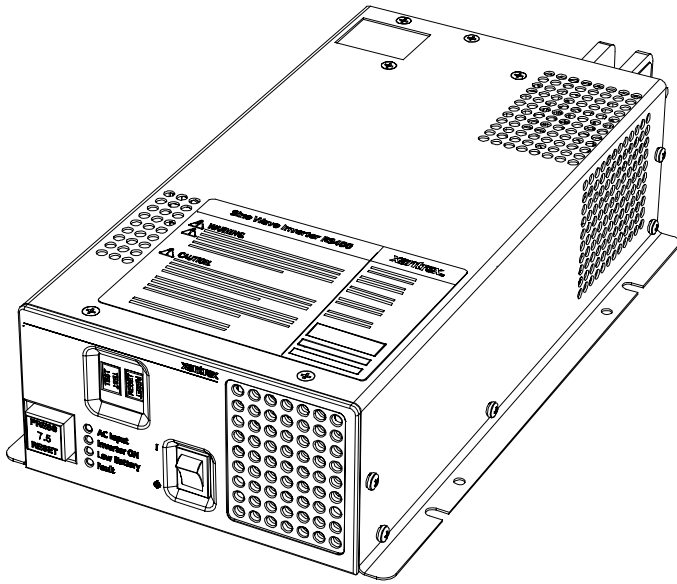


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Installation Guide

RS400 Sine Wave Inverter

www.xantrex.com

RS400 Sine Wave Inverter

Installation Guide

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Xantrex Technology Inc. is a world-leading supplier of advanced power electronics and controls with products from 50 watt mobile units to one MW utility-scale systems for wind, solar, batteries, fuel cells, microturbines, and backup power applications in both grid-connected and stand-alone 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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Important Safety Instructions



WARNING

This Installation Guide contains important safety and operating instructions.

Before using your RS400 Sine Wave Inverter, be sure to read, understand, and save these safety instructions.



WARNING: Restrictions on Use

The RS400 Sine Wave Inverter shall not be used in connection with life support systems or other medical equipment or devices.

General Precautions

1. Before installing and using the inverter, read all appropriate sections of this guide and any cautionary markings on the inverter and the batteries.
2. Do not operate the inverter if it has received a sharp blow, been dropped, or otherwise damaged. If the unit is damaged, refer to the RS400 Sine Wave Inverter Owner's Guide, Warranty and Product Information.
3. Do not dismantle the inverter; it contains no user serviceable parts. Attempting to service the unit yourself could cause electrical shock or fire. **Internal capacitors remain charged after all power is disconnected.** See the RS400 Sine Wave Inverter Owner's Guide for instructions on obtaining service.
4. To reduce the risk of electrical shock, disconnect both AC and DC power from the inverter before working on any circuits connected to the inverter. Turning the On/Standby switch to Standby (⏻) will not reduce this risk.
5. Protect the inverter from rain, snow, spray, and water.
6. To reduce the risk of overheating, keep the ventilation openings clear, and do not install the inverter in a compartment with limited airflow.

Explosive Gas Precautions

1. Batteries generate explosive gases during normal operation. Be sure you follow all relevant instructions exactly before installing or using your inverter.
2. This equipment contains components which tend to produce arcs or sparks. To prevent fire or explosion, do not install the inverter in compartments containing batteries or flammable materials or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.

FCC Information to the User

This Class B device complies with Part 15 of the FCC Rules and all requirements of the Canadian Interference-Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Installation

The Installation section provides detailed information for installing the RS400 Sine Wave Inverter (RS400) and the optional S400 Remote Switch. This section provides:

- a system diagram
- safety instructions and installation codes that must be observed during installation
- a list of installation tools and materials
- illustrations of front and back panel features
- detailed installation procedures
- chassis ground and DC cabling information
- procedures for hardwiring the AC output
- an illustration of inverter dimensions



CAUTION

Be sure to read all instructions before installing and operating this inverter.

Introduction

The system diagram shown in Figure 1 is the basic installation. Review this diagram carefully before installing the RS400.

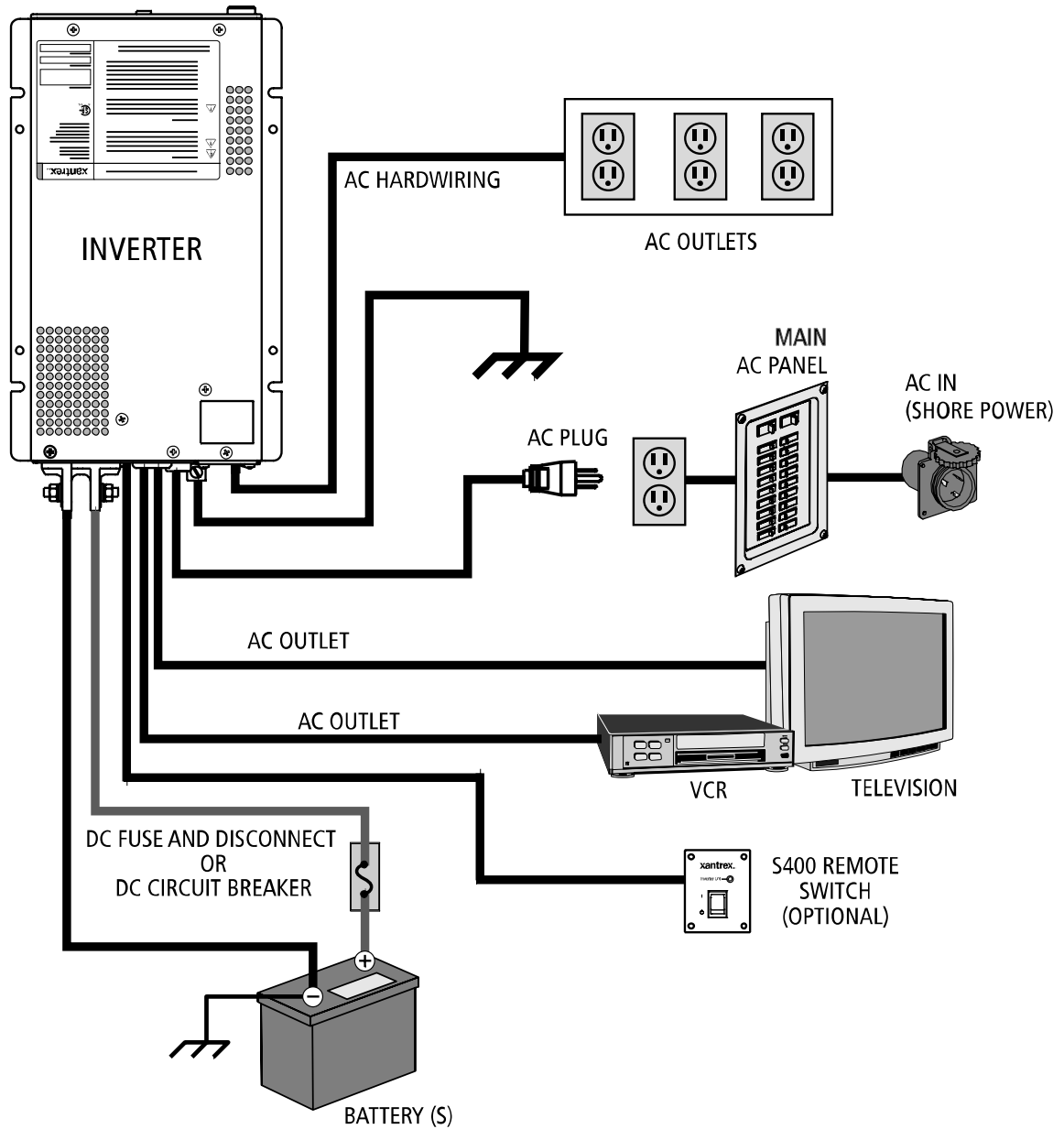


Figure 1 System Diagram

Preparing for Installation

Read this entire installation section so you can plan the installation from beginning to end. Prior to beginning your installation, review the “Important Safety Instructions” on page iii.



WARNING: Electrical shock and fire hazards

Xantrex recommends all wiring be done by qualified personnel. Disconnect all AC and DC power sources to prevent accidental shock. Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

It is the installer’s responsibility to ensure compliance with all applicable installation codes and regulations.



WARNING: Fire hazard

To meet regulatory requirements, the RS400 must be mounted on a flat horizontal surface with the front panel in the upright position.

Installation Codes

It is the installer’s responsibility to determine which codes apply and to ensure that all applicable installation requirements are met.

Applicable installation codes vary depending on the specific location and application of the installation. Some examples are:

- The U.S. National Electrical Code (NEC)
 - The Canadian Electrical Code (CEC)
 - Canadian Standards Association (CSA), and RV Industry Association (RVIA) requirements for installation in RVs.
-



WARNING: Restrictions on use

The RS400 Sine Wave Inverter shall not be used in connection with life support systems or other medical equipment or devices.

Installation Tools and Materials

You will need the following tools and materials to install the RS400 and the optional S400 Remote Switch:

Tools

To install the RS400, you need:

- Phillips screwdriver: #2
- Slot screwdrivers: 1/8 inch and 1/4 inch
- Wrench for DC terminals: 10 mm or adjustable
- Wire stripper

To install the optional S400 Remote Switch, you need:

- Power drill with 1/8-inch bit
- Jigsaw (optional)
- Feed wire (optional)

Materials for RS400 and Optional S400 Remote Switch

To install the RS400 and optional S400 Remote Switch, you require:

- DC cables (See Table 3 on page 10.)
- Appropriately sized connectors. Two DC connectors suitable for 1/4 inch (6 mm) that go on the DC input cable terminals. The other cable connectors will depend on your installation.
- Crimping tool for fastening lugs and terminals on DC cables (You may find it more convenient to have the crimp connectors attached by the company that sells you the cable.)
- DC fuse and Disconnect or DC circuit breaker (See page 10.)
- Four #10 hardware fasteners to mount the RS400
- Four #6 self-tapping screws to mount the S400 Remote Switch

Materials for AC output hardwiring

- Cable requirements:
 - Within the range of No. 14 to No. 18 AWG (minimum size)
 - Three conductors
 - Solid or stranded
- 1/2 inch cable clamp

Front Panel Features

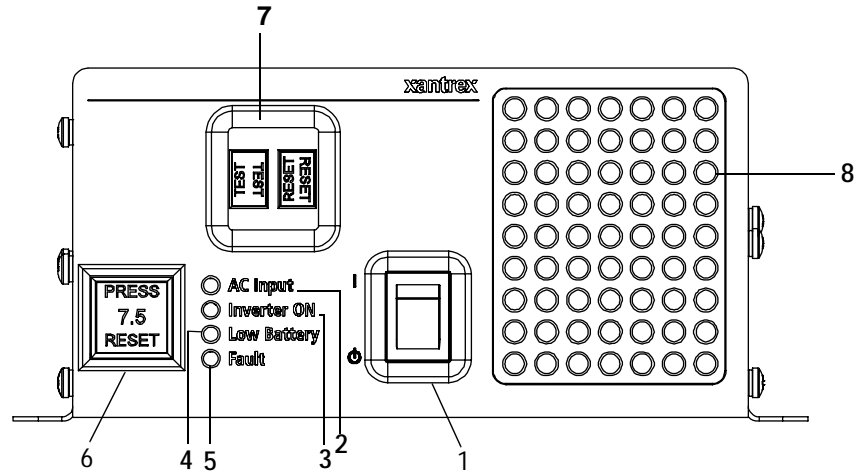


Figure 2 Front panel of the RS400

For a detailed description of the front panel features, refer to the RS400 Sine Wave Inverter Owner's Guide, Introduction chapter.

Table 1 Front Panel Features

Feature	Description
1	On (I)/Standby (O) Switch
2	AC Input light
3	Inverter ON light
4	Low Battery light
5	Fault light
6	Supplemental Circuit Protection button
7	GFCI
8	Ventilation openings

Back Panel Features

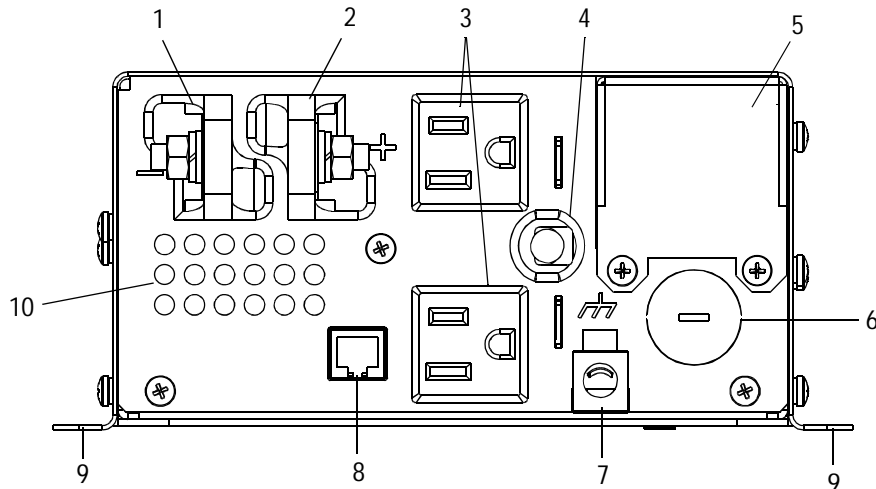


Figure 3 Back panel features

Table 2 Back panel features

Feature	Description
1	DC terminal, negative
2	DC terminal, positive
3	Two AC outlets
4	AC input cord for shore power
5	Wiring box access panel. (For a view with the panel removed, see Figure 10 on page 22.)
6	AC knockout (output) for hardwiring
7	Chassis ground lug
8	Jack for optional remote switch
9	Mounting flanges
10	Ventilation openings

Installing the RS400

Overview

This section provides detailed information on installing the RS400. The overall procedure is divided into 12 steps:

1. Designing your installation (page 8)
2. Mounting your inverter (page 11)
3. Connecting the chassis ground (page 12)
4. Installing the optional S400 Remote Switch (page 13)
5. Getting ready to connect the DC cables (page 15)
6. Routing the DC cables (page 16)
7. Connecting the DC cables (page 17)
8. Connecting your appliances to the AC outlets (page 19)
9. Hardwiring the AC output (page 20)
10. Performing checks prior to initial start-up (page 22)
11. Connecting the AC input cord (page 23)
12. Testing your installation (page 24)

Step 1: Designing Your Installation

Before doing anything else, you need to determine how you are going to use your RS400, and then design a power system that will give you maximum performance. The more thorough your planning, the better your power needs will be met. In particular, you will need to:

- Be aware of installation codes
- Choose an appropriate location
- Calculate the DC cable size
- Select the correct DC fuse and disconnect or the DC circuit breaker

Installation Codes

See “Installation Codes” on page 3 for more information.

Choosing a Location



WARNING: Risk of fire or explosion

This equipment contains components that could produce arcs or sparks. To reduce the risk of fire or explosion, do not install this equipment in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system.



WARNING: Fire hazard

Do not cover or obstruct the ventilation openings. Do not install this equipment in a compartment with limited airflow. Overheating may result.

The inverter should only be installed in a location that meets the following requirements:

Dry	Choose a dry location. Do not allow water or other fluids to drip or splash on the inverter. Do not expose to rain, snow or splashing water.
Cool	Normal air temperature should be between 32 °F (0 °C) and 104 °F (40 °C) — the cooler the better within this range.
Ventilated	The inverter requires air circulation to maintain optimum operating temperature and provide best performance. If the unit has inadequate ventilation, it may shut down due to overheating. Allow as much space around the ventilation openings as possible. Xantrex recommends that other objects be at least 3 inches (76 mm) away from the ventilation openings for best performance. The air vented through the openings should also have a path to circulate away from the inverter.
Safe	Do not install the inverter in the same compartment as batteries or in any compartment containing flammable liquids like gasoline.

Installation

Close to battery compartment	Long DC cables must be very large (and expensive), so they should be kept short (see Table 3). However, the unit should NOT be installed in the battery compartment due to the possible presence of explosive hydrogen gas from the batteries.
Protected from battery acid and gases	Never allow battery acid to drip on the inverter or its wiring when filling the batteries or reading their specific gravity. Do not mount the unit where it will be exposed to gases produced by the batteries. These gases are corrosive and prolonged exposure will damage the inverter.
Orientation	To meet regulatory requirements, the RS400 must be mounted on a flat horizontal surface with the front panel in the upright position.

DC Cables

For the best load starting performance, the DC cables should be as short and large as possible. See Table 3 for minimum recommended cable size. Using a smaller cable may cause the inverter to shut down under heavy load. A larger cable may be used.

Table 3 Minimum Recommended DC Input Cable (copper) — AWG

Cable Length: Battery to Inverter (each cable)	Minimum Recommended Cable Size – AWG
0–10 feet (0–3 meters)	No. 6
10–15 feet (3–4.5 meters)	No. 4
15–30 feet (4.5–9 meters)	No. 2
30–40 feet (9–12 meters)	No. 0

DC Fuse and Disconnect or DC Circuit Breaker

If you are using a DC fuse and Disconnect, a maximum 80 amp Class T fuse shall be used for the DC fuse. A fuse of lower rating can be used, but it shall not be lower than 60 amp Class T. The Disconnect shall be rated at least 50 amps.

Alternately, a DC circuit breaker rated 50 amps can be used.

Step 2: Mounting Your Inverter

Mount your inverter prior to connecting any wires or cables.

For your convenience, the inverter dimensions are provided in Figure 11 on page 26.



WARNING: Fire hazard

To meet regulatory requirements, the RS400 must be mounted on a flat horizontal surface with the front panel in the upright position.

To mount your RS400:

1. Turn the On/Standby switch on the front panel of the inverter to Standby (⏻) position.
2. Select an appropriate mounting location and orientation.
See “Choosing a Location” on page 9.
3. Hold the inverter against the mounting surface, mark the position of the mounting screws, and then remove the inverter.

OR

Use Figure 11 on page 26 to mark the position of the mounting screws.

You can also download a full-scale version of the mounting template from www.xantrex.com

4. Pilot drill the four mounting holes.
5. Fasten the inverter to the mounting surface with four #10 hardware fasteners.

Step 3: Connecting the Chassis Ground

The chassis ground lug is used to connect the chassis of the inverter to your system's chassis grounding point, as required by installation codes.

Use copper cable that is either bare or provided with green insulation. Do not use the chassis ground lug for your AC output grounding wire.

To connect the chassis ground:

Refer to Figure 4.

1. Using the 1/4 inch slot screwdriver, loosen the screw on the chassis ground lug.
2. Connect a No. 8 AWG copper cable between the inverter's chassis ground lug and the DC grounding point for your system.

In an RV or vehicle installation, this will usually be the vehicle chassis or a dedicated chassis ground bus.

3. Tighten the screw to a torque of 6–7 lbf-in (0.68–0.79 Nm).

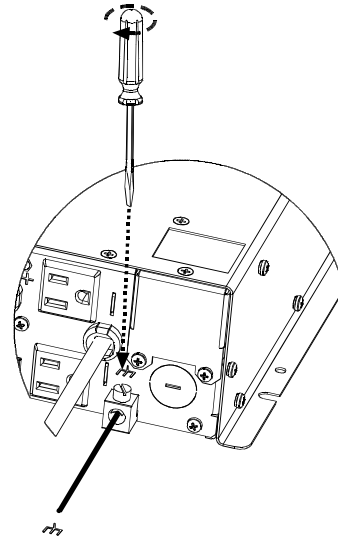


Figure 4 Connecting the chassis ground

Step 4: Installing the Optional S400 Remote Switch



WARNING: Shock hazard

Before making an opening in a wall, bulkhead or panel, ensure there is no wiring or other obstruction within the wall.



WARNING: Shock hazard

Ensure both the S400 Remote Switch and the RS400 are in Standby (⏻) mode before installing.

Installing the S400 Remote Switch (Xantrex product number 808-2400) is optional. The RS400 operates normally without the remote switch.

The S400 Remote Switch is designed to be flush mounted on a wall, bulkhead or panel. A 20 foot (6 meter) telephone cable is supplied with the remote switch.

If you want to extend the cable, use a high quality, 4-wire telephone extension cable with 6-position, 4-contact connectors. The maximum recommended cable length is 50 feet (15 meters).

For your convenience, a full-scale mounting template is provided on page 27.

Note: The S400 Remote Switch connects to a jack at the back of the inverter. See “System Diagram” on page 2.

To install the remote switch:

1. Choose a location that is dry, free from corrosive or explosive fumes, and otherwise appropriate for installing an electronic device.
2. Using the template, pilot-drill the mounting holes. Cut an opening about 2 inches x 1.2 inches (50 mm x 30 mm) and 1.4 inches (35 mm) deep.
3. Route the telephone cable inside the wall and through the opening to the inverter.

4. Connect one end of the telephone cable to the back of the inverter as shown in Figure 5.

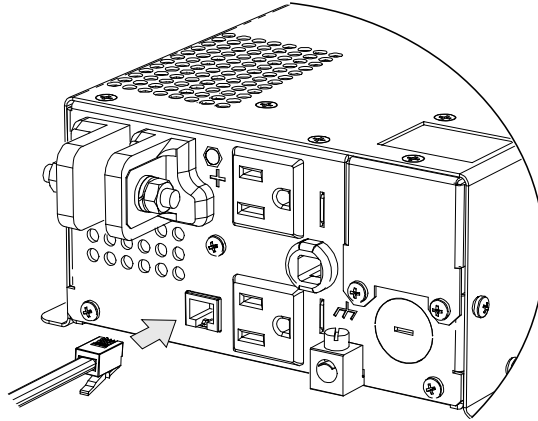


Figure 5 Connecting Cable to the RS400 (cord not shown for clarity)

5. Connect the other end of the telephone cable to the remote switch as shown in Figure 6.

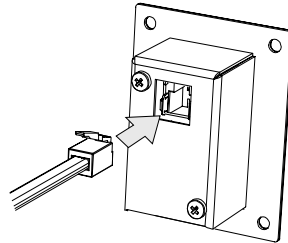


Figure 6 Connecting Cable to the S400 Remote Switch

6. Place the remote switch in the opening and secure it with the four #6 fasteners.

Step 5: Getting Ready to Connect the DC Cables

The DC cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. Table 3 on page 10 specifies the minimum recommended DC cable size. For the recommended DC fuse and Disconnect or DC circuit breaker, see page 10.

To prepare the DC cables:

Refer to Figure 7, “Connection order for DC cables” on page 17.

1. Cut the negative cable to the recommended length. (See Table 3 on page 10 for DC cable size.) Strip off enough insulation so you can install the terminal you will be using.

Xantrex recommends the use of crimp connectors such as a ring lug type. The connector should be designed for a 6 mm or 1/4 inch stud size to connect to the RS400. If a crimp connector is used, it should be crimped using the tool indicated by the connector manufacturer.
2. Cut two lengths of positive cable. One cable (maximum 18 inches) goes from the battery to the DC fuse and disconnect or to the DC circuit breaker. The other cable goes from the DC fuse and Disconnect or to the DC circuit breaker to the positive DC terminal.
3. Attach the connectors to both cables. Make sure no stray wire strands protrude from the terminals.

Step 6: Routing the DC Cables



WARNING: Fire and shock hazard

Route the cables away from sharp edges that might damage the insulation. Avoid sharp bends in the cable.

Guidelines for Routing the DC Cables

- Do not attempt to use the chassis in place of the battery negative connection for grounding. The inverter requires a reliable return path directly to the battery.
- To reduce the chance of interference, keep the positive and negative cables close together—ideally, tied together at regular intervals as shown in Figure 7, “Connection order for DC cables” on page 17.
- To ensure maximum performance from the inverter, do not route your DC cables through a DC distribution panel, battery isolator, or other device that will cause additional voltage drops. The exception is the DC fuse and Disconnect or the DC circuit breaker which is required to protect the DC wiring.

Step 7: Connecting the DC Cables

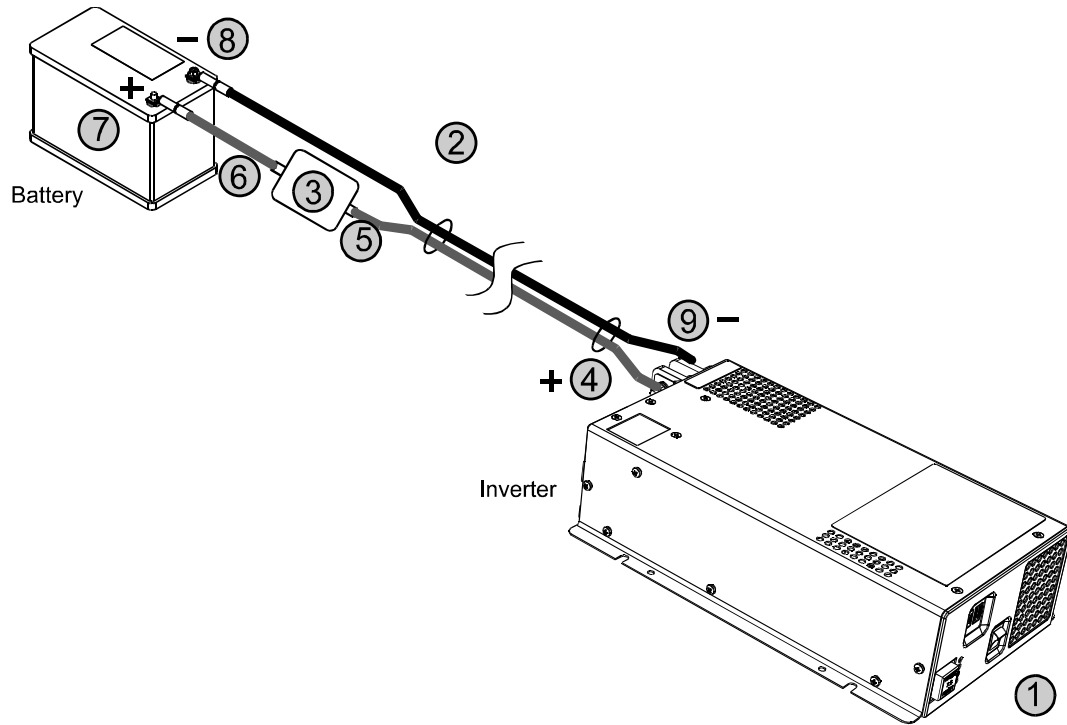


Figure 7 Connection order for DC cables



CAUTION: Reverse polarity

Before making the final DC connection, check cable polarity at both the battery and the inverter. Positive (+) must be connected to positive (+); negative (-) must be connected to negative (-).

Reversing the positive (+) and negative (-) battery cables will damage the inverter and void your warranty.



WARNING: Fire hazard

Use only appropriately sized copper cable. Make sure all DC connections are tightened to a torque of 2.2–2.6 lbf-ft (3.0–3.5 Nm). Loose connections will overheat.

To connect the DC cables:

Connect the DC cables as shown in Figure 7, in the order shown by the numbers.

1. Switch the On/Standby switch to the Standby (Φ) position.
2. Route the DC cables from the battery bank to the inverter. See “Step 6: Routing the DC Cables” on page 16.
3. Install a DC fuse and Disconnect or a DC circuit breaker in the positive side of the circuit within 18 inches of the battery.
This protects your battery and wiring in case of accidental shorting. (See “DC Fuse and Disconnect or DC Circuit Breaker” on page 10 for recommended fuse size and type.) Open the DC fuse and Disconnect or turn off the DC circuit breaker.
4. Connect one connector on the POSITIVE (+) cable to the POSITIVE DC terminal on the inverter. Tighten the nut to a torque of 2.2–2.6 lbf-ft (3.0–3.5 Nm).
5. Connect the other connector to the positive (+) terminal DC fuse and Disconnect or to the DC circuit breaker. Use a wrench to tighten the connection according to the manufacturer’s recommendations. Test that the cable is secure.
6. Attach a short DC cable from the unconnected end of the DC fuse and Disconnect or DC circuit breaker. Tighten appropriately.
7. Observing polarity carefully, connect the other end of the fused cable to the POSITIVE (+) terminal of the battery. Tighten this connection to the battery manufacturer’s recommended torque.
8. Connect one connector on the NEGATIVE (–) cable to the NEGATIVE (–) battery terminal (or to the current shunt if a shunt is used). Tighten the connection according to the battery manufacturer’s recommended torque.
9. Check that the polarity of the DC connections is correct: positive (+) on the inverter is connected to the positive (+) on the battery, and negative (–) is connected to the negative (–).
10. Connect the other connector of the NEGATIVE (–) cable onto the NEGATIVE (–) terminal on the RS400.
11. Use a wrench to tighten the nut to a torque of 2.2–2.6 lbf-ft (3.0–3.5 Nm). Test that the cable is secure.

Step 8: Connecting Your Appliances to the AC Outlets

To connect your appliances to the AC outlets:

1. Turn the inverter's On/Standby switch to Standby (⏻).
2. Turn your AC appliances off.
3. Connect your appliances to the AC outlets on the back of the unit.
4. If you wish to connect more appliances, use a multiple-outlet extension cord. Ensure the total power drawn does not exceed 400 watts.

Note: Ensure that the Reset button is not tripped.

Important: If you have more permanent loads to connect to the inverter, Xantrex recommends that they be hardwired. See “Step 9: Hardwiring the AC Output” on page 20.

Step 9: Hardwiring the AC Output

If you wish to permanently connect additional AC outlets, Xantrex recommends hardwiring the AC output connections.



WARNING: Fire, shock, and energy hazards

Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes. Do not connect the output leads of the inverter to any incoming AC source.

To hardwire the AC output connections:

1. Turn the On/Standby switch to Standby (⏻).
2. Remove the knockout using a slot screwdriver as shown in Figure 8. Do not leave the knockout inside the wiring box.

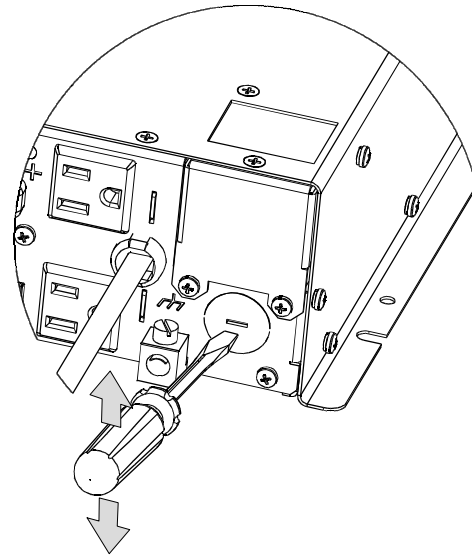


Figure 8 Removing the knockout

3. Locate the wiring box access panel, and remove the three screws to access the wiring box as shown in Figure 9.

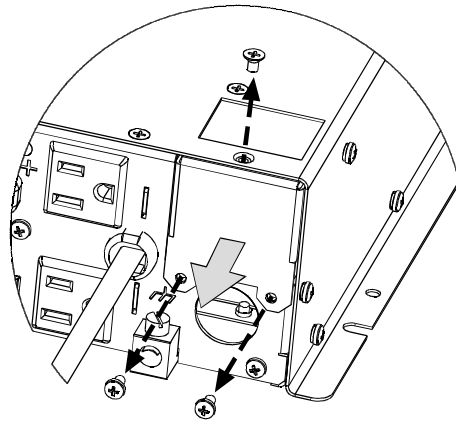


Figure 9 Removing the three screws on the wiring box access panel

4. Remove the wiring box access panel from the unit.
5. Install a 1/2 inch cable clamp.
6. Locate the terminal block.

The three terminals are labelled as follows:

- **L** Line
- **N** Neutral
- \perp Ground

7. Strip about 2 inches (50 mm) off the jacket of the AC output cable.
The AC output cable must be either solid or stranded, within the range of No. 14 to No. 18 AWG, and have three conductors.
8. Strip approximately 3/8 inch (10 mm) off the insulation of the cable.
9. Run the AC cable through the cable clamp and into the wiring box.
10. Using the 1/8 inch slot screwdriver, loosen the wire attachment screws on the terminals by five turns.
11. Insert and fasten the Ground wire into the corresponding terminal.
12. Insert the Line and Neutral wires into the corresponding terminals.
13. Tighten the wire attachment screws to a torque of 1.3–1.8 lbf-ft (1.76–2.44 Nm) as shown in Figure 10. Leave some slack inside the output wiring box.
14. Secure the cable clamp on the cable jacket.
15. Attach the wiring box access panel and tighten the three screws.

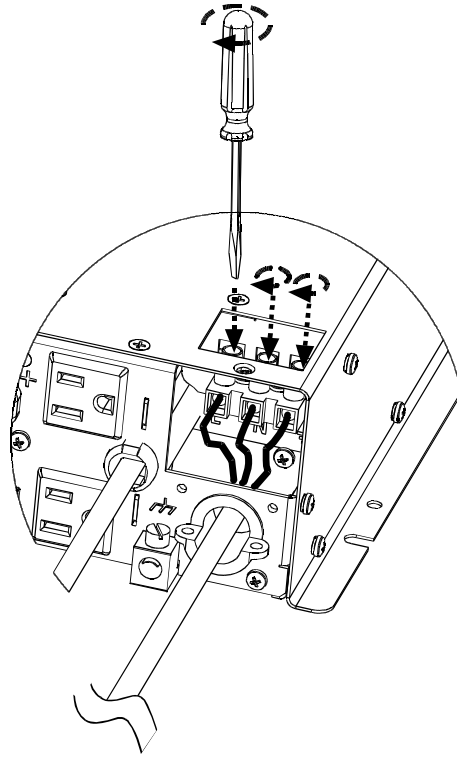


Figure 10 Completing the hardwiring

Step 10: Performing Checks Prior to Initial Start-up

Before starting up your inverter, ensure these conditions are met:

- Chassis ground is properly installed.
- On/Standby switch is in the Standby (ϕ) position.
- Positive (+) battery cable is connected to the positive (+) battery terminal through the DC fuse and Disconnect or DC circuit breaker.
- Negative (-) battery cable is connected to the negative (-) battery terminal.
- Battery voltage is within the proper range for this unit (10.3–15.3 volts DC).
- DC fuse and Disconnect is intact (not blown).

Step 11: Connecting the AC Input Cord



WARNING: Shock hazard

Connect the AC input cord only to a properly grounded standard 120 volts AC, 15 or 20 amp receptacle. If the correct type of receptacle is not available, have an electrician install one.



WARNING: Shock hazard

When the On/Standby switch is in the Standby (⏻) position with the RS400 connected to shore power, AC voltage will be present at the output.

To connect the AC input cord:

- ◆ Plug the AC input cord into a properly grounded 120 volts AC, 15 or 20 amp receptacle, connected to an external shore power source such as a utility grid or a generator.

Step 12: Testing Your Installation



WARNING: Shock hazard

The On/Standby switches on the RS400 and the optional S400 Remote Switch do not disconnect DC or AC input power to the RS400.

There are two tests to be performed. The first test verifies that the RS400 works in invert mode. The second test verifies that the RS400 works in shore power mode.

When you are ready to test your installation and operate the RS400, close the DC fuse and Disconnect or the DC circuit breaker to supply DC power to the RS400.

Testing in Invert Mode

To test the RS400 in invert mode:

1. Ensure that shore power is disconnected.
2. Turn the inverter's On/Standby switch to the On (I) position. If the S400 Remote Switch is installed, turn the On/Standby switch to the On (I) position.

The green Inverter ON indicator illuminates.

3. Plug an appliance of 400 watts or less into one of the AC outlets.
4. Turn the appliance On to verify that it operates.
5. If the appliance operates, your installation is successful.
6. If the red Fault light illuminates, see the Troubleshooting chapter in the RS400 Sine Wave Inverter Owner's Guide.

Testing in Shore Power Mode

To test the RS400 in shore power mode:

Note: shore power (pass-through) refers to the AC input power from a utility grid, generator or external AC source.

1. Connect to the shore power source.

The RS400 transfers the appliances to shore power with the On/Standby switch of the inverter or the S400 Remote Switch in either the On (I) or Standby (⊖) position. The green AC Input light illuminates.

2. Plug an appliance of 400 watts or less into one of the AC outlets.

3. Turn the appliance On to verify that it operates.
4. If the appliance operates, your installation is successful.

Note: If the On/Standby switch on the RS400 and the S400 Remote Switch are turned to On (I), the RS400 will automatically supply the appliances with inverter power if the shore power source fails or becomes disconnected.

The transfer to inverter power will also occur if shore power is present but either the shore power voltage is too low (less than 85 volts AC) or too high (greater than 140 volts AC). In this case, the transfer from inverter power to shore power to power will prevent damage to your appliances.

Installation

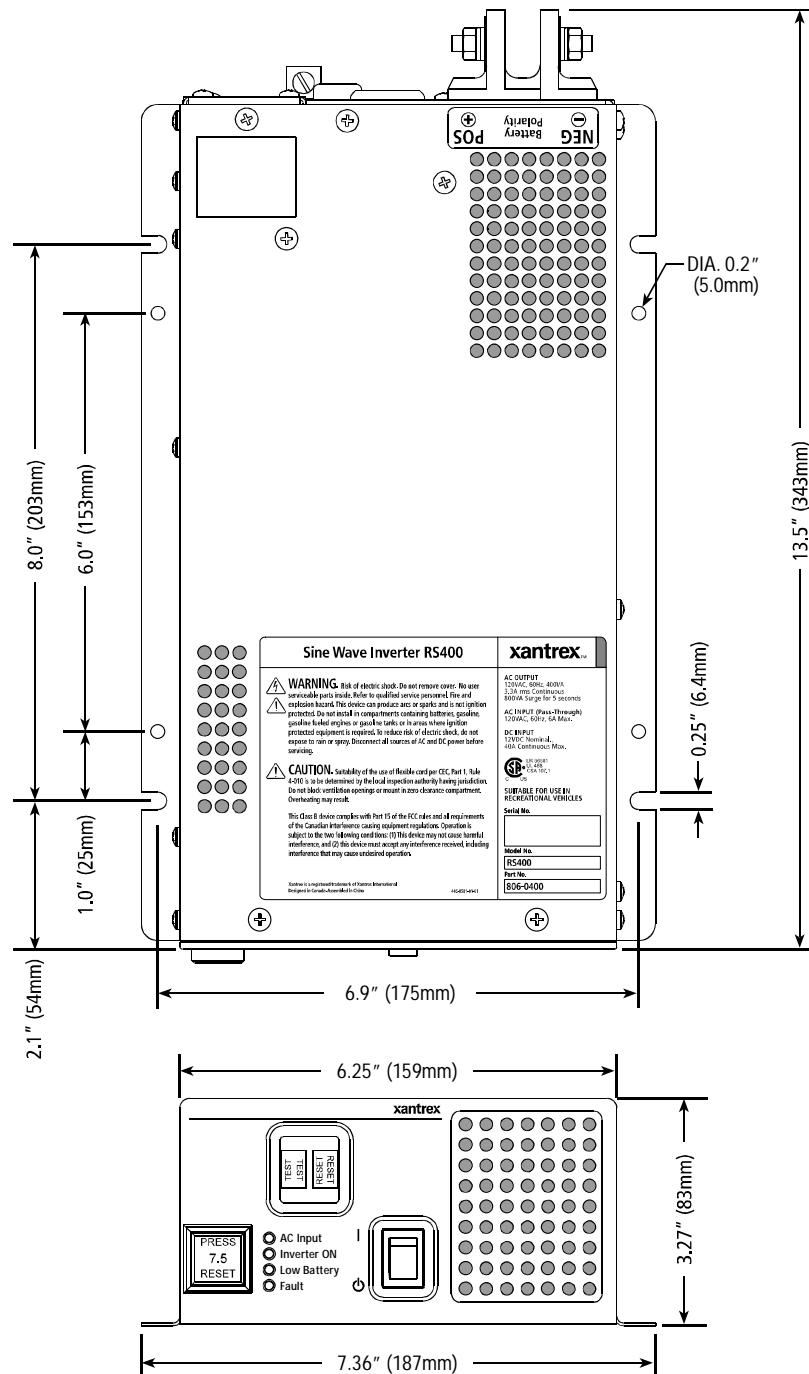


Figure 11 Inverter dimensions

This drawing is not to scale. A full-scale mounting template is available at www.xantrex.com

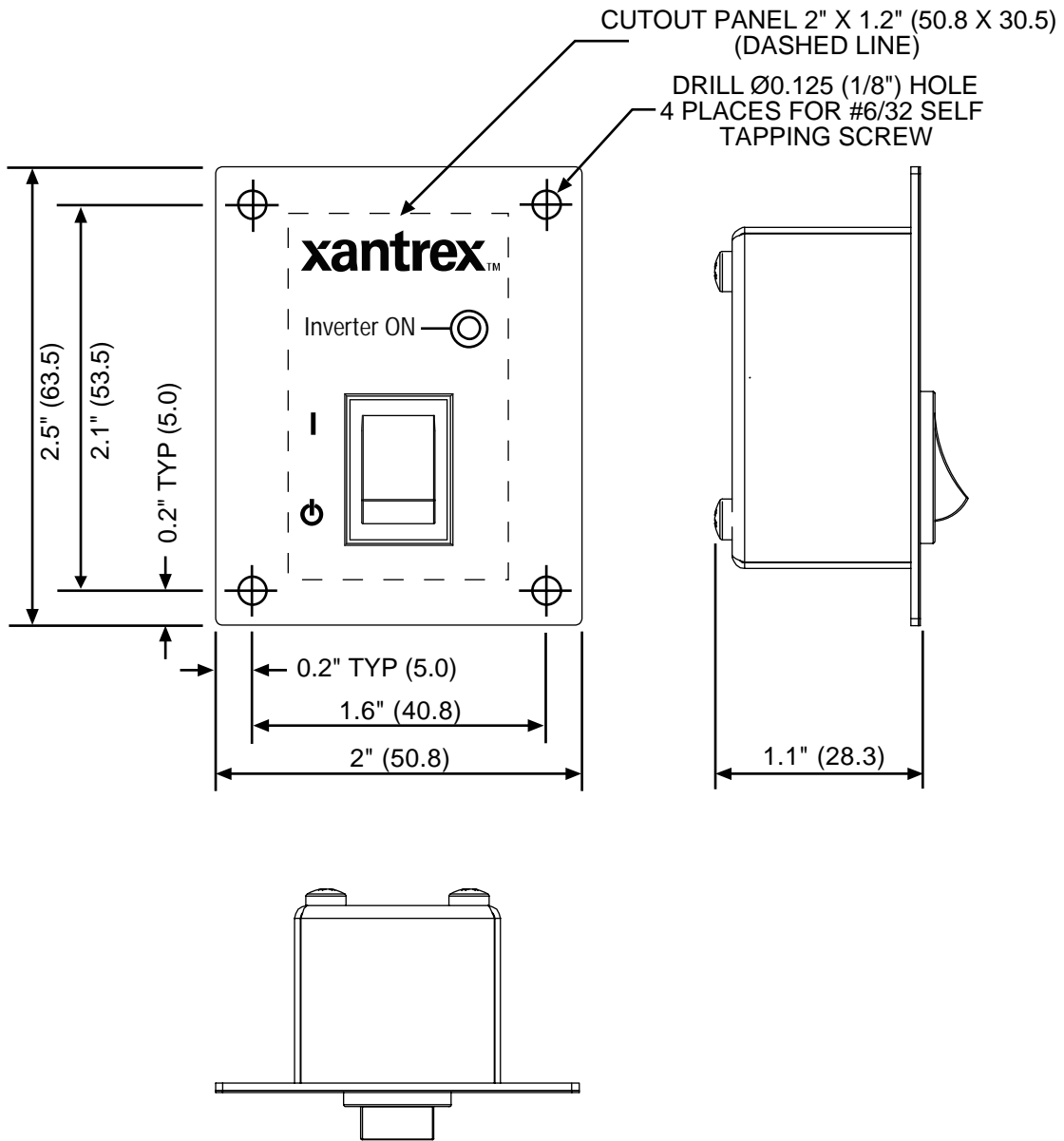


Figure 12 S400 Remote Switch mounting template (scale approximately 1:1)

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