

Sunny Boy SB 700U



Copyright © 2007 SMA America, Inc. All rights reserved.

No part of this document may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photographic, magnetic, or otherwise, without the prior written permission of SMA America, Inc.

SMA America makes no representations, express or implied, with respect to this documentation or any of the equipment and/or software it may describe, including (with no limitation) any implied warranties of utility, merchantability, or fitness for any particular purpose. All such warranties are expressly disclaimed. Neither SMA America nor its distributors or dealers shall be liable for any indirect, incidental, or consequential damages under any circumstances.

(The exclusion of implied warranties may not apply in all cases under some statutes, and thus the above exclusion may not apply.)

Specifications are subject to change without notice. Every attempt has been made to make this document complete, accurate, and up-to-date. Readers are cautioned, however, that SMA America reserves the right to make changes without notice and shall not be responsible for any damages, including indirect, incidental or consequential damages, caused by reliance on the material presented, including, but not limited to, omissions, typographical errors, arithmetical errors, or listing errors in the content material.

Revision History

Rev. No.	Date	By	Reason
0.1	Sept. 2, 2003	Mike Brazil	Alpha draft
0.2	Oct. 16, 2003	Mike Brazil	Beta draft
0.3	Nov. 12, 2003	Jeffrey Philpott	Preliminary Release
1.0	March 22, 2004	Gerald Salisbury	First official version
1.1	March 2, 2007	Diana Welzel	Adjustment for new Certification

SMA America, Incorporated
12438-C Loma Rica Drive
Grass Valley, California 95945
Tel 530.273.4895
Fax 530.274.7271
www.sma-america.com

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the Sunny Boy 700U that must be followed during installation and maintenance of the inverter.

The Sunny Boy is designed and tested according to international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the Sunny Boy. To reduce the risk of personal injury and to ensure the safe installation and operation of the Sunny Boy, you must carefully read and follow all instructions, cautions, and warnings in this *Installation Guide*.

Safety and Hazard Symbols



This symbol is used to call attention to important information that you must have when installing and/or operating the Sunny Boy. Failure to read and follow instructions marked with this symbol could result in injury or death and/or damage to the equipment.



This symbol appears beside instructions and warnings that deal with dangerous voltages that can injure or kill people who come in contact with them.



This symbol appears beside instructions, cautions, and warnings that deal with portions of the equipment that can operate at temperatures high enough to cause burns.

Cautions and Warnings



WARNING:A Warning describes a hazard to personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment or personal injury.



CAUTION:A Caution describes a hazard to equipment. It calls attention to an operating procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment.

Warnings and Cautions may also be accompanied by one or more of the safety and hazard symbols described above to indicate the type of hazard described therein.

Other Symbols

In addition to the safety and hazard symbols described on the previous pages, the following two symbols are also used in this *Installation Guide*:



This symbol accompanies notes that call attention to supplementary information that you should know and use to ensure optimal operation of the system.



This symbol appears beside terminations that are connected to earth-ground.

General Warnings



All electrical installations must be done in accordance with the local and National Electrical Code ANSI/NFPA 70.



The Sunny Boy contains no user-serviceable parts. Always return the unit to an authorized SMA Service Center for repairs and maintenance.



Before installing or using the Sunny Boy, read all of the instructions, cautions, and warnings on the Sunny Boy, the PV array, and in this Installation Guide.



You must not connect the Sunny Boy to the electrical utility grid until you have received prior approval from the utility company. This connection must be made only by qualified personnel.



PV arrays produce electrical energy when exposed to light and thus can create an electrical shock hazard. Completely cover the surface of all PV-arrays with opaque (dark) material before wiring them.



The Sunny Boy has a heat sink on its top surface to help cool the internal components. This heat sink can reach temperatures as high as 158° F (70° C). To avoid the risk of burns, never touch the Sunny Boy's heat sink while the unit is in operation.

Warranty

All Sunny Boy SB 700U inverters sold in the USA have a five-year warranty, as indicated on the warranty card included in the Sunny Boy shipping container. For warranty coverage, or if you have questions about the Sunny Boy warranty, contact SMA America at the address, telephone number, or Web site listed on page iii (to send E-mail, see the Contact section of the SMA America Web site).

Contents

Revision History	iii
Safety and Hazard Symbols	iv
Cautions and Warnings	v
Other Symbols	v
General Warnings	vi
Warranty	vi
1 Introduction	
Product Overview	1-2
Safety	1-3
Installation Overview	1-5
2 Unpacking and Inspection	
3 Mounting the Sunny Boy	
Choosing a Mounting Location	3-2
Dimensions and Recommended Clearances	3-4
Mounting Procedure	3-6
4 Wiring and Connecting the Sunny Boy	
Sequence of Connecting	4-2
Sunny Boy 700U Internal Components	4-3
Opening the Sunny Boy 700U	4-3
Locating Internal Components	4-3
Wiring the AC Output	4-6
AC Connection Requirements	4-6
Connecting the AC Wires	4-8
Wiring the DC Input	4-10
DC Connection Requirements	4-10
Configuring the DC Input-Voltage Range	4-11
Connecting the DC Wires	4-15
Connecting Communication Cables	4-18
RS-485 Communication	4-18
Replacing the Cover	4-20
5 Commissioning	

6 Displays and Messages

LED Operation Indicators	6-3
LED Fault Indicators	6-6
Status Messages on the Display	6-11
Sunny Display Language Selection	6-15
Communication Options	6-16
Measuring Channels and Messages	6-18
Measuring Channels	6-18
Operating Mode	6-19
Sunny Boy 700U Operating Parameters	6-20

7 Troubleshooting

General	7-1
Error messages.	7-3

8 Technical Specifications

FCC Compliance Information	8-1
Sunny Boy Wiring Diagram	8-2
Specifications	8-3
Trip Limits / Trip Times	8-5
Torque Values and Wire Sizes.	8-5

Section 1: Introduction

This installation guide provides all the information needed to mount, wire, and commission a Sunny Boy 700U grid-tied photovoltaic (PV) inverter.



Note:To help avoid problems during the installation, familiarize yourself with the installation process by reading the entire *Installation Guide* before starting the installation.



WARNING:Lethal voltages are present at various points in a PV system. For safety reasons, it is recommended that only trained professionals attempt to install this equipment.

Product Overview

The Sunny Boy is a DC to AC grid-tied utility interactive inverter for use with photovoltaic (PV). The SB 700U is additionally UL listed for the use with fuel cell, wind turbine and other sources of DC power.

In general, the Sunny Boy takes power from a DC source (PV modules) and converts it to AC power for the utility grid. This power is delivered first to local loads (household appliances, lights, motor loads, etc.), with any excess power fed to the utility. The power consumed by the local loads reduces the power needed from the utility. Excess power may actually “spin the utility meter backwards” depending on the type of meter in your system. This power may also be recorded as power credits by the utility company depending on the interconnection agreement. An example of basic system components is shown in Figure 1-1 (page 1-2).

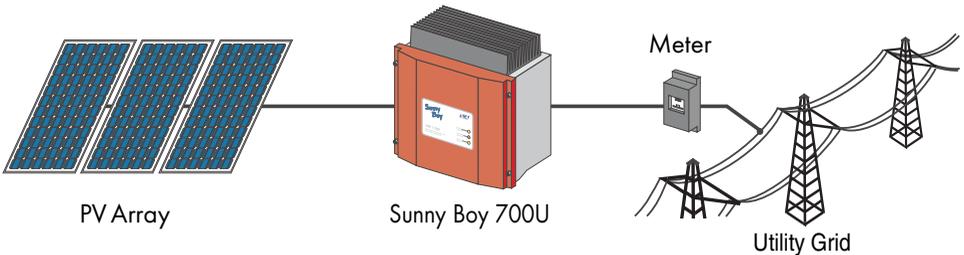


Figure 1-1 Sunny Boy 700U Installed in a Utility Interactive PV System



Note: Policies vary from one utility company to another. Consult with a representative of the local utility company before planning and installing a PV system.

Safety

Anti-Islanding Protection

Islanding is a condition that can occur if the utility grid is disconnected while the Sunny Boy is operating and the remaining load is resonant at 60 Hz and matches the output of the Sunny Boy perfectly. This condition is highly unlikely and had never been witnessed outside of a controlled laboratory. Nevertheless, the Sunny Boy incorporates an advanced active islanding protection algorithm to insure that the system will not export power into a balanced 60 Hz resonant load while the utility is disconnected. The Sunny Boy periodically injects both leading and lagging reactive current into the utility grid. This method has been proven by U.S. regulatory agencies to effectively destabilize and disconnect from a balanced island condition.

PV Ground Fault Detection and Interruption

The Sunny Boy is equipped with a ground fault detection device. If a ground fault current greater than 1 Amp is detected, the Sunny Boy will shut down and display the fault condition on the user interface display. Once the ground fault is located and corrected, the ground fault error will need to be manually cleared and the inverter will then resume normal operation.

PV Series Fusing

Series fusing may be required depending on the type of PV module used in the system. See NEC 690.9

Interconnection Code Compliance

The Sunny Boy has been tested and certified by UL to meet the requirements of UL1741 Static Inverters and Charge Controllers for use in Photovoltaic Power Systems as well as IEEE-929-2000 Recommended Practice for Utility Interface of Photovoltaic Systems and IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems. The Sunny Boy is also UL listed under UL1741 for use in Canada.



UL1741 is the standard applied by Underwriters Laboratories to the Sunny Boy to certify that it meets the requirements of the NEC and IEEE-929-2000. IEEE 929-2000 provides recommendations regarding the proper equipment and functionality necessary to ensure compatible operation when power generation is connected to the utility grid.



Note: Contact the local utility and/or the authority having jurisdiction prior to connecting the Sunny Boy to the utility grid.

FCC Compliance

The Sunny Boy has been tested and certified by a nationally recognized testing laboratory and conforms to all FCC Part 15 B EMI/EMC emissions regulations.

Feature Overview

Over twenty years of inverter manufacturing experience has gone into the design of the Sunny Boy. As a result, the Sunny Boy represents state-of-the-art technology, high reliability and overall ease of use - all the qualities you've come to expect from SMA, the industry leader in inverter technology. Some of the features included are:

- LCD
- Advanced communication options
- Compatible with all SMA inverter and communication products
- Simple installation
- Rugged stainless steel enclosure

Installation Overview

This section provides a high-level overview of the installation process so you have an idea what to expect as you proceed through the rest of the *Installation Guide*.

The installation process is broken down into the following tasks:

Section 2: Unpacking and Inspection

This section provides instructions and information for unpacking the Sunny Boy, inspecting it for shipping damage, and if necessary, returning a damaged Sunny Boy.

Section 3: Mounting the Sunny Boy

This section includes guidelines to help you select the best mounting location, cautions and warnings that you should follow to avoid injury and/or equipment damage, and step-by-step instructions for mounting a Sunny Boy 700U inverter.

Section 4: Wiring and Connecting the Sunny Boy

This section includes guidelines for selecting the correct wire sizes, cautions and warnings that you should follow to avoid injury and/or equipment damage, and step-by-step instructions for setting the internal voltage-range jumper, wiring a Sunny Boy to a PV array, household electrical circuits, and the utility grid. Procedures are also included for connecting optional data-communication cables to the Sunny Boy.

Section 5: Commissioning

Commissioning involves applying DC input power to the Sunny Boy, observing the LED indicators on the cover, and resolving any problems that occur.

Section 6: Displays and Messages

This section provides tips and procedures for resolving problems that can occur during installation.

Section 2:

Unpacking and Inspection

All Sunny Boy inverters are thoroughly checked before they are packed and shipped. Although they are shipped in sturdy, recyclable packaging, damage can still occur during shipping and delivery. It is important for you to carefully inspect the shipping container prior to beginning the installation. If you detect any external damage to the packaging that makes you suspect the inverter itself could be damaged, or if you find that the inverter is damaged after unpacking it, report the damage immediately to your SMA dealer and to the shipping company that delivered the Sunny Boy. If it becomes necessary to return the Sunny Boy, use the original packaging in which the Sunny Boy was delivered.



WARNING: The Sunny Boy 700U weighs 16kg (36 lb.). To avoid injury, lift the Sunny Boy carefully, and be careful to prevent the weight of the inverter from causing you to lose your balance and fall. If possible, have someone help you when you unpack the Sunny Boy.

If you need assistance in dealing with a damaged Sunny Boy, contact your SMA dealer or SMA America. Contact information for SMA America is provided below.

SMA America, Incorporated
12438-C Loma Rica Drive
Grass Valley, California 95945
Tel 530.273.4895
Fax 530.274.7271
www.sma-america.com

Section 3:

Mounting the Sunny Boy

This section provides guidelines to help you select the best mounting location, cautions and warnings that you should follow to avoid injury and/or equipment damage, and step-by-step instructions for mounting a Sunny Boy 700U inverter.



WARNING:To avoid injury, lift the Sunny Boy carefully, and handle it carefully to prevent the weight of the inverter from causing you to lose your balance and fall. If possible, have someone help you when you mount the Sunny Boy.



Note:Occasionally, the rating label on the Sunny Boy will need to be referred to. For this reason, it is required that the inverter be mounted so that the rating label on the side of the inverter be visible.

Choosing a Mounting Location

Consider the following guidelines, cautions, and warnings when choosing a mounting location for a Sunny Boy inverter:

- The Sunny Boy 700U should be installed in a location where it is not exposed to direct sunlight, since the higher temperature within the unit caused by the sun can result in reduced output from the PV system. When the heatsink on the top of the Sunny Boy is exposed to direct sunlight, the inverter operates in Derate Mode, which reduces the output power of the system to keep the heatsink temperature below 158° F (70° C).
- The inverter must be installed in a location that is inaccessible to children.
- The Sunny Boy emits a slight vibrating noise when operating. This vibration is normal and has no effect on performance, but it can be objectionable if the inverter is mounted on a wall in a living area, on the outside of a wall that is part of a living area, or on certain types of materials, such as thin wood panelling or sheet metal.
- If the inverter is installed outside, it must be mounted vertically or with the top tilted towards the back. To ensure optimum energy yield and ease of operation, mount the inverter vertically and at eye level (see Figure 3-1).

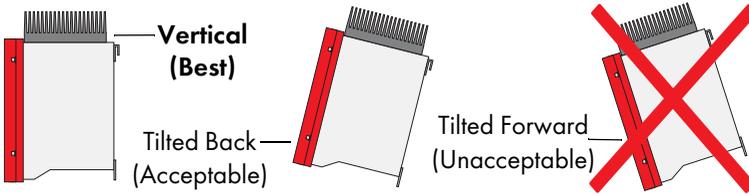


Figure 3-1 Sunny Boy Mounting Positions



CAUTION: *The Sunny Boy 700U weighs 16kg (36 lb.). Ensure that the surface on which you mount the Sunny Boy is strong enough to hold the weight. Do not mount the Sunny Boy on plasterboard (sheet-rock) or thin wood panelling.*



CAUTION: *All electrical conduits and any communication cables must be positioned and/or sealed so that no water can enter the inverter enclosure through these conduits and cables.*



CAUTION: Rain-tight or wet location hubs that comply with the requirements in the Standard for Fittings for Cable and Conduit , UL 514 B, are to be used.



CAUTION:If the Sunny Boy is mounted outside, humid weather during the installation could cause eventual damage to the inverter. If moisture from damp air is enclosed in the case when you complete the installation, it will eventually condense within the case, and the moisture can damage the electronic components. **Do not** install the Sunny Boy when it is raining, and if possible, choose a day when the humidity is low to install it.



CAUTION:If you are installing the Sunny Boy in a cabinet, closet, or other relatively small enclosed area, you must provide sufficient air circulation to dissipate the heat generated by the inverter.



WARNING:When the Sunny Boy is operating, individual parts of the enclosure may reach temperatures of 158° F (70° C). To prevent fires, ensure that nothing comes in contact with the heat sink and that surrounding materials are sufficiently heat-resistant.



WARNING:To prevent electrical shock or other injury, check for existing electrical or plumbing installations in the walls where you plan to drill mounting holes for the Sunny Boy prior to drilling.

Dimensions and Recommended Clearances

The outer dimensions of the Sunny Boy 700U are shown in Figure 3-2. The Sunny Boy must be mounted so that there is at least eight inches of clearance above the heat sink that is mounted on the top of the inverter.

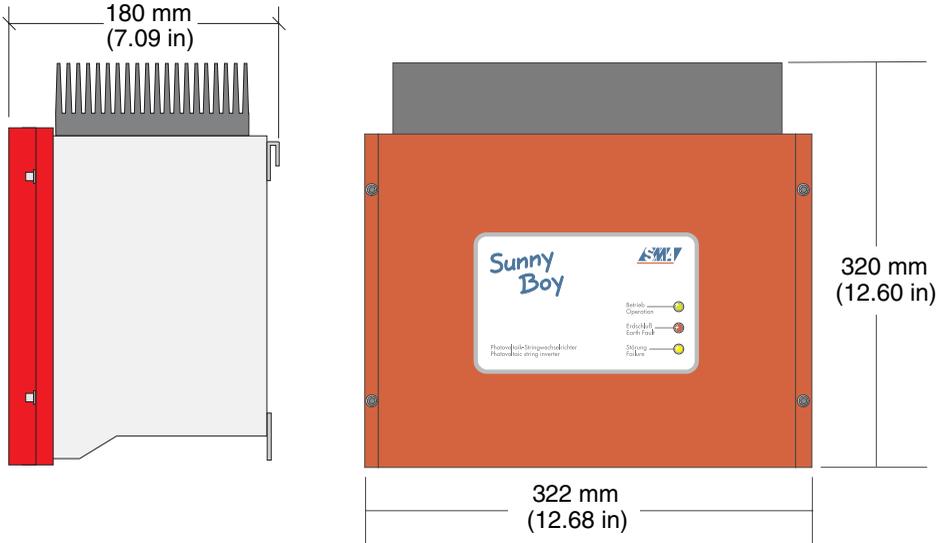


Figure 3-2 Outer Dimensions of the Sunny Boy 700U



CAUTION: You **must** ensure that there is sufficient clearance for heat dissipation above the Sunny Boy's heat sink! In a normal operating environment with good ventilation, eight inches of clearance is adequate. However, if the airflow to the Sunny Boy is restricted or it is subjected to other abnormal operating conditions, enough additional clearance (or forced ventilation) **must** be provided to allow the heat that the Sunny Boy produces to dissipate freely.



Note: If additional ventilation is required use the optional Sunny Breeze fan that mounts to the heat sink.



Note: The National Electrical Code may require significantly larger working clearances (see NEC Section 110.26).

Wall-Mounting Bracket

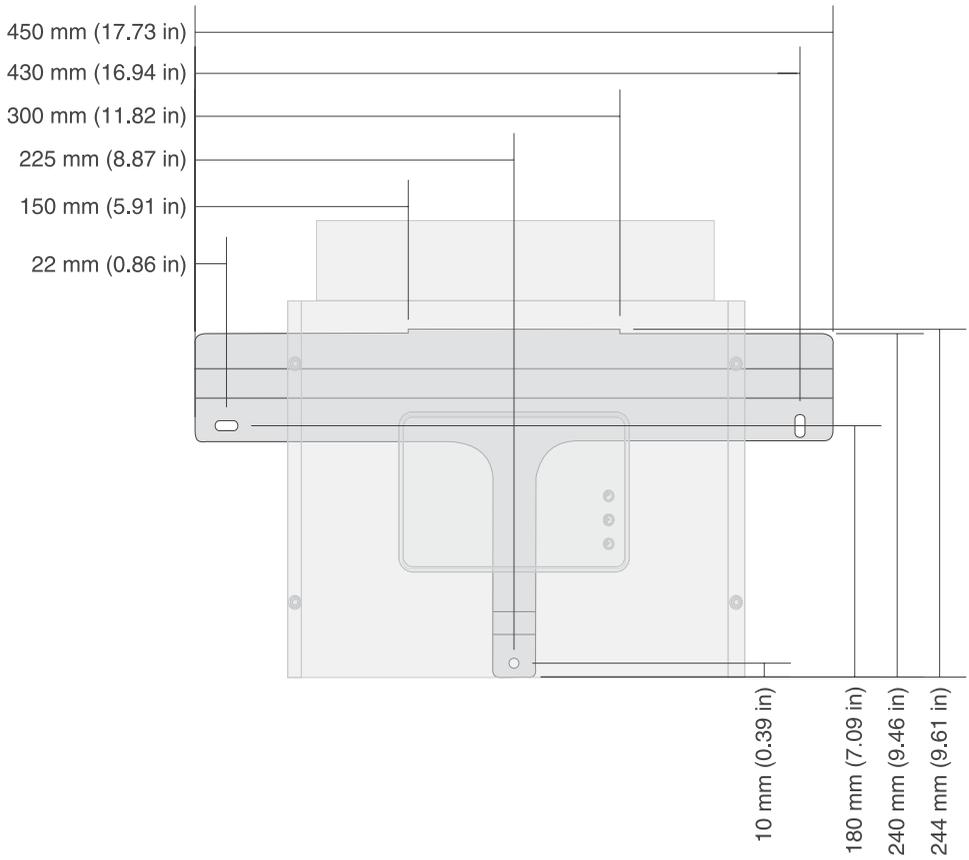


Figure 3-3 Dimensions of the wall-mounting bracket

Mounting Procedure

The Sunny Boy 700U is shipped with a T-shaped wall-mounting bracket that is suitable for use with most walls (see Figure 3-4). The horizontal part of the T bracket has two holes spaced for 16-inch centers for mounting on wooden wall studs, or it can be mounted on concrete or stone walls. Make sure that the wall you choose to mount the Sunny Boy on is sturdy enough to support its weight (16 kg/36 lb.) over a long period of time and that the wall is plumb.

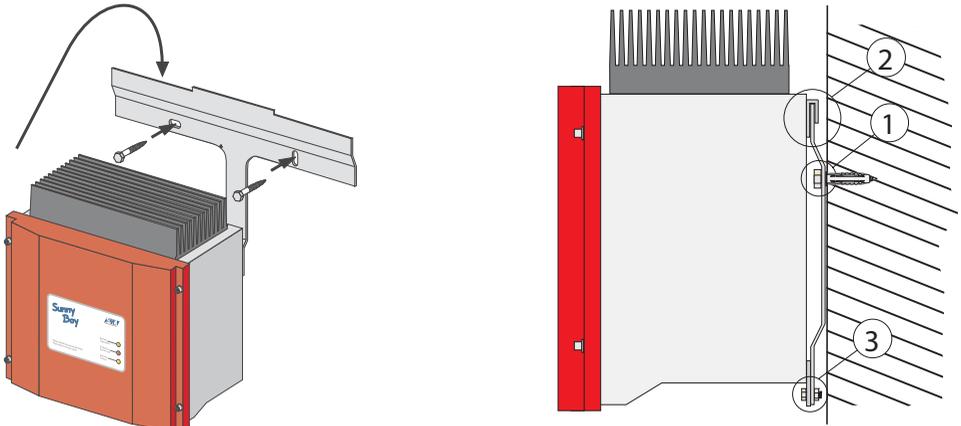


Figure 3-4 Sunny Boy 700U with Mounting Bracket

Use the following procedure to mount the Sunny Boy:

1. Locate the T-shaped wall-mounting bracket included in the shipping container with the Sunny Boy.
2. Position the wall-mounting bracket against the wall where you intend to mount the Sunny Boy (it is best to mount the Sunny Boy at approximately eye-level), place a level on the top edge of the bracket, and adjust the position of the bracket so that it is level.
3. Using the wall-mounting bracket as a template, mark the wall through the two holes in the horizontal portion of the bracket.



CAUTION: Ensure that there are studs in the wall at the places where you intend to drill the mounting-holes. DO NOT use molly or toggle bolts to mount the Sunny Boy to sheet rock or panelling.

4. Set the bracket aside temporarily, and drill holes at the marks you made on the

wall.



Note: The diameter of the holes you drill must match the hardware you are using to mount the Sunny Boy. For example, if you are mounting the Sunny Boy on a concrete wall, the hole diameter should be approximately the same as the outside diameter of the concrete anchors you intend to use. If you are mounting the Sunny Boy on a wall that has wooden studs inside it, the hole diameter should be the correct size for the lag screws you intend to use to mount the bracket. If you are installing the Sunny Boy outside, the lag screws must be made of stainless steel, and the diameter of the screws should closely match the diameter of the holes in the wall-mounting bracket. If you use M6x10 or 1/4" screws, drill 7/32-inch pilot holes.

5. Insert two stainless-steel lag screws through the holes in the horizontal part of the wall-mounting bracket and into the holes you drilled in the wall. Tighten the screws until the bracket is held firmly against the wall (see #1 in Figure 3-4). Do not overtighten the screws.
6. Carefully lift the Sunny Boy into position near the mounting bracket. The upside-down, U-shaped bracket attached to back of the Sunny Boy at the top edge fits over the top edge of the bracket so that the Sunny Boy hangs from the bracket (see #2 in Figure 3-4).



WARNING:To avoid injury, lift the Sunny Boy carefully, and handle it carefully to prevent the weight of the inverter from causing you to lose your balance and fall. If possible, have someone help you when you mount the Sunny Boy.

7. Inspect the Sunny Boy from both sides to ensure that the U-shaped bracket on the Sunny Boy fully engages the top edge of the mounting bracket and that the Sunny Boy is centered on the bracket.
8. Locate the mounting strap that hangs from the back of the Sunny Boy at the bottom.
9. Insert an M6x10 bolt through the hole in the mounting strap and into the threaded hole in the bottom end of the wall-mounting bracket (see #3 in Figure 3-4).
10. Tighten the bolt fully (do not overtighten).

11. Verify that the Sunny Boy 700U is firmly mounted in place.

Section 4:

Wiring and Connecting the Sunny Boy

This section provides step-by-step procedures and other information required for wiring the Sunny Boy 700U to the PV array, the household circuits, and the utility grid. To accomplish the installation in the safest and most efficient manner, complete the steps in the order that they appear.



WARNING: Before connecting or operating the Sunny Boy, read all of the instructions, cautions, and warnings on the Sunny Boy, the PV array, and in this *Installation Guide*.



WARNING: You must connect the wires that carry the AC voltage from the Sunny Boy to the utility grid and the wires that carry the DC voltage from the PV array to the Sunny Boy in the order described in the procedures in this section. Deviating from these procedures could expose you to lethal voltage that can cause serious injury.



WARNING: Always turn OFF all breakers and switches in the PV system before connecting any wires to the Sunny Boy or disconnecting any wires from the Sunny Boy.

For inverters provided with a fixed AC output:



Note: The AC input and AC output circuits are isolated from the enclosure and system grounding, if required by section 250 of the National Electric Code, ANSI/NFPA 70, is the responsibility of the installer.



Note: The Photovoltaic System Grounding shall be installed per the requirements of sections 690.41 through 690.47 of the National Electric Code, ANSI/NFPA 70, and is the responsibility of the installer.

Sequence of Connecting



WARNING: Always connect the wires to the Sunny Boy in the following sequence:

1. De-energize all AC and DC sources by switching all AC and DC disconnects and/or breakers OFF.
2. Wiring from AC breaker to the AC disconnect switch.
3. Wiring from the AC disconnect switch to the Sunny Boy, follow the procedure on page 4-6 et seq..
4. Wiring from the PV wires to the DC disconnect.
5. Wiring from the DC disconnect to the Sunny Boy, follow the procedure on page 4-10 et seq..
6. Turn the DC switches and/or breakers ON.
7. Turn the AC switches and/or breakers ON.

To disconnect the Sunny Boy first turn OFF all AC disconnects and then all DC disconnects. The AC system should always be disconnected before the DC system. After the Sunny Boy is de-energized, disconnect the wiring in the reverse order from above.



WARNING: Always wait a minimum of 5 minutes for the stored potential in the Sunny Boy to discharge completely before opening the enclosure.



WARNING: All electrical installations must be done in accordance with all local electrical codes and the National Electrical Code (NEC), ANSI/NFPA 70.



WARNING: Before connecting the Sunny Boy to the electrical utility grid, contact the local utility company. This connection must be made only by qualified personnel.

Sunny Boy 700U Internal Components

All of the terminals and connectors for DC input, AC output, and communications are inside the Sunny Boy's case. To gain access to these and other internal components, you must remove the cover.

Opening the Sunny Boy 700U

Remove the four M5 screws and lock washers that attach the cover to the Sunny Boy. Place the cover, screws, and lock washers aside where they will be out of your way while you are connecting wires and cables to the Sunny Boy.



CAUTION: Be careful not to misplace the screws or the lock washers, as all four screws and lock washers are required to ensure that the cover is grounded properly and is fully sealed to the case. Handle the cover carefully, as even minor damage to the cover could result in an inadequate seal between the cover and the case, thus allowing moisture to enter the case and damage the sensitive electronic components.

Locating Internal Components

Figure 4-1 shows the internal components of the Sunny Boy 700U. Refer to this illustration whenever you need to locate a component to complete a step of the installation procedure.

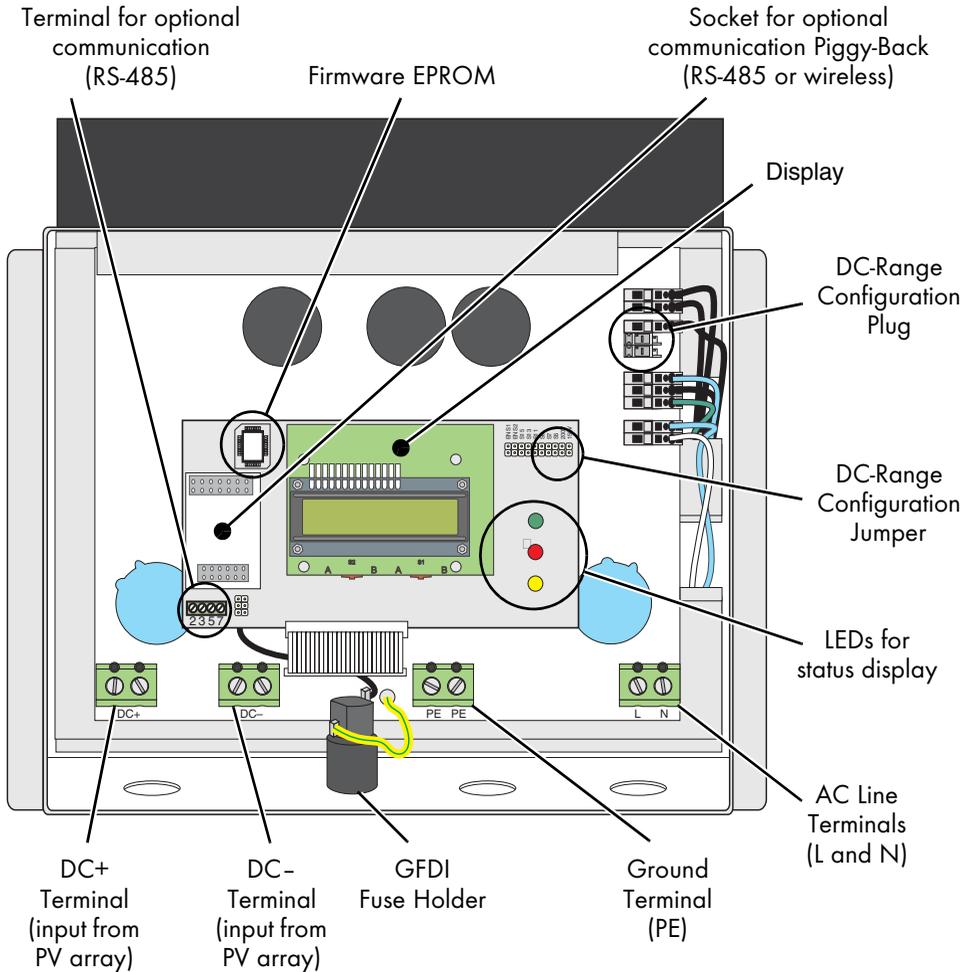


Figure 4-1 Sunny Boy 700U Internal Component Locator

The DC input from the PV array (via the DC disconnect enclosure) and the output to the AC utility grid connect to the inverter inside the Sunny Boy's case. These internal AC and DC wiring terminals (see Figure 4-1) accept a maximum wire size of #6 AWG. Knockouts are provided on the bottom of the Sunny Boy near each of the terminals for the wires to enter the case (Figure 4-2).

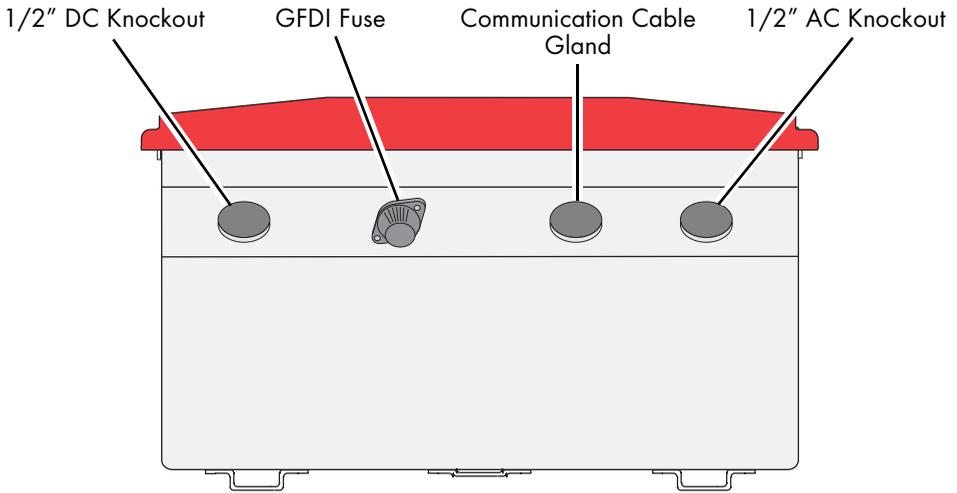


Figure 4-2 Bottom View of the Sunny Boy 700U Showing 1/2" Wiring Knockouts



CAUTION: All knockouts in the Sunny Boy chassis are sized for 1/2-inch rigid conduit (EMT). DO NOT enlarge any of these holes, as this is a violation of UL requirements and voids the SMA warranty.

Wiring the AC Output

This subsection provides complete, step-by-step procedures for wiring the AC output from the Sunny Boy to the dedicated circuit and the utility grid.

AC Connection Requirements



All electrical installations AC and Protective Earth (PE) must be done in accordance with all local electrical codes and with the National Electrical Code (NEC), ANSI/NFPA 70.

Use for all AC and Protective Earth (PE) wiring connections to the Sunny Boy:

- 6 - 14 AWG
- 90° C (194° F)
- solid or stranded copper wire



WARNING:The National Electrical Code (NEC) states that the inverter must be connected to a dedicated circuit, and that no other outlets or devices can be connected to the same circuit. See NEC Section 690-64(b)(1). The NEC also imposes limitations on the size of the inverter and the manner in which it is connected to the utility grid. See NEC Section 690-64(b)(2).



WARNING: To reduce the risk of fire, connect only to a circuit provided with 15 amperes maximum branch circuit overcurrent protection in accordance with the National Electric Code, ANSI/NFPA 70.

The diagram in Figure 4-3 shows the potential losses in AC wires with respect to the cross-sectional area of the cable and the length of the cable. Use this table to determine the best wire size to use for your particular installation. The diagram is an example for the SB 700U with a maximum input voltage of 250 V DC.

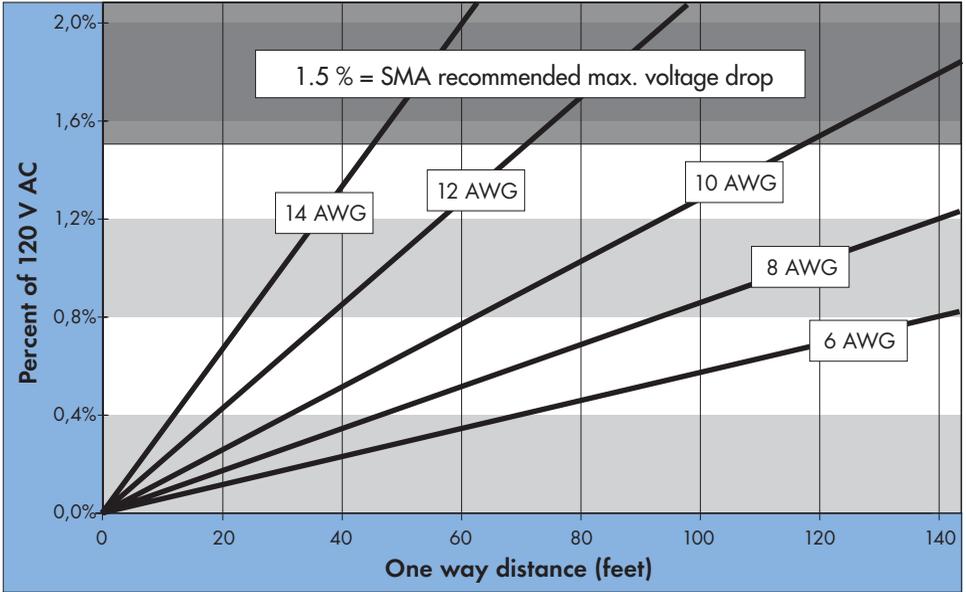


Figure 4-3 Energy Losses in Various Wire Sizes and Wire Lengths



Note: The „Voltage Drop Calculator“ tool for calculating the potential losses in AC wires is available on www.sma-america.com.

The Sunny Boy 700U is designed to feed 106 V AC to 132 V AC to the utility grid at frequencies from 59.3 Hz to 60.5 Hz. Table 4-1 lists the voltage and frequency limits for the AC connection. See our web site for additional information.

Table 4-1 Voltage and Frequency Limits for the AC Connection

Voltage Range	106 V - 132 V
Frequency Range	59.3 Hz - 60.5 Hz

Connecting the AC Wires

Use the following procedure to connect the AC wires to the Sunny Boy:



WARNING: You must connect the wires that carry the AC voltage from the Sunny Boy to the utility grid in the order described in this procedure. Deviating from this procedure could expose you to hazardous voltages that can cause serious injury and/or death.

1. Turn OFF the main breaker in the main utility breaker box.
2. If you are replacing an existing inverter, disconnect the wires for the AC line you are working with in the breaker box.
3. Install a ½-inch conduit fitting in the Sunny Boy's AC wiring knockout (the knockout farthest to the right on the bottom of the Sunny Boy, as shown in Figure 4-2 on page 4-5). Fasten the fitting on the inside of the Sunny Boy with the nut supplied with the fitting.
4. Install ½-inch conduit between the main breaker box and the Sunny Boy's AC wiring knockout.
5. Pull the AC wires through the conduit from the interior of the breaker box to the interior of the Sunny Boy.



Note: Refer to Figure 4-4 on page 4-9 for steps 7 through 8.



CAUTION: Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system. Wire nuts are a frequent cause of unreliable connections, resistive connections, and ground faults.

6. Connect the equipment-grounding wire to the terminal labeled PE in the Sunny Boy and tighten to a torque of 15 in-lbs.
7. Connect the L1 (AC line) wire to the terminal labeled L in the Sunny Boy.
8. Connect the N (AC neutral) wire to the terminal labeled N in the Sunny Boy.
9. Fasten the wires while applying a torque of 15 in-lbs.
10. Verify that all connections are correctly wired and properly torqued.

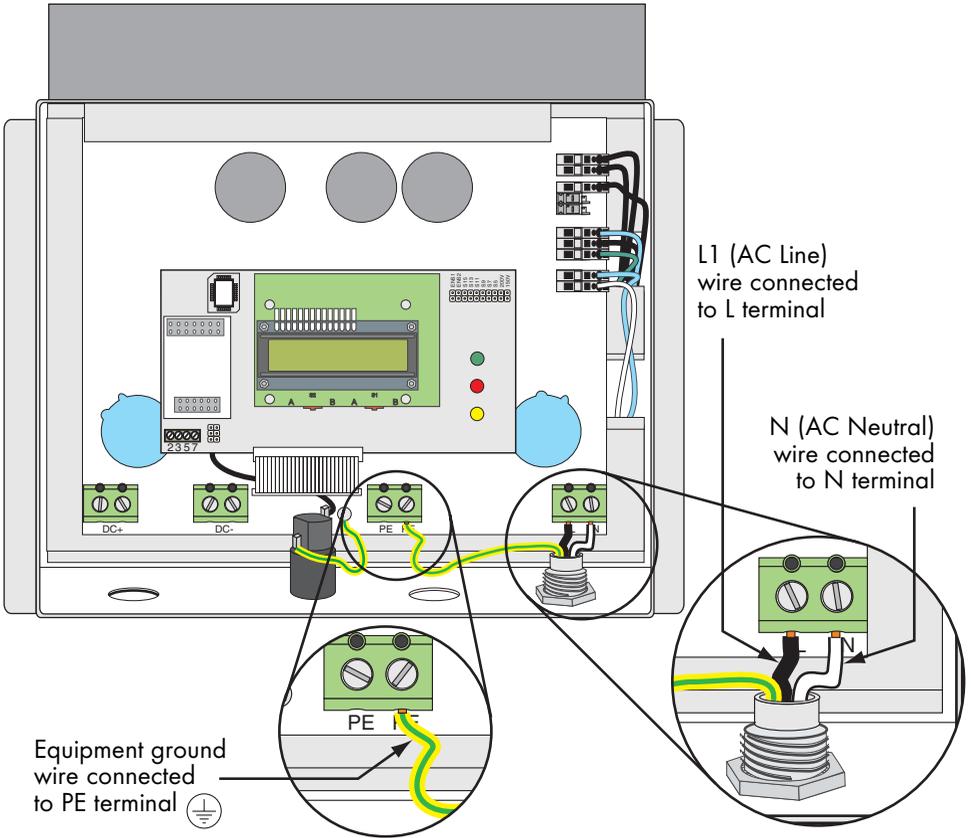


Figure 4-4 AC Connection Terminals

Wiring the DC Input

This subsection provides procedures for configuring the Sunny Boy's DC input-voltage range and for wiring the DC input from the PV array (via the DC disconnect enclosure) to the Sunny Boy. Figure 4-5 shows a simplified wiring diagram of a PV system.

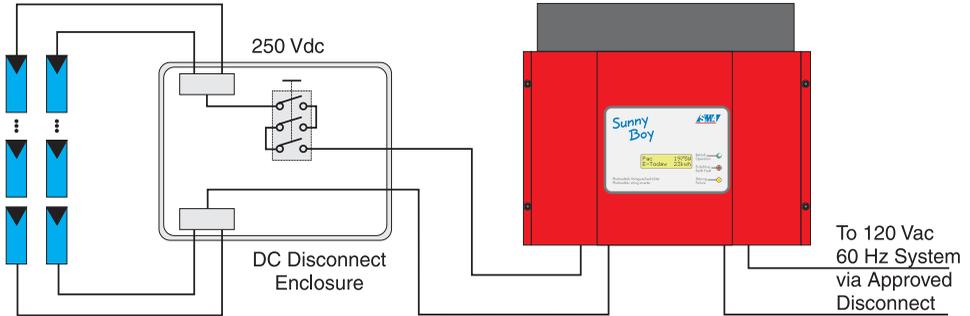


Figure 4-5 Simplified Electrical Wiring Diagram of a PV System

DC Connection Requirements



All electrical installations DC and Protective Earth (PE) must be done in accordance with all local electrical codes and with the National Electrical Code (NEC), ANSI/NFPA 70.

Use for all DC wiring connections to the Sunny Boy:

- 6 - 10 AWG
- 90° C (194° F)
- solid or stranded copper wire

Use for all Protective Earth (PE) wiring connections to the Sunny Boy:

- 6 - 14 AWG
- 90° C (194° F)
- solid or stranded copper wire



WARNING:The DC disconnect for the inverter must have a minimum rating of 250 V DC and 18 A continuous.

Configuring the DC Input-Voltage Range

The Sunny Boy 700U is designed for a maximum DC input voltage of 250 V DC. The input voltage range can be configured to match the output of your PV array in three ranges: 125 V DC to 250 V DC (700 W max), 100 V DC to 200 V DC (600 W max), and 75 V DC to 150 V DC (460 W max).

Figure 4-6 (page 4-12) and Table 4-2 (page 4-13) show where to position the range-configuration plug and jumper to configure the Sunny Boy's DC input-voltage range. Table 4-1 (page 4-11) lists the AC-current and power specifications for the Sunny Boy 700U for each of the DC input-voltage range configurations.



CAUTION: *The open-circuit voltage of the connected DC string **must never** exceed the maximum DC input-voltage configured by the DC range-configuration plug and jumper (Figure 4-6 and Table 4-2 on pages 4-12 and 4-13). Applying an open-circuit voltage that does exceed the maximum DC input voltage will cause irreversible damage to the Sunny Boy and void the warranty!*

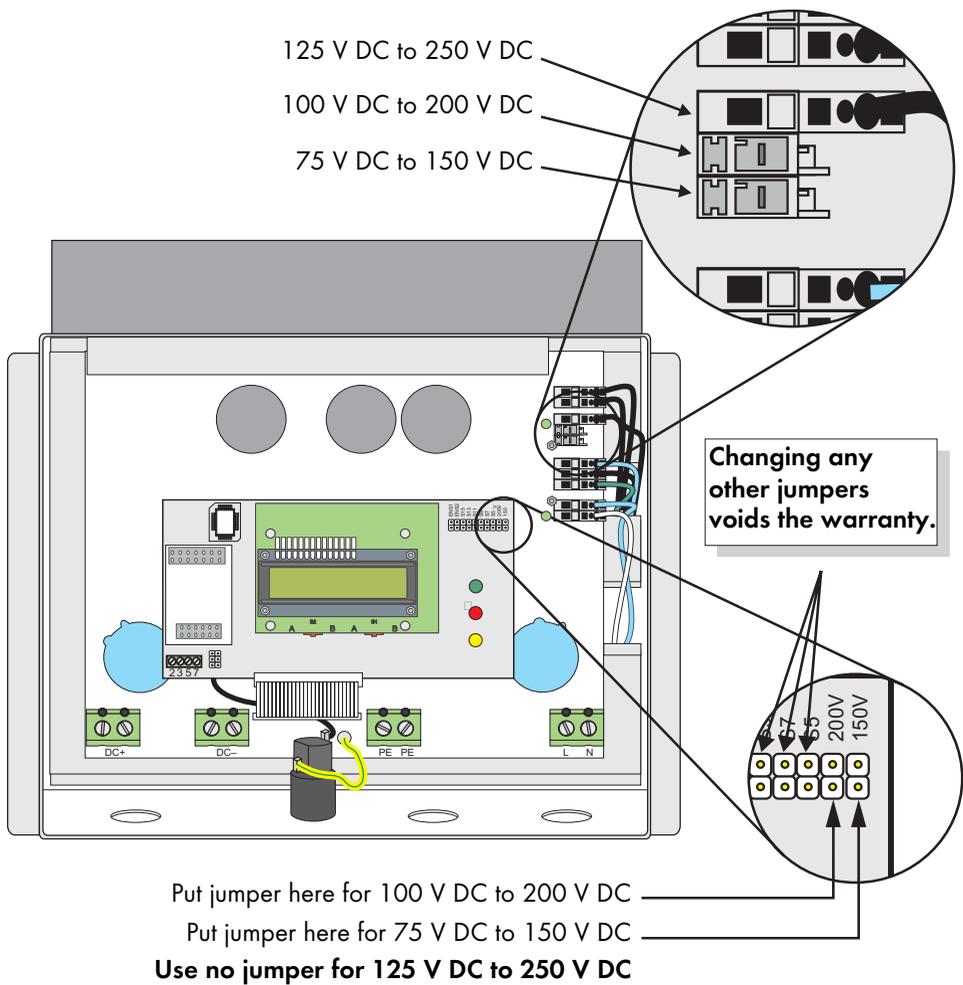


Figure 4-6 Configuring the DC Input-Voltage Range



Note: The Sunny Boy 700U is shipped from the factory with the DC input-voltage range configured for 125 V DC to 250 V DC. Do not discard the jumper when the Sunny Boy is set for 125 V DC to 250 V DC. Store the jumper on a single, empty pin in case it is needed later (see Table 4-2).

Table 4-2 DC Input-Voltage Range Configuration

DC Range	DC Range-Configuration Plug	DC Range-Configuration Jumper
125 V DC to 250 V DC (jumper in storage position) (same as no jumper)		
100 V DC to 200 V DC		
75 V DC to 150 V DC		

Table 4-3 Voltage Range Specifications for the Sunny Boy 700U

DC Configuration	Rated AC Current	Maximum AC Current	Maximum AC Power
125 V DC to 250 V DC	5.8 A	6.6 A	700 W
100 V DC to 200 V DC	5.0 A	5.7 A	600 W
75 V DC to 150 V DC	3.8 A	4.3 A	460 W



Note: Use the online string-sizing calculator at < www.sma-america.com > to determine the correct string configuration (see Figure 4-7). To navigate to the string-sizing calculator, click "String Sizing" in the menu bar on the right side of the page.

SMA America USA - Microsoft Internet Explorer bereitgestellt von SMA v1.1

String Sizing Program

Further Instructions
If you are having difficulty with the String Sizing Program, or it is not operating properly, see this [Read Me](#) file for the operating instructions and version history of the String Sizing Program.

By using this String Sizing Program you agree that this Program is for approximating PV module string sizes only. Further you agree that SMA America, Inc. makes no claim as to the actual performance of your system, including, but not limited to, the efficiency or power production of the inverter and PV modules based on the information from this Program. Additionally, you agree that it is the responsibility of the system design engineer to ensure that the PV module selection, array configuration, and associated wiring diagrams are appropriate for the system being considered.

NOTE:
For an explanation of any particular [entry definition](#) click on the actual term for a glossary.

Design Options

Please Select an Inverter	Please Select a PV Manufacturer	Please Select a PV Module
SWR 1800U (120) ▾	Please Select ▾	Please Select ▾

Inverter Data

Design Irradiance (W/m ²) 1000	Paac 1800	Pdcmax 2000
Idc Max 12	Vdc Max 400	Vmpt Max 400
	Vmpt Min 150	Vmin 139

Module Data

Module Pnom (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Temperature Coefficient of Voltage	Temperature Coefficient of Current	Temperature Coefficient of Power		
<input type="text"/>	<input type="text"/>	<input type="text"/>		

Mounting Method

Please select the [mounting method](#) for the array: Mounted flat against the roof ▾

Temperature Data

If you do not know the [hottest](#) and [coldest](#) ambient temperatures that you should select for your area please enter the 5-digit postal ZIP code of the address of the installation here: and then [Click Here](#)

Select the [coldest](#) record low ambient temperature when sunlight will be on the array: °F

Select the [hottest](#) average high ambient temperature when sunlight will be on the array: °F

Imperial units Metric units

Results

1 string configurations	2 string configurations	3 string configurations	4 string configurations	5 string configurations
<input type="text"/>				

* Some derating possible ** Some derating likely with out adequate [air flow](#) *** Install a Sunny Breeze Kit to prevent derating

Lokales Intranet

Figure 4-7 Online String-Configuration Calculator at < www.sma-america.com >

Connecting the DC Wires



WARNING: You must connect the wires that carry the DC voltage from the PV array to the Sunny Boy in the order described in the following procedure. Deviating from this procedure could expose you to lethal voltages that can cause serious injury and/or death.



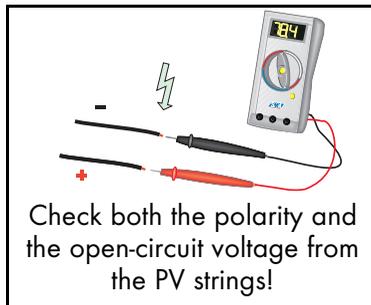
WARNING: PV arrays are energized when exposed to light. Use safe working practices when working on PV arrays.



WARNING: Always turn OFF *all* AC and DC breakers and switches in the PV system and wait a minimum of 5 minutes for the Sunny Boy to completely discharge before connecting any wires to the Sunny Boy or disconnecting any wires from the Sunny Boy. Failure to do so could expose you to lethal voltages that can cause serious injury and/or death.



CAUTION: Verify the polarity and the open-circuit voltage from the PV strings before you connect the DC wires to the Sunny Boy. Applying an open-circuit DC-input voltage that exceeds the maximum for the currently configured DC-input-voltage range or has reversed polarity will cause irreversible damage to the Sunny Boy and void the warranty! Always configure the DC-input-voltage range correctly before connecting the DC-input wires from the PV array to the Sunny Boy (see "Configuring the DC Input-Voltage Range" on page 4-11).



Use the following procedure to connect the DC wires to the Sunny Boy:

1. Verify that the main breaker in the main utility breaker box is OFF.
2. Open the DC disconnect in the DC disconnect enclosure.
3. Install a ½-inch conduit fitting in the Sunny Boy's DC wiring knockout. The DC knockout is the one farthest to the left on the bottom of the Sunny Boy, as shown in Figure 4-2 (page 4-5) and Figure 4-8 (page 4-16). Fasten the fitting on the inside of the Sunny Boy with the nut supplied with the fitting.
4. Install ½-inch conduit between the DC disconnect enclosure and the Sunny Boy's DC wiring knockout.



Note: Refer to Figure 4-8 (page 4-16) for steps 5 through 7.

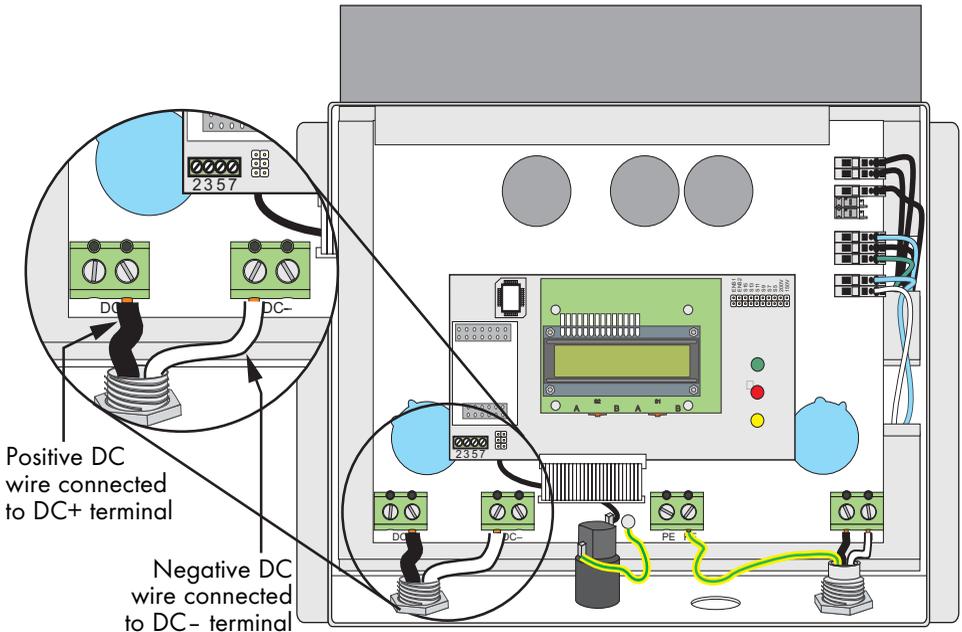


Figure 4-8 DC Connection Terminals

5. Pull the DC wires from the DC disconnect through the conduit into the interior of the Sunny Boy.
6. Connect the positive DC wire to the terminal labeled DC+ in the Sunny Boy.
7. Connect the negative DC wire to the terminal labeled DC- in the Sunny Boy.



Note: The Sunny Boy has provisions for either one or two PV strings. The positive and negative terminal blocks each have two positions, so two pairs of DC-input wires can be connected in parallel.



CAUTION: Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system. Wire nuts are a frequent cause of unreliable connections, resistive connections, and ground faults.

8. Connect the positive and negative DC wires to the appropriate terminals in the DC disconnect enclosure.
9. Fasten the wires while applying a torque of 15 in-lbs.
10. Verify that all connections are correctly wired and properly torqued.

Connecting Communication Cables

Various data-communication options are available for the Sunny Boy 700U. These options are provided in the form of Piggy-Back modules that can be installed and connected either at the time the inverter is installed or at any time thereafter. Refer to the instructions included with the communication module for installation procedures.

The following subsection provides instructions for connecting communication cables of RS-485 between a Sunny Boy with a communication module and a personal computer (PC).

RS-485 Communication

RS-485 is a communication standard for bidirectional transmission of data between one or more Sunny Boy inverters and a PC.



Note: All Sunny Boy inverters are capable of RS-485 communication as long as the requirements below are met. You can mix different Sunny Boy models on the RS-485 communication bus.

Requirements for RS-485 Communication:

- The Sunny Boy 700U must be equipped with an RS-485 Piggy-Back communication module.
- A 3 conductor cable no longer than 4000 feet (1200 meters) with a common shield, and a wire size no smaller than 24 AWG. The cable must consist of 2 twisted pairs with a common shield surrounding all 4 wires.

Connecting an RS-485 Cable

Use the following procedure to install an RS-485 data-communication cable:



Note: The following steps describe how to connect one Sunny Boy inverter to an RS-485 bus. For information on connecting more than one inverter to an RS-485 bus, please see “Technical Note: RS-485 Communication” in the Tech Updates section of our web site at www.sma-america.com

1. Connect the three insulated wires of the RS-485 cable to terminals 2, 5, and 7 of the communication terminal block. Record the wire color used for each of the terminals.
2. Connect the shield of the cable to the Sunny Boy’s case.

3. Install a jumper in position A, the bottom set of pins on the communication jumper block, to set it for termination.



Note: The termination of the other end of the RS-485 cable will depend on what type of device you're connecting to. For detailed information, please see the Tech Updates section of our web site at www.sma-america.com There you will find tech notes on all of the Sunny Boy communication options.

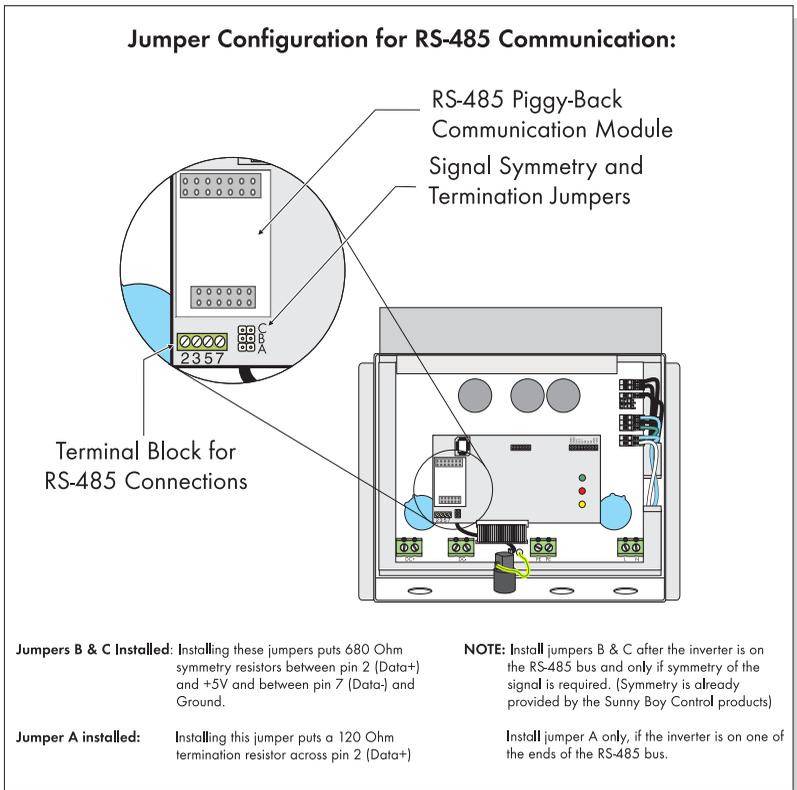


Figure 4-9 Detail of RS-485 Termination and Jumper Settings

RS-485 Pinouts

- 2 - A (+)(Data+)
- 7 - B (-) (Data-)
- 5 - SR (Signal Ref.)

Replacing the Cover

When you have finished connecting the AC-output wires, the DC-input wires, the grounding wires, and the communication cables, re-check all your connections to ensure that everything is in the right place and that all connections and knockout fittings are secure and properly torqued. Check all of the knockout fittings on the bottom of the Sunny Boy to ensure that they provide a weather-tight seal.



WARNING: Never apply power to the Sunny Boy with the cover removed.



WARNING: Never install the Sunny Boy during rain or very damp conditions. Because the Sunny Boy is completely sealed, you must be sure no moisture is trapped inside the enclosure when securing the lid.



CAUTION: Be careful not to misplace the screws or the lock washers that attach the cover to the case, as all four screws and lock washers are required to ensure that the cover is grounded properly and is fully sealed to the case. Handle the cover carefully, as even minor damage to the cover could result in an inadequate seal between the cover and the case, thus allowing moisture to enter the case and damage the sensitive electronic components.

Use the following procedure to replace the cover on the Sunny Boy:

1. Check wire dress to ensure that no wires can interfere with proper sealing of the cover and that no pressure will be exerted on the connections when the cover is replaced.
2. Locate the four screws and lock washers you removed to take the cover off the Sunny Boy. Make sure you have all four screws and lock washers, as all of this hardware is necessary to ensure proper grounding and a weather-tight seal.
3. Check the seal on the inside of the cover to ensure it is undamaged and in the correct position.
4. Carefully position the cover on the front of the Sunny Boy so that the four holes in the cover are aligned correctly with the four threaded holes in the case.



Note: Be sure when reinstalling the four screws that the lock washers are installed correctly. The teeth of the washers

should face the LID.

5. While holding the cover in place, carefully insert the four screws with lock washers through the holes in the cover into the threaded holes in the case and turn them in until they are finger-tight. Be careful not to cross-thread any of the screws.
6. Verify that the cover is in the correct position and that the seal is in place between the case and the cover.
7. Tighten the cover screws fully, and reinspect the seal to ensure that it is in the correct position.

Section 5: Commissioning



WARNING: Follow the steps in the commissioning procedure in the order they are presented. Deviating from these procedures could expose you to lethal voltages that can cause serious injury and/or death.



WARNING: never insert the GFDI fuse into the Sunny Boy without the fuse holder base. Lethal voltage may still be present and electric shock may result.



CAUTION: Follow the steps in the commissioning procedure in the order they are presented. Deviating from these procedures could cause irreversible damage to the Sunny Boy and void the warranty.

All Sunny Boy inverters have a sophisticated system for detecting and responding to PV array ground faults as required by NEC Section 690.5. The PV array normally operates in a grounded configuration. The array's negative conductor is connected to the grounding system inside the inverter as a part of the UL1741 Listed ground-fault detection system. The GFDI protection is active whenever there is sufficient DC voltage to turn on the LCD in the Sunny Boy.

To commission the Sunny Boy, follow these simple instructions:

1. Make sure any covering placed over the PV array is removed.
1. Connect the grid voltage to the Sunny Boy by switching on the main AC circuit breaker in the main utility panel.
2. Switch the DC disconnect to the "on" position: If there is sufficient sunlight available, the Sunny Boy will enter the „Wait“ mode at this time and the green LED will begin to blink.
3. If no AC faults are detected, the "Wait" mode will end after approximately 10 seconds and the green LED will stop blinking, remain on and the Sunny Boy will begin to operate normally. If an AC fault was registered, the Sunny Boy will wait 5 minutes prior to starting.



Note: If there is a ground fault in the array, the „EarthCurrentMax“ error message will be displayed and the GFDI fuse may clear. If this error message is encountered, switch off the DC and AC disconnects to the Sunny Boy and troubleshoot the array.



Note: If the Sunny Boy is not operating as expected after the commissioning procedure has been completed, refer to Section 6: Displays and Messages and to Section 7: Troubleshooting.



Note: If there is adequate solar irradiation and the resulting PV input voltage is sufficient, the Sunny Boy will automatically begin feeding power to the utility grid.



Note: The Sunny Boy operates from the power produced by the PV array and is designed for minimal internal DC-power consumption. The maximum power that the Sunny Boy will consume in normal operation is 4 W.



Note: Anytime the AC power is disconnected from the inverter, either manually or as a result of an AC disturbance, the inverter will wait 5 minutes after the AC power has been restored to reconnect. When servicing the inverter, always disconnect the DC first, then the AC.

Section 6:

Displays and Messages

Each Sunny Boy inverter comes equipped with a three LED status indicator. This allows the user to determine the operating mode of the inverter at a glance. The basic definitions of the indicator lights are as follows:

The green LED indicates that the inverter is operating and in which mode.

The red LED indicates that the GFDI fuse, located in the holder on the underside of the inverter, is defective.

The yellow LED indicates that there is a fault of some kind, either inside the inverter itself or somewhere in the system, and that the inverter has ceased operation until the fault is corrected. The different error codes and possible causes are addressed later in this section.

The red and yellow LEDs combined indicate that the GFDI has detected a ground fault. The ground fault must be located and cleared and the inverter reset manually. The inverter will not restart automatically after detecting a ground fault.

Sunny Boy



Photovoltaik-Stringwechselrichter
Photovoltaic string inverter

Betrieb ———— 
Operation

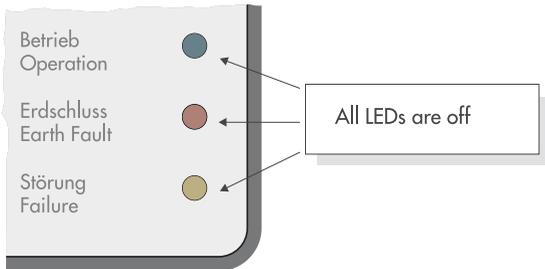
Erdschluss ———— 
Earth Fault

Störung ———— 
Failure

Figure 6-1 The Sunny Boy LED Status Indicator

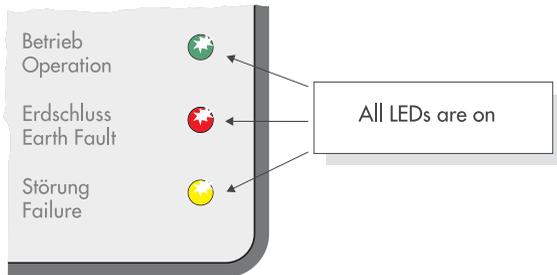
LED Operation Indicators

Standby (Night)



The inverter is in standby mode because the input voltage is too low for operation.

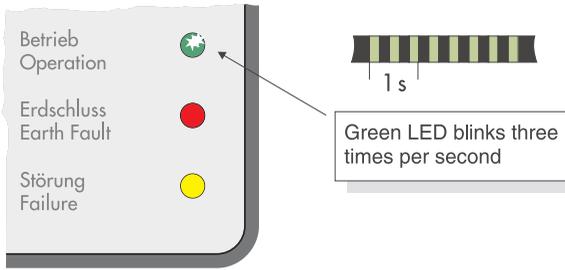
Initialization



The inverter is initializing. The power from the array is sufficient to operate the control, but not yet powerful enough to begin feeding the grid. Data transmission is not possible during initialization.

Occasionally, during inclement weather or low solar radiation, the LEDs may all turn on at once and then go off again. This indicates that the inverter is trying to initialize but the power available from the array is not sufficient to operate. This is not a malfunction.

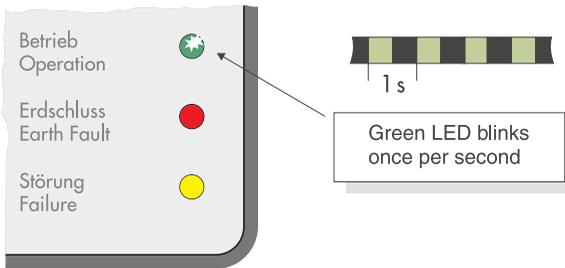
Stopped



The inverter has stopped operating while there is sufficient power available to calibrate its internal systems. Typically, the calibration lasts less than 10 seconds and then the inverter resumes normal operation.

This status can also be adjusted manually (operating mode „Stop“)

Waiting

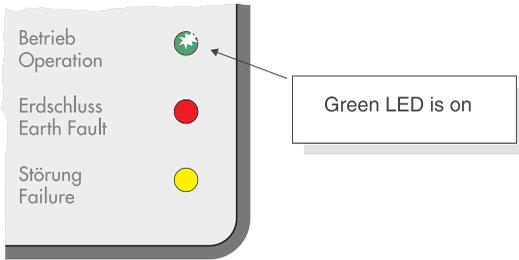


The inverter has determined that there is enough power from the array to operate and is checking the condition of the grid in preparation to connect to it.



Note: If the inverter fails to connect to the utility grid 3 times in a row, it will wait 10 minutes before the next attempt.

Normal Operation

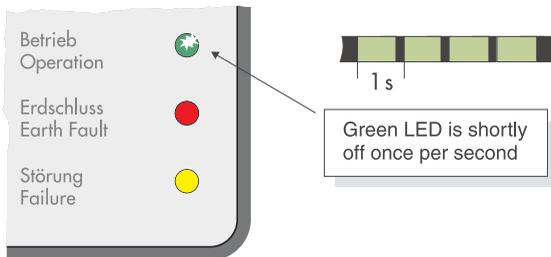


The inverter is feeding the utility grid in either "MPP" or "Constant Voltage" mode.

"MPP" Mode: The Sunny Boy adjusts the voltage from the PV array to match the voltage with the highest output power.

"Constant Voltage" Mode: The voltage from the PV array has been set to a fixed value. This value is set by using the Sunny Boy Control or the Sunny Data software. (The parameter name is "V-Const" or „U-Konst" depending on which software you are using to access the parameters.)

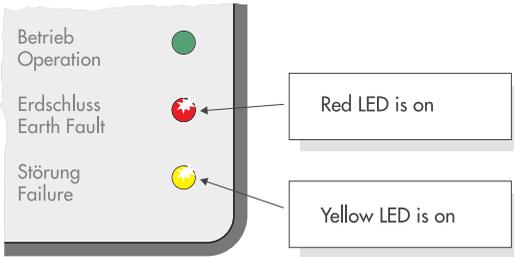
Derating



The inverter is feeding power to the utility grid at a derated rate due to excessive heating of the heat sink.

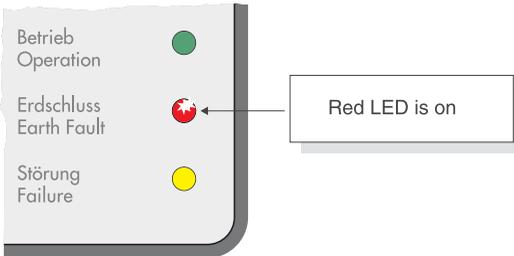
LED Fault Indicators

Ground Fault



The inverter has detected a ground fault in the PV system and has disconnected from the grid. The ground fault must be located and cleared and the inverter reset manually. (The inverter will not restart automatically)

Defective GFDI Fuse

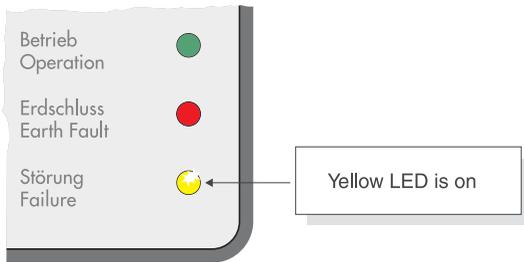


The GFDI fuse located in the fuse holder on the bottom of the inverter is defective. If the fuse has blown due to a ground fault, the fault must be cleared before replacing the fuse.



CAUTION: For continued protection against the risk of fire, replace the GFDI fuse with fuses of the same type and rating only. The recommended type is a Littelfuse KLKD 1 Amp, 600V AC/DC

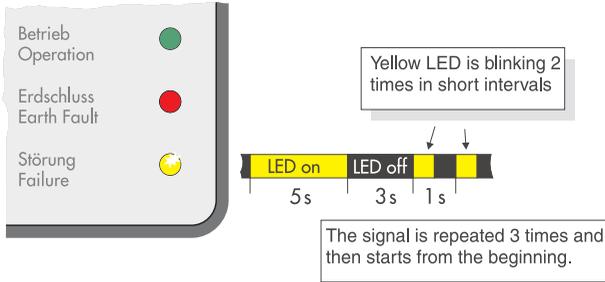
Consistent Fault



The yellow LED remains lit.

The Sunny Boy has detected a fault with the internal utility monitoring system. When the inverter detects a fault of this kind it will no longer connect to the utility grid. To correct this, the inverter must be serviced by a qualified service technician.

Grid Failure



The yellow LED is on for 5 seconds, out for 3 seconds and then blinks twice. The code is repeated 3 times. If the condition remains, the code will continue to be sent.

This code can be caused by any of the following conditions:

- Low Grid Voltage (<Vac Min)
- High Grid Voltage (>Vac Max)
- Low Grid Frequency (< fac Min)
- High Grid Frequency (>fac Max)
- Significant change in grid frequency

Check the condition of the grid by verifying service to other customers or to other equipment. Also inspect the AC disconnect between the Sunny Boy and the grid.

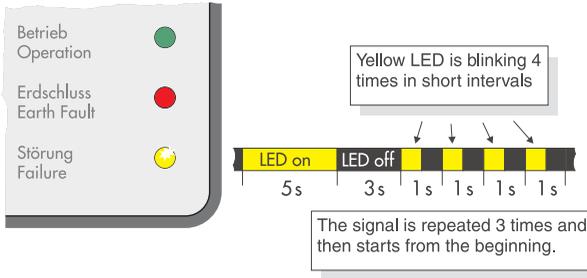


CAUTION: Have the grid connection to the Sunny Boy checked only by a qualified electrician.



WARNING: If troubleshooting methods require that you open the Sunny Boy inverter, do so only after disconnecting all sources of power to the Sunny Boy.

High Input Voltage



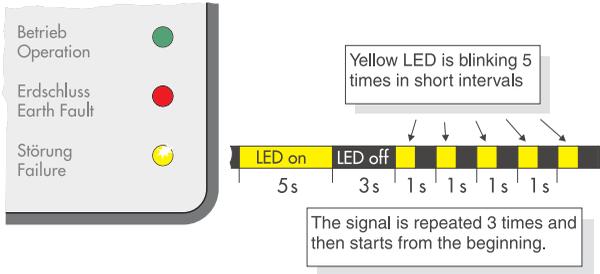
The yellow LED is on for 5 seconds, remains off for 3 seconds and then blinks 4 times. The code is repeated 3 times. If the condition remains the code will continue to be sent.

The inverter has detected an input voltage that is too high for safe operation.



WARNING: Disconnect the PV array from the Sunny Boy immediately! High input voltage can permanently damage the inverter. Have the PV array checked by a qualified technician.

Inverter Fault



The yellow LED is on for 5 seconds, remains off for 3 seconds and then blinks 5 times. The code is repeated 3 times. If the condition remains the code will continue to be sent.

The inverter has encountered a condition that makes it impossible to return to normal operation and will most likely require servicing.



CAUTION: The Sunny Boy must be serviced only by a qualified technician.

Status Messages on the Display

The Sunny Boy 700U is optionally equipped with the „Sunny Display“ LCD in the lid.

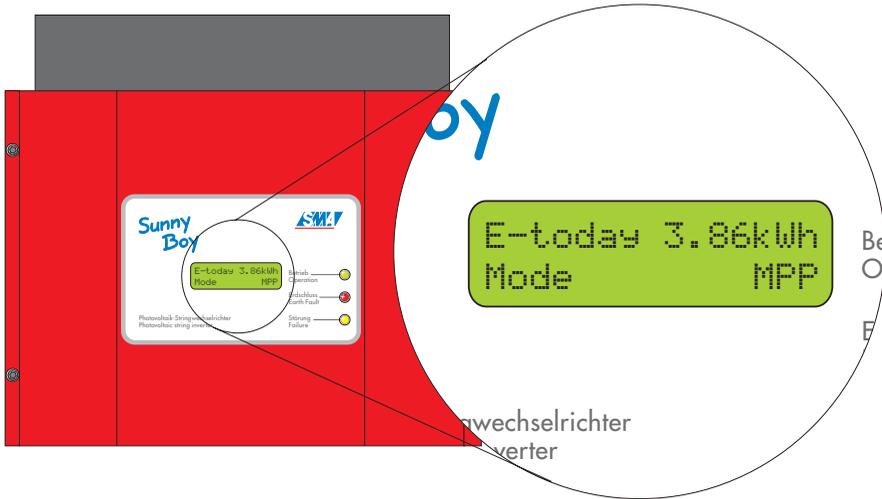


Figure 6-2 Display of the Sunny Boy 700U

Activation of the Background Illumination

The background illumination is activated by slightly knocking on the lid. Knocking once more activates the next message on the display.

The background illumination is automatically deactivated after 2 minutes.

Messages of the Sunny Display During Initialization

The following messages are displayed during initialization of the inverter.

**Sunny Boy 700U
WR7xxUxxE**

Initialization of the display on the Sunny Boy 700U

The installed firmware versions of the control system (BFR) and the current control processor (SRR) are displayed after 6 seconds.

**BFR Version x.xx
SRR Version x.xx**

Initialization of the display on the Sunny Boy 700U

Messages of the Sunny Display During Operation

The Sunny Display presents all relevant operating data one screen after the other. The images on the side indicate the messages. Each message is displayed for 5 seconds, after all messages have been displayed the display starts from the beginning again.

First the „E-Today“ (total energy produced on this day) is displayed together with the current operating status.

E-today	3.86kWh
Mode	MPP

Energy produced today
and current operating status

The message is followed by the current power and the current PV-voltage.

Pac	700W
Upv	250V

Current AC power
and AC voltage

Finally the accumulated yield of the device since installation is displayed together with the total operating hours.

E-total	179.2kWh
h-total	512h

Total energy yield
and total operating hours

Messages of the Sunny Display in Case of a Failure

In case of a failure the Sunny Display switches to „Failure“ and the background illumination is activated.

The upper line indicates one of the three following failure types:

- Disturbance

A condition is only considered as a Disturbance as long as the reasons for this condition still are present.

- Error

A condition is considered as an Error in case the inverter cannot restart without user interaction.

The bottom line indicates the type of a failure for 5 seconds.

**Disturbance
Fac-Bfr**

Indication of a failure
and failure type

Failures that result from a specific value that e.g. exceeds a limiting are specified with the value that caused the failure as well as the current value.

**at: 59.31Hz
present: 59.30Hz**

Display of the value that caused the
failure and the current value

The normal operating data is displayed after 5 seconds.

The display starts from the beginning again in case the failure is still present. For detailed information concerning the failure messages have a look to "Measuring Channels and Messages" (page 6-18).

„Error ROM“ indicates that the Sunny Boy has detected a defective firmware in the EEPROM. Contact SMA in order to remove this failure.

**Error
ROM**

Indication of defective firmware

Indication of DC Overvoltage

A too high voltage on the input (DC) side is indicated with a blinking background illumination and the display shown on the side.

**!PU-Overvoltage!
!DISCONNECT DC !**

Indication of an overvoltage on one of the DC input connectors



WARNING: Disconnect the inverter from the supply voltage immediately, otherwise it can be severely damaged.

Check the input voltage and your module configuration before you reconnect the DC voltage to the inverter again.

Sunny Display Language Selection

The Sunny Display option has the ability to display information in any of four different languages. Setting the language is performed by using a pair of slide switches located along the bottom edge of the display PC board. The language choices are: Spanish, English, French and German. Use the diagram and chart below for setting the display.

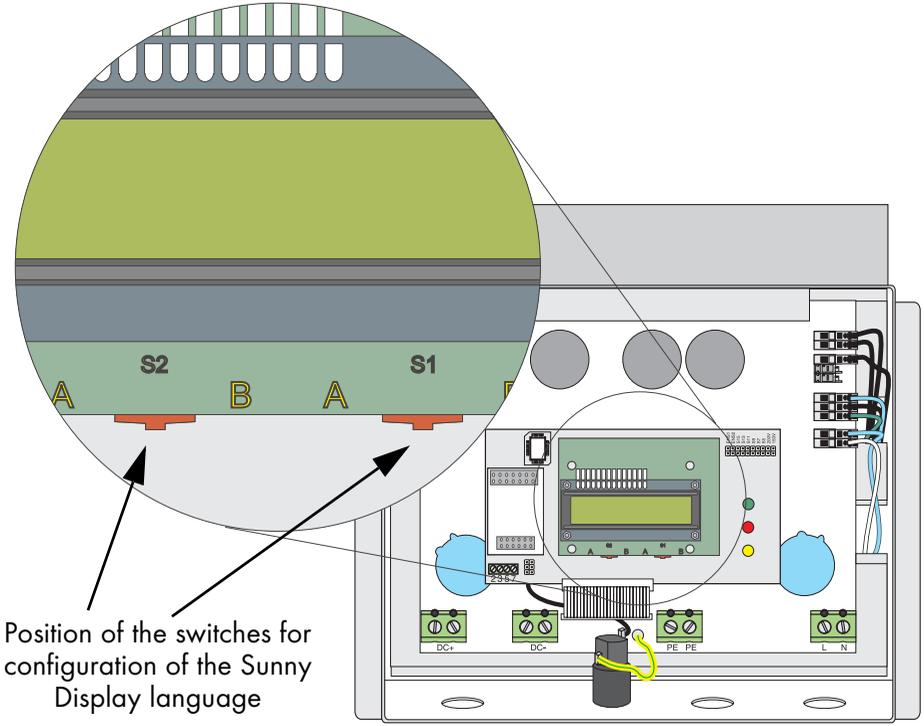
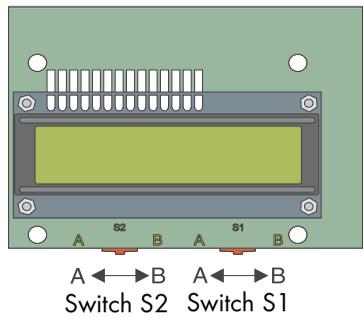


Figure 6-3 Language Selecting Switches for the Sunny Display Option

Language	Switch S2	Switch S1
German	B	B
English	B	A
French	A	B
Spanish	A	A
Language	Switch S2	Switch S1



Communication Options

Sunny Boy inverters are available with different communication options depending upon your needs. The Sunny Boy series allows for both internal and external metering options to be used simultaneously. These options may also be installed in the field by qualified personnel.

PC Applications and Monitoring

Sunny Boy operating data may be transmitted to, and stored in, a remote system or PC by one of the following methods:

- RS-485: Data from up to 50 inverters is sent via RS-485 cable to a remote control unit or to a PC. Maximum length of cable is 4000' (1200 m). An RS-485/232 converter may be necessary for communication with a PC.
- Wireless: Data from up to 4 inverters is sent to the Sunny Beam by means of an antenna installed in the Sunny Boy. Communication distance is dependent upon obstructions and the radio environment.

Sunny Data Control

This PC application is used to communicate with the Sunny Boy Control products. It can be used to monitor multiple inverters, download historical system data and adjust system parameters. It can also send system data to the Sunny portal server via analog modem or ethernet.

Sunny Boy Control Plus

The Sunny Boy Control Plus provides continuous monitoring and data acquisition of your PV system.

Sunny Beam

The Sunny Beam is a wireless desktop system monitor. It works together with the Sunny Beam Piggy-Back card and provides wireless communication with up to four Sunny Boys in the PV plant. Its graphical display shows a bar chart of actual power production as well as daily and total-energy-yields in a single window.

Sunny WebBox

The Sunny WebBox is a link between the PV-plant and the operator or owner. The direct connection to the Sunny Portal via internet gives you entirely new possibilities for data acquisition and evaluation as well as the visualization on a PC with an internet browser. No additional software needs to be installed.

Sunny SensorBox

The Sunny SensorBox is a useful extension for the Sunny Webbox which can monitor weather conditions. It is equipped with an integrated insolation and temperature sensor and can be connected to numerous additional sensors for the measurement of module temperature, ambient temperature, wind speed, humidity and more.

Sunny Portal

The Sunny Portal is a high performance interface from SMA for the monitoring and presentation of your system on the Internet. Details can be obtained directly from www.SUNNY-PORTAL.com.

For more information and assistance in choosing the right data option for your system, please visit the SMA America web site.

Measuring Channels and Messages

The communication options support a number of measuring channels and messages from the Sunny Boy inverters.

The following abbreviations are used:

BFR Betriebsführungsrechner (Sequential Control System)

SRR Stromregelungsrechner (Current Control System)

Measuring Channels

Vpv:	PV input voltage
Vpv Setpoint:	desired input voltage of the Vpv-control
Iac:	current to the grid
Vac:	grid voltage
Fac:	grid frequency
Pac:	power fed to grid
Vpv-PE:	PV-voltage to earth (for troubleshooting PV ground faults)
Temperature:	Temperature measured at IGBT module
Ipv:	current from PV-panels
Max. Temperature:	Max. temperature measured at IGBT module
Max. Vpv:	Max. PV input voltage
I-dif:	Error current
E-Total (E-total):	total energy yield
h-Total (h-total):	total operation hours
h-on:	h-on indicates how long sufficient DC voltage has been applied to the Sunny Boy and the Sunny Boy has been active including the time it was not able to feed to the utility with respect to too low voltage or operation in stop mode.
Power On:	total system start ups
Event-Cnt:	Event counter

Serial Number:	Sunny Boy serial number
CO2 saved:	CO2 saved in operation time
Mode:	operating mode
Error:	description of fault

Operating Mode

Stop:	manual system stop
Offset:	offset calibration of the electronics (at start-up)
Waiting:	grid switching-on conditions are not fulfilled (yet)
Grid monitoring:	checking grid (grid impedance)
MPP-Search:	PV voltage is determined and set
MPP:	Sunny Boy is in MPP mode
V-Const:	Sunny Boy is in constant voltage mode
Derating:	reduction of the grid feeding power
Disturbance:	A condition is only considered a Disturbance for as long as the reasons for this condition still are present.
Error:	A condition is considered an Error whenever the inverter cannot restart without user interaction.

Sunny Boy 700U Operating Parameters



CAUTION: Any unauthorized modifications of the operating parameters can

- Result in serious injuries or casualties due to altered internal safety precautions within the Sunny Boy
- Void the UL Listing of the Sunny Boy
- Void the warranty of the Sunny Boy
- Void any utility interconnection agreement

Never change the operating parameters without explicit permission and instructions!

Table 6-1 Operating Parameters of the Sunny Boy 700U; 75 - 150 V DC (changeable)

Name	Unit	Range	Default	Description
Antilsland-Ampl*	deg	0 ... 10	4	Amplification of the Antilsland process
Antilsland-Freq*	mHz	0 ... 2000	500	Repetition rate of the Antilsland process
CO2-Fact	lbs/ kWh	0 ... 2	1.7	The Sunny Boy evaluates the yield and indicates the approximate CO ₂ emission avoided by your Sunny Boy. The amount of CO ₂ avoided is computed according to the kWh produced (E-total) multiplied by the factor defined in the parameter „CO ₂ “.
Default		USA/UL1741/ 2005; OFF_GRID; ADJUSTED	USA/ UL1741/ 2005	Used for adjusting the parameters country specific settings Note: After changing one of the parameters marked with * the parameter „Default“ changes to „adjusted“ automatically.
E-Total	kWh	0 ... 200000	0	Total energy yield (E_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data
Fac-Delta- *	Hz	0.2 ... 3	0.69	Maximum allowable frequency above (Fac-Delta+) and below (Fac-Delta-) 60 Hz. Default value is optimal for installations < 30 kW.
Fac-Delta+ *	Hz	0 ... 4.5	0.49	
Fac-MinTripTime*	s	0.16 ... 300	0.16	Utility interconnection frequency trip time. Default value is optimal for installations < 30 kW.
h-Total	h	0 ... 200000	0	Total operating hours (h_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data

Name	Unit	Range	Default	Description
Memory Function		no function default param. reset Op.Data Reset errors	No function	Default param.: Sets all parameters to default. Reset Op.Data: Sets all parameters that are visible in user level to default values. Reset errors: Resets all permanent device disable (dBh) and the failure „EarthCurMax“ occurs. To remove this failure, follow the steps in „Section 5: Commissioning the Sunny Boy“
Operating Mode		MPP-Operation Turbine V-const Stop	MPP	Operating Mode of the Sunny Boy: MPP-Operation: Maximum Power Point Turbine: Operating mode for wind power plants V-const: Constant Voltage Mode (Setpoint defined in „Vconst-Setval“) Stop: Disconnection from utility, no operation
Pmax	W	0 ... 510	460	Maximum power output of the inverter
T-Start	s	5 ... 1600	10	The time the inverters waits to connect to the grid after Vpv-Start is exceeded. This value defaults to 5 minutes after a utility fault.
T-Stop	s	1 ... 1800	2	Time that the Sunny Boy wait until it disconnects from the grid.
Vac-Min *	%	0 ... 50	12	Lower (Vac-Min) and upper (Vac-Max) limit of allowable AC voltage. Default value is optimal for installations < 30 kW.
Vac-Max *	%	0 ... 20	10	
Vac-Min-Fast *	%	0 ... 50	50	Lower and upper limits of allowable AC voltage for fast disconnection. Default value is optimal for installations < 30 kW.
Vac-Max-Fast *	%	0 ... 20	20	
Vac-Min-Recnct*	%	0 ... 50	11.7	Values are used to calculate the lower and upper limits to reconnect to the grid after a grid failure
Vac-Max-Recnct	%	0 ... 20	5.83	
Vconst-Setval	V	75 ... 330	275	PV Setpoint voltage for constant voltage operation. These parameters only are important in case the parameter „Operating Mode“ is set to „V-const“.
Vpv-Start	V	75 ... 150	95	Voltage where the Sunny Boy starts connecting to the grid.

The following parameters appear in parameter list but cannot be modified:

Table 6-2 Operating Parameters of the Sunny Boy 700U; 75 - 150 V DC (fixed)

Name	Unit	Range	Default	Description
Plimit	W	460	460	Upper limit of AC output power
SMA-SN				Serial Number of the Sunny Boy
Software-BFR				Firmware version of the operation control unit (BFR)
Software-SRR				Firmware version of the current control unit (SRR)

Table 6-3 Operating Parameters of the Sunny Boy 700U; 100 - 200 V DC (changeable)

Name	Unit	Range	Default	Description
Antilsland-Ampl*	deg	0 ... 10	4	Amplification of the Antilsland process
Antilsland-Freq*	mHz	0 ... 2000	500	Repitition rate of the Antilsland process
CO2-Fact	lbs/ kWh	0 ... 2	1.7	The Sunny Boy evaluates the yield and indicates the approximate CO2 emission avoided by your Sunny Boy. The amount of CO2 avoided is computed according to the kWh produced (E-total) multiplied by the factor defined in the parameter „CO2“.
Default		USA/UL1741/ 2005; OFF_GRID; ADJUSTED	USA/ UL1741/ 2005	Used for adjusting the parameters country specific settings Note: After changing one of the parameters marked with * the parameter „Default“ changes to „adjusted“ automatically.
E-Total	kWh	0 ... 200000		Total energy yield (E_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data
Fac-Delta- *	Hz	0.2 ... 3	0.69	Maximum allowable frequency above (Fac-Delta+) and below (Fac-Delta-) 60 Hz. Default value is optimal for installations < 30 kW.
Fac-Delta+ *	Hz	0 ... 4.5	0.49	
Fac-MinTripTime*	s	0.16 ... 300	0.16	Utility interconnection frequency trip time. Default value is optimal for installations < 30 kW.
h-Total	h	0 ... 200000		Total operating hours (h_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data

Name	Unit	Range	Default	Description
Memory Function		no function default param. reset Op.Data Reset errors	No function	Default param.: Sets all parameters to default. Reset Op.Data: Sets all parameters that are visible in user level to default values. Reset errors: Resets all permanent device disable (dBh) and the failure „EarthCurMax“ occurs. To remove this failure, follow the steps in „Section 5: Commissioning the Sunny Boy“
Operating Mode		MPP-Operation Turbine V-const Stop	MPP	Operating Mode of the Sunny Boy: MPP-Operation: Maximum Power Point Turbine: Operating mode for wind power plants V-const: Constant Voltage Mode (Setpoint defined in „Vconst-Setval“) Stop: Disconnection from utility, no operation
Pmax	W	0 ... 650	600	Maximum power output of the inverter
T-Start	s	5 ... 1600	10	The time the inverters waits to connect to the grid after Vpv-Start is exceeded. This value defaults to 5 minutes after a utility fault.
T-Stop	s	1 ... 1800	2	Time that the Sunny Boy wait until it disconnects from the grid.
Vac-Min *	%	0 ... 50	12	Lower (Vac-Min) and upper (Vac-Max) limit of allowable AC voltage. Default value is optimal for installations < 30 kW.
Vac-Max *	%	0 ... 20	10	
Vac-Min-Fast *	%	0 ... 50	50	Lower and upper limits of allowable AC voltage for fast disconnection. Default value is optimal for installations < 30 kW.
Vac-Max-Fast *	%	0 ... 20	20	
Vac-Min-Recnct*	%	0 ... 50	11.7	Values are used to calculate the lower and upper limits to reconnect to the grid after a grid failure
Vac-Max-Recnct	%	0 ... 20	5.83	
Vconst-Setval	V	75 ... 330	275	PV Setpoint voltage for constant voltage operation. These parameters only are important in case the parameter „Operating Mode“ is set to „V-const“.
Vpv-Start	V	100 ... 200	125	Voltage where the Sunny Boy starts connecting to the grid.

The following parameters appear in parameter list but cannot be modified:

Table 6-4 Operating Parameters of the Sunny Boy 700U; 100 ... 200 V DC (fixed)

Name	Unit	Range	Default	Description
Plimit	W	600	600	Upper limit of AC output power
SMA-SN				Serial Number of the Sunny Boy
Software-BFR				Firmware version of the operation control unit (BFR)
Software-SRR				Firmware version of the current control unit (SRR)

Table 6-5 Operating Parameters of the Sunny Boy 700U; 125 - 250 V DC (changeable)

Name	Unit	Range	Default	Description
Antisland-Ampl*	deg	0 ... 10	4	Amplification of the Antisland process
Antisland-Freq*	mHz	0 ... 2000	500	Repitition rate of the Antisland process
CO2-Fact	lbs/ kWh	0 ... 2	1.7	The Sunny Boy evaluates the yield and indicates the approximate CO2 emission avoided by your Sunny Boy. The amount of CO2 avoided is computed according to the kWh produced (E-total) multiplied by the factor defined in the parameter „CO2“.
Default		USA/UL1741/ 2005; OFF_GRID; ADJUSTED	USA/ UL1741/ 2005	Used for adjusting the parameters country specific settings Note: After changing one of the parameters marked with * the parameter „Default“ changes to „adjusted“ automatically.
E-Total	kWh	0 ... 200000		Total energy yield (E_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data
Fac-Delta- *	Hz	0.2 ... 3	0.69	Maximum allowable frequency above (Fac-Delta+) and below (Fac-Delta-) 60 Hz. Default value is optimal for installations < 30 kW.
Fac-Delta+ *	Hz	0 ... 4.5	0.49	
Fac-MinTripTime*	s	0.16 ... 300	0.16	Utility interconnection frequency trip time. Default value is optimal for installations < 30 kW.
h-Total	h	0 ... 200000		Total operating hours (h_Total) of the inverter. Changing the value can be necessary when a Sunny Boy is exchanged and you wish to match the previously acquired data

Name	Unit	Range	Default	Description
Memory Function		no function default param. reset Op.Data Reset errors	No function	Default param.: Sets all parameters to default. Reset Op.Data: Sets all parameters that are visible in user level to default values. Reset errors: Resets all permanent device disable (dBh) and the failure „EarthCurMax“ occurs. To remove this failure, follow the steps in „Section 5: Commissioning the Sunny Boy“
Operating Mode		MPP-Operation Turbine V-const Stop	MPP	Operating Mode of the Sunny Boy: MPP-Operation: Maximum Power Point Turbine: Operating mode for wind power plants V-const: Constant Voltage Mode (Setpoint defined in „Vconst-Setval“) Stop: Disconnection from utility, no operation
Pmax	W	0 ... 750	700	Maximum power output of the inverter
T-Start	s	5 ... 1600	10	The time the inverters waits to connect to the grid after Vpv-Start is exceeded. This value defaults to 5 minutes after a utility fault.
T-Stop	s	1 ... 1800	2	Time that the Sunny Boy wait until it disconnects from the grid.
Vac-Min *	%	0 ... 50	12	Lower (Vac-Min) and upper (Vac-Max) limit of allowable AC voltage. Default value is optimal for installations < 30 kW.
Vac-Max *	%	0 ... 20	10	
Vac-Min-Fast *	%	0 ... 50	50	Lower and upper limits of allowable AC voltage for fast disconnection. Default value is optimal for installations < 30 kW.
Vac-Max-Fast *	%	0 ... 20	20	
Vac-Min-Recnct*	%	0 ... 50	11.7	Values are used to calculate the lower and upper limits to reconnect to the grid after a grid failure
Vac-Max-Recnct	%	0 ... 20	5.83	
Vconst-Setval	V	75 ... 330	275	PV Setpoint voltage for constant voltage operation. These parameters only are important in case the parameter „Operating Mode“ is set to „V-const“.
Vpv-Start	V	125 ... 250	150	Voltage where the Sunny Boy starts connecting to the grid.

The following parameters appear in parameter list but cannot be modified:

Operating Parameters of the Sunny Boy 700U; 125 ... 250 V DC (fixed)

Name	Unit	Range	Default	Description
Plimit	W	700	700	Upper limit of AC output power
SMA-SN				Serial Number of the Sunny Boy
Software-BFR				Firmware version of the operation control unit (BFR)
Software-SRR				Firmware version of the current control unit (SRR)

Section 7: Troubleshooting

General

Our quality control program assures that each inverter is manufactured to exacting specifications and is thoroughly tested before leaving the factory. If you encounter difficulty with the operation of your inverter, please follow the steps below in an effort to correct the problem.

- Check the blinking code on the lid of the Sunny Boy and compare the code with the blinking codes in chapter 6.
- Check and record the exact "Mode" and "Error" messages on the LCD display or other communication system if installed. Take appropriate action to correct the issue.
- If necessary, check the DC and AC voltages at terminals inside the inverter. Be sure to observe all of the safety precautions listed throughout this manual when doing so, or hire a qualified professional.
- If the system problem persists, contact technical support at: 530.273.4895 Ext. 101

In order to better assist you when contacting SMA America, please provide the following information. This information is required before removing the inverter from service and prior to making a warranty claim.

Information Regarding the Sunny Boy:

- Serial number
- Model number
- Short description of the problem
- Blinking code (chapter 6)
- What error code is indicated? (Provided a communication option is installed)
- AC line voltage
- DC line voltage
- Check GFDI fuse
- Can you reproduce the failure? If yes, how?
- Has this problem occurred in the past?
- What were the ambient conditions when the problem occurred?

Information Regarding the PV modules:

- Manufacturer and model of the module
- Output power of the module
- Open circuit voltage (Voc) of the module
- Number of modules in each string

If it becomes necessary to send the Sunny Boy back to the manufacturer for service, please ship it in the original box to avoid damage during shipping.

Error messages

In case of an error, the Sunny Boy 700U generates the error code according to the operating mode and the detected error.

Error Code	Description	Error Type
Bfr-Srr	Communication between micro-controllers is failing	Error
EarthCur-Max-Bfr	BFR-earth current between PV+ and GND is out of tolerable range	Error
EarthCur-Max-Srr	SRR-earth current between PV+ and GND is out of tolerable range	Error
EEPROM	Transition failure during reading or writing of data EEPROM, the data is not essential for safe operation - this failure does not effect performance.	Error
EEPROM p	Data EEPROM defective, device is set to permanent disable due to the fact that the data loss affects important functions of the inverter. Contact SMA.	Error
EeRestore	Internal failure	Error
Fac-Bfr Fac-Srr	<p>The AC grid frequency is exceeding the allowable range. („Bfr“ or „Srr“ is an internal message and is not important to the user.) The Sunny Boy assumes that the public grid is down and disconnects from the grid in order to avoid islanding.</p> <p>Check the grid frequency and the grid cable connection in the Sunny Boy enclosure. If the grid frequency is out of range due to your local grid conditions contact the utility company and ask, if it is permissible to change the grid monitoring parameters of the inverter. Contact SMA about how to change the grid monitoring parameters of your Sunny Boy. If the grid frequency is within the tolerable range and you still observe the failure message „Fac-Bfr“ or „Fac-Srr“ contact SMA.</p>	Disturbance
GFDI Fuse Open	The GFDI-Fuse is defective or open	Error
Imax	Overcurrent on the AC side. This failure code is indicated in case the current to the AC grid exceeds the specification. This may happen in case of harmful interference on the grid. If you observe „F-I _{max} “ often, check your grid. For assistance contact SMA.	Disturbance

Error Code	Description	Error Type
K1-Close K1-Open K2-Open	Relay test failed. Contact SMA for assistance.	Error
MSD-Time-out	BFR or SSR controller failure	Error
MSD-VAC MSD-FAC MSD-Idif	Internal measurement comparison error: The Sunny Boy measured values of BFR and SRR are too different from each other.	Error
OFFSET	Grid monitoring self-test failed.	Error
ROM	The internal test of the Sunny Boy Control system firmware failed. Contact SMA in case you observe this failure often.	Error
Shut-Down	Internal over current continuous	Error
Vac-Bfr Vac-Srr	<p>The AC grid voltage is exceeding the permissible range. („Bfr“ or „Srr“ is an internal message and is not important for the user.) „Vac“ can also result from a disconnected grid or a disconnected AC cable. The Sunny Boy assumes that the public grid is down and disconnects from the grid in order to avoid islanding.</p> <p>Check the grid voltage and the grid cable connection in the Sunny Boy enclosure. If the grid voltage is out of range due to your local grid conditions contact the utility company and ask, if it is possible to modify the utility conditions. If the grid voltage is within the tolerable range and you still observe the failure message „Vac-Bfr“ or „Vac-Srr“ contact SMA.</p>	Disturbance
VpvMax	DC input voltage above the tolerable maximum value	Warning
Watchdog	Watchdog for operation control triggered. Contact SMA for assistance.	Error

Section 8: Technical Specifications

FCC Compliance Information

Sunny Boy Utility Interactive Inverter, Model SB700U

This device complies with Part 15 of the FCC Rules. 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.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Caution: Changes or modifications not expressly approved by SMA America, Inc. could void the user's authority to operate this equipment.

Contact SMA America for information

12438-C Loma Rica Drive

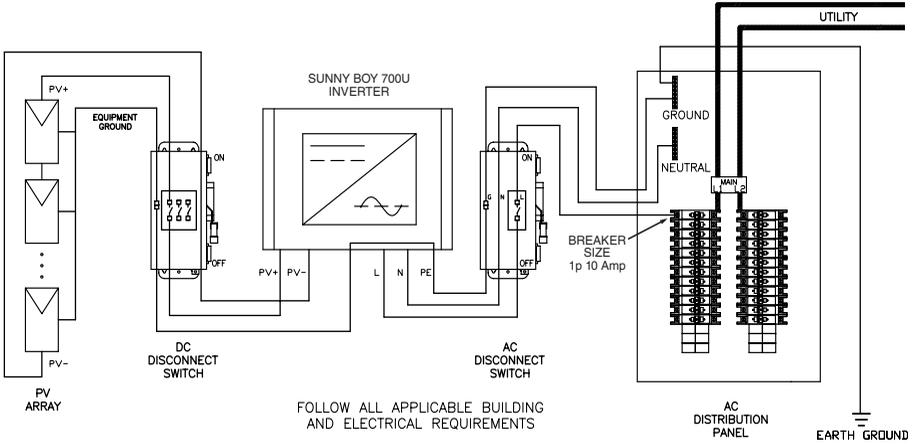
Grass Valley, CA 95945, USA

530.273.4895

www.sma-america.com

Sunny Boy Wiring Diagram

Sunny Boy connection to 120 V AC utility grids.



The AC disconnect switch shown above may or may not be required by the local utility.

Specifications

Inverter Technology	Sine-wave, current source, high frequency PWM
AC Input Voltage	106 - 132 @ 120 V AC
AC Input Frequency	59.3 - 60.5 (60 Hz)
Peak Power Tracking Voltage	125 - 200 V DC / 100 - 160 V DC / 77 - 120 V DC
Range of Input Operating Voltage	125 - 250 V DC / 100 - 200 V DC / 77 - 150 V DC
Maximum DC Power	780 W / 670 W / 510 W
Maximum AC Continuous Output Power	700 W / 600 W / 460 W
Current THD	Less than 3%
Output Power Factor	> 0.99 @ nominal power
Peak Inverter Efficiency	93.6 % / 93.3 % / 92.4 %
CEC Weighted Efficiency	91.5 %
Cooling	Convection cooling (no fan)
PV Start Voltage	150 V DC / 125 V DC / 95 V DC
Maximum AC Continuous Output Current	6.6 A / 5.7 A / 4.3 A
Maximum DC Input Current	7 A

Maximum Input Short Circuit Current	18 A
Maximum Input Source Back-feed Current to Input Source	15 A
Maximum Output Fault Current	15 A
Maximum Output Overcurrent Protection	15 A
Synchronization In-Rush Current	3.6 A
DC Voltage Ripple	Less than 10 %
Power Consumption	0.1 W nighttime, < 4 W in operation
Ambient Temperature Rating	-13 °F ... +113 °C -25 °C ... +45 °C
Enclosure	NEMA 4X (IP65) (stainless steel)
Dimensions	12.70 W x 12.60 H x 7.10 D inches (322 W x 320 H x 180 D mm)
Weight	35 lbs. (16 kg)
Compliance	UL1741, UL 1998, IEEE 929, IEEE 1547, IEEE C37.90.1, IEEE C62.41.2 (test conditions 2 kV / 1 kA), FCC Part 15 A & B

Specifications subject to change without notice.

Trip Limits / Trip Times

Nominal Freq. (Hz)	Trip Limit (Hz)	Trip Frequencies (Hz)	Trip Times (s)
60	> 60.5	60.45 - 60.55	max. 0.1602
	< (57.0 - 59.8) (default 59.3)	56.95 - 59.85 (default 59.25 - 59.35)	adjustable 0.16 - 300 (default max. 0.1602)
	< 57.0	56.95 - 57.05	max. 0.1602

Nominal Voltage (V)	Trip Limit	Trip Voltages Line-to-Neutral (V)	Trip Voltages Line-to-Line (V)	Trip Times (s)
120	50 %	57.6 - 62.4	N/A	max. 0.1602
	88 %	103.2 - 108.0		max. 2.002
	110 %	129.6 - 134.4		max. 1.001
	120 %	141.6 - 146.4		max. 0.1602

Manufacturer's Accuracies:

- Trip Limit Accuracy: $\pm 2\%$ of nominal grid voltage
- Trip Time Accuracy: $\pm 0.1\%$ of nominal trip time
- Trip Frequency Accuracy: $\pm 0.1\%$ of nominal frequency

Torque Values and Wire Sizes

Terminal	in. lbs.	Nm.	Wire Size
AC Terminal Blocks	15	1.7	6 - 14 AWG
DC Terminal Blocks	15	1.7	6 - 10 AWG
Protective Earth Terminal Blocks	15	1.7	6 - 14 AWG

SMA America, Inc.

www.sma-america.com

12438 Loma Rica Drive, Unit C
Grass Valley, CA 95945
Phone 530.273.4895
Fax 530.274.7271
E-mail: info@sma-america.com
Toll Free 888-4SMAUSA



SMA Technologie AG

Niestetal, Germany
E-mail: info@SMA.de

SMA Beijing Commercial Co., Ltd.

Beijing, China
E-mail: info@SMA-China.com

SMA Technology Korea Co., Ltd.

Seoul, Korea
E-mail: info@SMA-Korea.com

SMA Ibérica Tecnología Solar, S.L.

Barcelona, Spain
E-mail: info@SMA-Iberica.com

SMA Italia S.r.l.

Milan, Italy
E-mail: info@SMA-Italia.com

SMA France S.A.S.

Lyon, France
E-mail: info@SMA-France.com

