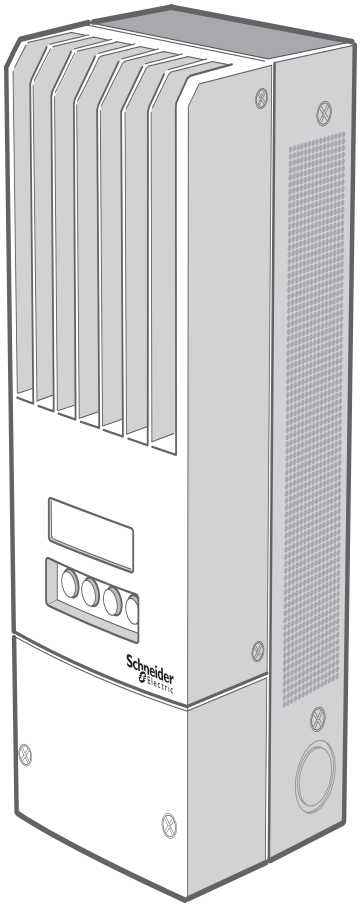
Conext™ MPPT 60 Solar Charge Controller

Installation Guide

990-6546

June 2022



https://www.se.com/

Legal Information

Contact Information

For country-specific details, please contact your local Schneider Electric Sales Representative or visit the Schneider Electric website at: https://www.se.com/

Information About Your System

As soon as you open your product, inspect the contents and record the following information and be sure to keep your proof of purchase. If any damage is found, contact customer support.

Serial Number	_____	Purchased From	_____
Product Number	_____	Purchase Date	_____

Document Number: 990-6546	**Date:** June 2022
Model Name:	Model name 1
Product Part Number:	Model part# 1
Model Name:	Model name 2
Product Part Number:	Model part# 2

Audience

This manual is intended for use by qualified personnel installing a system involving Schneider Electric Conext MPPT 60 Solar Charge Controller.

The qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment and PV and battery input systems (up to 1000 V).
- Applying all applicable installation codes.
- Analyzing and reducing the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).

Configuration, servicing, and maintenance must be performed by authorized service personnel only. Authorized service personnel meet the requirements for a qualified installer, plus they have received specific training from the manufacturer on servicing the Conext MPPT 60 Solar Charge Controller.

This manual does not contain information regarding servicing or de-energization for servicing. Authorized service personnel must refer to the system schematics to identify, open, lock-out and tag-out, and verify de-energization of all power sources.

About This Guide

Purpose

This Guide provides explanations and procedures for installing and and troubleshooting the following Schneider Electric Conext MPPT Solar Charge Controllers:

- Conext MPPT 60 150 Solar Charge Controller (150 A), part number: 865-1030-1

Scope

This Guide provides safety guidelines, detailed planning and setup information, procedures for installing the charge controller, and information about troubleshooting. It does not provide details about particular brands of photovoltaic (PV) panels or batteries.

Conventions Used

This Guide uses the term “charge controller” to refer to the Conext MPPT 60 Solar Charge Controllers.

Abbreviations and Acronyms

CEC	Canadian Electric Code
CSA	Canadian Standards Association
DC	Direct Current
FCC	Federal Communications Commission
GFP	Ground Fault Protection
I_{MP}	Current at maximum power per STC
ISC	Short circuit current rating of an PV panel under STC
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MPP	Maximum Power Point
MPPT	Maximum Power Point Tracking
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
PDP	XW Power Distribution Panel
PV	Photovoltaic
STC	Standard Test Conditions specific to photovoltaic panels (1000 W/m2, light spectrum AM 1.5 and 25 °C); panel nameplate ratings are based on STC and may be exceeded under other conditions.
UL	Underwriters Laboratories
VAC	Volts AC
VDC	Volts DC
V_{MP}	Voltage at maximum power per STC
V_{OC}	Open circuit voltage rating of a PV panel under STC

Related Information

You can find information about operating the charge controller in the *Conext MPPT 60 Solar Charge Controller Owner's Guide*. It is provided with the charge controller and is also available at solar.schneider-electric.com.

You can find information about the following available configuration and monitoring gateway devices at solar.schneider-electric.com.

- Conext Gateway: Conext Gateway Owner's Guide (975-0806-01-xx)
- InsightHome: InsightHome Owners Guide (990-91410)
- InsightFacility: InsightFacility Owners Guide (990-91411)

You can find more information about Schneider Electric as well as its products and services at solar.schneider-electric.com.

Compatible Products

- XW Pro Inverter
- Conext XW+ Inverter
- Conext SW Inverter
- Conext AGS Automatic Generator Start (with a compatible inverter)

Related Documents

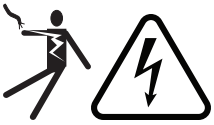
All related documents can be found at solar.schneider-electric.com. Go to the product page and scroll down to **Downloads** > **User Documentation**.

- XW Pro Installation and Operation manuals
- Conext XW+ Installation and Operation manuals
- Conext SW Installation and Operation manuals
- Conext AGS Installation and Operation manuals

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 documentation 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. For more information, see "Audience" on page 2.

Change Controller Safety Information

Before using the charge controller, read all instructions and cautionary markings on the unit, the batteries, and all appropriate sections of this manual.

Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons.

The charge controller is designed to be permanently connected to your AC and DC electrical systems. The manufacturer recommends that all wiring be done by a certified technician or electrician to ensure adherence to the local and national electrical codes applicable in your jurisdiction.

To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the charge controller with damaged or substandard wiring.

Do not operate the charge controller if it has been damaged in any way.

This unit does not have any user-serviceable parts. Do not disassemble the charge controller except where noted for connecting wiring and cabling. See your warranty for instructions on obtaining service. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.

To reduce the risk of electrical shock, disconnect both AC and DC power from the inverter before attempting any maintenance or cleaning or working on any components connected to the charge controller. Putting the unit in Standby mode will not reduce this risk.

The charge controller must be provided with an equipment-grounding conductor.

Do not expose this unit to rain, snow, or liquids of any type. This product is designed for indoor use only. Damp environments will significantly shorten the life of this product and corrosion caused by dampness will not be covered by the product warranty.

To reduce the chance of short-circuits, always use insulated tools when installing or working with this equipment. Do not leave tools inside the unit.

Remove personal metal items such as rings, bracelets, necklaces, and watches when working with electrical equipment.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized with covers removed
- Energized from multiple sources. Before removing covers identify all sources, de-energize, lock-out, and tag-out and wait 2 minutes for circuits to discharge.
- Always use a properly rated voltage sensing device to confirm all circuits are de-energized.

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

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

- Disconnect positive and negative PV conductors before servicing. PV conductors are a shock hazard and must be disconnected before servicing the installation.
- Normally GROUNDED conductors may be UNGROUNDED and ENERGIZED when a GROUND FAULT is indicated. Must be serviced by qualified personnel.

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

⚠ WARNING

LIMITATIONS ON USE

Do not use the charge controller with life support equipment or other medical equipment or devices.

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

⚠ CAUTION

BURN HAZARD

Do not touch the solar charge controller’s heatsink during operation or before servicing immediately after ceasing operation.

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

NOTICE

LIGHTNING PROTECTION

To protect the charge controller's insulation and conductors from damage due to a sudden over-voltage surge such as a lightning strike, install a DC-rated lightning arrestor on the PV source circuits.

Failure to follow these instructions can result in equipment damage.

Battery Safety Information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN, FIRE, AND EXPLOSION

Lead acid batteries contain corrosive electrolyte and can give off explosive gases. Battery circuits present a shock and energy hazard. Observe proper precautions when working with batteries and battery circuits, including:

- Always wear eye protection when working with batteries.
- Wear rubber gloves and boots when handling batteries.
- Remove all jewellery before performing electrical work.
- Install batteries in a well-ventilated area to help prevent the possible buildup of explosive gases.
- Do not dispose of batteries in a fire.
- Do not open or damage the batteries. Exposure to electrolyte is harmful to eyes and skin. It is toxic.
- Do not mix battery types.
- Do not smoke in the vicinity of a battery.
- Use insulated tools when working with batteries.
- When connecting batteries, always verify proper voltage and polarity.
- Do not short-circuit the battery.
- Always use proper lifting techniques when handling batteries.
- Determine if the battery is inadvertently grounded and if so, remove the source from ground. Contact with any part of a grounded battery can result in electrical shock. Remove these grounds during installation and maintenance.
- When using Lithium Ion batteries, ensure that the battery pack being used includes a certified Battery Management System (BMS) with safety protocols.

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

For full installation instructions and safety information, see the documentation provided with the batteries. Consult the MSDS for the batteries for first aid procedures, emergency procedures, and clean-up instructions.

Further details about Lithium Ion support can be found in the document *XW PRO Li-Ion Battery Solution Guide (990-6359A)* available at solar.schneider-electric.com.

FCC Information to the User

This charge controller has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and Industry Canada ICES-003. These limits are designed to provide reasonable protection against harmful interference when the charge controller is operated in a residential environment. This charge controller generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the installation and operation guides, could cause harmful radio frequency interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this charge controller does cause harmful interference with radio or television reception, which can be determined by turning the charge controller off and on, try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the charge controller and the receiver.
- Connect the charge controller to a different circuit from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

⚠ CAUTION

RISK OF INJURY

Unauthorized changes or modifications to the equipment could void the user's authority to operate the equipment.

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

Maintenance

The Conext MPPT 60 does not require scheduled maintenance.

The surface of Conext MPPT 60 can be cleaned by using a lint-free soft cloth.

NOTICE

RISK OF PHYSICAL DAMAGE

Use only a soft cloth dampened with water and mild soap to clean the charge controller.

Do not use solvents or chemicals that are corrosive or flammable.

Failure to follow these instructions can result in equipment damage.

Contents

Figures

Tables

1 Introduction

What's in This Chapter?

Features

The Conext MPPT 60 Solar Charge Controller (charge controller) tracks the maximum power point of a PV array to deliver the maximum available current for optimum charging of batteries. The charge controller can be used with 12, 24, 36, 48, and 60 VDC battery systems.

The solar charge controller is designed to regulate PV sources, but will also work with other DC sources. To be used, the DC source must meet the specifications listed in "Electrical Specifications" on page 56.

The solar charge controller can be installed (in single or multi-unit configurations) with a Conext SW Inverter, Conext XW+ or XW Pro Inverter/Charger or as a stand-alone installation.

Standard features of the solar charge controller include:

- Two- or three-stage charging process, with manual equalization to maximize system performance and maintain expected battery life.
- True dynamic Maximum Power Point Tracking (MPPT) to deliver the maximum available power from a PV array to a bank of batteries. See the Conext MPPT 60 Operation Guide (990-6547).
- Integrated PV Ground Fault Protection (PV-GFP).
- Convection cooled (no internal fan) using aluminum die-cast chassis and heat sink.
- 60-amp capacity.
- Configurable auxiliary output. See Conext MPPT 60 Operation Guide (990-6547).
- Input over-voltage and under-voltage protection, output over-current protection, and backfeed (reverse current) protection. Warning and Fault messages appear on the gateway device when the unit shuts down as a protective measure.
- Over-temperature protection and power derating when output power and ambient temperature are high.
- Battery Temperature Sensor (BTS) to provide automatically temperature-compensated battery charging. If the BTS is lost or damaged, a replacement can be ordered from Schneider Electric (part number 808-0232-02).
- Xanbus communications network. Xanbus is a network communications system developed by the manufacturer which allows the solar charge controller to communicate settings and activity to other Xanbus-enabled devices.
- Five-year limited warranty.

There are three gateway devices that allow you to configure and monitor the charge controller through a web interface called InsightLocal on a connected PC or laptop. In addition, the InsightCloud option has available any-where-in-the-world cloud-based monitoring.

You can find information about the following available configuration and monitoring gateway devices at solar.schneider-electric.com.

- Conext Gateway: Conext Gateway Owner's Guide (975-0806-01-xx)
- InsightHome: InsightHome Owners Guide (990-91410)
- InsightFacility: InsightFacility Owners Guide (990-91411)

Charge Controlling

The solar charge controller can regulate PV array current for charging batteries at 12, 24, 36, 48, and 60 volts. It produces 60 amps of charging current and up to 3500 W (on 60-volt batteries) of charging power.

The solar charge controller controls how the batteries are charged by the DC source (the PV array). It can be configured to use a two-stage (“No Float”) or three-stage charging process.

When charging, the solar charge controller regulates the charging voltage and current based on the amount of DC power available from the PV array and the current state of charge of the battery.

The solar charge controller is able to charge a lower nominal-voltage battery from a higher-nominal voltage array. For example, the solar charge controller can charge a 48-volt battery from a 100-volt array. This gives flexibility to installers to use longer wiring runs without compromising the efficiency of a higher-voltage array.

The solar charge controller is not able to charge a higher-voltage battery from a lower-voltage array. Minimum Vmp (temperature compensated for warmest weather) must be at least 15 VDC higher than the target Bulk voltage

Battery System Voltage	Minimum PV Array Voltage	Maximum PV Array Voltage (Operating)	Maximum PV Array Voltage (Open Circuit)
12 V	15 V	140 V	150 V
24 V	27 V		
36 V	39 V		
48 V	54 V		
60 V	66 V		

Configurations

The charge controller must be configured to use a three- stage charging algorithm. The charging algorithm helps to ensure that the battery is optimally charged with the available amount of solar energy.

Although two-stage battery charging is allowed via Conext XW+ or XW Pro Inverter/Charger, the charge controller should not typically be set to two-stage charging as this results in the controller interrupting PV power flow after the Absorption stage is finished.

NOTE: For grid interactive functionality, the inverter in the system must be set for two-stage charging (or Ext_BMS depending on battery compatibility), while the charge controller remains set for three-stage charging.

See the *Conext MPPT 60 Solar Charge Controller Owner's Guide* for more information on two-stage and three-stage charging, and the different stages.

2 Installation

What's in This Chapter?

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

Installation of this equipment should only be planned and performed by qualified personnel in accordance with all applicable installation codes. See "Audience" on page 2 for the definition of qualified personnel.

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

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, BURNS, FIRE, AND EXPLOSION

Follow all instructions and electrical, physical, and environmental installation specifications in this Guide.

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

Required Materials and Tools

The following materials are shipped with the charge controller:

- One Conext MPPT 60 Solar Charge Controller
- One Conext MPPT 60 Solar Charge Controller Installation Guide
- One Conext MPPT 60 Solar Charge Controller Owner's Guide
- One CE Conformity Declaration
- One Battery Temperature Sensor (BTS)
- One network terminator

The following tools are required for installation:

- Phillips head screwdriver
- Torque wrench
- Wire cutters and wire strippers

PV Array Requirements

NOTE: The following information only provides general guidelines. PV array installation is subject to installation codes and, in some areas, inspection and approval by the authority having jurisdiction. For example, installations in the United States must be compliant with NEC and, in particular, Article 690.

Each charge controller must be connected to its own PV array. Although the charge controller can harvest a maximum of 3500 W, the PV array size can be as high as 6720 W (based on 48 A × 140 Voc = 6720 W).

⚠ WARNING

HAZARD OF ELECTRIC SHOCK AND FIRE

- The PV array voltage must never exceed 150 V in any condition (open circuit, cold temperature, bright sun, etc.).
- The array I_{sc} (short circuit current) must not exceed the 60 A input current rating of the solar charge controller at any time.

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

Panels rated up to 48 A at 25°C (77°F) are recommended to allow for increases in I_{sc} caused by irradiance enhancement under certain conditions (reflection from snow, for example).

Mounting

The instructions in this chapter are applicable to a typical stand-alone installation. Installation procedures will vary according to your specific application. For special applications, consult a qualified Renewable Energy System Installer or a Certified Dealer.

Choosing a Location

⚠⚠ WARNING

HAZARD OF ELECTRIC SHOCK, BURN, FIRE, AND EXPLOSION

The charge controller must be mounted vertically and installed indoors in a dry, protected location away from flammable materials, sources of high temperature, moisture, and vibration. The location must also be sheltered from direct sunlight, dust, and wind-blown debris. Exposure to salt water will void the warranty.

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

Flammable or combustible materials are defined as “any material containing wood, compressed paper, cellulose, plant fibers, plastics, liquids, or other material that will ignite and burn, whether flame-proofed or not” according to the NFPA. Flammable liquids are defined as “any liquid whose flash point does not exceed 100 °F (38 °C).” Examples of flammable liquids are gasoline, methanol, and ether.

When choosing a wall to install the charge controller, choose a wall that is not considered a flammable material such as drywall, concrete, brick, or metal.

⚠ WARNING

HAZARD OF EXPLOSION

Do not install the charge controller in a sealed compartment containing batteries.

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

NOTICE

CHARGE CONTROLLER DAMAGE

The charge controller can overheat if installed in a sealed, indoor enclosure. Do not install the charge controller in a sealed compartment.

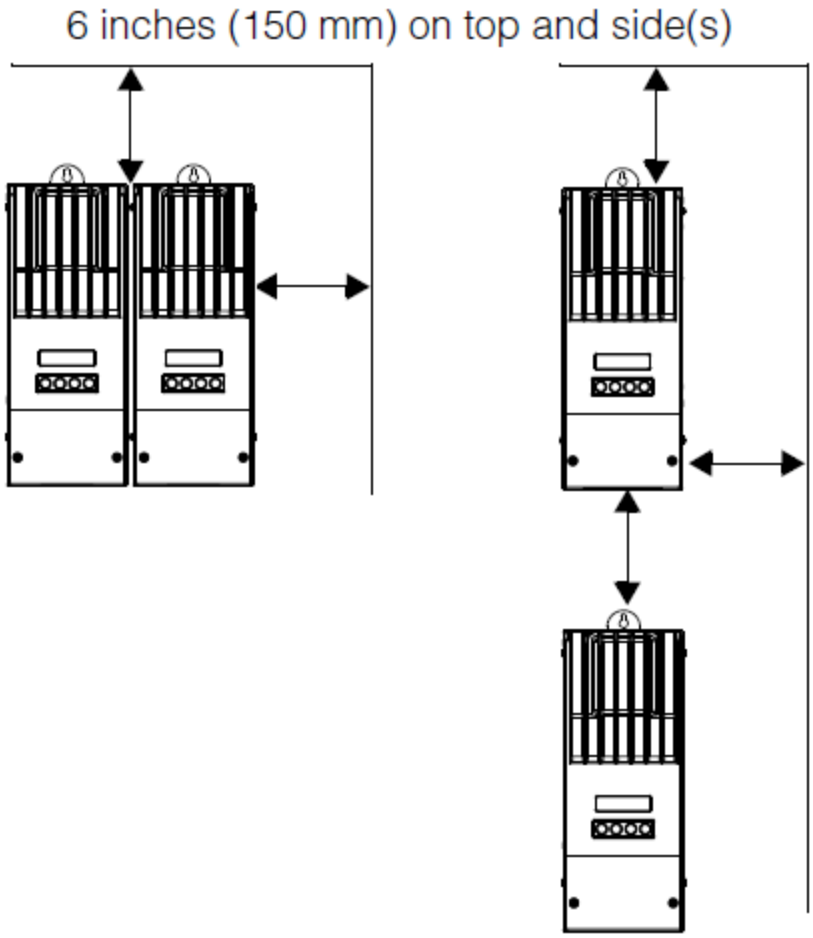
Failure to follow these instructions can result in equipment damage.

To help ensure optimal and safe operation, make sure there is adequate clearance around the charge controller. See Table 1 and Figure 1. If clearances are reduced below these minimums, charging performance might be impaired.

Table 1 Minimum clearance requirements

Location	Minimum Clearance
Above and below	6 inches (150 mm). When units are mounted in a vertical stack, the topmost unit must maintain the minimum clearance to the nearest surface.
In front	Sufficient room to prevent accidental contact with the heat sink and to perform maintenance.
Sides	6 inches (150 mm) on at least one side of the overall assembly. A maximum of two units can be mounted side by side or side mounted against a PDP. In both configurations, the minimum clearance around the outermost unit must be maintained.

Figure 1 Minimum Clearance Requirements



Removing the Wiring Compartment Cover

⚠⚠ DANGER

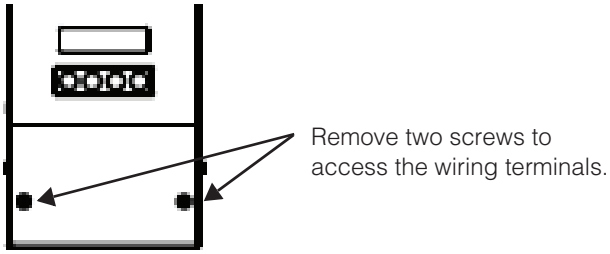
HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

Before removing the wiring compartment cover, make sure all electrical power sources have been disconnected for at least two minutes. Before energizing the charge controller, make sure the wiring compartment cover has been replaced and all fasteners are in place.

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

Before mounting, remove the wiring compartment cover to access the mounting holes and the wiring terminals. The wiring compartment cover is secured with two screws on the front of the charge controller (see Figure 2).

Figure 2 Removing the wiring compartment cover



Removing Knockouts

Six dual and two single knockouts are provided for routing battery, PV array, BTS, and network cables into the solar charge controller. Use bushings or conduits to protect the wiring from damage from rough edges around the knockout holes.

When removing knockouts, make sure no metal shavings or fragments fall into the wiring compartment. Use bushings or conduits to help protect the wiring from damage from the rough edges around the knockout holes.

NOTICE
CHARGE CONTROLLER DAMAGE Do not drill, cut, or punch holes in the charge controller. Use only the knockouts provided for conduit entry. **Failure to follow these instructions can result in equipment damage.**

Figure 3 Knockout dimensions

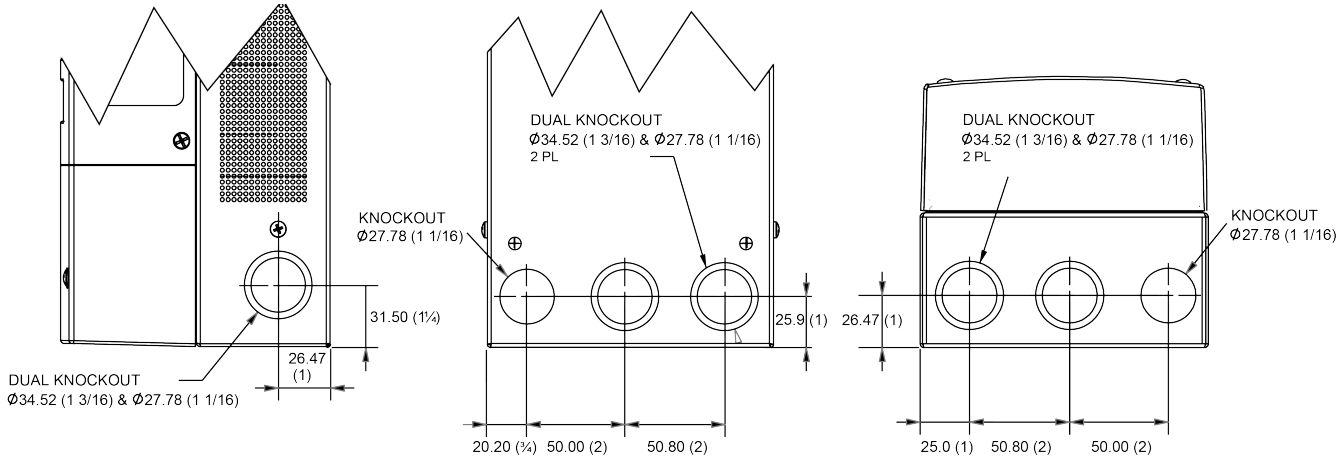
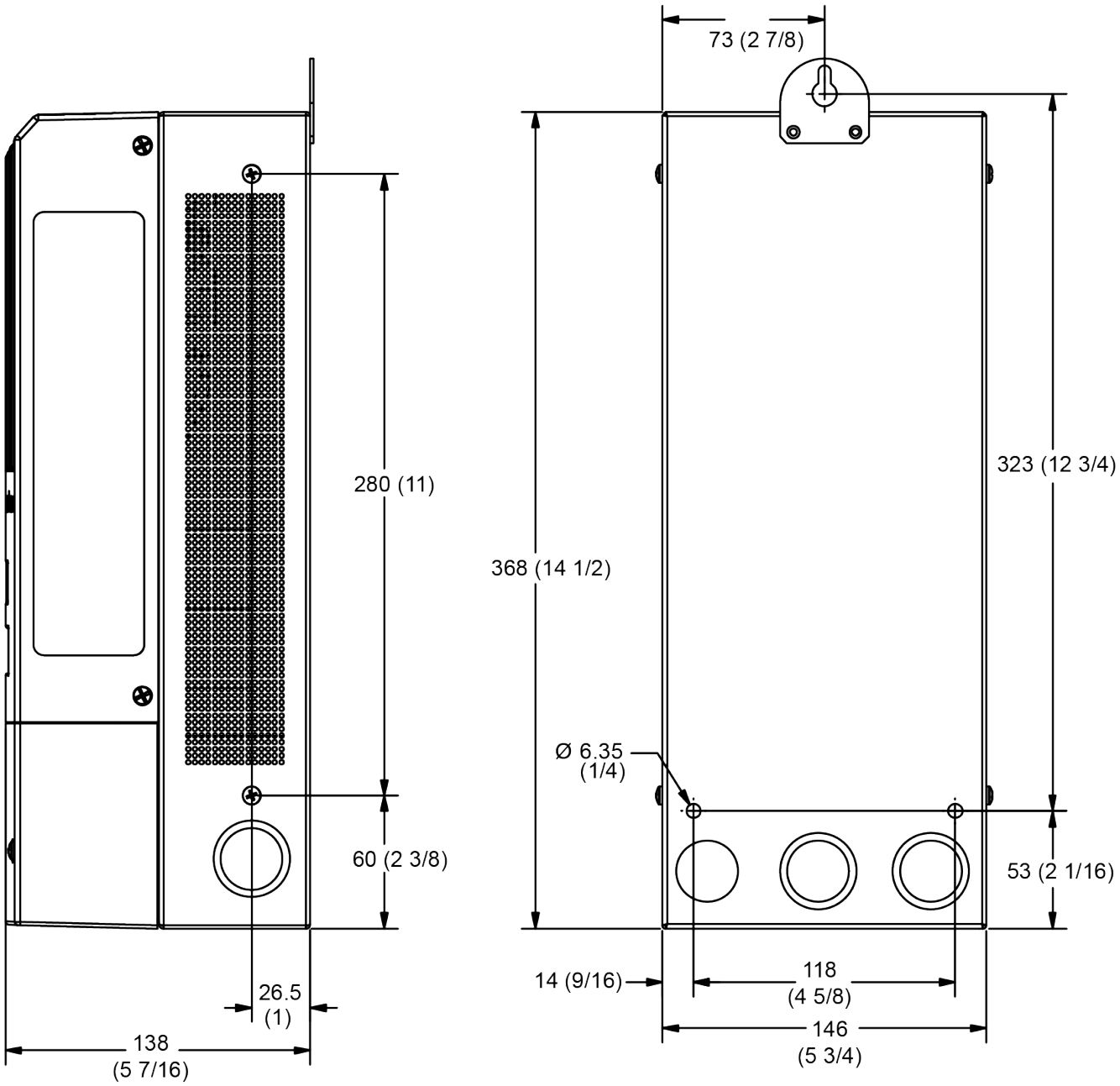


Figure 4 Dimensions and knockout locations



Mounting the Charge Controller

The charge controller must be vertically mounted to the wall using three #10 × ½-inch or #12 × ½-inch (12.5 mm) pan-head screws . Alternatively, the it can also be mounted on the side of the PDP (the hardware is provided with the charge controller).

⚠ WARNING

FIRE HAZARD

When choosing a wall to install the solar charge controller, choose a wall that is not considered a flammable material such as drywall, concrete, brick, or metal.

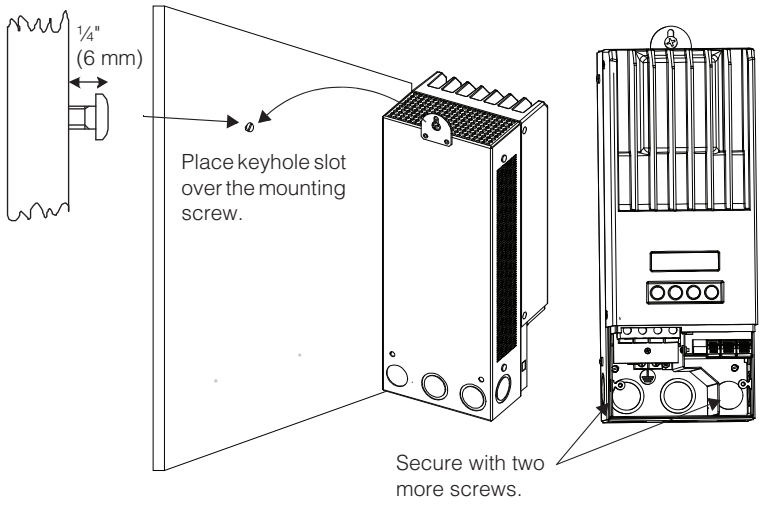
Provide strain-relief clamps or a conduit to prevent damage to the circuit board and terminal block from pulling on the wires.

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

To mount the charge controller on the wall (see Figure 5):

1. Remove the wiring compartment cover (see Figure 2).
2. Mark the location of the keyhole slot on the wall.
3. Secure the top mounting screw in the location marked, but leave the screw head backed out approximately ¼ inch (6 mm).
4. Place the charge controller onto the screw and pull it down into the keyhole slot.
5. Insert two screws in the two mounting holes provided to secure the charge controller to the wall.

Figure 5 Mounting the Charge Controller



PV Grounding

You can configure the charge controller to be compatible with either negative-grounded or ungrounded (floating) PV arrays. For information about routing the array ground connection, see Figure 10.

Chassis Grounding

The maximum size of the ground conductor is #6 AWG (16 mm^2). This wire gauge is determined by electrical code requirements regarding conduit knockout sizes, wire bending radius, and space available within the solar charge controller wiring compartment. For ground conductor requirements for your specific installation, consult your local electrical code.

Internal Ground Fault Protection

The solar charge controller has a PV ground fault protection (PV-GFP) fuse (600 V, 1 A) and a PV negative-ground jumper located inside the wiring compartment. These provide a negative ground bond and ground-fault protection for negative grounded PV array systems common in North American installations.

⚠ ⚠ WARNING

ELECTRIC SHOCK HAZARD

If a ground fault is indicated, normally grounded conductors and battery terminals may be ungrounded and energized. Disconnect all sources of DC power and wait at least 4 minutes for the internal circuitry to discharge before servicing the unit.

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

⚠ ⚠ WARNING

ELECTRIC SHOCK HAZARD

- Fuses must only be replaced by qualified service personnel, such as a certified electrician or technician. For continued protection against risk of fire, replace the fuse with Littelfuse KLKD 1 or equivalent.
- If PV-GFP is enabled, do not ground either PV negative or battery negative circuits. Grounding these circuits will defeat the internal PV-GFP protective function. See Figure 10 on page 39 for recommended battery circuit wiring.

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

⚠ ⚠ WARNING

ELECTRIC SHOCK HAZARD

- Only one charge controller is to have the PV-GFP fuse installed in installations with multiple parallel solar charge controllers.
- Before mounting and connecting the solar charge controllers, remove the PV-GFP fuse from each unit except one.
- Installing more than one fuse in a multi-controller system will increase amperage required to blow fuses 1A times the number of charge controllers.

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

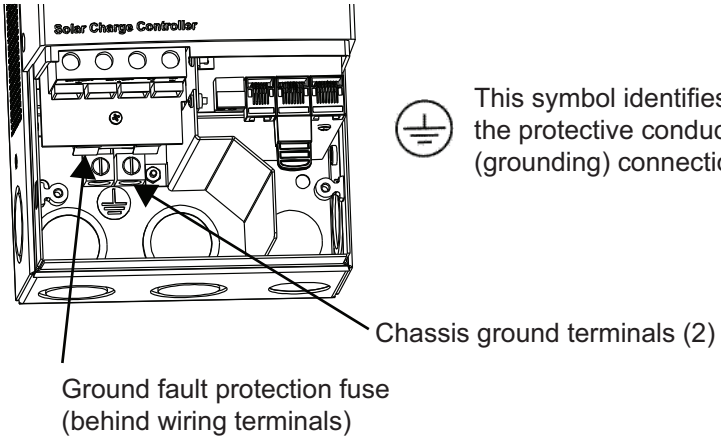
⚠ CAUTION

EQUIPMENT DAMAGE

The factory default configuration of the solar charge controller will ground the PV array negative to the chassis ground through the internal PV-GFP fuse. Disable the PV-GFP circuit for ungrounded PV arrays.

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

Figure 6 Charge controller safety ground connector



Disabling Ground Fault Protection for Negative Grounded and Ungrounded Arrays

⚠ ⚠ WARNING

ELECTRIC SHOCK HAZARD

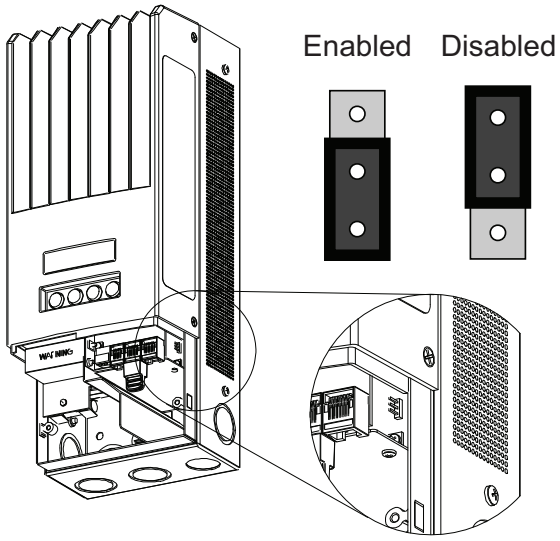
Disconnect PV and battery circuits before accessing the charge controller wiring compartment.

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

To install the solar charge controller in a system where an external battery negative-ground bond is required, or where a positive grounded battery, or where the PV array must not be grounded, the solar charge controller internal PV-GFP circuit and ground bond must be disabled. To disable the unit's PV-GFP circuit and ground bond, move the jumper connector located on the circuit board within the wiring compartment and remove the 1A ground fault protection fuse. See Figure 7.

Disabling the PV-GFP circuit in this way opens the negative-to-ground bond within the unit. This provides the option of using an external PV-GFP circuit, operating the charge controller with an ungrounded PV array, or grounding the negative circuit of the battery elsewhere in the system.

Figure 7 PV negative ground jumper location



Installing a Positive-Grounded Battery System

The solar charge controller's internal design has a built-in fuse—rated at 1 A, 600 V—which grounds both the PV negative and battery negative conductors and provides PV ground-fault protection (PVGFP) to the system.

To avoid a short circuit, ground fault protection must be disabled before grounding the positive battery terminal for negative voltage reference. Disabling the PVGFP circuit in this way opens the negative-to-ground bond within the unit, allowing for a positive battery ground connection.

If PVGFP is required, install an external protection circuit that is compatible with a positive-grounded battery system.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

PV array terminals and auxiliary terminals must not be grounded in the installed system.

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

Because there is no isolation between the battery and the PV array, this positive-grounded battery configuration will bias the PV array terminals and the internal auxiliary lines to –Batt V with respect to chassis ground.

For example, using a 100 VOC PV array and a 60 V battery bank, grounding the positive battery terminal will make PV(–) sit at -60 V and PV(+) at +40 V. Aux(–) will be biased at -60 V and Aux(+) at -45 V.

These voltage levels on both battery and auxiliary outputs are considered safe, extra-low voltages and do not present a hazard as long as the PV terminals are kept floated or ungrounded.

Follow the instructions in Wiring on page 34 for connecting the PV array and battery to the unit. Next, follow these steps for a safe, negative voltage reference connection:

1. Disable the solar charge controller's internal PVGFP circuit, as explained below.
2. Make sure PV array terminals (positive and negative) are ungrounded.
3. Make sure auxiliary terminal lines (positive and negative) are ungrounded.
4. Ground the positive terminal of the battery only.

Disabling the Charge Controller's Internal PVGFP Circuit

Before grounding the positive battery terminal to obtain a negative reference voltage, you must disable the solar charge controller's internal PVGFP circuit.

⚠⚠ DANGER

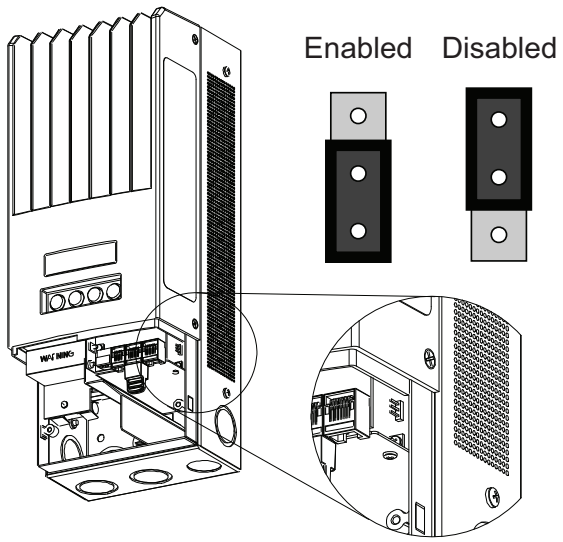
HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

Disconnect positive and negative PV and battery circuits before accessing the solar charge controller's wiring compartment.

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

To disable the PVGFP circuit, remove the small jumper connector located on the circuit board within the wiring compartment of the unit. See Figure 7 for the jumper location. After removal, the jumper can be stored on a single pin of the 2 pin connector or moved into the location marked for units with a 3-pin connector.

Figure 8 Jumper location



PV Connection and Auxiliary Lines

⚠ WARNING

FIRE HAZARD

Do not ground the negative conductor of the auxiliary circuit.

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

The PV array must not be grounded in either its positive or negative terminal. Do not attempt to ground the PV+ terminal to have a common ground with the battery. A positive ground connection at the PV array will bias both battery and auxiliary terminals to –PV voltage with respect to chassis ground. This will present shock hazardous voltages at the battery terminals and the auxiliary lines.

The internal auxiliary connector lines must not be grounded in either their positive or negative terminal. Grounding the negative terminal of the auxiliary lines will create a short on the battery side outside the reach of the unit's over-current protection.

Wiring

The following sections provide information about wiring.

⚠⚠ WARNING

HAZARD OF ELECTRIC SHOCK, ENERGY, AND FIRE

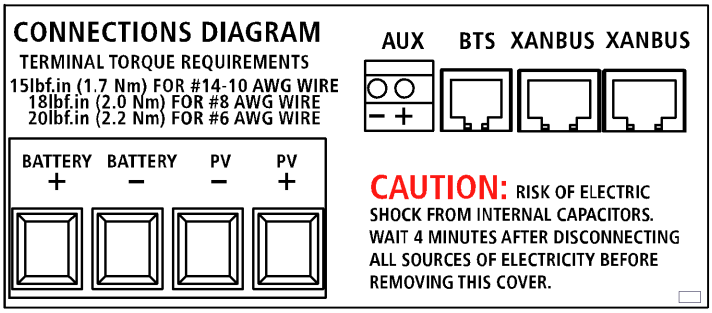
All wiring must be done by qualified personnel and in accordance with local electrical codes.

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

Connector Locations

Terminal connectors for DC wiring are located inside the wiring compartment. Labels above the DC wiring terminals identify all the connection points. See Figure 9.

Figure 9 DC Terminal Connector Locations



A label providing details on each connector and torque requirements for each terminal is affixed to the inside of the wiring compartment cover plate.

Wire Size and Over-current Protection Requirements

⚠⚠ WARNING

HAZARD OF ELECTRIC SHOCK, ENERGY, AND FIRE

The wiring, over-current protection devices (fuses and circuit breakers), and installation methods used must conform to all applicable code requirements. Wiring must be protected from physical damage with appropriate methods such as the use of conduit and strain relief clamps. To prevent intermingling with hazardous voltage-level wiring, the BTS, auxiliary output, and network cables must pass through a different conduit than the PV and battery cables.

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

PV Current Rating and Wire Gauge

The minimum wire size is determined by the specific installation, in particular, the short circuit current available from the panel array, which is rated for 60 A maximum I_{sc}. It is

important that a qualified installer determine the correct wire size for the specific installation and the local electrical codes.

For installations where the PV array output is the maximum allowable 60 A I_{sc}, the minimum allowable wire gauge is #6 AWG (16 mm^2) copper wire with a 90°C (194°F) insulation rating. This wire gauge is determined by electrical code requirements regarding conduit knockout sizes, wire bending radius, and space available within the solar charge controller wiring compartment.

No crimp-on terminals or lugs are required.

Over-current Protection

⚠ ⚠ WARNING

HAZARD OF ELECTRIC SHOCK, ENERGY, AND FIRE

Over-current protection must be provided, external to the unit, to protect the battery wiring. External disconnecting means must also be provided for both the PV and battery circuits. Consult applicable electrical codes to establish the correct fuse or circuit breaker ratings and for required locations of protection and disconnecting means.

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

Battery Circuit

The NEC requires the battery circuit to be protected with a device rated for 125% of the rating of the circuit. The DC-rated fuse or circuit breaker between the battery and the solar charge controller must be rated for 1.25 × 60 A (the maximum current rating of the solar charge controller).

PV Circuit

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK

The PV array will produce a hazardous voltage with even a small amount of light. Appropriate measures must be taken to prevent electric shock.

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

A PV disconnect device between the PV array and the solar charge controller must be installed. The disconnect device should be rated according to local electrical codes; 60 A is recommended.

Long-distance Wire Runs

If there is a significant distance between the PV array and the solar charge controller or between the solar charge controller and the battery, larger gauge wires can be used to reduce the voltage drop and improve performance.

NOTICE

EQUIPMENT DAMAGE

Do not connect an array capable of delivering over 60 A $_{Isc}$ to the solar charge controller. Wire sizes larger than #6 AWG (16 mm^2) may be used to reduce resistive losses but should not be installed directly into the solar charge controller. Use a splicer block or similar to connect wires of different gauges together. Follow manufacturer's recommendations for torque and mounting.

Failure to follow these instructions can result in equipment damage.

Maximum One-way Distance and Wire Size

Local and national electrical codes must be followed for determining additional installation requirements.

To calculate the maximum one-way distance of the cable from the PV array to the solar charge controller (or from the solar charge controller to the battery) on the same line, installers can arrive at the distance using the below formula.

Distance in meters may be calculated using the formula below.

L = (V x A x k) / (2 x I x R)

where

V = Voltage drop in %

A = Cross sectional area of the cable in (mm²)

L = Cable length in meters

I = Maximum current in amps

R = Resistance of cable (Resistance of Copper = 0.0172 ohm-m)

k = factor of safety which is 0.775 (about 77.5%)

2 = considering 2 runs

Example:

Considering the 3% voltage drop for a battery voltage of 12 V, 10 Amps current and 10 AWG copper cable with cross sectional area of 5.261 mm², the length can be as follows:

L = {((12V x 0.03) x 5.261 mm² x 0.775)/ (2 x 10A x 0.0172)}

L = (1.8936 x 0.775 / 0.344) = 4.27 meters.

For equivalent metric wire sizes, consult a local electrician or certified installer.

Connecting the Charge Controller

The following procedure is illustrated in Figure 10.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

Whenever a PV array is exposed to light, a shock hazard exists at the output wires or exposed terminals. Open the array disconnect switch before making the connections.

If the PV-GFP is enabled, do not connect the battery negative to ground. Bonding the battery negative to ground disables the unit's internal PV groundfault protection. For more information, see "PV Grounding" on page 28.

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

NOTICE

EQUIPMENT DAMAGE

Do not connect the PV negative and battery negative terminals together anywhere in the system, including the XW Power Distribution Panel or other DC disconnect. The PV negative and battery negative must be connected to separate terminals as marked on the unit.

Failure to follow these instructions can result in equipment damage.

To connect the charge controller:

1. Make sure the PV array disconnect and battery disconnect are turned off.
2. Ground the charge controller: connect a grounding conductor between a charge controller ground lug and the grounding electrode (see Figure 10).
3. Connect the PV array's negative (–) output to the charge controller terminal marked PV –.
4. Connect the PV array's positive (+) output to the PV array disconnect.
5. Route another positive (+) cable from the other end of the PV array disconnect to the charge controller terminal marked PV +.
6. Connect the negative (–) battery cable to the charge controller terminal marked BAT –.
7. Connect a positive (+) cable from the charge controller terminal marked BAT + to the battery disconnect.
8. Connect a second positive (+) cable from the other side of the battery disconnect to the positive (+) battery terminal.

NOTICE

REVERSE POLARITY DAMAGE

Before energizing the charge controller from either the PV array or from the battery, check the polarity of all power connections. Positive (+) must be connected to positive (+). Negative (–) must be connected to negative (–).

Failure to follow these instructions can result in equipment damage.

9. Torque the charge controller's battery terminals according to the following table:

Wire Size		Torque Value	
AWG	**mm^2**	**in-lb**	**Nm**
14-10	2.5-6	15	1.7
8	10	18	2
6	16	20	2.25

10. Allow some slack on the cables within the solar charge controller and secure the wiring with strain reliefs or cable clamps.

In general, the same rules apply for disconnect switches as for battery circuits: they must be located in all ungrounded conductors. Requirements vary so consult applicable codes.

NOTICE

DAMAGE FROM LIGHTNING

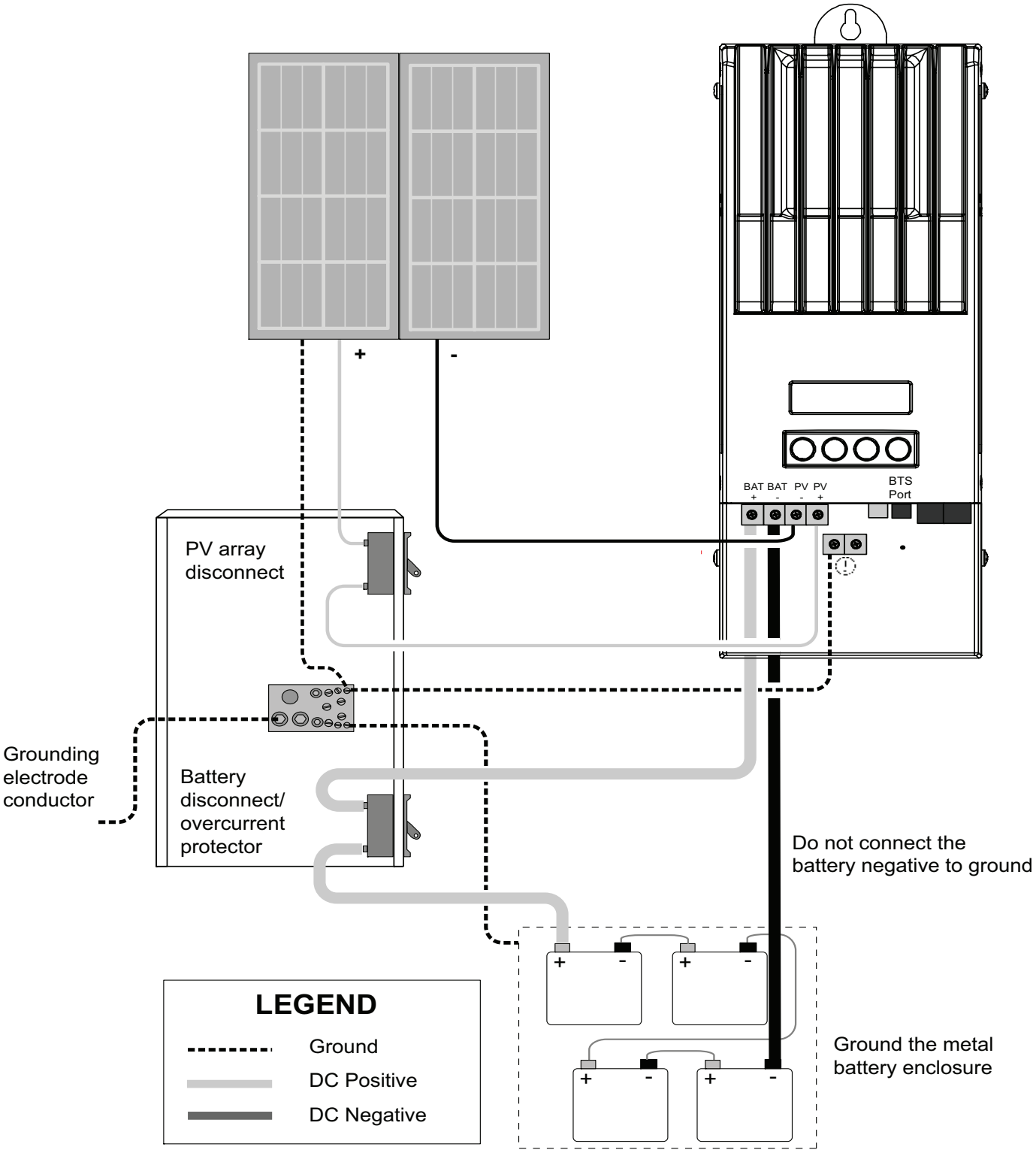
To protect the charge controller's insulation and conductors from damage due to a sudden over-voltage surge such as a lightning strike, install a DC-rated lightning arrestor on the DC input line.

Failure to follow these instructions can result in equipment damage.

NOTE:

- Grounding and disconnect locations will vary according to system design and local electrical codes.

Figure 10 Typical Wiring Diagram



Connecting Multiple Units

In a multiple-unit installation, each charge controller must be connected to a dedicated PV array. See Figure 11. For other multiple-unit installation considerations, see Network Installation on page 43.

⚠ ⚠ WARNING

ELECTRIC SHOCK HAZARD

- Only one charge controller is to have the PV-GFP fuse installed in installations with multiple parallel solar charge controllers.
- Before mounting and connecting the solar charge controllers, remove the PV-GFP fuse from each unit except one.
- Installing more than 1 fuse in a multi-controller system will increase amperage required to blow fuses 1A times the number of charge controllers.

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

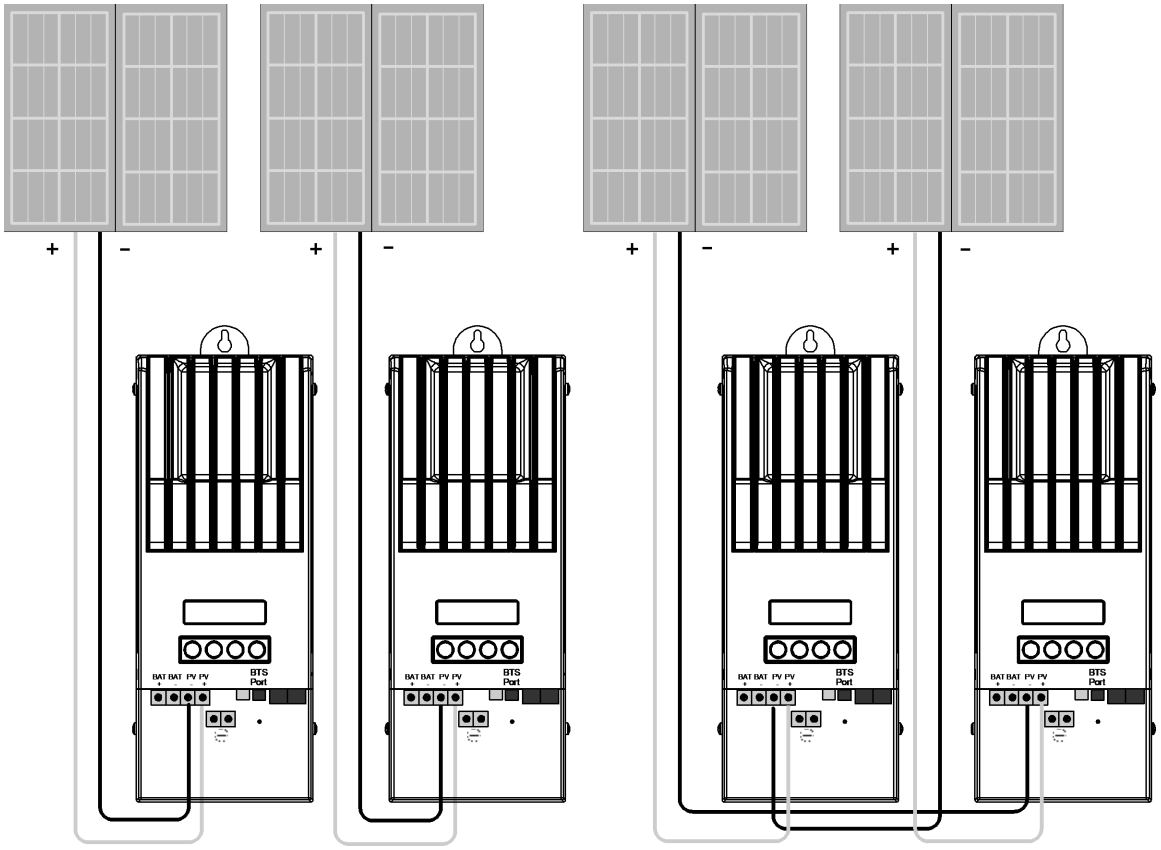
NOTICE

PV ARRAY AND CHARGE CONTROLLER DAMAGE

Make sure that each charge controller is correctly connected to its own dedicated PV array and that no wires are interconnected between charge controllers.

Failure to follow these instructions can result in equipment damage.

Figure 11 Multiple unit DC wiring



Left: Correct wiring —no interconnection between systems	**Right:** Incorrect wiring—systems are interconnected

Auxiliary Output Connections

⚠⚠ WARNING

HAZARD OF ELECTRIC SHOCK AND FIRE

If the PV-GFP internal protection has activated, shock-hazardous voltage may appear at the AUX connector and at the battery terminals. To avoid a shock hazard, ensure that all connections made to the AUX terminals have no uninsulated wire segments and that all wiring has an insulation rating of at least 300 V.

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

NOTICE

EQUIPMENT DAMAGE

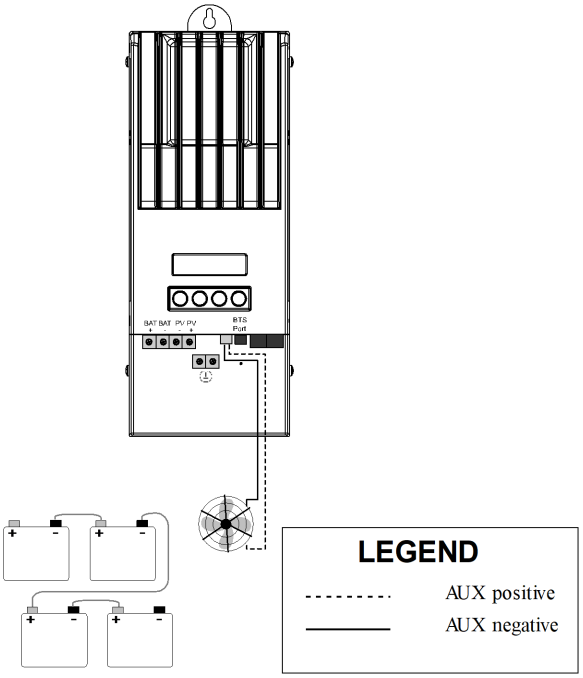
Do not connect a high amperage device to the auxiliary output. The auxiliary output is intended only to energize a low-current circuit such as a relay coil. Connecting to a high-amperage device will open the fuse in the common line and possibly damage the unit.

Failure to follow these instructions can result in equipment damage.

The auxiliary output connectors can accept #22 to #14 AWG (0.5 to 1.5 mm^2) copper solid or stranded wire. The auxiliary output is short-circuit protected and is disabled when a ground fault occurs.

To use the solar charge controller to control loads and protect your batteries, you must connect the solar charge controller auxiliary output to a relay that controls a battery disconnect to disconnect the load from the batteries.As shown in Figure 12, the auxiliary output can also control 12 VDC power to a fan to vent the battery compartment. The solar charge controller auxiliary output (producing 5 to 13 V and up to 200 mA) must be configured to activate when the batteries reach a pre-set voltage level. See “Auxiliary Output Settings” in the *Conext MPPT 60 Solar Charge Controller Owner's Guide*.

Figure 12 Auxiliary output vent fan application



Aux terminals (from left to right): COMMON | NO | NC

Disconnecting the Charge Controller

⚠ ⚠ WARNING

HAZARD OF ELECTRIC SHOCK

- Ensure that the positive and negative PV conductors and the battery conductors are disconnected from the solar charge controller before servicing the solar charge controller or the batteries. After disconnecting the batteries, the solar charge controller can appear de-energized when the PV array is still connected.
- After disconnecting power from the solar charge controller, wait at least four minutes before attempting any maintenance or cleaning or working on any circuits connected to the unit. Internal capacitors remain charged for four minutes after disconnecting all sources of power.

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

Before disconnecting batteries and the PV array from the unit, ensure the solar charge controller is not charging the batteries. If the solar charge controller is charging, you can wait until the charge cycle is complete or you can put the unit into standby mode. Standby mode shuts off the solar charge controller output. The solar charge controller can be put into standby mode using the gateway device.

If the solar charge controller is charging when the batteries are disconnected with a DC disconnect switch, an over-voltage output fault occurs due to the load on the solar charge controller output being removed. After approximately 10 seconds the solar charge controller loses power.

Normal operation resumes when the battery is reconnected.

If the unit is not charging, the charge controller simply shuts down when the batteries are disconnected. No faults are generated.

Network Installation

The charge controller is a Xanbus-enabled device. Xanbus is a network communications system which allows the charge controller to communicate settings and status information to other Xanbus-enabled devices.

Xanbus connections between multiple charge controllers allow information about each charge controller and its associated PV array to be communicated among all of the charge controllers in the system. Information about the entire system can be viewed on InsightLocal.

For example, in a two-charge controller system, if charge controller #1 is producing 1500 W and charge controller #2 is producing 2000 W, the gateway device displays a total system power of 3500 W. The accumulated amp hours and kilowatt hours produced by each charge controller for that day is also displayed.

NOTE: Networked charge controllers can also share battery temperature information if a single BTS is connected to a charge controller in the system. BTS information is only shared between networked devices of the same type.

Network Components

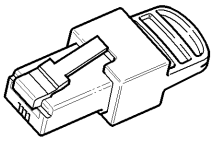
A Xanbus network consists of the following components:

- Xanbus-enabled devices:
  - Conext MPPT 60 Solar Charge Controller
  - Conext SW Inverter, Conext XW+ or XW Pro Inverter/Charger
  - Conext Automatic Generator Start
  - InsightHome, InsightFacility, or Conext Gateway
- Xanbus power supply—When only solar charge controllers are installed, a Xanbus power supply is required to supply network power. The charge controller does not provided Xanbus power. The solar charge controller will communicate with other solar charge controllers, but the units can not supply network power to any other devices.

  In systems that combine solar charge controllers with other Xanbus-enabled devices, the Conext XW+ or XW Pro Inverter/Charger provides the required 15 VDC/200 mA network power.
- Network cables—each Xanbus-enabled device is connected by a standard Ethernet (CAT 5/CAT 5e) patch cable. Do not use crossover cable.
- Network terminators (see Figure 13)—the Xanbus network must be properly terminated at each end (except when InsightHome is used) to help ensure communication signal quality.

  Network terminators plug into network ports on Xanbus-enabled devices. The charge controller ships with one terminator. Depending on your network layout, this terminator might need to be inserted into another device elsewhere in the network. Two network terminators are required for all Xanbus network configurations except InsightHome, which is terminated internally.

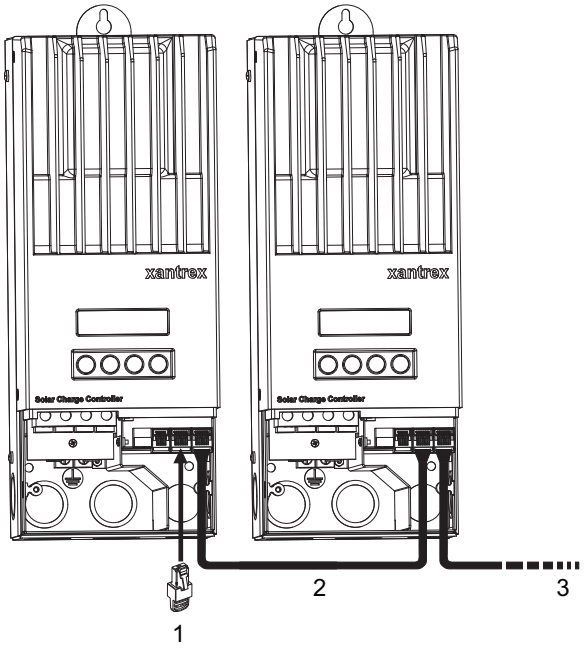
  Figure 13 Network terminator



Network Layout

Xanbus-enabled devices are connected with separate lengths of cable. The devices at each end of the chain must have a terminator inserted into their open network ports, as shown in Figure 14. Total cable length for the Xanbus network must not exceed 131 feet (40 m).

Figure 14 Network layout



1	Network terminator
2	Charge controller cable
3	Cable to next device

Connecting Network Cables Between Multiple Units

⚠ ⚠ WARNING

HAZARD OF ELECTRIC SHOCK

Do not route the network cables with the same conduit or panel as the PV or battery input and output cables, and make sure the network cables are not intermingled with other conductors in those systems.

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

Single knockouts on the back and bottom of the charge controller are provided for routing the Xanbus network cable (see Figure 3 on page 26). See Figure 9 on page 34 for the location of the charge controller's network ports.

NOTICE

RISK OF EQUIPMENT DAMAGE

- Connect only Xanbus-enabled devices. Although the cabling and connectors used in this network system are the same as ethernet connectors, this network is not an ethernet system.
- Do not connect one end of the network to the other to make a ring or loop.

Failure to follow these instructions can result in equipment damage.

To connect network cables between multiple charge controllers:

1. Remove the wiring compartment cover from each charge controller (see Removing the Wiring Compartment Cover on page 25).
2. Remove a single knockout from the back or bottom of each solar charge controller.
3. Connect the network cable to a network port in charge controller #1.
4. Route the cable to charge controller #2.
5. Connect the network cable to a network port in charge controller #2.
6. Connect another network cable to charge controller #2, and then route the cable to the next device in the network.
7. Make sure the factory-supplied network terminators are inserted into the empty network ports in the devices at the beginning and end of the network.

   There should be no empty network ports in any of the charge controllers.

Installing the Battery Temperature Sensor

⚠ WARNING

RISK OF BATTERY DAMAGE

Always install and connect the Battery Temperature Sensor (BTS) unless a Li-ion battery is used. See the note directly below.

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

NOTE: For all BTS compatible Xanbus-enabled devices in the system, at least one BTS must be separately installed for each device type associated with a battery.

If there is a group of the same devices forming a multi-unit setup, only one BTS is required per device type connected to the same battery (same DC association).

See the installation guide of each device for BTS installation instructions.

Installing a BTS is recommended for optimum charging performance and battery life. If a BTS is not installed and the batteries must operate in hot or cold conditions, manually adjust the temperature settings to suit the conditions. See “Charger Settings and Battery Settings” in the *Conext MPPT 60 Operation Guide (990-6547)*. A BTS should not be used with a closed-loop compatible BMS (battery managment system).

See Figure 9 on page 34 for the location of the BTS port. Single knockouts on the back and bottom of the charge controller are provided for routing the BTS cable (see Figure 3 on page 26).

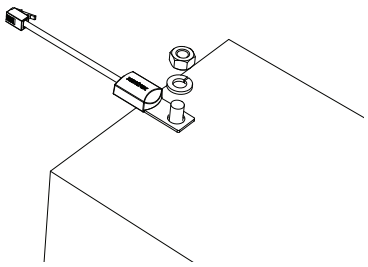
NOTE: If the sensor cable is damaged and the wires are shorted, the charge controller registers a battery over temperature fault condition. If the BTS wires have been cut, the charge controller assumes that the BTS is not connected. A replacement BTS can be ordered from a third-party supplier (part number 808-0232-02).

To install the BTS:

1. Remove the charge controller’s wiring compartment cover (see Removing the Wiring Compartment Cover on page 25).
2. If necessary, remove a single knockout from the back or bottom of the solar charge controller.

3. Connect the ring terminal on the BTS directly to the negative battery terminal or positive battery terminal, or use the adhesive backing on the sensor back to attach the sensor to any side of the battery to be monitored.

   Figure 15 Attaching the BTS to a battery terminal



4. If connecting to the battery terminal, make sure the BTS does not prevent the power wiring from making the best possible contact with the battery terminal. If using the adhesive backing, install the BTS on the side of the battery below the electrolyte level. It is best to place the sensor between batteries and place the batteries in an insulated box to reduce the influence of the ambient temperature outside the battery enclosure.

   ⚠ WARNING

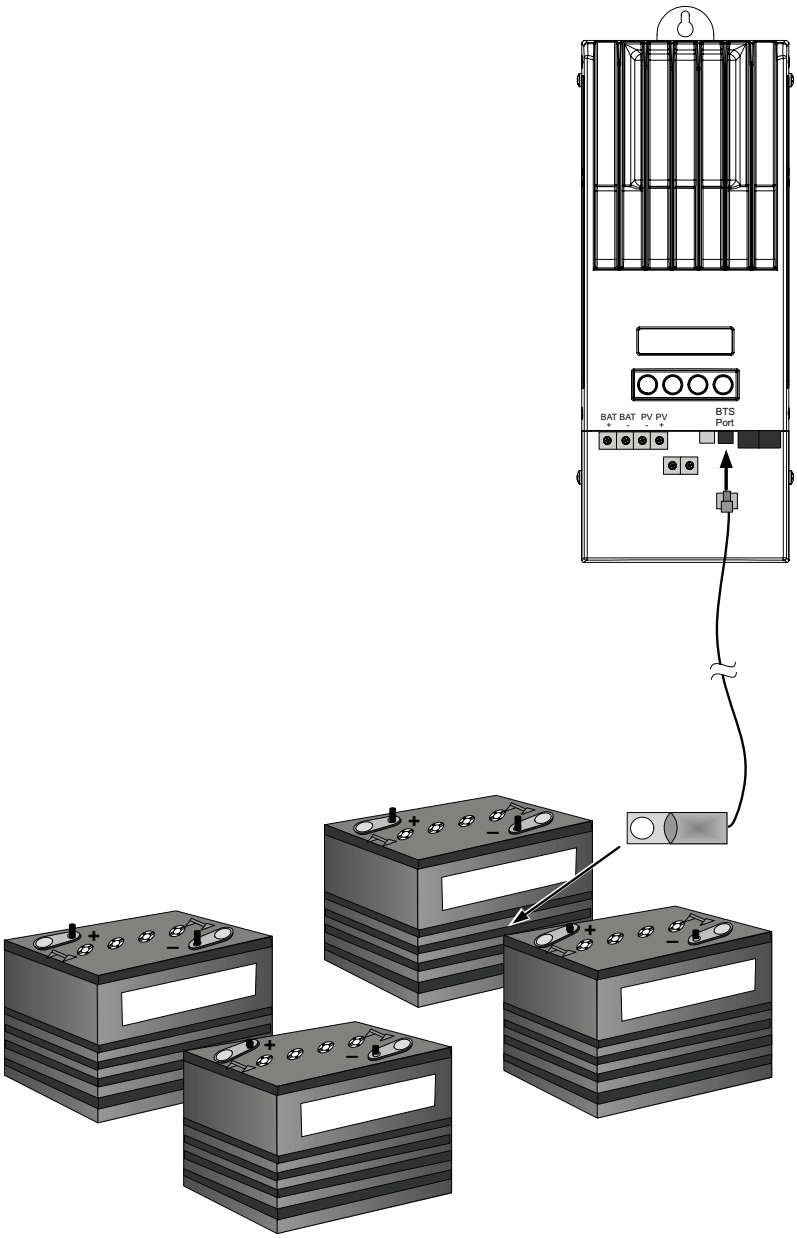
   HAZARD OF ELECTRIC SHOCK

   The BTS cable must not pass through the same conduit used for PV wiring and battery cables.

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

5. Pass the other end of the BTS cable through a conduit hole on the charge controller, and then insert the BTS plug into the BTS RJ-11 port.

Figure 16 Installing the BTS



1	Insert the BTS plug into the charge controller's BTS port.
2	Attach the BTS to a battery terminal or to the side of a battery.

6. Replace the charge controller's wiring compartment cover.

Commissioning Checklist

Before powering on the inverter, perform the following inspections:

- ❑ All clearances are correct (see Choosing a Location on page 23).
- ❑ The Conext MPPT 60 is stable and securely fixed to the mounting surface.
- ❑ There are no objects such as tools or extra screws inside or on top of the Conext MPPT 60.
- ❑ The cables are routed through cable glands or conduits and protected against potential mechanical damage. Do not over-tighten the sealing locks, if used.
- ❑ The wires are properly and firmly connected.
- ❑ If you are using gateway device, checkthat you have a laptop with Microsoft® Windows® 7 or later, or Mac OS® X 10.4.8. or later at the commissioning site.
- ❑ If you are using gateway device, checkthat you have InsightLocal installed on your laptop or tablet.
- ❑ If you are viewing this document online, download a copy that you can access offline.
- ❑ Complete the stepsin the following section to verify that the MPPT operates as expected.

Commissioning Steps

You can either chose to use the Conext MPPT 60 150 LCD screen to commission the MPPT, or use a gateway device.

There are three gateway devices that allow you to configure and monitor the charge controller through a web interface called InsightLocal on a connected PC or laptop. In addition, the InsightCloud option has available any-where-in-the-world cloud-based monitoring.

Follow the instructions in the *Configuration* chapter in *Conext MPPT 60 Operation Guide (990-6547)* to set up the initial configuration for your Conext MPPT 60.

Before you begin, make sure you have all important system information such as the nominal battery voltage, battery type, and battery bank capacity available.

When commissioning multiple charge controllers on the same Xanbus network, make sure to set a unique device number and the correct battery connection. The connection is important to define so that system totals and other related information are displayed accurately.

Starting the Charge Controller

To start the charge controller:

1. Turn on the charge controller battery breaker.
2. Close the PV array disconnect switch.

If the PV array voltage exceeds the minimum start voltage, the charge controller begins charging and the On/Charging LED starts flashing.

If the PV array voltage is not above the start voltage, the charge controller is powered but not charging. The On/Charging LED stays solid green.

Shutting off the Charge Controller

To shut off the charge controller:

1. Open the PV array disconnect switch.
2. Turn off the charge controller battery breaker.

3 Troubleshooting

What's in This Chapter?

Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

This chapter includes tasks that must be performed only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices. Review the Change Controller Safety Information on page 8 before proceeding.

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

Table 2 Troubleshooting

Issue	Possible Cause	Solution
Uneven output current between multiple charge controllers.	A.. PV arrays are supplying different amounts of current to each charge controller. B. Charging set points are not all set the same. C. Excess voltage drop in wiring is causing charge controllers to measure the battery voltage differently and regulate accordingly. D. Charge controllers are in constant voltage (absorption) mode and therefore are limiting their output current to maintain the present battery voltage. In this situation, some charge controllers will produce more output current than others.	A.. Check array output, but consider that this could be a normal operating condition if the arrays are located in different locations or point in different directions. B. Set charge controllers to the same settings. C. Check wiring. Upgrading or shortening the wire run might be required. D. No need to intervene as this is a normal operating condition.
InsightLocal shows a ground fault and the charge controller has stopped operating.	A ground fault has caused the ground fault protection fuse to blow, or a normally ungrounded array contains a ground fault.	See Replacing the Ground Fault Protection Fuse on page 53.
InsightLocal shows a fault, error, or warning.	An active fault, error, or warning is present on the charge controller.	See “Viewing Active Faults, Errors, and Warnings” in the *Conext MPPT 60 Operation Guide (990-6547)* to determine which alarm is active on the charge controller. The tables in this section provide detailed information on why various alarms could be occurring on the charge controller.
Low panel output. Input and output voltages read about the same.	Array maximum power point is less than the nominal battery voltage. The solar charge controller is still charging, but cannot charge at V_{mpp}.	Check or reconfigure the array.

Battery voltage is exceeding Bulk and Float settings in cold weather and not reaching settings in hot weather.	BTS is compensating charging voltages based on battery temperature.	No problem. This is the intended operation.
The charge controller does not show up in InsightLocal or it drops off the network periodically.	A.. Network cable is not working. B. Xanbus cables are running in parallel with current-carrying conductors. C. The total network length exceeds the maximum length specification.	A.. Replace cable. B. Reroute Xanbus cables away from current-carrying conductors. C. See Network Layout on page 44 for specifications.
The charge controller does not produce any power.	A.. No PV input voltage. B. PV input voltage is not within operating range. C. PV wires are connected in reverse polarity. The PV input has short circuited and input voltage is zero volts.	A.. Change the PV disconnect switch from the off position to the on position. B. Make sure that the PV panels are configured to provide voltages within the charge controller's operating voltage window. C. Verify PV polarity relative to battery negative.
The charge controller produces less power than expected.	A.. Arrays from multiple controllers share a common PV (-). B. The PV polarities are swapped from one controller to the other (i.e. POS and NEG of array connected to different controllers).	A.. Connect each charge controller to a dedicated PV array. B. Follow the instructions in "Connecting Multiple Units" on page 40.
The charge controller does not show up in InsightLocal.	A. No battery connection to the charge controller. B. The charge controller is wired incorrectly. C. Charge controller is not operational.	A. Change the battery disconnect from the off position to the on position. B. Check all connections and correct the wiring if voltage is not present on the charge controller's battery terminals. C. If you have verified there is at least 20 V present on the charge controller's battery terminals yet the On/Charging (green) LED remains off, contact customer service.

Replacing the Ground Fault Protection Fuse

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK

If a ground fault is indicated, normally grounded PV conductors could be ungrounded and energized. Before working on any portion of the array or wiring, make sure that portion of the array is de-energized by blanketing, use of disconnects, or other safe working procedures and by testing for voltage before beginning work.

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

The ground fault protection fuse blows when a significant leakage current flows between the PV array and earth ground or when the system has been installed with

deficient wiring. Before replacing the fuse, it is important to have qualified service personnel, such as a certified electrician or technician, determine the cause of the ground fault and effect repair.

To replace the ground fault protection fuse:

1. Make sure the PV and battery disconnect switches are open and the charge controller is de-energized.
2. Remove the wiring compartment cover, as described in Wiring on page 34. The ground fault protection fuse is located behind the wiring terminals.
3. Remove the blown fuse and replace it with a new AC/DC midget cartridge, DC-rated 600 VDC, 1 A (Littelfuse® KLKD 1 or equivalent). Be careful not to damage the fuse clips, circuit board, and surrounding components.
4. Replace the wiring compartment cover.
5. Clear the fault and reset the system by removing and then reapplying both PV and battery power.

A Specifications

What's in This Chapter?

Electrical Specifications

Note: All specifications are subject to change without notice.

Table 3 Electrical specifications

Specification	Rating
Minimum PV Array Voltage (Operating)	Battery Voltage + 15 V
Maximum PV Array Voltage (Operating)	140 VDC
Maximum PV Array Open Circuit Voltage	150 VDC
Array Short Circuit Current	60 ADC maximum
Maximum PV Array Rating	5250 W, oversizing up to 7200 W
Nominal Battery Voltage	12, 24, 36, 48, 60 VDC
Battery Voltage Range (Operating)	10 VDC to 80 VDC
Maximum Output Current	60 A (for all battery voltages except 60 V)
Maximum Output Power	3500 W
Auxiliary Output	5–13 V, up to 200 mA
Tare Loss/Night-time Power Consumption	2.5 W
Charger Regulation Method	Three-stage (bulk, absorption, float) Available, but not recommended: Two-stage (bulk, absorption) see Charge Controlling on page 19

Note:

- PV array voltages often exceed STC voltage specifications, especially when the array is cold. At cold temperatures the open circuit voltage will be higher than at STC or MPPT operating points. Refer to data provided by the maker of the PV panels and ensure the maximum voltage can never exceed the limits in the table above.
- PV array current might exceed STC current specifications, especially under intense sunlight, certain atmospheric conditions, or from reflections (i.e, water, snow, or ice). Some electrical codes (eg. the NEC) consider the worst case current to be 25% higher than the short circuit current at STC. For selection of wire and some components (breakers, fuses) a further 25% derating is applied.

MPPT Voltage Range

The solar charge controller maximum power point tracking algorithm maximizes the energy drawn from a PV array as long as the array operating voltage is within the MPPT operational window. Charging begins when the input voltage is greater than the battery voltage. Ensure that the PV array used in the system operates within the MPPT operational window.

Effects of array voltages outside of the MPPT operational window are shown in the table.

Voltage	Effects of Array Voltage	Charge Controller Mode
$V_{oc} < V_{batt}$ (system battery voltage)	Charge controller does operate.	Low Light
$V_{MPP} < V_{batt}$	Harvest of solar energy less than optimal.	Charging
$V_{MPP} = V_{batt}$ +15 VDC to 120 VDC	Maximum harvest of solar energy.	Charging (MPPT window)
120 VDC < V_{MPP} < 140 VDC	Charge controller reduces the charging current to protect the unit from voltage spikes.	Input voltage derating
V_{MPP} > 140 VDC (or V_{oc} > 140 VDC)	Charge controller shuts down. Unit may be damaged if Voc > 150 V.	Over-voltage fault

Default Battery Charging Settings

All settings in the following table are based on a 12-volt nominal battery bank. For the other nominal voltages, scale the values in this table appropriately (48-volt systems would use voltages four times that of the values listed in this table). An exception to this is for equalize voltage on a 60-volt system. The maximum programmable output voltage is 72 volts, but a 60-volt system would need to be equalized at 80 volts. Therefore, the maximum equalize voltage is limited to 72 volts on a 60-volt system.

Setting	Battery Type		
	Flooded[1]	Gel	AGM
Equalize Voltage	16.0 V	n/a	n/a
ReCharge Voltage	12.5 V	12.5 V	12.5 V
Bulk Voltage	14.4 V	14.2 V	14.3 V
Absorption Voltage	14.4 V	14.2 V	14.3 V
Float Voltage	13.5 V	13.8 V	13.4 V
Absorption Time	180 min	180 min	180 min
Batt Temp Comp	-27 mV/C	-27 mV/C	-21 mV/C

[1] When **Custom** is selected for the battery type, the default settings are based on the flooded battery type.

Mechanical Specifications

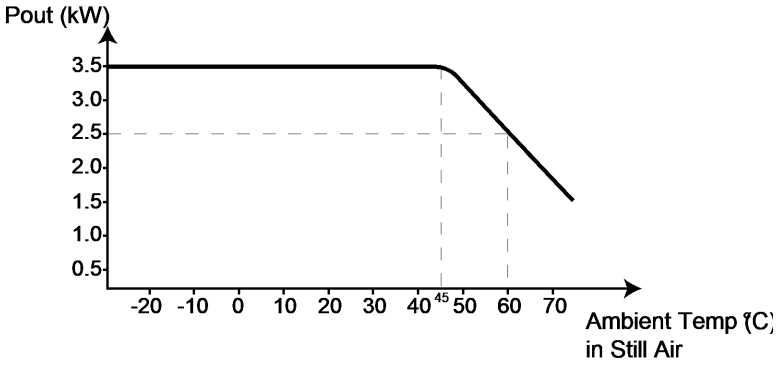
Table 4 Mechanical specifications

Enclosure Type	Indoor, ventilated, sheet metal chassis with " and 1" (22.22 mm and 27.76 mm) knockouts and aluminum heat sink
Maximum and Minimum Wire Size in Conduit	#6 AWG to #14 AWG (13.5 to 2.5 mm^2)
Maximum and Minimum Wire Size Rating of Terminal Block	#3 AWG to #14 AWG (25 to 2.5 mm^2)
Operating Temperature Range	-20 to +45°C (-4 to 113°F)
Storage Temperature	-40 to +85°C (-40 to 185°F)
Pollution degree	2
Over voltage category	CAT II
Altitude Limit (operating)	Sea level to 6,500 feet (approximately 2000 m) recommended
Unit Dimensions (H × W × D)	14 ½ × 5 ¾ × 5 ½" (368 × 146 × 138 mm)
Mounting	Vertical wall mount
Weight (charge controller only)	10.75 lb (4.8 kg)
Weight (shipping)	13.75 lb (6.2 kg)

Output Power Versus Ambient Temperature

Once the charge controller's heat sink reaches maximum full-power operating temperature, the charge controller reduces its power output to ensure component ratings are not exceeded.

Figure 17 Output power vs. ambient temperature



Regulatory Approvals

Certified to UL 1741:2005 and to CSA 107.1-01 and carries the c(CSA)us mark.
EMC - North America:

FCC Part-15 sub part B, Class B, emission limits

Industry Canada ICES-003, Class B, emission limits

CE Marked and complies with the following:

Low Voltage Directive 73/23/EEC, per:

EN50178 “Electronic Equipment for Use in Power Installations”.

EMC Directive 2004/108/EC, per:

EN61000-6-3 “Emission Standard for Residential, Commercial, and Light-Industrial Environments”

EN61000-6-1 “Immunity for Residential, Commercial, and Light-Industrial Environments”

Australia:

C-tick marked

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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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