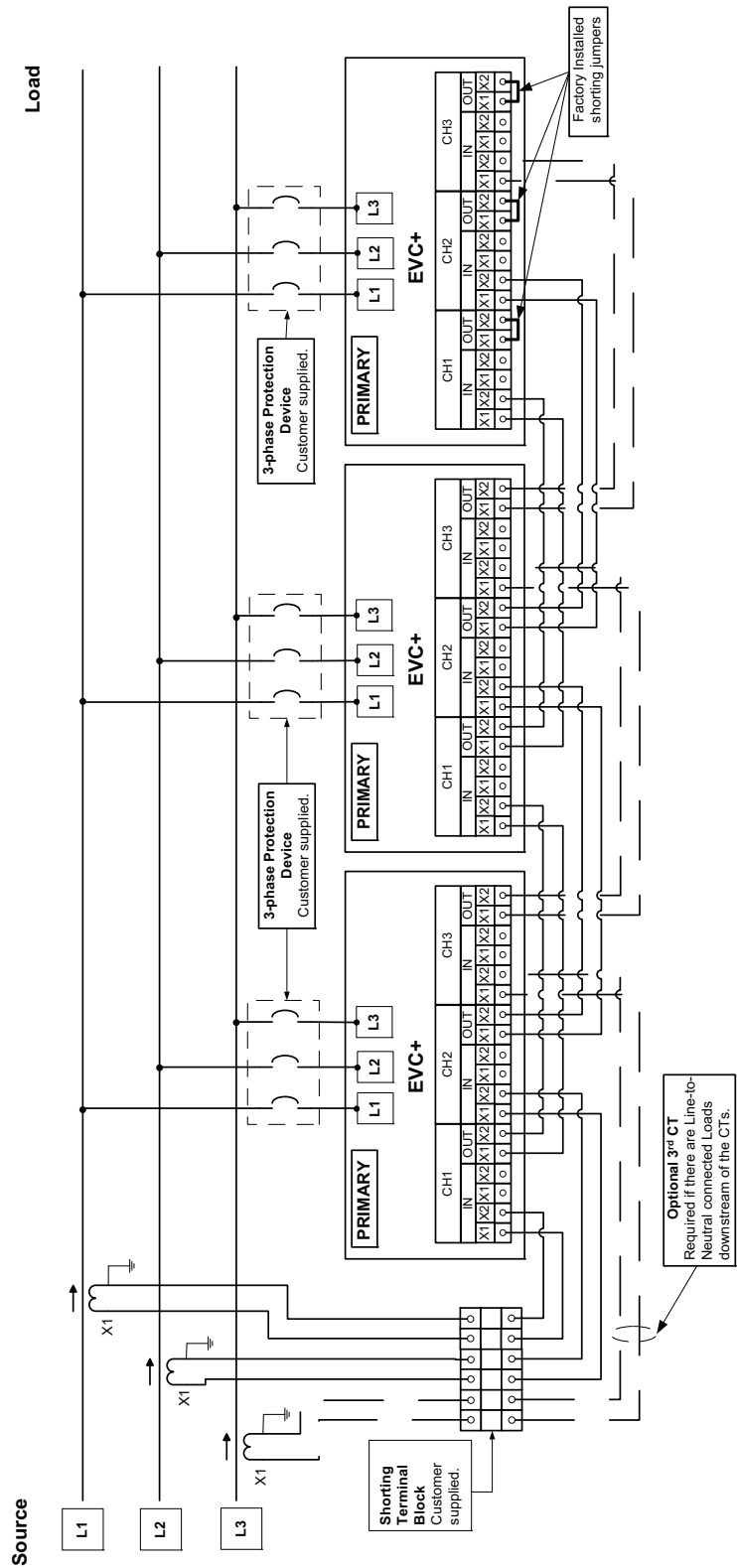
The EVC+ can be set up to be either Primary or Secondary. To be a candidate as a Primary, the unit must be provided with CT secondary wiring to the CT board. See “Control Board and CT Board Details” on page 41. There is no limit to the number of units that can be set up as a Primary candidate. At least two units should be capable of being the Primary in any parallel installation.

The main CTs must be installed on the source side of the EVC+ system. Examples of CT secondary wiring can be seen on the following pages in this section. Refer to “Circuit Breaker and Manual Disconnect Selection” on page 24 for information on circuit breaker and fuses required.

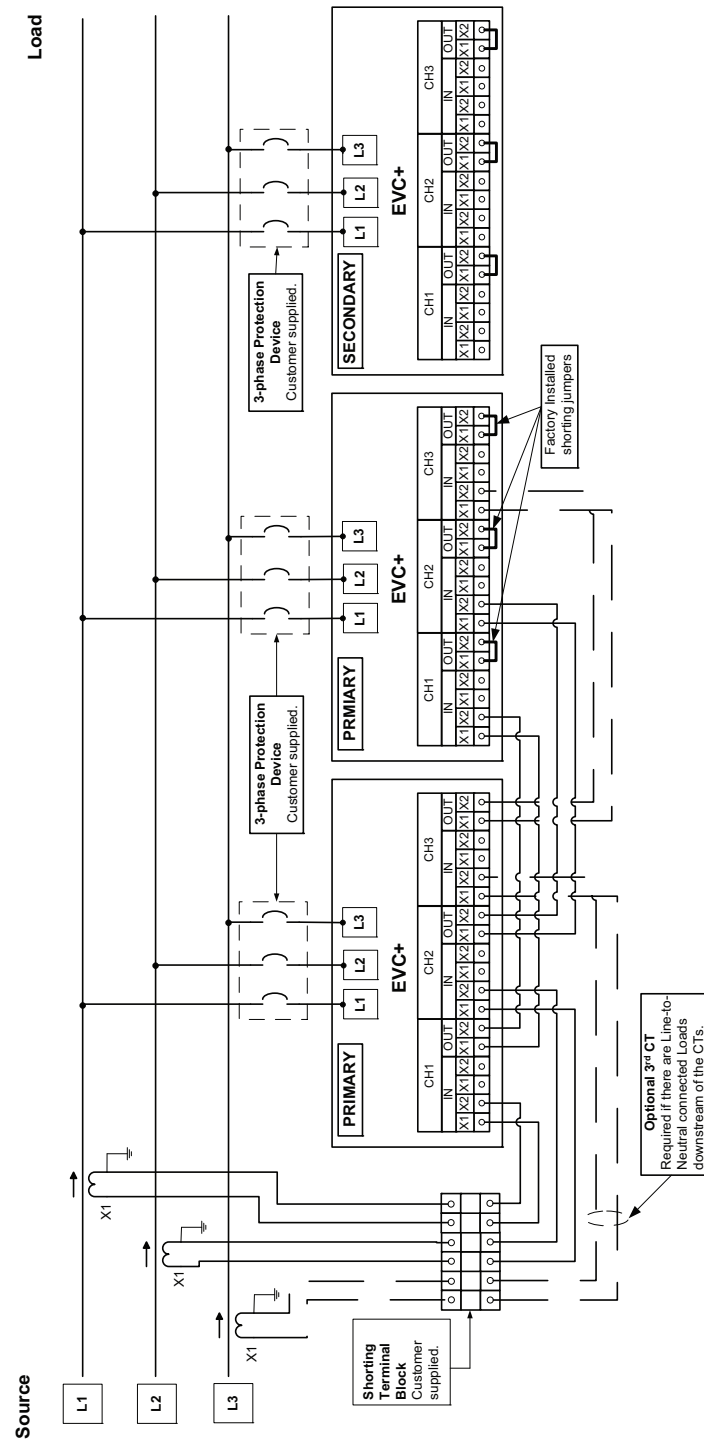
Source Side CT Position Parallel Units Diagram



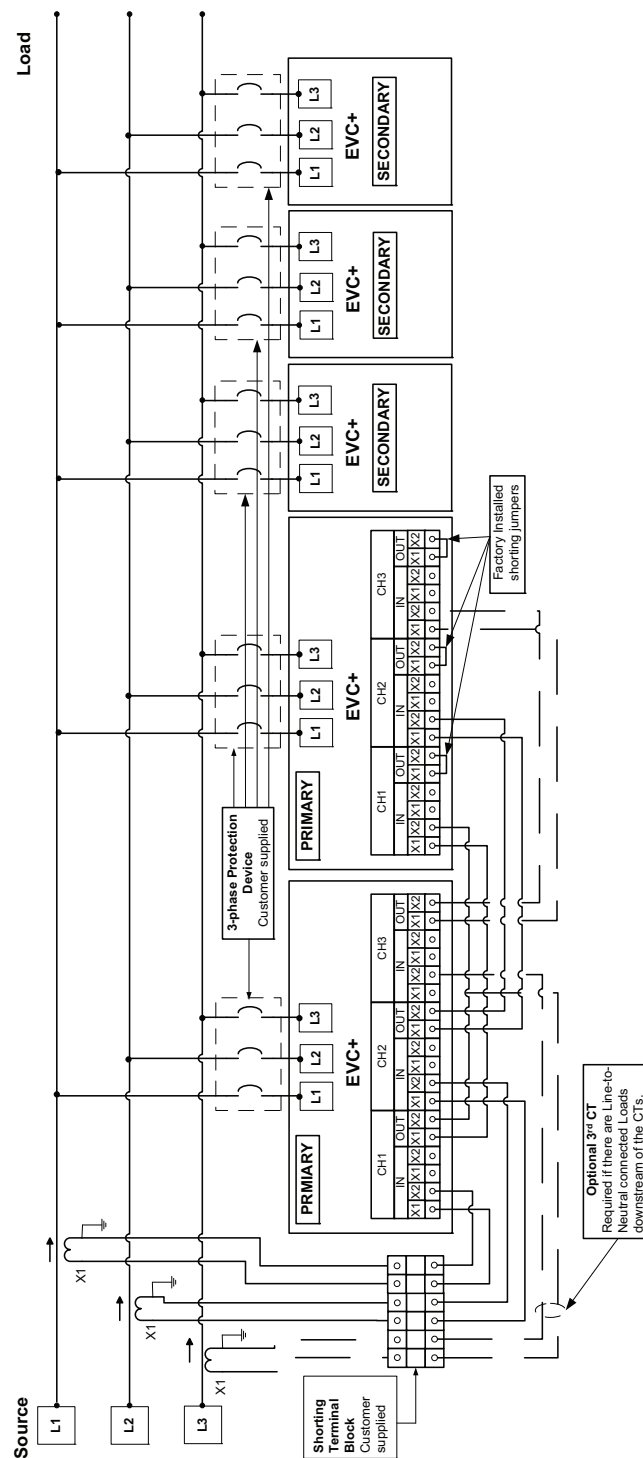
CT Wiring for three Primary



CT Wiring for two Primary and one Secondary



CT Wiring for two Primary and three Secondary



Parallel Communication

For parallel operation, the units communicate through the RJ-45 connectors labeled 1P and 2P on the Control Board. This is a unique communication protocol that is only to be used for parallel communication. The 2P jack has an RJ-45 termination plug installed at the factory.

NOTICE

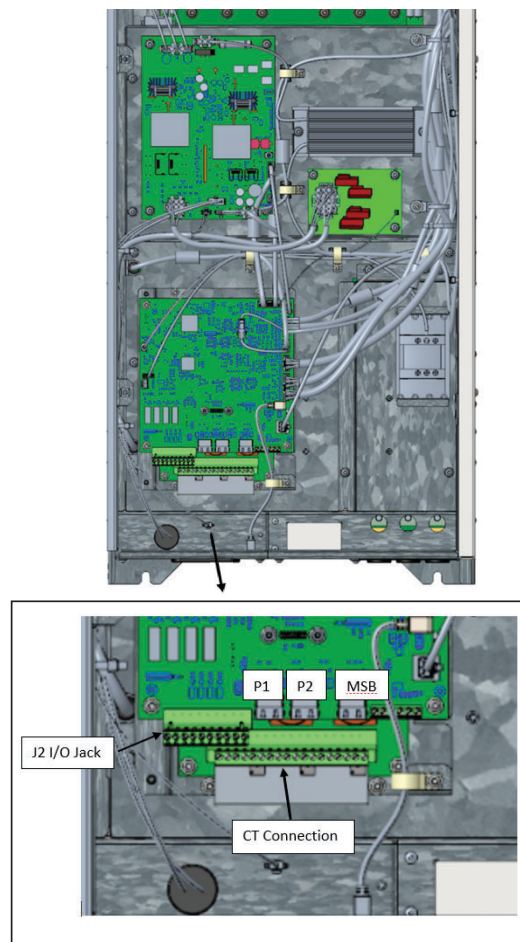
EXCESSIVE NOISE IN THE COMMUNICATION CIRCUIT

When the unit is set to operate in parallel mode, the termination plug must be installed in any RJ-45 jacks that are not used for parallel communication wiring. See the wiring diagrams in this section.

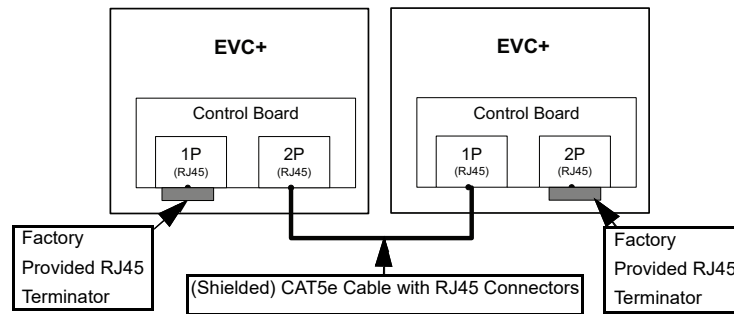
Failure to follow this instruction can result in communication errors.

CAT5e cable with all eight conductors terminated at the RJ-45 connections is required for parallel communication. It is recommended that shielded Cat5e cable be used. Make sure that the total cable length does not exceed 76 meters (250 feet). The CAT5e cable with RJ-45 plugs can be purchased as an option. Refer to the catalog for optional paralleling cable part numbers.

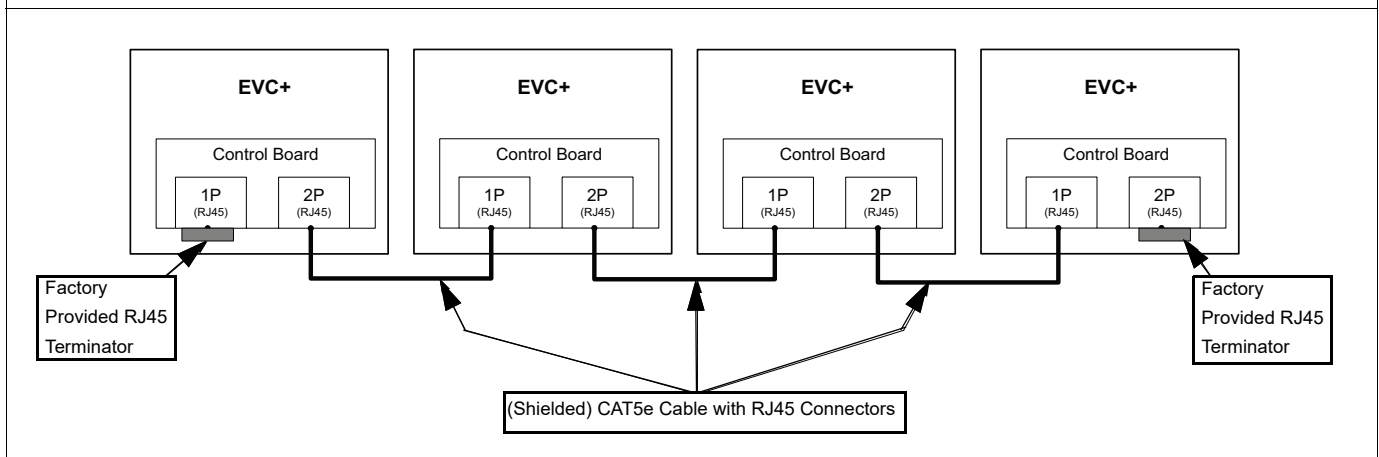
Control Board and CT Board Details



Two Unit Parallel Communication Wiring Diagram



Four Unit Parallel Communication Wiring Diagram



Control Wiring

Dry Contact output

Four dry Contact outputs are available at J2 of the Control Board. See “Control Board and CT Board Details” on page 41. One common and four switchable outputs are available labeled Q1 to Q4. The four outputs can be programmed to change states on different conditions by the HMI and be set to either normally open or normally closed. See the User Manual for setting the output contacts. Maximum voltage accepted is 250 Vac or 30 Vdc with a 0.5 A maximum current per Dry Contact.

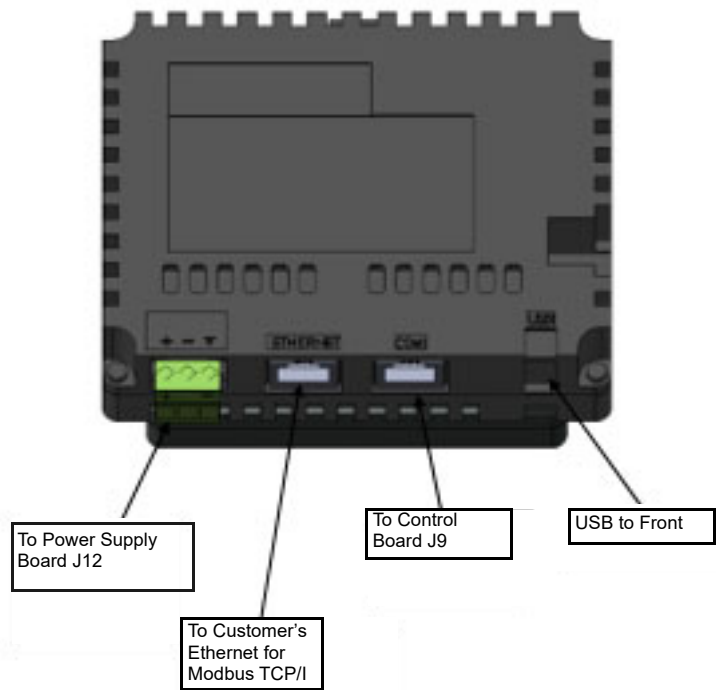
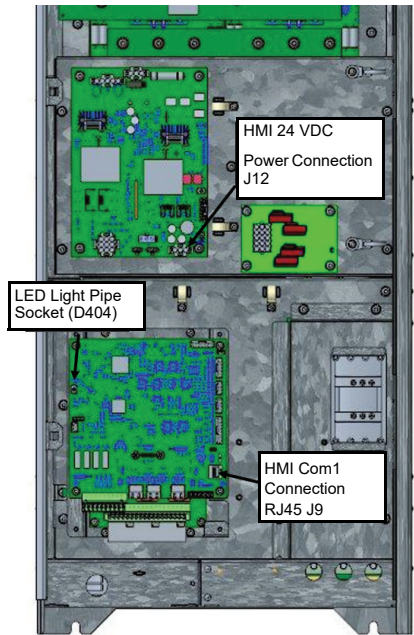
Digital Input Control

Four input controls are available at J2 of the Control Board. See “Control Board and CT Board Details” on page 41. One Ground and four inputs labeled I1 to I4. The inputs are at 5 Vdc and are grounded to activate. The control function can be programmed by the HMI. See the User Manual for setting the functionality of the input control.

Modbus TCP/IP

Modbus TCP/IP monitoring is available at the RJ-45 jack on the back of the HMI labeled **ETHERNET**.

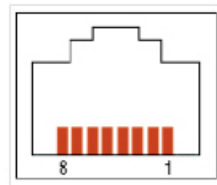
Chassis to HMI/Front Panel Connections



Modbus Serial

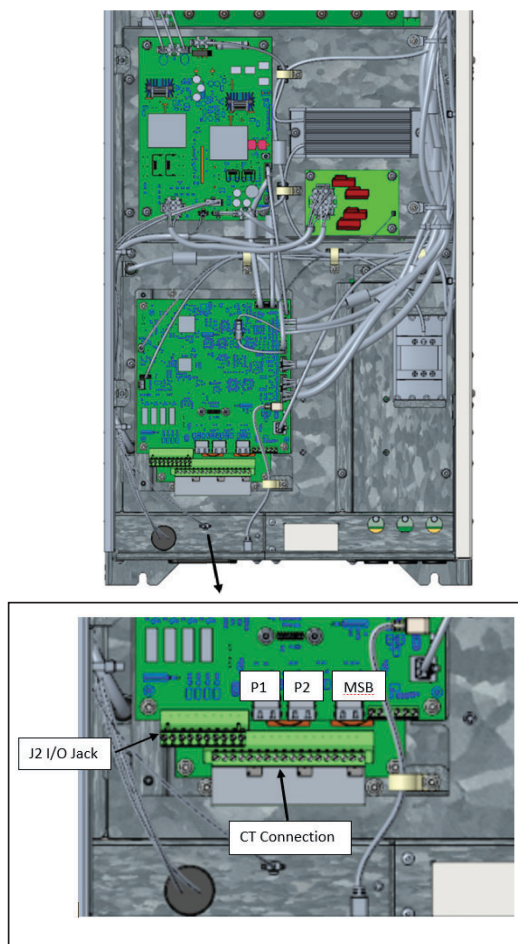
A serial Modbus connection is available through an RJ-45 jack labeled MBS on the control board. Refer to “Control Board and CT Board Details” on page 41. Modbus addresses are provided in the User Manual.

Serial Modbus Pin-out

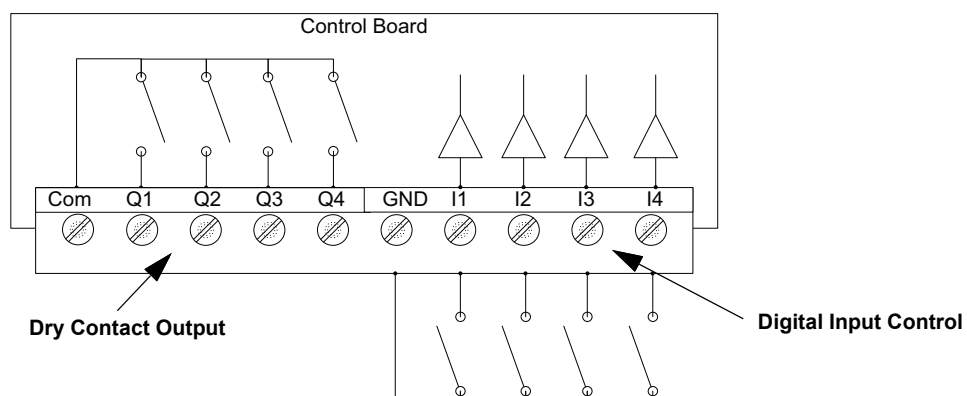


Pin	Signal Name	Direction	Meaning
1	Not connected	-	
2	Not connected	-	
3	Not connected	-	
4	D1	Input/Output	Transfer data (RS-485)
5	D0	Input/Output	Transfer data (RS-485)
6	Not connected	-	
7	Not connected	-	
8	SG	-	Signal ground

Control Board and CT Board Details



Control Board J2 Detail



Chapter 5 Pre-Commissioning

This chapter provides information for preparation of the EVC+ for commissioning. Before applying power, read and understand this information thoroughly.

Instruments Required for Commissioning

- Voltmeter or multimeter
- Clamp-on ammeter
- Megohmmeter

Pre-Energizing Procedure

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462, or applicable local standards.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Do not exceed the device's ratings for maximum limits.
- Ground equipment using the ground connecting point provided before turning on any power supplying this device.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- After removing power, wait for 15 minutes to allow the capacitors to discharge prior to opening the doors or removing covers.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Carefully inspect the interior for tools left behind before closing and sealing the door.
- Verify the rating of the neutral conductor for each unit in the system is greater than the neutral current limit setting.

Failure to follow these instructions will result in death or serious injury.

Installation Inspection

Inspect all connections for both power and control wiring. Make sure that the correct termination points have been made for each wire. Make sure that all connections are firmly tightened prior to start-up.

Pre-Commissioning Checklist

Prior to commissioning the EVC+ system, the following items must be completed:

- Electrical connections have been made in accordance with local codes.
- Main CTs are installed to measure the current of the system to be corrected.
- The secondary wiring of the main CTs have been connected to the CT board of the EVC+.
- If it is a parallel EVC+ system, CT wiring and parallel communications wiring have been installed between the CT boards of each unit.
- All drives, harmonic generating loads, downstream of the main CTs must have the recommended minimum 3% line reactor or DC choke installed (required for optimum performance when harmonic mode is intended).
- There are no un-isolated capacitors, such as power factor correction capacitors downstream of the main CTs. (required when harmonic mode is intended to operate).
- To fully test the system integration, all loads supported by the EVC+ system should be available for operation. The total output current required for the system must be at least 10% of the unit's nameplate rating. For example, a 60 A unit will need a minimum of 6 A Total Output current.
- If backup generation is connected to the EVC+, the system should also be tested with the generator supporting the connected loads.

The Field Service Engineer will need to know the following information to commission the EVC+:

- Installation location of the main CTs in relationship to the EVC+ (load or grid).
- The ratio of the main CTs installed.
- The phase on which each CT is installed.
- Intended mode of operation (Harmonic, Power Factor, Load Balancing).

Commissioning Procedures

Refer to the User Manual for commissioning procedures. The User Manual is available as a download from our website.

Chapter 6 IP00/Chassis Installation

An IP00 chassis can be installed in other types of enclosures to provide a greater degree of ingress protection. IP00 units can be purchased either as Main units, with an HMI or Expansion units to add units in parallel for additional capacity.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462, or applicable local standards.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Do not exceed the device's ratings for maximum limits.
- Ground equipment using the ground connecting point provided before turning on any power supplying this device.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- After removing power, wait for 15 minutes to allow the capacitors to discharge prior to opening the doors or removing covers.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Carefully inspect the interior for tools left behind before closing and sealing the door.

Failure to follow these instructions will result in death or serious injury.

The Main units are provided with:

- HMI
- HMI Instruction Bulletin
- LED Light Pipe (2 meters)
- Shielded CAT5e (2 meters)
- 24 Vdc HMI power wiring (2 meters)

When designing the enclosure, the following items must be considered:

- Make sure that the enclosure can support the weight of the unit.
- Make sure that sufficient airflow is provided to the unit.
- Intake air temperature will remain between 0 °C to 45 °C.
- Make sure that the Service Door can be opened when the maintenance is required.
- Over-current protection device is provided for the unit installed. See "Circuit Breaker and Manual Disconnect Selection" on page 24.
- A USB A Male to Female cable will be required for each Main unit installed to allow user access from the front panel. The female end shall be rated to meet or exceed the enclosure environmental rating.
- The LED light pipe shall be made visible to the user.
- Locate the HMI so that it is convenient for operation.

- Make sure that the HMI installation is performed in accordance with the HMI Instruction Bulletin.
- Verify the installation method is in accordance with the provided HMI Instruction Sheet. Mounting instruction for the HMI are available in the HMI Instruction Sheet.

DANGER

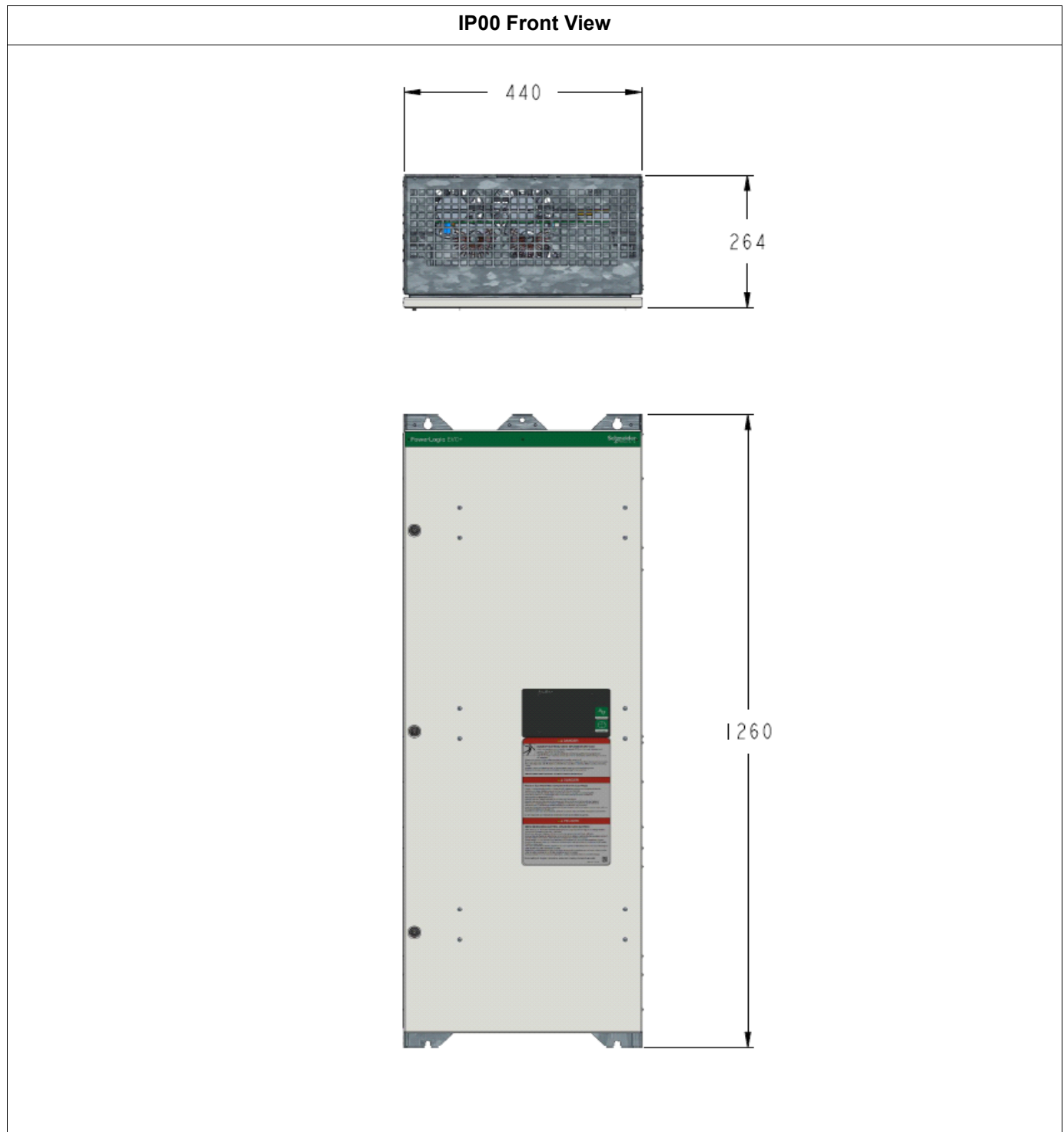
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Verify that the rating of the neutral conductor for each unit in the system is greater than the neutral current limit setting.

Failure to follow these instructions will result in death or serious injury.

Physical Description								
EVC+	Kvar Rating		Nominal Voltage	Mounting Style	Cable Entry	Weight (kg)	Air Flow (mm ³ /h)	Exterior Dimensions (mm)
IP00	75	100	208 - 480	Vertical	Bottom	95	912	1260 x 440 x 264

Dimensional Drawings

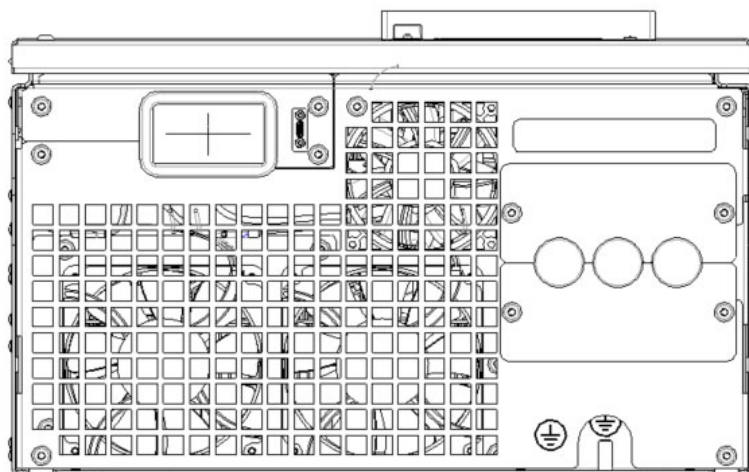


Total height including mounting features 1260 mm

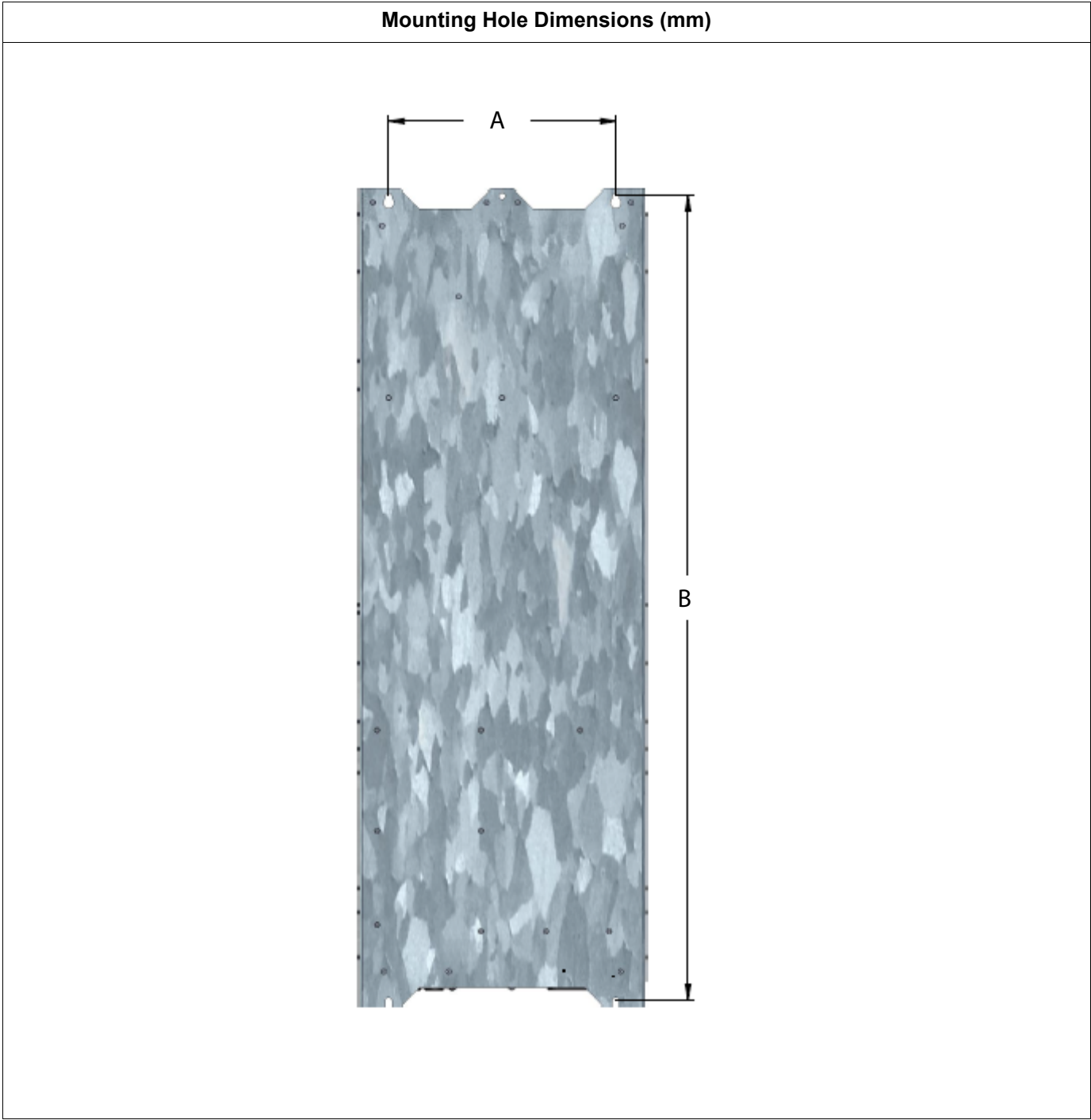
Width 440 mm

Zero side clearance

Top and bottom clearance 200 mm each

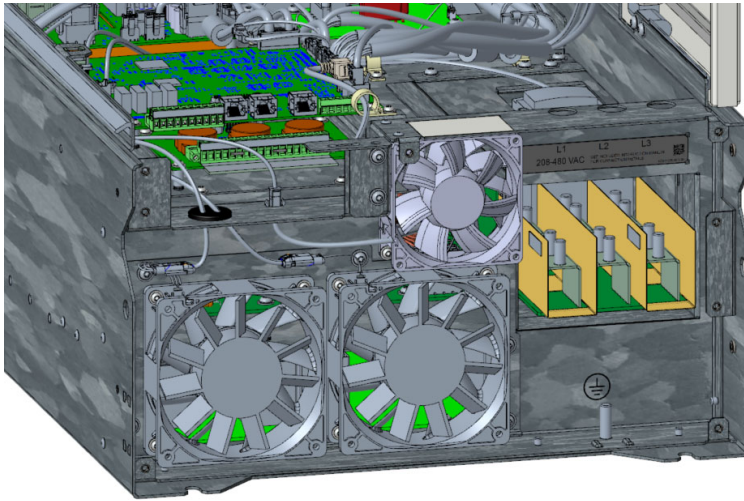
Bottom/Air Intake

Use M8 hardware to mount the unit in the enclosure. Mounting hole layout is provided in the drawing below.



Dimension	mm	Inches
A	350	13 3/4
B	1240	48 7/8

IP00 Electrical Connection



8 mm Studs are used for the line and ground connections.

Stud size M8

Torque value 18.2 Nm (161 in-lb)

- Using a punch or similar, create a hole in the grommet just large enough to allow the line, ground and neutral (if required) wires to pass through the grommet.
- Pass one cable through each of the grommets.
- Connect an appropriate one-hole crimp lug on the end of each wire for an 8 mm stud.
- Reinstall the power cable cover using the T25 hardware. Make sure that the grommets are properly seated.

⚠ CAUTION

INAPPROPRIATE EQUIPMENT OPERATION

For UL Applications, the chassis requires the addition of UL Class T fuses.

- 20 and 30 amp units provide a 40 amp fuse (PCSNFUSKIT230).
- 50 and 60 amp units provide a 80 amp fuse (PCSNFUSKIT560).

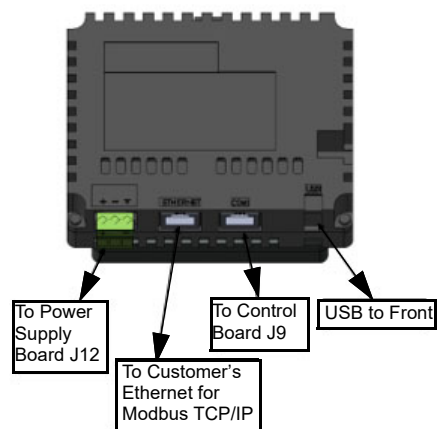
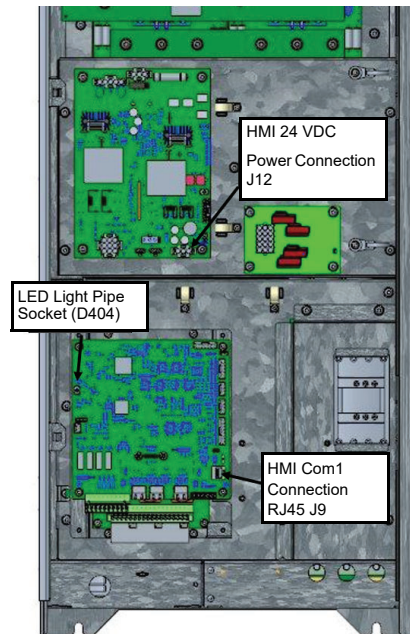
Failure to follow these instructions can result in injury or equipment damage.

HMI Connections

When making the HMI connections, make sure it is mounted in a location that is accessible for users. HMI mounting instructions are provided in the box containing the HMI and interconnection wiring.

Chassis to HMI/Front Panel Connections

Chassis to HMI/Front Panel Connections



HMI Power Connections

The HMI Power connections are as follows:

- Connect the red (+) to the +
- Connect the black (-) to the -
- Connect the green to the ground

LED Light Pipe

The LED Light Pipe connections are as follows:

- Drill 6.5 mm hole, pass the light pipe through the hole seating the light pipe lens.
- Route the light pipe into the control board D404.
- Cut the light pipe to length and insert the light pipe into light pipe socket on control board D404.

24 Volt Power

Make the 24 volt power connection as follows:

1. Connect the HMI power cable, which has a green connector on one end and a black connector on the other end.
 - Connect the green connector to the chassis green connector labeled PWR.
 - Connect the black connector to the HMI labeled DC24 V.
2. Provide a ground wire from the HMI ground connection to the enclosure/chassis ground. The ground wire size must be between 0.2 to 1.5 mm² (24 - 16 AWG) with a temperature rating of 75 °C (167 °F).
3. Connect the provided 3 pin connector to J12 of the power supply board.

Ethernet

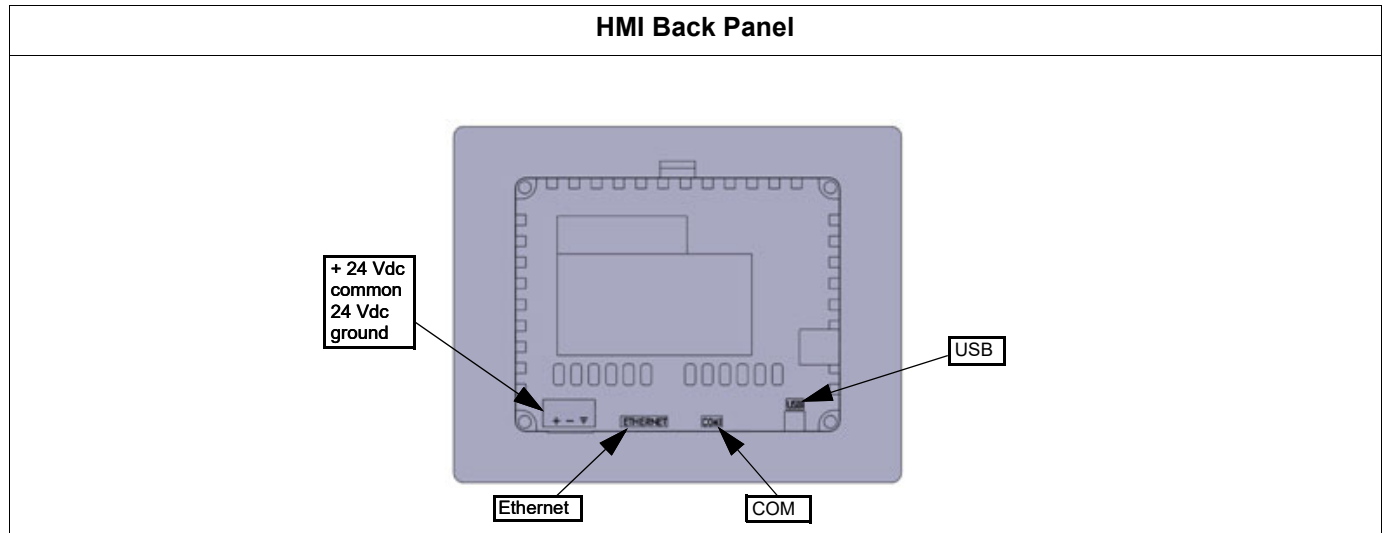
Connect the green CAT5 cable labeled ETH to the EVC+ front connection labeled ETH.

Communication

Connect the black CAT5 cable labeled COM to the EVC+ front connection labeled COM. Connect the other end to the RJ45 connector on the HMI labeled COM1.

Enclosure Mount USB

Provide a female USB that can be accessed by the user. Use a panel mount type A female to standard type A male. Connect the standard type A male to the USB A jack on the back of the HMI. Make sure that the panel mount type A female end is accessible to the end user. Use a USB cable that meets the requirement for the type of enclosure utilized.





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