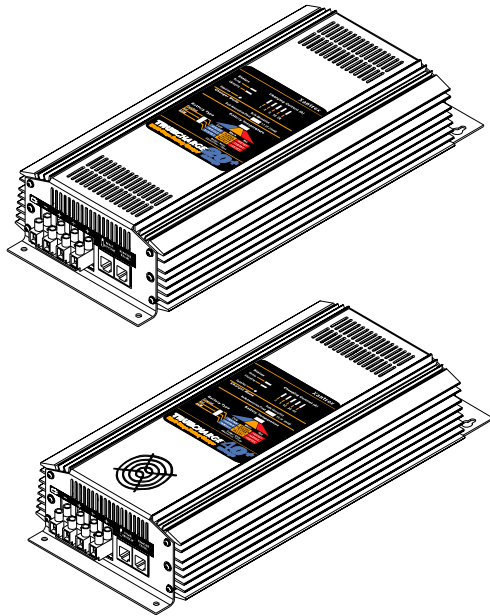


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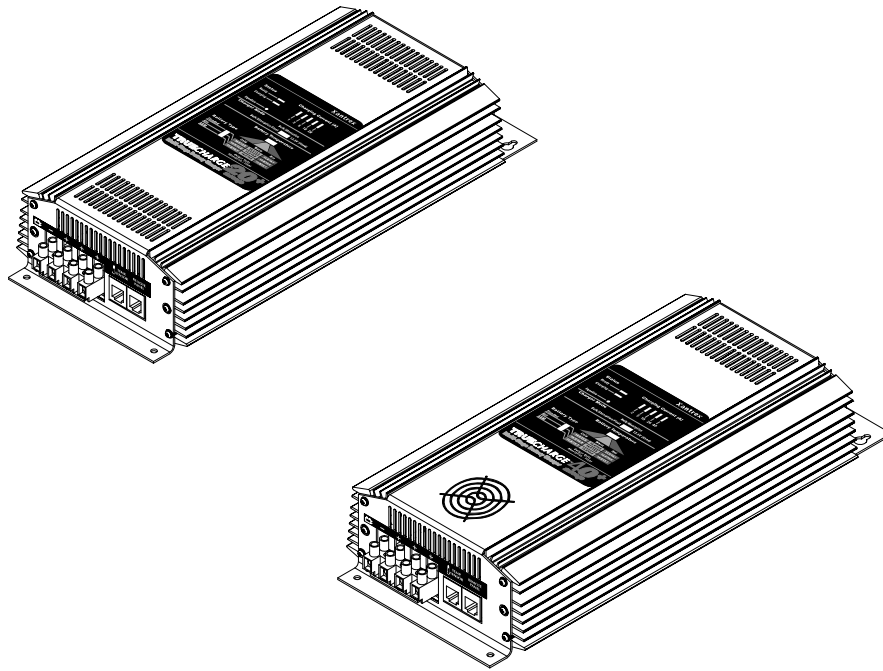
TC20+
TC40+

Owner's Guide

Xantrex
Truecharge 20+/40+ Amp
Multistage Battery Charger

www.xantrex.com

Truecharge 20 + /40 + Amp Multistage Battery Charger



Owner's Guide

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Smart choice for power

About Xantrex

Xantrex Technology Inc. is a world-leading supplier of advanced power electronics and controls with products from 50 watt mobile units to 1 MW utility-scale systems for wind, solar, batteries, fuel cells, microturbines, and backup power applications in both grid-connected and standalone systems. Xantrex products include inverters, battery chargers, programmable power supplies, and variable speed drives that convert, supply, control, clean, and distribute electrical power.

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About This Guide

Purpose and scope

This guide introduces the Truecharge+ battery chargers, describes their features, explains how they charge batteries, and provides procedures for their installation and operation. The guide does not provide details for particular brands of batteries. Please consult the battery manufacturer for this information.

This guide provides information for two products, Truecharge 20+ and Truecharge 40+. Where information is specific to one product, that product is referred to by name. Where information applies to both products, they are referred to collectively as Truecharge+.

Audience

The guide is written for anyone intending to install and operate a Truecharge+ battery charger. Xantrex recommends, however, that the product be installed by a certified technician or electrician.

Organization

This guide contains four chapters and four appendixes.

Chapter 1, "Introduction" introduces and describes features of the Truecharge+ multistage battery chargers.

Chapter 2, "Installing Truecharge+" lists the materials you receive, provides site recommendations for installing Truecharge+, and provides the materials and procedures for its installation.

Chapter 3, “Operation” provides background information for charging batteries with Truecharge+ and procedures for charging and for equalizing batteries. Chapter 3 also explains how to calculate charging times, how generators affect Truecharge+ and explains how the front panel indicator lights are interpreted.

Chapter 4, “Maintenance and Troubleshooting” provides information for maintaining and troubleshooting Truecharge+.

Appendix A “Specifications” contains the Truecharge+ physical, electrical, AC input, and protection feature specifications.

Appendix B “Battery Charging” describes the Truecharge+ multistage charging algorithm.

Appendix C “Battery Maintenance” contains procedures for maintaining the battery enclosure, battery terminals and lugs, and battery cables. It also provides a list of the clothing, tools, equipment, and supplies you should have before you begin battery maintenance.

Appendix D “Product and System Information” contains the Xantrex warranty for your product and return instructions. It also contains a place for you to record the serial number and date of purchase and other details of your battery charger.

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Important Safety Instructions



WARNING

This chapter contains important safety and operating instructions as prescribed by UL and CSA standards for chargers used in residential, RV, and marine applications. Read and keep this Owner's Guide for future reference.

1. Before using the charger, read all instructions and cautionary markings on the charger, the batteries, and all appropriate sections of this guide.
2. Do not expose the charger to rain, snow, spray, or bilge water. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the charger in a zero-clearance compartment. Overheating may result.
3. Use only attachments recommended or sold by the manufacturer. Doing otherwise may result in a risk of fire, electric shock, or injury to persons.
4. The charger is designed to be permanently connected to your AC and DC electrical systems. Xantrex 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 application.
5. 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 charger with damaged or substandard wiring.
6. Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. If the unit is damaged, see the Warranty section in Appendix D, "Product and System Information".

7. Do not disassemble the charger. See Appendix D, “Product and System Information” 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.
8. To reduce the risk of electrical shock, disconnect both AC and DC power from the charger before attempting any maintenance or cleaning or working on any circuits connected to the charger. Turning off controls will not reduce this risk.
9. The charger must be provided with an equipment-grounding conductor connected to the AC input ground.
10. For marine applications in the United States, external connections to the charger shall comply with the United States Coast Guard Electrical Regulations (33CFR183, Sub part 1).

Explosive gas precautions

1. Working in the vicinity of lead-acid batteries is dangerous. Batteries generate explosive gases during normal operation. Therefore you must read this guide and follow the instructions exactly before installing or using your charger.
2. TrueCharge 20+ and TrueCharge 40+ have been approved as Ignition Protected. They may be installed in areas containing gasoline tanks and fittings which require Ignition Protected equipment. Xantrex recommends, nevertheless, that it is safest not to install electrical equipment in these areas.
3. To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of the equipment in which the battery is installed.

Precautions When Working With Batteries

1. Have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.

3. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near batteries.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.

1

Introduction

Chapter 1, “Introduction” introduces and describes features of the Truecharge+ multistage battery chargers.

Truecharge + Features

Truecharge+ is an advanced battery charger designed specifically for high performance, deep-cycle lead-acid batteries. It is smaller and lighter than many other chargers and can be installed or stored in small compartments. It has AC to DC isolation, a surge protector, and many other safety features which reduce potential shock and fire hazards.

20/40 Amp Continuous Rating

Truecharge 20+ delivers a 20 amp charging current and the Truecharge 40+ delivers 40 amps for approximately 75% of the charging cycle. The chargers only reduce the charging current below these rated levels when the battery is approaching full charge or when there may be overheating in high ambient temperatures. Because it delivers rated current over most of the charge cycle, Truecharge+ charges your batteries faster than many other chargers with a higher rating.

Many other chargers only deliver their rated charging current for a short initial part of the charge cycle.

Simultaneous Three-Battery Bank Charging

Truecharge+ has three separate DC positive terminals to allow charging of three separate batteries (or battery banks). The total current into the batteries is a maximum of either 20 amperes or 40 amperes, depending on the model, which is divided amongst the batteries according to their state of discharge.

Note: The three outputs are not independently voltage regulated so it is important to avoid systems with mixed types of batteries.

Wide Voltage Range Operation

Truecharge+ maintains the correct charging voltage for your battery when the AC line voltage drops as low as 90 VAC, or rises as high as 135 VAC. A surge protector in Truecharge+ protects it from surges and spikes on the AC power line.

Selector Switches

	Truecharge+ has selector switches for charge mode, battery type, and battery temperature setting.
Charge mode	The charge-mode switch allows you to select three-step charge, two-step charge or 13.5 volt fixed output modes. Refer to Appendix B, “Battery Charging” for an explanation of the charging algorithms.
Battery type	The battery-type switch allows you to set the Truecharge+ for the charging characteristics of flooded, AGM, and gel batteries.
Temperature	The battery temperature switch allows you to set charging characteristics based on the battery temperature. By setting the switches correctly before you begin charging your battery, you will be ensuring that it receives the best possible charge.

Extensive Protection Features

Truecharge+ provides the following protection features:

- Opening of the internal output fuse if a battery is accidentally connected with reversed polarity
- Fuse opening or electronic shutdown if there is a short circuit on the output of the Truecharge+
- Built-in protection against accidental connection to a higher battery voltage, up to 24 VDC
- Unit shutdown if it becomes overheated because of inadequate ventilation or a high ambient temperature
- Unit shutdown if the battery gets too hot (with battery temperature sensor only)

Isolated Design

The DC battery charging circuits of Truecharge+ are galvanically isolated by a transformer from the AC power circuits. This feature reduces the risk of electric shock and helps to prevent corrosion problems in marine applications.

Fixed Voltage Mode

The fixed voltage mode setting is meant to be used as a power supply or battery eliminator. It is not meant for charging batteries. The battery type, battery temperature, and equalize switches are all ignored in fixed voltage mode. The remote battery temperature sensor does not compensate the voltage, but the battery over-temperature shutdown is still active.

Optional Accessories

Battery Temperature Sensor	The remote Battery Temperature Sensor (BTS) automatically adjusts the charge according to the temperature of one of the batteries. With a BTS installed, the unit provides a more accurate temperature-compensated charge for the battery to which the sensor is attached.
Remote panel	The remote panel allows you to monitor the charging progress of two batteries or battery banks, the total charge current, and charger status from a convenient location.

Indicator Lights and Settings on the Front Panel

This section describes the parts of the front panel of the Truecharge 20+. Figure 1-1 shows the front panel. Descriptions are provided in Table 1-1

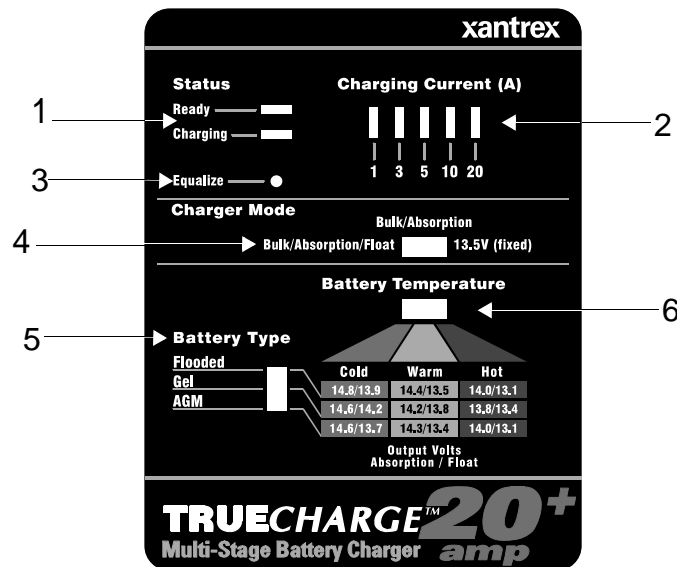


Figure 1-1 Front panel of Truecharge 20+ battery charger

Table 1-1 Truecharge+ front panel

Panel Item	Description
1	Status indicator lights which indicate that batteries are charged and ready for use or that the batteries are being charged or equalized.
2	Indicator lights which show the total charging current, in amps, into the three battery banks. The indicator lights show: 1, 3, 5, 10, 20 A (Truecharge 20+) 2, 5, 10, 20, 40 A (Truecharge 40+)
3	The recessed Equalize button is triggered manually to enter or leave the equalization mode.
4	The Charger Mode switch from which you can select a three-stage or two-stage charge or a 13.5 volt power supply mode to power 12 volt loads when you don't have a battery.
5	The battery selection switch for choosing flooded, gel or AGM batteries.
6	The battery-temperature switch for choosing the battery temperature for the charge. Temperature settings compensate the output voltage for the battery temperature. Note that a battery temperature sensor overrides the temperature settings on the front panel.

The indicator lights are also used to indicate error codes. See Chapter 4, "Maintenance and Troubleshooting"

How Truecharge + Works

Truecharge+ changes the alternating current (AC) supply from the utility to the controlled low-voltage, direct current (DC) required to charge the battery by using high-frequency, switched-mode power conversion circuits. The high-frequency power conversion method is similar to that used in power supplies for computers and other electronic equipment. It results in a significantly smaller and lighter charger than other power conversion methods allow.

The controlled DC output is fed to three isolation diodes, one for each battery bank. These diodes isolate the batteries from each other and prevent current flow from one battery to the others.

2

Installing Truecharge +

Chapter 2, “Installing Truecharge+” lists the materials you receive, provides site recommendations for installing Truecharge+, and provides the materials and procedures for its installation.

The chapter also makes reference to the installation codes that may be applicable in your application, for example, the US National Electrical Code (NEC, NFPA 70), the Canadian Electrical Code (CEC, CSA C22.1), and the American Boat and Yacht Council (ABYC) Recommended Practices.

Materials List

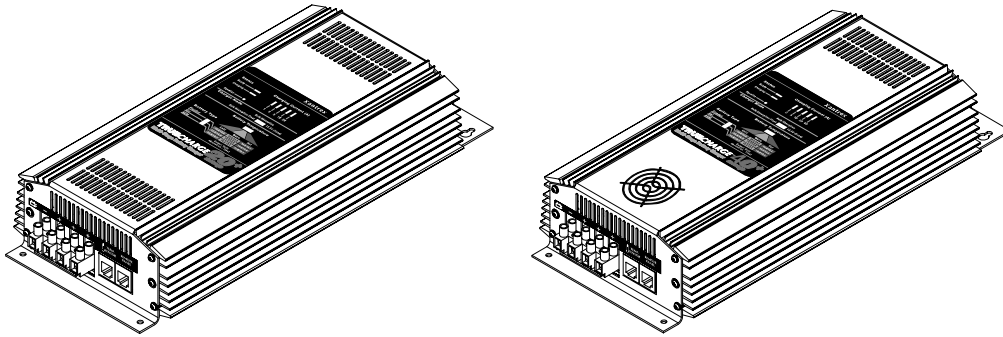


Figure 2-1 Truecharge 20+ (left) and Truecharge 40+ (right)

Contents	The unit is packed with the following materials: <ul style="list-style-type: none">• Owner's Guide• Wiring cover with 2 blunt-tip screws and two lock washers• AC cable clamp• Three twist-on wire nuts• Three crimp-on butt-splices
Recording information	After unpacking the unit, record the serial number and other purchase information on page D-7 of this guide.

Preparing for Installation

Mounting	Truecharge+ is designed to be permanently mounted. It is virtually maintenance free when properly installed.
Conditions	Before mounting and connecting Truecharge+, be sure you meet the requirements for <ul style="list-style-type: none">• location• circuits• wiring• tools and materials

Location

Install Truecharge+ in a location that meets the requirements set out in Table 2-1.

Table 2-1 Physical requirements for a Truecharge + installation

Condition	Description
Dry	The unit is intended for use in a dry location. Do not allow water or other fluids to drip or splash on Truecharge+. Do not mount the charger in an area subject to rain, spray or splashing bilge water.
Clean	Do not expose Truecharge+ to metal filings or any other form of conductive contamination. The presence of conductive contamination can cause damage and void your warranty.
Cool	For best performance, the ambient air temperature should be between 32 °F (0 °C) and 95 °F (30 °C)— the cooler the better. At higher ambient temperatures, the output current will be automatically reduced to protect the charger from high internal temperatures.
Ventilated	Allow <i>at least</i> 4 inches (10 cm) of clearance around all sides of the Truecharge+ for air flow. Ensure that the ventilation openings on the unit are not obstructed. If mounting in a compartment, ventilate the compartment with louvres or cut-outs to prevent overheating.
Safe	This battery charger is Ignition Protected, so it can be installed in areas containing gasoline tanks or fittings which usually require Ignition Protected equipment. Xantrex recommends, however, that it is safest not to install electrical equipment in these areas.
Close to AC junction box	Avoid the use of extended wire lengths if possible.
Close to batteries	Avoid excessive cable lengths and use the recommended wire lengths and sizes. Undersized or overly long cables may affect charging accuracy.

Circuits

Truecharge+ is designed to operate from a 15 amp, 120 VAC (nominal) branch circuit. The circuit must be protected by a 15 amp circuit breaker. Any switch in the circuit should be rated for a minimum of 10 amps for Truecharge20+ installations and 15 amps for Truecharge40+ installations. Refer to Appendix A “Specifications” for the actual current draw.

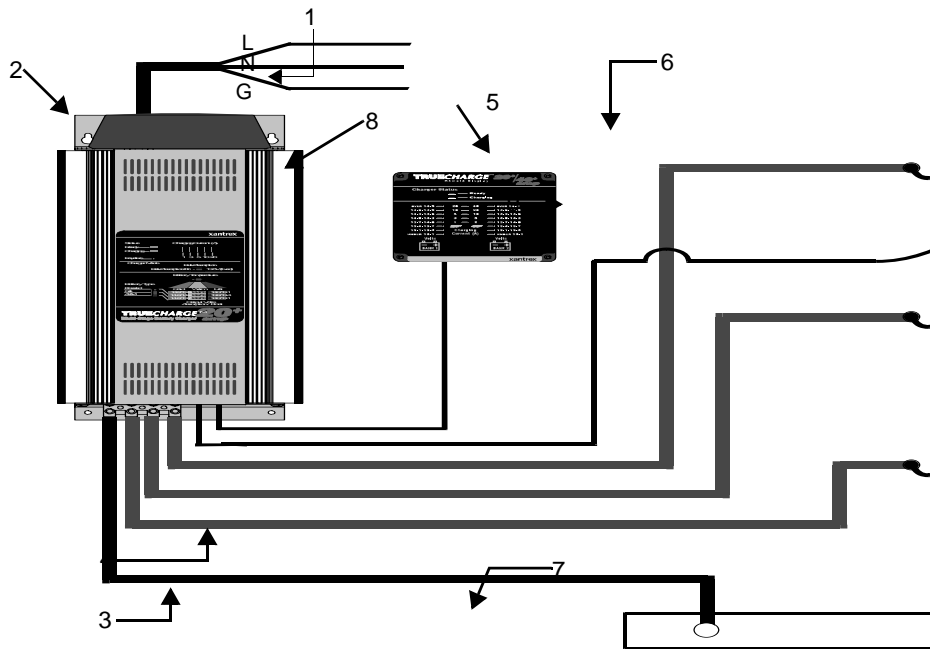


Figure 2-2 Truecharge+ system

1	120 VAC source with 15 amp breaker
2	AC input wiring compartment
3	DC negative cable
4	DC positive cables
5	DC circuit breaker or DC fuse and disconnect rated at 25 amps maximum for TC 20+ or 50 amps maximum for the TC 40+
6	Battery or battery bank
7	Engine negative bus or DC ground bus
8	Remote panel (optional)
9	Battery temperature sensor (optional)

Wiring Requirements

Figure 2-2 depicts a typical configuration system for the Truecharge+ showing the AC and DC wiring and protection devices required for a successful installation.

DC Wiring

The DC wiring must meet the following requirements:

- Length and size

Wire Length (maximum length one way)		Wire Size AWG ^a	
feet	meters	TC 20+	TC 40+
5	1.5	No. 10	No. 8
7.5	2.25	No. 8	No. 6
20	3	No. 6	No. 6

a. Based on ABYC Recommended Practice E-9, 75 °C wire, 3% voltage drop

Use the largest recommended size rather than the minimum for best performance and safety.

- DC Disconnect

The DC circuit from the battery to the charger must be equipped with a disconnect and over-current protection device. The device usually consists of a DC-rated circuit breaker, a “fused disconnect”, or a separate fuse and disconnect. These devices must be rated for DC voltage and current. Do not substitute devices rated only for AC voltage: they may not operate properly.

- Over-current protection

The current rating must be matched to the size of the DC wiring used and to the charger output, in accordance with the applicable codes. The following recommended current ratings for the DC fuse or breaker meet the requirements in ABYC, NEC, and CEC codes.

Truecharge 20+: 25 A

Truecharge 40+: 50 A

AC Wiring

Be sure that your AC wiring meets the following requirements before you install the Truecharge+:

- **Input wiring**
The AC input wiring for Truecharge+ should be three-conductor cable, providing a line, neutral, and ground conductor in an outer jacket. The conductors must be No. 14 AWG or larger. For marine applications the ABYC requires stranded wire. It stands up to vibration better than solid wire. For RV applications, the NEC allows solid wire in multi-conductor cable, but stranded wire will again withstand vibration better.
- **120 VAC, 15 amp branch circuit**
The circuit supplying the Truecharge+ must be rated 120 VAC, single-phase, 15 amps maximum. It may be either a 15 amp shorepower connection or a dedicated 15 amp branch circuit from your 30 amp or 50 amp shorepower connection. In either case the charger must be protected by a 15 amp breaker or fuse maximum.
- **Disconnect devices**
Each system requires a method of disconnecting the AC and DC circuits. If the over-current protection device is a circuit breaker, it will also serve as the disconnect. If a fuse is used, a disconnect switch is needed ahead of the fuse.

Tools

To mount and connect Truecharge+ you need:

- a slot screwdriver with a maximum 3/16 in wide blade for the DC terminals
- a No. 1 Phillips screwdriver for securing the AC wiring compartment cover
- a wire stripper
- the manufacturer's recommended crimp tool for any crimp terminals that are being used

Materials

You need the following material:

- 3 conductor No. 14 AWG AC cable
- Appropriately sized DC cables for each battery, with suitable connectors at the battery end
- DC fuse and disconnect or circuit breaker for each battery bank
- Mounting hardware (#8 recommended), minimum 4.
- Other means to route and secure AC and DC wiring

Installing Truecharge +



WARNING Shock and Energy Hazards

Be sure to read the safety guidelines and pay attention to all cautions and warnings throughout the installation procedure. The installer is responsible for ensuring compliance with the installation codes for your particular application.

Disconnect all sources of AC and DC power before proceeding.



CAUTION Reverse polarity

Before making the final DC connection, check the cable polarity at both the battery and the charger. Positive must be connected to positive; negative must be connected to negative.

Reversing the positive and negative battery cables can damage your charger and void the warranty. This type of damage is easily detected.

Installation steps

Truecharge+ is installed in three steps. The unit is

1. mounted (page 2–8)
2. connected to the batteries (page 2–9)
3. connected to its AC power source (page 2–11)

Mounting

Mount the Truecharge+ on a vertical surface such as a bulkhead, using the mounting holes provided. Mounting hardware should be corrosion resistant and #8 (4 mm). For secure, permanent mounting, use all four mounting holes. The DC connections should be at the bottom and the AC connections at the top.

Connecting DC Wiring For A Single Battery Or Multiple Batteries



WARNING

Truecharge+ cannot be set to deliver different charging profiles at each output. Therefore all the batteries you are charging *must* be the same type, that is, all should be flooded, *or* all gel, *or* all AGM.

The procedure for installing the DC wiring applies to a single battery or multiple batteries or battery banks. Figure 2-3 shows the connection order.

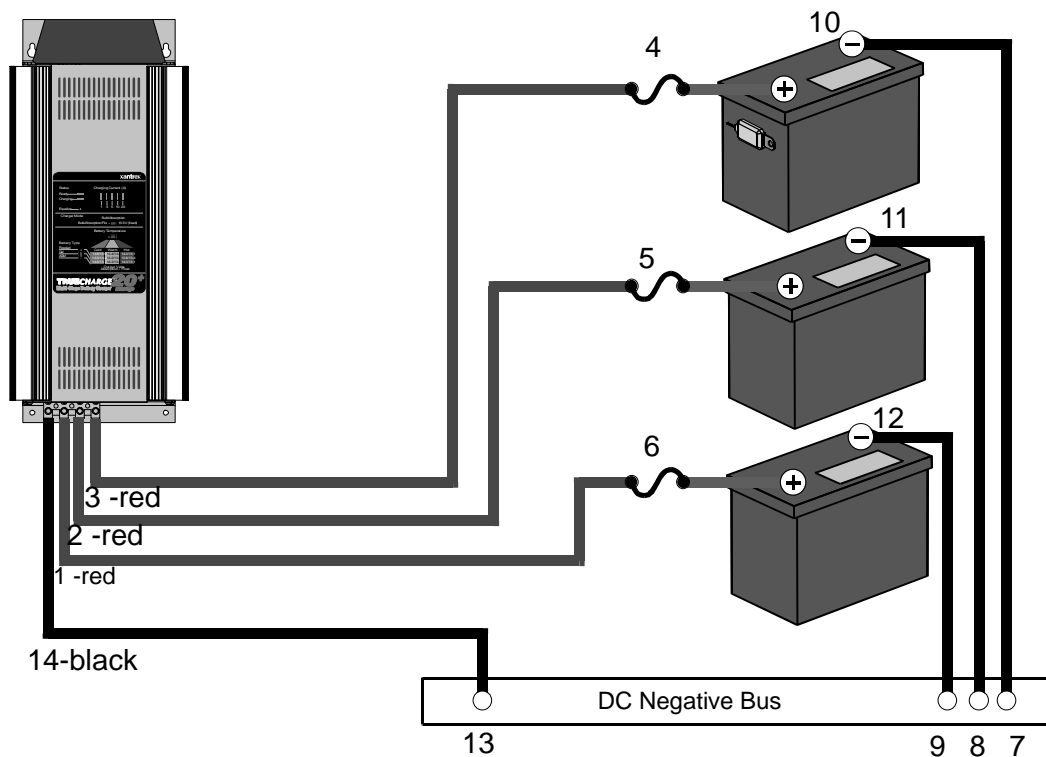


Figure 2-3 DC wiring connection order

To install the DC wiring:

1. Plan the route the DC wires will follow trying to make it as short as possible. Measure the required wire length, and cut the cables. Allow some extra length for connections and to provide slack in the wires.

It is possible that the connection to the battery negative circuit may not actually be right at the battery. For example, on boats the proper location for the negative connection is often at an engine negative bus or a DC negative bus. If in doubt, consult the boat schematics.

2. Identify the positive wires, by using color-coded wire or by marking both ends of the wire with colored tape or similar kind of marking. Repeat with a different color for the negative. Most installation codes recommended color codes, with the positive usually being red and the negative being black.

Note: You may find it helpful to label each cable, associating it with the battery bank it is connected to. For example, Bank 1 (-), Bank 1 (+), Bank 2 (-) and so on.

3. Install the DC circuit breakers or fuses in the battery positive circuits close to the battery.
4. Route the wiring to the batteries and to the charger, but don't connect it yet. Try to avoid routing wiring through an electrical distribution panel, battery isolator, or other device that will add additional voltage drops.
5. Strip 5/16 in (8mm) of insulation from the ends to be connected to the charger.
6. Fully insert each positive wire into the positive terminal on the charger (Figure 2-3, 1, 2, 3). Make sure there are no stray wire strands protruding from the terminal. Tighten the connector (20 in-lbs torque) and test that the wire is secure. Repeat this step for up to three batteries or battery banks.
7. Connect the positive cable from the positive wire terminals on the charger to the battery fuse or breaker, which should be installed on the battery positive terminals (Figure 2-3, 4, 5, 6).

Leave the DC disconnects or breakers in the Off position until installation is complete. Leaving them off helps prevent sparking when you actually make the connections.

8. Before proceeding, carefully check the wiring polarity – make sure the positive on the charger is going to the positive on the batteries (fuse or breaker) and make sure the negative on the charger is going to the battery negative terminal (or engine negative bus or DC negative bus). Do *not* reverse the connections.

If you reverse the polarity of any one of the DC connections, the internal fuse for that output bank opens. A qualified technician must replace this fuse for that bank to function. The other banks should continue to function normally.

9. To make a **single** battery bank connection:
 - Connect the negative cable to the battery negative terminal
 - Fully insert the negative wire into the negative terminal on the charger (Figure 2-3,14). Make sure there are no stray wire strands protruding from the terminal. Tighten the connector (20 in-lbs torque) and test that the wire is secure.
10. To make **multiple** battery bank connections using a DC negative bus:
 - Connect up to three negative cables to the DC negative bus or engine negative bus (Figure 2-3, 7,8,9), one for each battery bank.
 - Connect each negative cable to the battery negative terminal (Figure 2-3, 10, 11, 12)
 - Connect a negative cable from the DC negative bus to the negative terminal on the Truecharge+ (Figure 2-3, 13, 14).
11. Fully insert the negative wire into the negative terminal on the charger (Figure 2-3, 14). Check all connections for tightness and to ensure the conductors are fully inserted in their terminals with no stray wire strands protruding. Tighten the connector (20 in-lbs torque recommended) and test that the wire is secure.

Connecting to AC Wiring

To connect AC wiring:

1. Make sure the AC source circuit is disconnected by turning off the breaker feeding the circuit, unplugging from shorepower and disconnecting any other power sources such as a generator.
2. Plan the routing the AC wiring will follow from the source (usually a 15 amp breaker in an AC distribution panel) to the charger. Measure the required length of three-conductor No. 14 AWG wire, and cut it. Allow some extra length for connections and to provide slack.

3. Route the wiring without connecting it to the AC source or to the charger yet.
4. Install the supplied cable clamp in the knock-out of your choice on the AC wiring compartment on the top end of the charger and tighten the locknut. Run the AC wiring through the cable clamp and about 6 inches into the wiring compartment.
5. Carefully remove approximately 3 inches of the outer jacket, being careful not to cut or nick the insulation on the individual conductors.
6. Connect the AC wiring to the Truecharge+ pigtail wires in the wiring compartment junction box, being sure to connect the line conductor to the line, the neutral to the neutral, and the ground to the ground. The pigtail wires are color coded as follows:

Conductor	Color code
Line	Black or brown
Neutral	White or blue
Ground	Green or green with yellow stripe

7. Make the connections with the twist-on or crimp-on connectors supplied or with other approved connectors suitable for your installation.

For boat installations, use the crimp-on butt splice connectors following the procedure “To connect AC wires with the crimp-on butt-splice connector” on page 2–13. The ABYC Standards and Recommended Practices for Small Craft prohibit twist-on connectors for AC connections on a boat. For non-marine installations in locations not subject to vibration, either type of connector may be used.
8. When all connections are completed, push the wiring with connectors inside the wiring compartment. Install wiring compartment cover and fasten with the blunt-tip screws and lock washers supplied
9. Tighten the cable clamp to secure the wiring. Be sure it grips the outer cable jacket and not the individual wires.
10. Continue the installation by connecting the other end of the AC wiring to your AC source, observing the color code described above.

To connect AC wires with the crimp-on butt-splice connector:

Note: You must exercise care when crimping butt-splice connectors. Use a crimp tool designed for this type of connector such as a Panduit, catalog number CT100, CT160, or CT 260.

1. Using a wire stripper, carefully strip $5/16''$ (8mm) from the ends of the two wires being connected.
2. Insert one wire into one end of the butt-splice, insert the butt-splice into the crimping tool, and crimp firmly. The proper location for the crimp is approximately $1/16''$ (1.6mm) past where the butt-splice insulation tapers down as shown in Figure 2-4

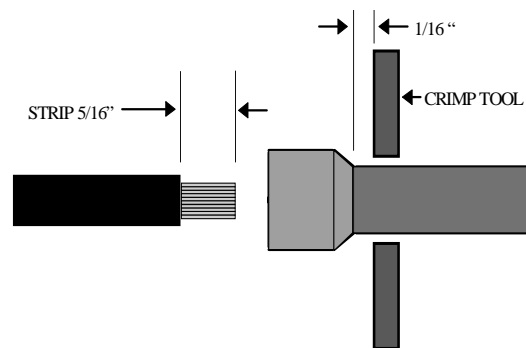


Figure 2-4 Butt-splice connection

3. Repeat Step 2 for the other end of the butt-splice.
4. Tighten the cable clamp to secure the wiring so that it grips the outer cable jacket (not the individual wires).
5. When all connections are completed, push the wiring with connectors inside the wiring compartment. Install wiring compartment cover and fasten with the blunt-tip screws and lock washers supplied.
6. Continue the installation by connecting the other end of the AC wiring to your AC source observing the color code described above.

Grounding



WARNING Electric shock hazard

Do not make an ungrounded connection. Have an electrician install a properly grounded circuit if one is not already installed. Improper connection can result in risk of an electric shock.

Truecharge+ must be grounded to reduce the risk of electrical shock. The AC input ground wire must be properly connected to ground in accordance with all applicable electrical codes. Meeting electrical codes is achieved by connecting the ground conductor of the AC input cable to a properly grounded ground terminal in the AC distribution panel where the 15 amp branch circuit originates.

If your installation code allows the use of a flexible AC cord to attach Truecharge+ to a standard AC socket, the cord and plug must be equipped with a ground conductor and a ground pin (that is, a three-prong plug) and the socket must be able to accept the plug without modification.

Installing Optional Accessories

If you have purchased the accessories, you can also install the Battery Temperature Sensor (BTS) and the Remote Display Panel at this time. For maximum battery life, Xantrex strongly recommends the use of the BTS.

Battery Temperature Sensor

Purpose	The BTS provides the charger with temperature information which overrides the temperature settings on the front panel. If your batteries are located where temperatures are consistently high or consistently low, or vary frequently, consider the use of a BTS to prolong the life of your batteries.
Installation	The Battery Temperature Sensor Installation sheet offers suggestions for the most appropriate battery to monitor and the best placement of the temperature sensor on the battery.

Effect on charging

With the BTS, the charging setpoints are temperature-compensated up to 140 °F (60 °C). If the battery temperature exceeds 140 °F the charger stops charging. The BTS also provides more accurate compensation over a wider range of temperatures than the front panel temperature settings.

For example, with the switch in the HOT position, the charger compensation is equivalent to the BTS compensation at 95 °F (35 °C). At 95 °F, absorption voltage for a gel battery is reduced to 13.8 VDC. At 122 °F (50 °C) the absorption voltage for the same battery is reduced to 13.4 VDC if the BTS is installed. It would still be at 13.8 VDC if you are just using the temperature setting switch.

Remote Display Panel

The Remote Display Panel allows you to monitor battery charger activity away from the charger whenever Truecharge+ is operating. The panel displays the total charging current and the voltages of the two batteries or battery banks connected to the two positive terminals closest to the negative terminal.

The insert card which accompanies the panel provides the directions for installing it.

3

Operation

Chapter 3, “Operation” provides background information for charging batteries with Truecharge+ and procedures for charging and for equalizing batteries. Chapter 3 also explains how to calculate charging times, how generators affect Truecharge+ and explains how the front panel indicator lights are interpreted.

About Charging

This section provides information about

- calculating the charging time
- effect of battery temperature on charging
- indicator light activity during the charging process
- using a generator to run Truecharge+

Charging Time

Formula

Charging time will depend on the capacity of your battery and on how deeply it is discharged. The following equation calculates an approximate charging time:

$$\text{Charging time} = \frac{\text{CAP} \times \text{DOD}}{\text{CC} \times 80\%}$$

where:

Charging Time: Battery recharge time in hours

CAP: Battery capacity in amp-hours

DOD: Battery depth of discharge in per cent. A fully discharged battery has 100% DOD

CC: Charge current, the rated current output of the charger in amperes

80%: Typical charging efficiency for lead-acid batteries

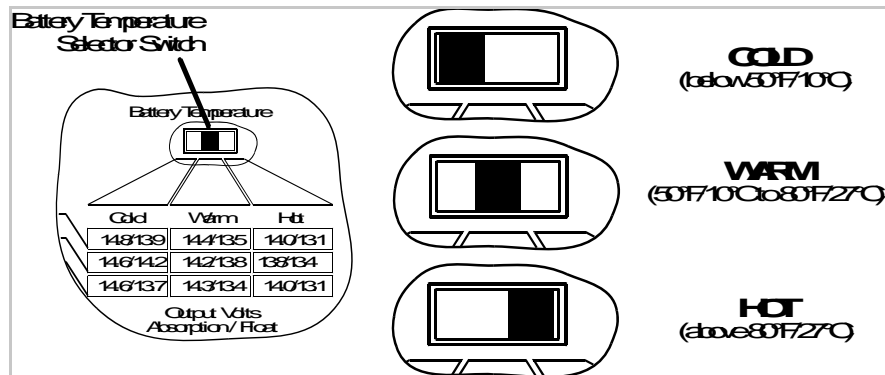
Example

A Group 27 size battery rated at 82 amp-hours is 40% discharged, that is, it has a DOD = 40. Charging time with a Truecharge 20+ unit is calculated as follows:

$$\text{Charging time} = \frac{82 \text{ Ah} \times 40\%}{20 \text{ A} \times 80\%} = 2 \text{ hours}$$

Battery Temperature

Temperature switch Selecting the correct temperature setting selects the appropriate charging voltage to compensate for battery temperature.



Effect of temperature

Cold battery temperature If you choose the Cold setting, Truecharge + delivers, for example, 14.8 volts in absorption mode and 13.9 volts in float for a Flooded battery.

Hot battery temperature If you choose the Hot setting for the same battery, the charger delivers 14.0 volts in absorption mode and 13.1 volts in float, nearly one volt of difference from the cold battery charge.

Consequence of wrong selection If you choose a cold temperature setting for a hot battery, you risk overcharging your battery. If you are in doubt about which to choose, or if you are leaving the charger connected for an extended time, select Hot to reduce the risk of overcharging. The same is true for Gel and AGM type batteries. The life of your battery will be extended if all banks are in a similar temperature environment and you make sure the switch setting is correct each time you charge. You should consider purchasing a Xantrex battery temperature sensor if you expect wide temperature fluctuations.

Using A Generator As Source Power

The Truecharge+ can be run from a regular power source or from an alternate power source such as a generator. Refer to Appendix A, “Specifications” for AC input draw to determine the size of generator you need.

Many generators provide output voltage that is modified sine wave (MSW) rather than the true sine wave (TSW) that your utility provides. Xantrex does not recommend the use of Truecharge+ with MSW generators due to increased heating of the charger.

Indicator Light Activity On The Front Panel

Indicator light activity shows what is happening during the charging process and is also helpful in troubleshooting. Refer to Chapter 4, “Maintenance and Troubleshooting” for more information about interpreting indicator lights.

During the charging process, indicator lights are interpreted as follows:

Activity	Charger status
Charging indicator light is lit	The unit is charging in bulk or absorption mode
Both Ready and Charging indicator lights illuminate	The unit is performing the pre-equalization absorption charge or is performing the equalization charge.

Activity	Charger status
Ready indicator is lit, Charging indicator is not	The unit is either in float mode of three-step charging, monitor mode of two-step charging, or in fixed-voltage output mode.
Rapid flashing of all indicator lights	Truecharge+ can't respond to your request. You may have pressed the equalization button for an inappropriate setting such as a gel battery. Check your settings.
Charging Current indicator lights	These lights indicate the charging current. At transition points when the current is changing, two indicator lights may flash alternately, then settle into the new charging current reading. This happens because the current is between the two values indicated by the two indicator lights. Note that the indicator light values are minimums. For example, the 10 amp indicator light indicates current in excess of 10 amps.

Charging batteries

Before you start Before you start to charge batteries read the "Important Safety Instructions" on page ix and take all safety precautions when working with batteries.

To charge your batteries:

1. If possible, disconnect all loads from the battery, by removing battery cables, by opening a disconnect switch, or by switching loads off.

The charger detects a battery is fully charged when its charging current drops below a preset limit. The presence of electrical loads on the battery may interfere with this detection method. A timer-based charge termination feature acts as a backup, but the charging current-based method is preferable.

- Set the Battery Type selector switch according to the table below.

If your battery is	then select
Flooded (has removable caps intended for refilling)	Flooded
Any sealed type but AGM	Gel
Absorbed glass mat	AGM

- Set the Battery Temperature selector switch for the temperature of your battery as follows:

If battery temperature is	Select
Below 50 °F (10 °C)	Cold
Between 50 °F (10° C) and 80 °F (27 °C)	Warm
Above 80 °F (27 °C)	Hot

If temperatures fluctuate near the batteries, set this switch each time you charge the batteries.

If your batteries are in different locations with different temperature ranges, set the switch to Hot or to the temperature of the warmest location.

Note: The remote temperature sensor, if installed, overrides this setting, and it controls the charge voltage based only on the battery to which the sensor is attached.

- Ventilate the area around the battery thoroughly. Review the charging instructions supplied by the manufacturer of your batteries and take any steps required such as removing battery caps, adding distilled water and so forth.
- Apply AC power to Truecharge+ by closing the AC breaker and/or applying shorepower. The indicator lights will blink as an initialization sequence runs, lasting typically 10 seconds or so. After initialization the yellow charging indicator light illuminates.

During charging, the charging current indicator lights show the total current being delivered to the batteries. When charging a discharged battery, the 20 A indicator light on Truecharge 20+ (40 A indicator

light on Truecharge40+) will light for most of the charging cycle. Near the end of the cycle, the charging current decreases and the other indicator lights illuminate in sequence.

The charger pauses every 15 minutes for approximately 10 seconds to measure the battery voltage and to check for new or disconnected batteries. It then resumes charging. You may notice an occasional change in fan speed on Truecharge 40+ as this takes place.

After charging	<p>After charging is complete Truecharge+ enters into one of these modes:</p> <p>Float mode When the Ready indicator light lights, the battery is fully charged and ready for use. If you selected Bulk/Absorption/Float mode, Truecharge+ is in Float mode and will maintain the battery's charge.</p> <p>Monitor mode If you selected Bulk/Absorption mode, the Ready indicator light shows the charger is now in Monitor mode and is checking battery voltage and elapsed time since the last charge cycle.</p>
Recharging	<p>With either charging mode, the Truecharge+ will begin a charging cycle 21 days after the last cycle, or when battery voltage drops to below 12.5 VDC for 15 minutes or if AC power is disconnected and reconnected.</p>

Equalizing Flooded Batteries

About Equalizing

Frequency	Approximately once a month, you may wish to equalize your flooded batteries by using the battery charger equalization mode.
Important	<p>Equalization can damage your batteries if it is not performed properly. Never equalize a battery more than twice a month. Always check battery fluid level before <i>and</i> after equalization. Fill batteries only with <i>distilled</i> water.</p> <p>Battery manufacturers' recommendations on equalization vary. Always follow the battery manufacturer's instructions so batteries are properly equalized. As a guide, a heavily used battery may require equalization once a month while a battery in light duty service, only needs equalizing every two to four months. Truecharge+ provides a high-quality charge so batteries will not need to be equalized as often as with a lower quality charger.</p>

Operation

Battery type	Truecharge+ equalizes only flooded lead-acid batteries. It does not equalize sealed lead-acid batteries since they can be damaged by this process. If the battery type selector is set for Gel or AGM, and you try to equalize them, the indicator lights on the front panel flash but Truecharge+ does not enter equalization mode.
Duration	Equalization is manually terminated when the specific gravity in each cell is about 1.265 and remains constant at that level. Truecharge+ automatically exits the equalization mode after six hours, whatever the specific gravity, in the event you cannot terminate the equalization yourself.
Battery charge state	Equalization is only performed on fully-charged batteries. If they are not charged, the first part of the process is similar to the absorption charge and ensures the battery is fully charged.
Recommended	Xantrex recommends that you run a normal charge cycle on the batteries before you equalize them. While Truecharge+ will charge discharged batteries as part of the equalization cycle, it does not indicate when the charging has finished and the equalization begins. It is a recommended practice to only equalize batteries which are fully charged.

Performing An Equalization



CAUTION Risk of battery damage

Truecharge+ *cannot* automatically determine when to stop the equalization of a battery. You must monitor the battery specific gravity throughout equalization to determine the end of the equalize cycle. The six hour time-out is intended as a safety feature but may not be sufficiently short to prevent battery damage.



WARNING Explosion hazard

During equalization, the battery generates potentially flammable gases. Follow all the battery safety precautions listed in this guide. Ventilate the area around the battery thoroughly and ensure that there are no sources of flame or sparks in the vicinity

Important

Turn off or disconnect all loads on the battery during equalization. The voltage applied to the battery during equalization may be above the safe levels for some loads. Be sure to check battery electrolyte before and after equalization. Fill only with distilled water.

To equalize your batteries:

1. Using a toothpick or other small object with a fine point such as a paper clip or pen-point, press the recessed Equalize button on the control panel below the Charging and Ready indicator lights. Press and hold for about 5 seconds until both the Charging and Ready indicator lights illuminate. The charger is now in equalization mode.
2. Monitor the specific gravity of each cell of the battery during equalization with a battery hydrometer.

Equalization is complete when the specific gravity of each cell of the battery remains constant. Most lead-acid batteries have a specific gravity of approximately 1.265 when fully charged.

3. To terminate the equalization charge when the battery reaches the target specific gravity, momentarily press the equalization button. The charger will go to float mode for three-stage charging or monitor mode for two-step charging.
4. If the specific gravity is still rising when the charger automatically exits equalization to float mode after 6 hours, you can initiate further equalization by pressing the Equalize button for five seconds.
5. When equalization has finished, check the battery electrolyte level. If necessary, refill with distilled water only.

4

Maintenance and Troubleshooting

Chapter 4, “Maintenance and Troubleshooting” provides information for maintaining and troubleshooting Truecharge+.

Care and Maintenance



WARNING Risk of electrical shock

Truecharge+ contains no user serviceable components. Do not attempt servicing unless you are a qualified technician or electrician. Contact your dealer or the manufacturer for service information.

Cleaning

Truecharge+ contains solid-state electronic components that require no maintenance. The best care you can give the unit is to protect it from contact with liquids, spray, or fumes which may cause corrosion. Disconnect all AC and DC power and clean the outside of the case and wiring with a damp cloth if you suspect it has come in contact with battery fluid, salt water, gasoline or oil, or other corrosive material. Corrosion on the battery terminal posts may be removed with a solution of water and baking soda.

Routine checks

Periodically, check all wiring connections, DC and AC, to be sure they have not loosened or deteriorated. Also check all cable clamps to ensure they are tightly fastened.

Troubleshooting

Indicator Light Flashing Sequences

Table 4-1 Indicator light sequences on Truecharge+

Display	Condition
Charging indicator light is on, all indicator lights light in sequence repeatedly	Battery is not detected
Charging indicator light blinks, all others are off	The battery voltage is greater than 15.5 VDC
Highest charging current indicator light blinks, all others are off	Unit is in over-temperature or under-temperature shutdown

Table 4-1 Indicator light sequences on Truecharge+

Display	Condition
Middle charging current indicator light blinks, all others are off	Truecharge+ is in over-temperature shutdown due to excessive battery temperature. This shutdown only occurs if the BTS is installed.

Typical Problems

This section lists typical problems you may have with the Truecharge+, suggests their causes, then offers possible solutions to the problems.

Symptom Indicator lights do not turn on, or remain on, when charger is connected to an AC receptacle.

Possible Cause	Solution
1. No power at AC receptacle	1. Ensure that power is available at receptacle
2. Defective wiring	2. Replace wiring
3. Open fuses in charger	3. Have charger serviced by qualified person

Symptom Indicator lights continue to blink when charger connected to battery. Charging indicator light does not turn on continuously.

Possible Cause	Solution
1. Charger does not detect battery for one of following reasons: <ul style="list-style-type: none"> • poor connection • reverse polarity connection • damaged wiring • open fuse in charger 	1. Check polarity and quality of battery connection. If cables are damaged or internal fuse open, have the charger serviced by a qualified person.
2. Battery voltage is too low.	2. Check the battery. Do not attempt to charge a 6 volt battery. If battery is rated for 12 volts, leave it connected for 8 hours to see if it will recover. If battery doesn't start charging after 8 hours, it is permanently damaged and will not accept a charge.

Symptom Charging light blinks but does not come on steadily. Other indicator lights are off.

Possible Cause	Solution
1. Battery voltage is too high (above 15.5 volts).	1. Check battery. Do not charge a battery rated at more than 12 volts nominal.
2. Battery is connected to another charging source with voltage above 15.5 VDC.	2. Disconnect or turn off other charging sources such as the alternator or the charger on a generator with electric start.

Symptom The 20 amp indicator light blinks on Truecharge 20+, or the 40 amp light blinks on Truecharge 40+. Other indicator lights are off (only when temperature sensor is installed).

Possible Cause	Solution
Battery temperature is too high for safe charging.	Allow battery to cool. Improve ventilation or install in cooler location. It may indicate a shorted cell in the battery or excessive water loss.

Symptom Truecharge + appears to be taking too long to charge battery. Ready indicator light does not light after 24 hours of charging.

Possible Cause	Solution
1. Battery capacity is too high for Truecharge+ model.	1. Use a higher capacity charger.
2. Load connected to battery is draining charge current so that battery does not recharge.	2. Disconnect load or switch load off.
3. Battery has a damaged cell.	3. Replace battery.

A

Specifications

Appendix A “Specifications” contains the Truecharge+ physical, electrical, AC input, and protection feature specifications.

Physical Specifications

Dimensions	15 1/8 in x 6 3/4 in x 2 3/4 in 385 mm x 172 mm x 70 mm
Weight	Truecharge 20+ 6.9 lbs (3.1 kg) Truecharge 40+ 7.4 lbs (3.3 kg)
AC input connections	Three color-coded No. 16 AWG wires (L, N, G) minimum 6 inches long in a separate AC wiring enclosure with provision for connection of a 1/2 inch cable clamp or conduit hub
DC output connections	Four-pole (3 positives and 1 common negative) terminal strip rated for 60 A per pole, No 6 - 14 AWG wire

Electrical Specifications

Electrical Specifications

Number of battery bank outputs	3, diode isolated (no independent regulation)	
Nominal battery voltage	12 VDC	
Normal operating output range	0 – 16 VDC	
Rated DC output current (total)	Truecharge 20+ 20 ADC	Truecharge 40+ 40 ADC
Charge modes	Switch settings for three-step, two-step, or fixed voltage	
Battery type compensation	Switch settings for Flooded, Gel, and AGM batteries	
Battery temperature compensation	Charge voltage is battery-temperature compensated manually (switch settings) for Cold (10 °C/ 50 °F), Warm (10–27 °C/50–80 °F) and Hot (>27 °C/80 °F) ranges, or automatically with optional remote battery temperature sensor	

Electrical Specifications

Absorption voltage		Hot	Warm	Cold
	Flooded	14.0	14.4	14.8 VDC
	Gel	13.8	14.2	14.6 VDC
	AGM	14.0	14.3	14.6 VDC
Float voltage at no load		Hot	Warm	Cold
	Flooded	13.1	13.5	13.9 VDC
	Gel	13.4	13.8	14.2 VDC
	AGM	13.1	13.4	13.7 VDC
Equalize mode current	Truecharge 20+		Truecharge 40+	
	5 ADC		10 ADC	
Equalize mode—maximum output voltage	16.0 VDC			
Fixed voltage mode—nominal output voltage	13.5 ± 0.12 VDC			

AC Input Specifications

	Truecharge 20+	Truecharge 40+
AC input voltage range	90 – 135 VAC, 50/60 Hz	
Maximum AC input current at 90 VAC	6.5 A _{rms}	12 A _{rms}
Typical AC input current at 120 VAC	4.6 A _{rms}	8.5 A _{rms}
No-load AC power draw (without remote panel)	less than 3 watts	less than 3 watts
Power factor rated load	0.66	0.68
Efficiency—peak	83%	83%
Surge protection	Line-to-neutral surge protector rated at 150 V	

Protection Features

Protection features

Battery reverse polarity	Internal fuses for each output, non-user replaceable	
Safe non-operating battery voltage	24 VDC maximum	
Over-voltage limits	Will not start charging if any battery voltage is greater than 15.0 VDC Will not continue charging if any battery voltage is greater than 16.0 VDC	
Output current limit	Truecharge 20+ 20.5 – 22.5 Adc	Truecharge 40+ 41.0 – 44.0 Adc

Protection features

Over-temperature	Internal charger temperature is measured. Unit shuts down and restarts as follows: <ul style="list-style-type: none"> • Over-temperature shutdown at 62 °C • Over-temperature restart at 61 °C 	
Current derating in ambient temperatures—automatic output	Truecharge 20+ 20 A at 30 °C to 10 A at 50 °C	Truecharge 40+ 40 A at 30 °C to 20 A at 50 °C
Battery over-temperature protection	Battery temperature as sensed by the battery temperature sensor (if installed) results in charger shutdown at a battery temperature of 60 °C.	

Approvals

Safety	CSA/NRTL approved to CSA107.2 and UL1236, including the marine supplement, ignition protection, and UL458, UL1564
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B

Battery Charging

Appendix B “Battery Charging” describes the Truecharge+ multistage charging algorithm.

Charging Algorithms

Battery Type

	Truecharge+ charges lead-acid flooded, gel, and AGM (absorbed glass mat) batteries.
Flooded	“Flooded” batteries have removable battery caps for refilling with distilled water and testing the electrolyte.
Gel	The sealed gel battery has its electrolyte in the form of a gel rather than a liquid and does not require topping up. Battery caps are not removable.
AGM	AGM (absorbed glass mat) batteries are similar to gel batteries except the electrolyte is absorbed into a fibreglass matting.



WARNING Risk of battery damage

Since the Truecharge+ has only one battery type setting for all batteries connected to its three banks, do *not* mix types. All connected batteries should be of one kind: Flooded *or* Gel *or* AGM.

Charge Algorithm Stages

Three-stage charging	<p>Truecharge+ charges batteries in a sequence known as a three-stage charge. The charging voltage delivered to the battery depends on the battery</p> <ul style="list-style-type: none">• type setting• temperature (by switch setting or battery temperature sensor)• state of charge
Stages	<p>The three automatic stages are:</p> <ul style="list-style-type: none">• bulk• absorption• float <p>There is a fourth stage, equalization, that is initialized manually since it is only performed occasionally and only on flooded batteries.</p>

Bulk Charge	<p>In the first stage, known as the bulk charge, Truecharge+ delivers its full-rated output current. This constant current is delivered to the batteries until the battery voltage approaches its absorption voltage—typically around 14.4 volts for 12 volt batteries. The bulk charge stage restores about 75% of the battery's charge.</p>
Absorption Charge	<p>During the absorption charge, the charging voltage is held constant near the gassing voltage, and the battery gradually reduces the charging current it demands as it attains full charge. Once the current drops below 4 Adc for three minutes, the charger either exits to Float for gel and AGM batteries or charges flooded batteries for one more hour.</p> <p>This extended one-hour charge ensures that the batteries are fully topped up and is recommended by the flooded battery manufacturers.</p>
Float Charge	<p>The float charge is a maintenance mode in which the output voltage of the charger is reduced to a lower level, typically about 13.5 volts to maintain the battery's charge without losing electrolyte through gassing. Unlike many standalone chargers, Truecharge+ can be left connected to your battery indefinitely without risk of overcharging.</p> <p>In the float mode, the charger will initiate a new charge cycle under any of these conditions:</p> <ul style="list-style-type: none">• AC power is disconnected and reconnected• any battery drops below 12.5 VDC for 15 minutes• 21 days have passed from the time the charger completed Absorption. <p>The chart in Figure B-1 shows the three-stage charging profile.</p>

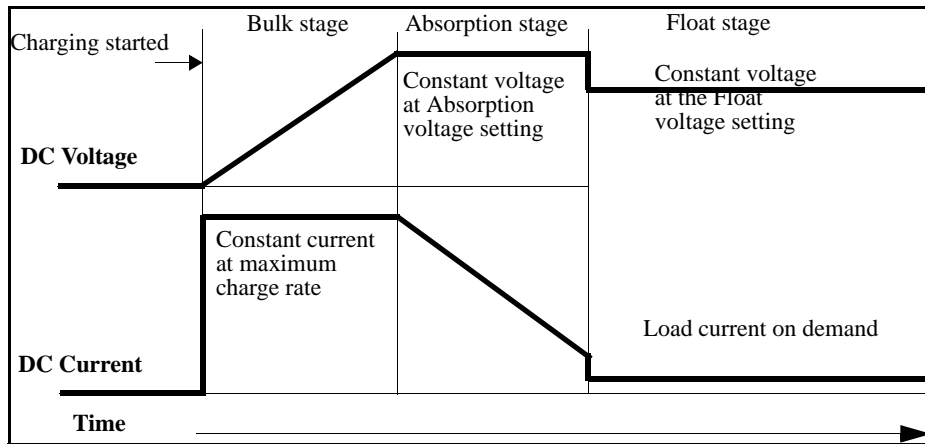


Figure B-1 Three-stage charging profile

Equalization Charge

The equalization charge must be manually initiated because it is not required each time the battery is recharged. Equalization is a deliberate overcharge designed to return each cell to optimum condition by reducing sulfation and stratification in the battery. The overcharge helps the battery to reach and maintain peak capacity by equalizing the chemistry in the individual battery cells.

An equalization charge should be performed *only* on vented, flooded (non-sealed or “wet”) batteries. It should be performed only if recommended by the battery manufacturer and only as often as specified.

Two-Stage Charging

Difference from three-stage

In a two-stage charge, the charger finishes the Absorption charge but does not go to Float mode because some battery manufacturers advise against floating their batteries. The Truecharge+ goes into a monitoring mode instead where the charger monitors the batteries but does not charge or float them.

A new charge cycle will be initiated under the same conditions as for three-step charging.

C

Battery Maintenance

Appendix C “Battery Maintenance” contains procedures for maintaining the battery enclosure, battery terminals and lugs, and battery cables. It also provides a list of the clothing, tools, equipment, and supplies you should have before you begin battery maintenance.

Maintenance Guidelines



WARNING Risk of acid burns

Wear appropriate eye protection and rubber gloves when carrying out battery maintenance activities.



WARNING Risk of fire, explosion, burns

Use caution when wearing jewellery or working with metal tools around batteries. Do not allow any metal object to contact both battery terminals at the same time. The metal may become welded to the battery terminals causing extreme heating or fire.

Electrolyte

At a minimum, check the level of the electrolyte in each battery cell once a month (for flooded batteries). It should be above the top of the plates, but not completely full. Most batteries have a plastic cup that just touches the electrolyte when the cell is full. Don't overfill the batteries, or the electrolyte will spill out when the batteries are being charged. Refill the batteries with distilled water only—"spring" water and regular tap water may have high mineral levels. These can poison the battery chemistry and reduce battery life and should not be used.

Battery connections

It is also good to periodically check the battery connections for tightness and corrosion. If you find any corrosion, disconnect power from Truecharge+, disconnect the cables, and carefully clean them with a mild solution of baking soda and water. Ensure that all caps are on tight so solution doesn't enter the battery. Rinse the top of the battery with clean water when you have finished.

To reduce the amount of corrosion on the battery terminals, coat them with anti-corrosion grease or liquid neoprene (liquid electrical tape) after re-assembly. This is available from automotive parts stores or battery suppliers. Do not apply anything between the terminal and the cable lugs. The connection should be metal to metal. Apply the protective material only after the bolts have been tightened.

Dirty batteries can leak current and tend to run warmer. Cleaning batteries when necessary is easy and safe when you follow the instructions below.

Preparation for Cleaning Batteries

The appropriate clothing, tools, equipment, and supplies are listed below. Gather what you need before beginning.

Clothing

Appropriate clothing could include old clothes, rubber boots, or old shoes. Battery acid is highly corrosive, so wear something you can live without just in case you splash some on yourself. Be sure to wear rubber gloves and eye protection.

Tools

- Adjustable wrench or appropriately sized sockets and ratchet for battery terminals
- Torque wrench
- Soft-bristled brush (a discarded toothbrush works fine)
- 6 inch scrub brush
- Inexpensive ½ inch chip brush or soldering brush

Equipment

- Eye protection
- Rubber gloves
- Water hose with spray nozzle or five gallon watering bucket
- Empty spray bottle

Supplies

- Baking soda. (Always keep on hand in the event of a spill.)
- Hand cleaner or soap
- Towel
- After reattaching cables: anti-corrosion grease (available at auto, RV, and marine stores)

Maintaining and Cleaning

Follow these procedures to maintain the

- battery enclosure
- battery terminal and lugs
- cables



WARNING

Review the “Important Safety Instructions” on page ix before you begin.

Battery Enclosure and Batteries

Mix four ounces of baking soda with a gallon of fresh water and fill a spray bottle. Spray the solution on all exposed surfaces of the battery compartment, and wash down the exposed surfaces of the batteries and their enclosure. Scrub stubborn areas with the scrub brush. Baking soda will neutralize any acid that may have collected on these surfaces. Finish by rinsing with water.

Terminals & Lugs

Loose battery terminals and lugs exposed to open air corrode rapidly. The corrosion appears as a white powder or granular foam on the terminals and any nearby exposed metal parts. This powder is actually a crystallized form of sulfuric acid. If it contacts your skin, it will cause burns unless you rinse it off immediately. Most textiles that are exposed to this corrosive eventually dissolve.

The most common cause of battery system failure is loose or corroded battery terminals and cable lugs. If any white powdery residue forms between the battery cable lug and the battery terminal, remove the cable for cleaning. When it is necessary to detach a battery cable from the battery, disconnect all loads and charging sources. Using the appropriate tool, remove the negative battery cable first and re-install it last.

To remove any stubborn residue, sprinkle baking soda directly on the area, scrub with a wet toothbrush (or other soft-bristle brush), add water as required, and then rinse.

Reconnect the battery cable terminals to the battery lugs and tighten to approximately 10–15 foot-pounds using the torque wrench. If you do not have a torque wrench, use an appropriate tool to tighten the bolts reasonably snug. Do not over-tighten.

After tightening the cables, evenly coat all the exposed metal surfaces of the battery terminals and lugs with liquid neoprene. This will cure to form an airtight protective layer. If liquid neoprene is not available, use a light coating of anti-corrosion grease or other sealant. Do not let anything come between the mating surfaces of the lugs and terminals.

Cables

Inspect all battery cables for missing or damaged insulation or loose connections. Inspect any openings that the cables pass through. All such openings must be equipped with a rubber grommet or conduit to prevent chafing on the cable. If necessary, replace worn grommets. If the cable insulation is worn, replace the cable.

D

Product and System Information

Appendix D “Product and System Information” contains the Xantrex warranty for your product and return instructions. It also contains a place for you to record the serial number and date of purchase and other details of your battery charger.

Warranty

What does this warranty cover? This Limited Warranty is provided by Xantrex Technology, Inc. ("Xantrex") and covers defects in workmanship and materials in your Xantrex Truecharge 20+ and Truecharge 40+. This warranty lasts for a Warranty Period of 12 months from the date of purchase at point of sale to you, the original end user customer.

This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period.

What will Xantrex do? Xantrex will, at its option, repair or replace the defective product free of charge, provided that you notify Xantrex of the product defect within the Warranty Period, and provided that Xantrex through inspection establishes the existence of such a defect and that it is covered by this Limited Warranty.

Xantrex will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Xantrex reserves the right to use parts or products of original or improved design in the repair or replacement. If Xantrex repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Xantrex.

Xantrex covers both parts and labor necessary to repair the product, and return shipment to the customer via a Xantrex-selected non-expedited surface freight within the contiguous United States and Canada. Alaska and Hawaii are excluded. Contact Xantrex Customer Service for details on freight policy for return shipments outside of the contiguous United States and Canada.

How do you get service? If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Xantrex directly at:

Phone: 1-800-670-0707 (toll free in North America) or 1-360-925-5097 (direct)

Fax: 1-360-925-5143

Email: CustomerService@xantrex.com

Direct returns may be performed according to the Xantrex Return Material Authorization Policy described in your product manual. For some products, Xantrex maintains a network of regional Authorized Service Centers. Call Xantrex or check our website to see if your product can be repaired at one of these facilities.

In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Xantrex.

Proof of purchase may be in any one of the following forms:

- The dated purchase receipt from the original purchase of the product at point of sale to the end user, or
- The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status, or
- The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover? This Limited Warranty does not cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Xantrex will not be responsible for any defect in or damage to:

- a) the product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment;
- b) the product if it has been subjected to fire, water, generalized corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Xantrex product specifications including high input voltage from generators and lightning strikes;
- c) the product if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");
- d) the product if it is used as a component part of a product expressly warranted by another manufacturer;
- e) the product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed.

DISCLAIMER

Product

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY XANTREX IN CONNECTION WITH YOUR XANTREX PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY.

IN NO EVENT WILL XANTREX BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING WHETHER IN CONTRACT OR TORT INCLUDING WITHOUT RESTRICTION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, ANY PERSONAL INJURY, ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT.

Exclusions

If this product is a consumer product, federal law does not allow an exclusion of implied warranties. To the extent you are entitled to implied warranties under federal law, to the extent permitted by applicable law they are limited to the duration of this Limited Warranty. Some states and provinces do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to you. This Limited Warranty gives you specific legal rights. You may have other rights which may vary from state to state or province to province.

WARNING: LIMITATIONS ON USE

Please refer to your product user manual for limitations on uses of the product.

Return Material Authorization Policy

Before returning a product directly to Xantrex you must obtain a Return Material Authorization (RMA) number and the correct factory "Ship To" address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location.

When you contact Xantrex to obtain service, please have your instruction manual ready for reference and be prepared to supply:

- The serial number of your product
- Information about the installation and use of the unit
- Information about the failure and/or reason for the return
- A copy of your dated proof of purchase

Return Procedure

1. Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging.
2. Include the following:
 - The RMA number supplied by Xantrex Technology Inc. clearly marked on the outside of the box.
 - A return address where the unit can be shipped. Post office boxes are not acceptable.
 - A contact telephone number where you can be reached during work hours
 - A brief description of the problem
3. Ship the unit prepaid to the address provided by your Xantrex customer service representative.

If you are returning a product from outside of the USA or Canada

In addition to the above, you **MUST** include return freight funds and are fully responsible for all documents, duties, tariffs, and deposits.

If you are returning a product to a Xantrex Authorized Service Center (ASC) A Xantrex return material authorization (RMA) number is not required. However, you must contact the ASC prior to returning the product or presenting the unit to verify any return procedures that may apply to that particular facility.

Information about your Truecharge +

Please record the following information when you unpack your Truecharge+unit.

- Model Number _____
- Serial Number _____
- Purchased From _____
- Purchase Date _____

If you need to contact Customer Service, please gather the following information before calling. The information will assist the service representative in providing you with better service.

- Type of installation (for example, home, boat, RV) _____
- Length of time unit has been installed _____
- Battery bank size _____
- Battery type (Flooded, Gel, AGM) _____
- AC wiring size and length _____
- DC wiring size and length _____
- Battery Temperature Sensor installed _____

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