



RS485 Communication Between Multiple Sunny Boy Inverters and a Sunny Boy Control

Technical Note

Revision 1.5

Revision History			
1.0	May 30, 2002	Kent Sheldon	Original Release
1.1	June 5, 2002	Kent Sheldon	Minor corrections
1.2	July 25, 2002	Kent Sheldon	Added graphic examples
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1.4	December 12, 2002	Kent Sheldon	Updated for Rev2 SBC control board
1.5	August 13, 2003	Kent Sheldon	Wiring diagram update, SB1800 addition

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Overview

This technical note details how to set up communication between one or more Sunny Boy photovoltaic inverters (SB) and a Sunny Boy Control (SBC) remote communication device, via RS485. This document does not attempt to describe communication between the SBC and a PC or other devices external to the SBC. Nor does this document attempt to describe the configuration of the Sunny Data Control software, used to communicate with a PC to the SBC devices (refer to the [Sunny Data Control Operating Instructions Manual](#) for further information). For information on using an RS232/485 converter for direct RS485 communication to a PC refer to [RS485 Communication Between Multiple Sunny Boys and a PC Using an Integrity Instruments RS485 to RS232 Converter](#).

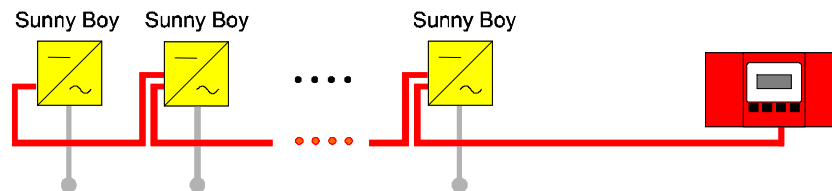
Safety Warning

The Sunny Boy inverters operate with potentially lethal voltage and current from multiple power sources. Only qualified personnel should attempt to work on the inverter.

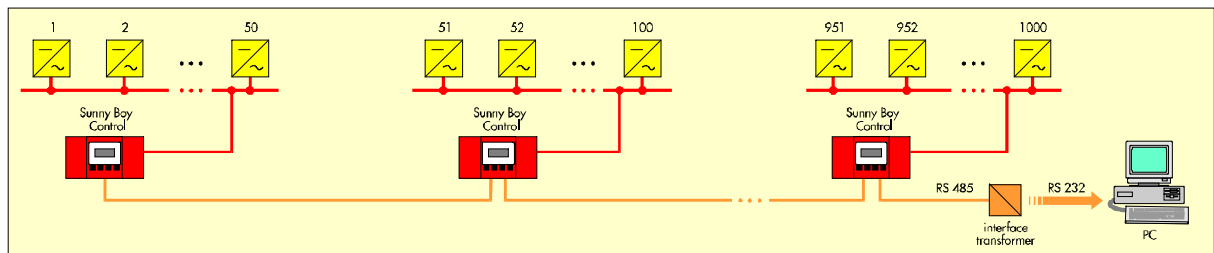
The Sunny Boy inverter must be isolated and locked-out from all AC and DC power sources prior to installing the hardware necessary for RS485 communication. Allow minimum of five minutes for internal capacitors to discharge before removing the cover to the Sunny Boy inverter.

Application

Communication between one or more SB inverter(s) and a SBC remote communication device may be accomplished using an RS485 direct drop-net wire connection. The maximum wire run distance between the farthest devices is 1200 meters. Up to 30 SB inverters may communicate with one SBC device.



Multiple SB and SBC units may be interfaced directly to a PC or another SBC if desired. This requires an RS232-RS485 converter. Refer to the Technical Note titled: [RS485 Communication Between Multiple Sunny Boys and a PC Using an Integrity Instruments RS485 to RS232 Converter](#).



plant configuration with several Sunny Boy Controls

Necessary Accessory Equipment

The following accessory equipment is required:

Sunny Boy Control, or the Sunny Boy Control Plus remote communication device

RS485 communication boards (one per SB inverter and one for each SBC)

RS485 wire harness between each inverter

RS485 wire harness between the SBC and one inverter

German – English dictionary (optional, a small portion of the SBC software text is still in German)



These devices are available from SMA-America. The wire harness between the SBC and one inverter is available in 10 meter increments. Bulk wire is also available for inverter inter-connection. Contact SMA America, Inc. for more information.

Sunny Boy Control Family of Devices

The Sunny Boy Control Family consists of three distinct devices designed for specific application needs. The three devices are the Sunny Boy Control Light, Sunny Boy Control, and the Sunny Boy Control Plus. These devices differ in function as described below. Refer to the User Manuals for complete functional descriptions of the SBC devices.

Sunny Boy Control Light

The Sunny Boy Control Light is not equipped to communicate with SB inverters via RS485. It is only capable of inverter communication by means of powerline carrier. Refer to the Technical Note, [Powerline Carrier Communication Between the Sunny Boy Inverters and a Sunny Boy Control.](#)

The Sunny Boy Control Light is the most economical of the SBC family. It was designed for the small PV system owner who wants a convenient way to view inverter real-time operating status and does not require historical data storage.

Sunny Boy Control

This is the original and intermediate device in the family. It is intended for the operator who wants to monitor and record data from a small or large PV plant, either from a remote site or locally. The SBC may communicate with up to 30 inverters and has a PC/external display interface. Real-time operating parameters for each inverter as well as the plant summary data may be viewed at the 4-line display.

The SBC may be configured to store individual and cumulative PV plant data in user-defined, averaged time intervals (DAS). It is capable of storing 100,000 data points between downloads. The total storage duration will vary depending on number of inverters, the averaging period and the number of data points (channels) stored. Data in the SBC will be overwritten in a First-In-First-Out (FIFO) manner.

The SBC may be accessed remotely by means of a fax-modem. The SBC will also support an external display or direct communication with a PC. It also has two user-programmable signal level dry contact relay outputs.

Sunny Boy Control Plus

The Sunny Boy Control Plus is the most functional of the SBC family. In addition to the functions found in the SBC, the SBC Plus is equipped with additional communications ports and data logging functions for external sensors:

- 6 user-defined analog inputs (irradiance, PT, CT, etc.)
- 2 PT100 temperature inputs
- 8 user-defined digital inputs (wind speed, wetted contact closure)
- 8 user-defined digital dry contact outputs
- 16 user-defined internal variable calculation channels, treated as a DAS data channel (for specific customer computations)
- 8 user-defined internal monitoring flags (variable min-max channel monitoring threshold alarms)

Cabling Requirements

If you choose to construct your own cable, we recommend using the following wire type:

- #24 AWG, stranded copper conductors
- Two twisted-pair (four wires) with overall shield (foil or braid), with drain wire
- Low capacitance, less than 15pF per foot.



- Outer insulation suitable for the specific application (outdoor, wire tray, UV resistant, wet weather, etc.)

Hardware Installation and Configuration

The following hardware changes must be made to each Sunny Boy inverter for RS485 communication to a SBC device:

SB1800U and SB2500U Inverter Resistor Removal

Disconnect the inverter from AC and DC power sources. Wait 5 minutes before removing the cover to let the internal capacitors discharge.

Remove the cover of the Sunny Boy inverter.

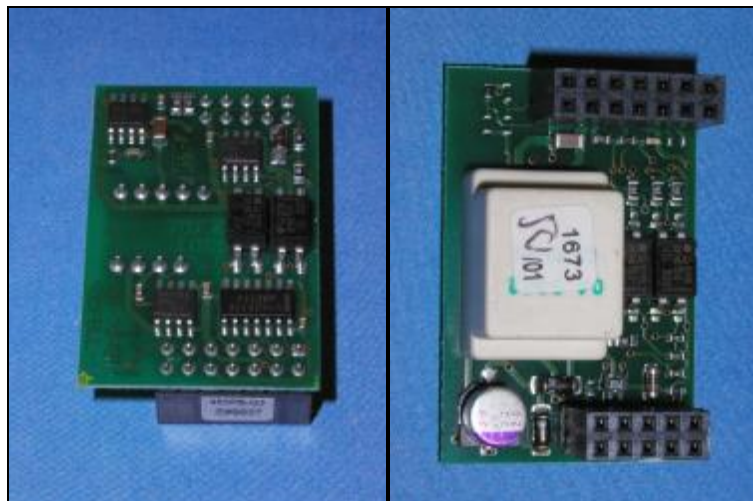
There are two resistors (light-blue or tan) in the lower left region of the small control board in the center of the inverter enclosure (these are shown in the diagram at the end of this section). They are part of the powerline communication circuitry which must be disabled for RS485 communication. These need to be removed. We recommend carefully cutting one side of each resistor and bending them away from the board. This will simplify reconnection if powerline communication is desired in the future.

SB1800U and SB2500U Inverter Jumper Configuration

Located directly below the powerline resistors are three sets of jumper pins labeled S4. Remove all three jumpers (if present) from each inverter in the communication chain, except the last inverter. The last inverter must have the lower jumper installed. We recommend hanging unused jumpers from one pin only for future use. Refer to the diagram in the [SB1800U and SB2500U Communication Wire Harness Installation](#) section in this document showing the jumper settings for all inverters in the chain. Below is a diagram detailing the RS485 default settings within the SBC devices.

SB1800U and SB2500U RS485 Communication Board Installation

To the left of the resistors are two, two-row header sockets (shown in the diagram in the next section). Install the RS485 piggyback board onto these headers. The long socket (2 x 7 pins) on the RS485 board mates with the upper set of header pins on the inverter control board. The lower header row will have an extra set of unused pins to the right side that **do not** connect with the RS485 board.

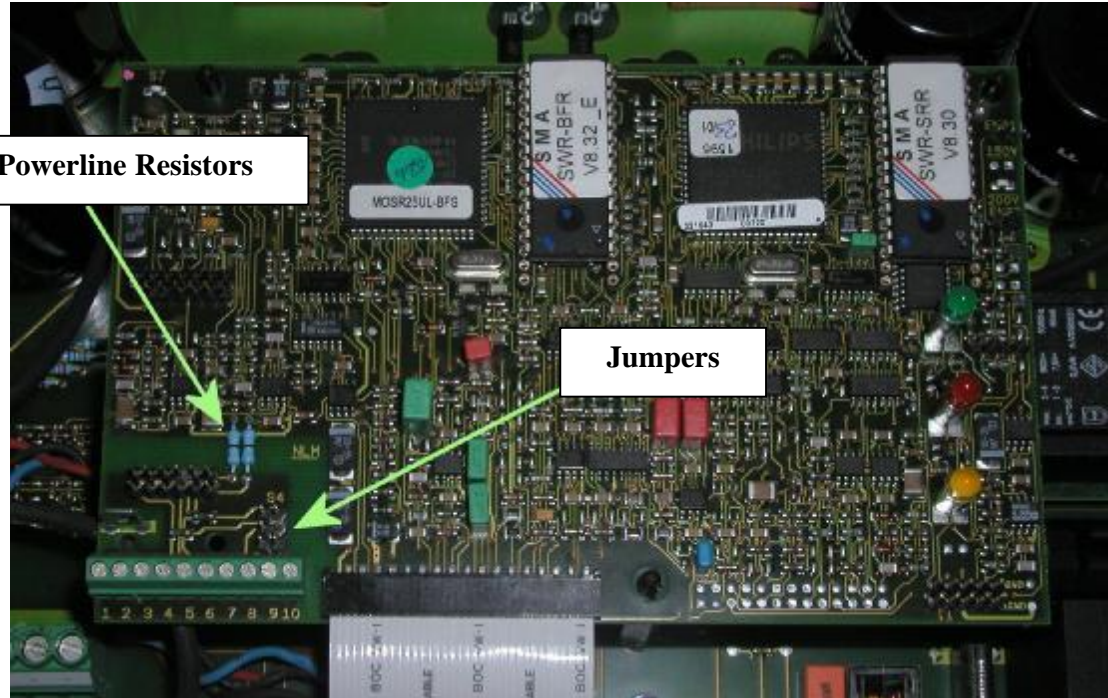


RS485 Piggyback Board



RS485 Communication Between Multiple Sunny Boy Inverters and a Sunny Boy Control

The following diagram shows the interior of the SB1800/2500U inverter. Note the location of the RS485 piggyback board, powerline resistors, jumpers and the terminal block for connecting the communication harness.



RS485 Board Installation



SBC RS485 Communication Board Installation

The SBC device may be ordered from SMA America with the inverter port pre-configured for RS485 communication. Contact SMA America for part numbers and ordering information.

To reconfigure an SBC device for RS485:

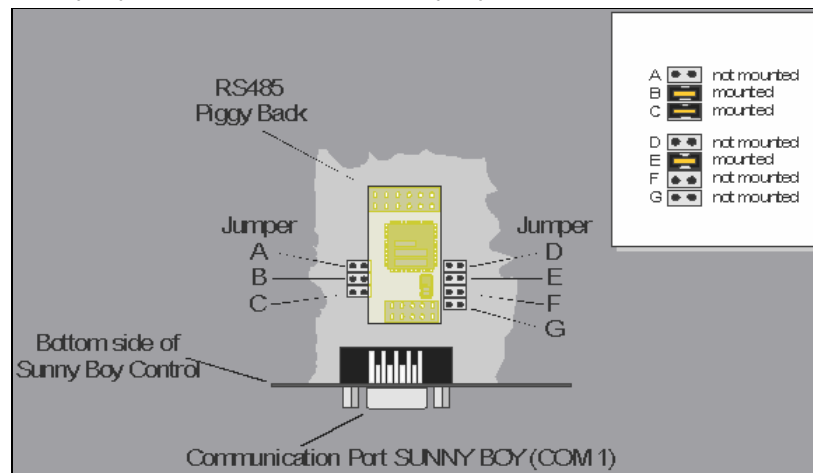
- Disconnect the SBC power plug from the wall outlet.
- Identify if the SBC device has the Rev1 or Rev2 control board. This is easily identifiable by the presence of a Net Plug next to the Sunny Boy Com 1 port. Rev1 boards do not have the Net Plug.
- Remove the four hex screws and the top cover of the SBC. It is not necessary to disconnect the two ribbon cables that connect the LCD display and keypad to the main SBC circuit board. Care should be taken not to twist or stress these ribbon cables.
- Locate both two row header pin sockets located directly behind the DB9 socket labeled Sunny Boy (COM1) on the outside of the SBC enclosure.
- Install the RS485 piggyback board onto these headers. The long socket on the RS485 board mates with the upper set of header pins on the inverter control board. The lower header row will have an extra set of pins to the right side that do not connect with the RS485 board.

SBC RS485 Jumper Configuration (Rev1 Boards, Without Net Plug)

There are two, two-row header jumper pins located to the left and right of the internal DB9 socket labeled Sunny Boy (COM1) on the outside of the SBC enclosure. The jumpers on the left side activate the pull-up/pull-down resistors required for RS485 communication. The jumpers on the right side enable the RS485 protocol within the SBC. The previous picture details the jumper configurations.

The left side jumper should have the second and third jumpers installed.

The right side jumper should have the second jumper installed.

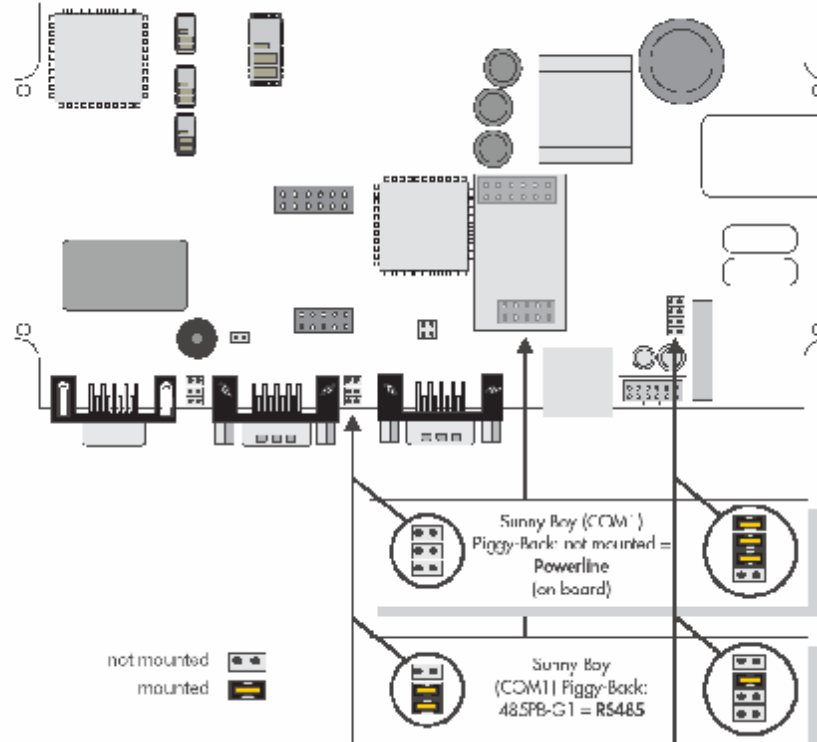




SBC RS485 Jumper Configuration (Rev2 Boards, With Net Plug)

There are two rows of, two-row header jumper pins shown in the drawing below. The drawing also shows the RS485 board placement on the SBC control board. The jumpers on the left side activate the pull-up/pull-down resistors required for RS485 communication. The jumpers to the right enable the RS485 protocol within the SBC.

Sunny Boy [COM1]



SBC Plus RS485 Communication Board Installation

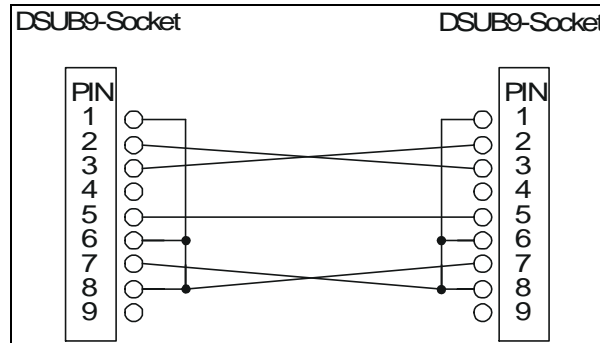
The SBC Plus RS485 communication board must be installed by SMA America prior to shipment. Any attempt to perform this installation will void the SBC Plus warranty.

SB1800U and SB2500U Communication Wire Harness Installation

Install the communication wire harness as shown in the drawing below. This type of communication wiring is commonly referred to as a 'drop-net'. It is simply three daisy-chained serial wires with balancing resistors on both ends of the network. The jumpers within the SBC and the last SB1800/2500U activate these resistors. The following diagram shows the communication harness wire configuration and connection from the SB1800/2500U inverters to the SBC:

Communication between the SBC and a PC

The SBC device family is shipped with an RS232 null-modem cable to interface a PC to Com2 of the SBC. Below is a wiring diagram for this cable should a longer cable be required. A combination of straight-through serial cables and a null-modem adapter may also be used.



Other communication options may be configured for Com2 for special communication requirements; however, these upgrades must be performed by SMA America. Please contact SMA America for further details.

Detecting Inverters with the SBC

A brand new SBC unit will perform an automatic plug-and-play routine when first plugged into a wall socket. It will ask you to set the language, time, and date. It will then attempt to detect any inverters connected to the Com 1 port of the SBC. Inverter detection may be performed manually in the event that no inverters were detected during the plug-and-play initialization. This section will detail a manual detection of SB inverters.

- From the main status screen of the SBC press the <Esc> button to access the SBC menu tree.
- With the down arrow button, move to [Configuration] and press <Enter>
- Enter the password, which is the sum of the day, month and year. For example April 28, 2002 is $4+28+2=34$, and would be entered [ID0034_]. The SBC will beep three times if the password is entered correctly. If this password does not work, make sure the SBC is set with the correct date.
- Move to [Setup], [PV Plant], then [Detection]. The SBC will attempt to detect all devices connected to Com1. After 1-4 minutes, depending upon the number of inverters on the system, the SBC will report a summary of old and new devices detected. It will also ask if you would like to repeat this process.
- Once all devices have been detected, press <Esc>. The SBC will ask if you want to save the changes. Press <Enter> to save this new configuration.
- Press <Esc> to return to the main status screen and resume normal operation.
- Note: While the SBC is being configured with the 4-button interface, it will not communicate with a PC, or any other device on the Com2 port.

Removing Devices from the SBC

Once devices have been detected, they will remain in the SBC device menu. If the device is removed or replaced, it must be manually deleted from the SBC.

- From the main status screen of the SBC press the <Esc> button to access the SBC menu tree.
- With the down arrow button, move to [Configuration] and press <Enter>
- Enter the password, which is the sum of the day, month and year. For example April 28, 2002 is $4+28+2=34$, and would be entered [ID0034_]. The SBC will beep three



times if the password is entered correctly. If this password does not work, make sure the SBC is set with the correct date.

- Move to [Setup], [PV Plant], then [Registration].
- Locate the device you wish to remove and change the Device ID to 99.
- Press <Enter>, the SBC will ask if you want to delete this device. Press <Enter> again to confirm removal of the device.
- Press <Esc> to return to the main status screen and resume normal operation. The SBC will ask if you want to save the changes. Press <Enter> to save this new configuration.
- Note: While the SBC is being configured with the 4-button interface, it will not communicate with a PC, or any other device on the Com2 port.

Troubleshooting RS485 Communication

Most problems installing RS485 are caused by improper wiring or incorrect use of the configuration jumpers. We recommend using wire that is clearly color coded to simplify installation and to help maintain continuity throughout the communication circuit. Some additional troubleshooting points to consider:

- Make sure all of the powerline resistors have been removed from the SB inverter control boards
- Verify the jumpers have been configured properly in the SB inverters. Remember, the jumpers for the last inverter in the drop-net chain are set differently than the rest.
- Verify the RS485 boards are properly installed within each SB inverter as well as on Com1 of each SBC device.
- Verify the jumper settings are set properly for Com1 within the SBC device.

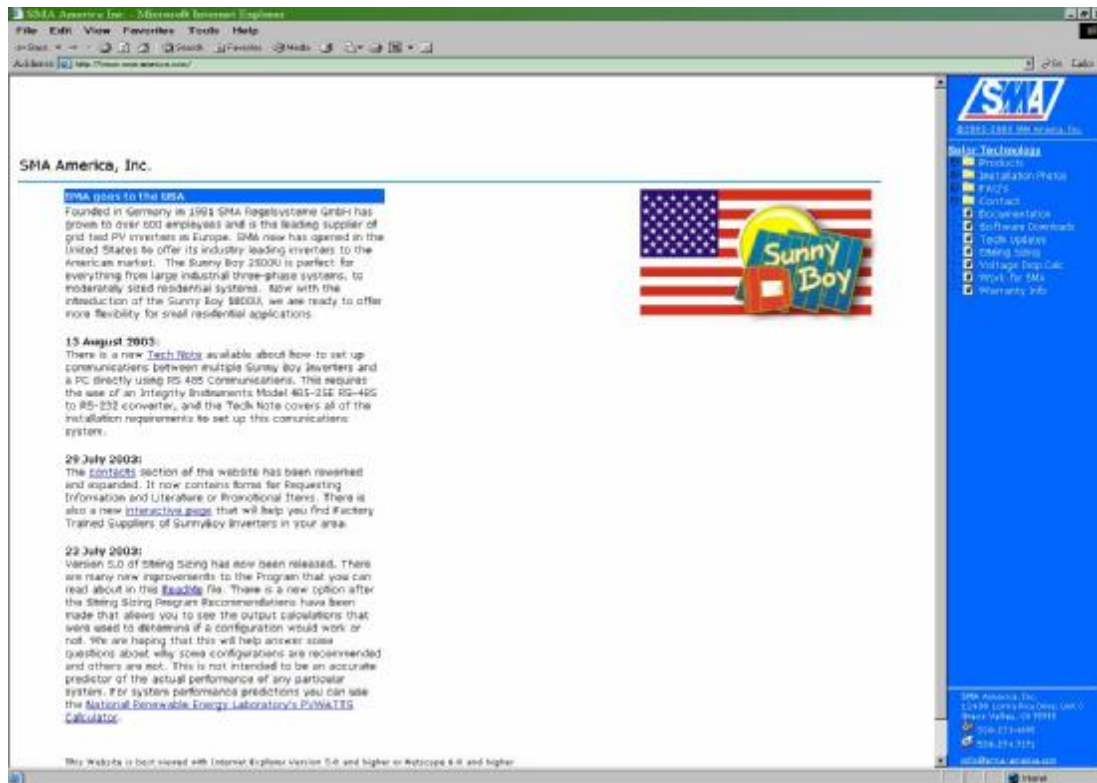


RS485 Communication Between Multiple Sunny Boy Inverters and a Sunny Boy Control

SBC Firmware Updates

The firmware for the SBC product family is updated periodically. Please refer to the Sunny Data Control Operations manual for further information on the functions and operation of the Sunny Data Control program. Current versions of this software, manuals, and firmware may be downloaded from the SMA America website: www.sma-america.com.

The English versions of all documents are found in the right hand column of this web site.



Appendix

Contact Information

SMA America:
12438-C Loma Rica Drive
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www.sma-america.com