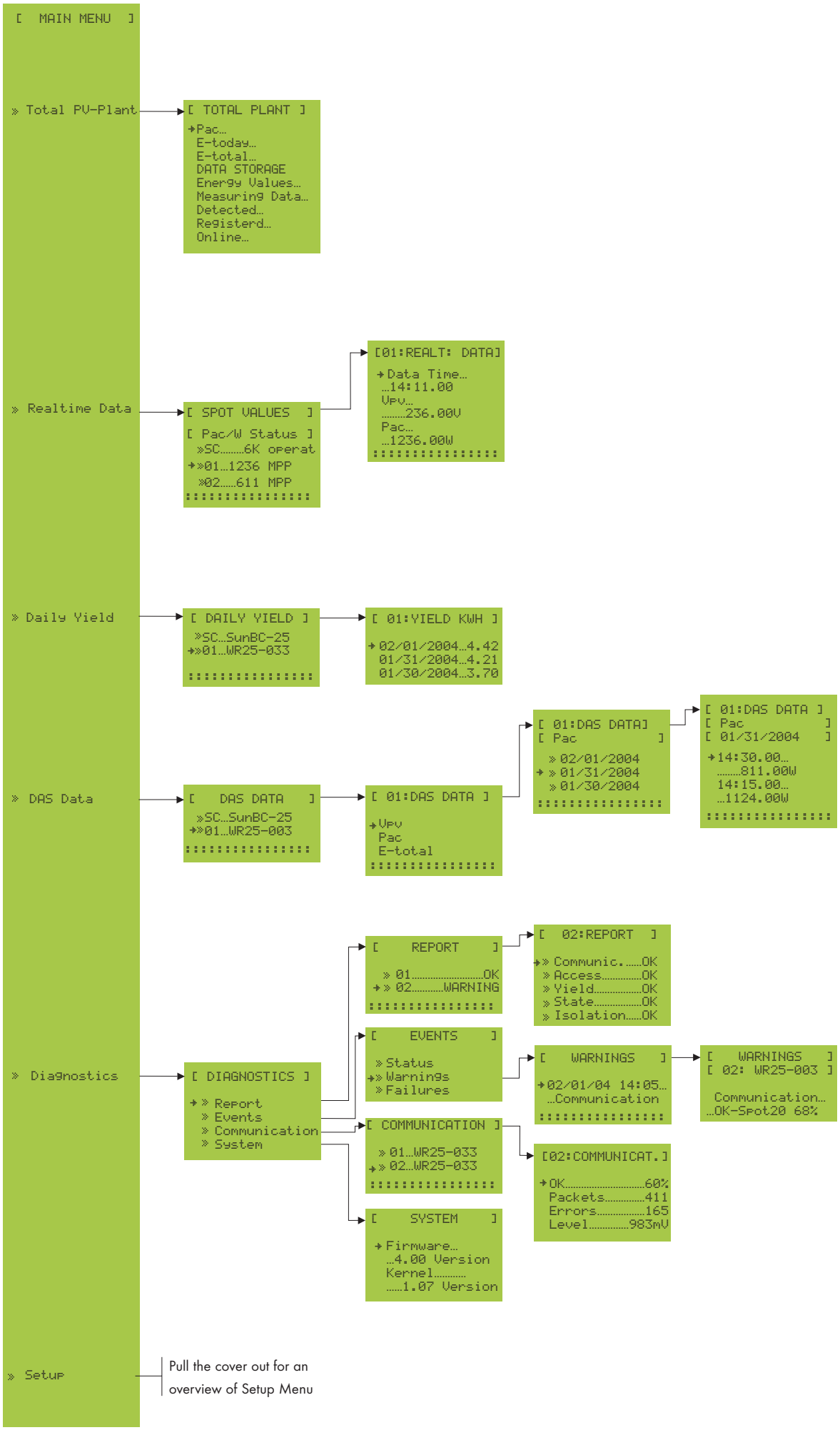
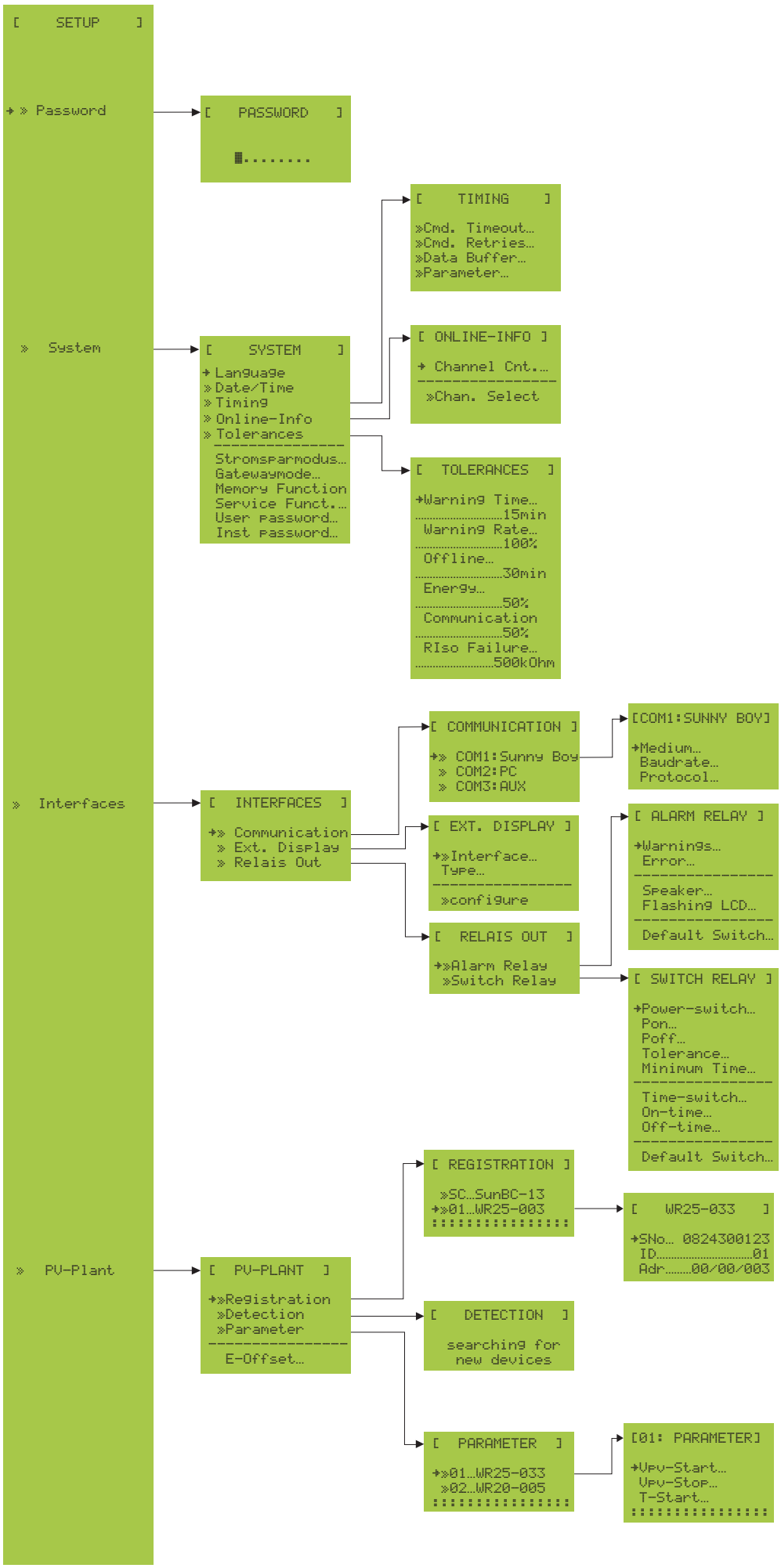
Sunny Boy Control
Sunny Boy Control Plus

User Manual | Version 4.4 | SUNBC-14:NE0206
TBE-SBCO/P

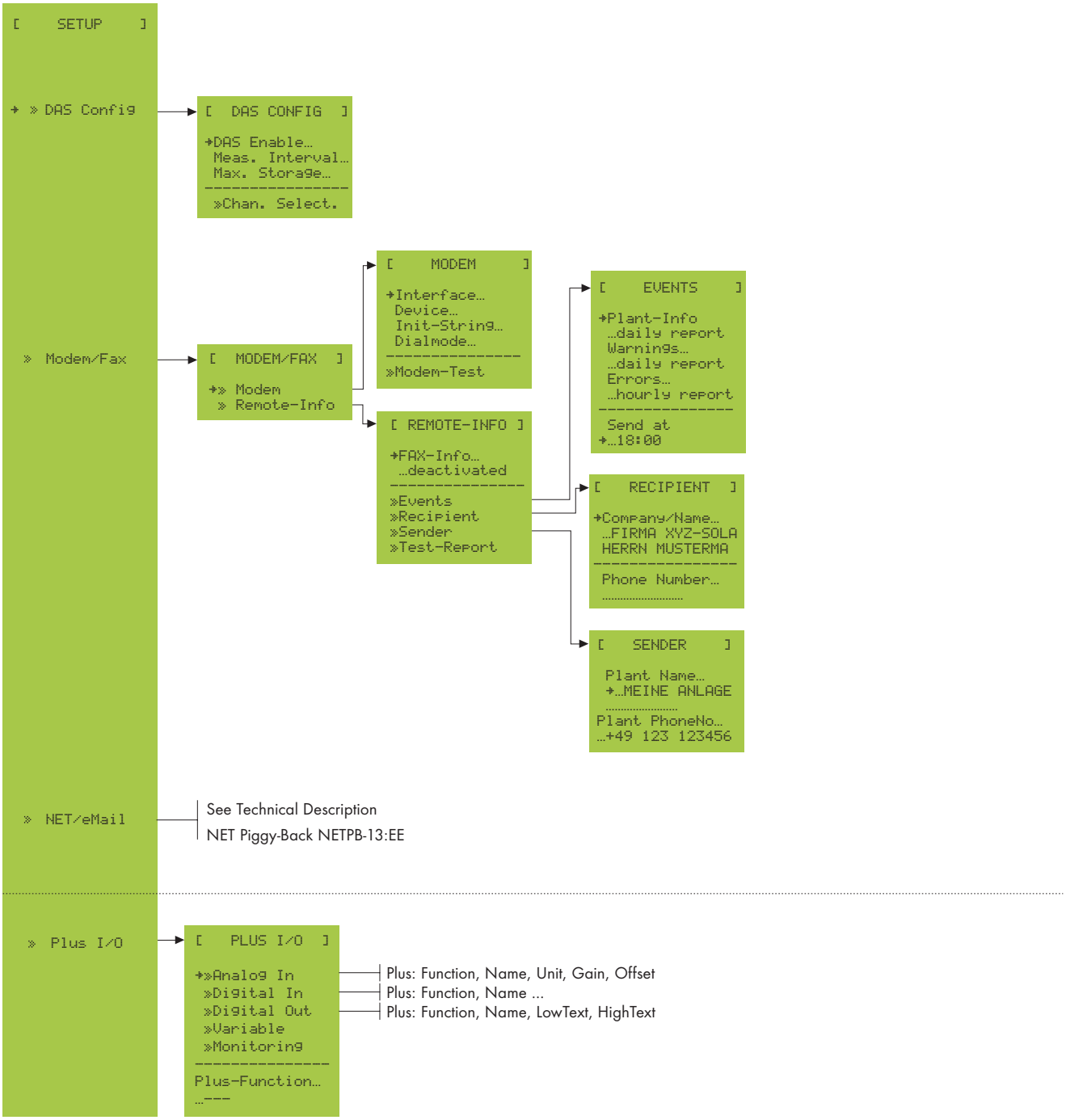
Overview Main Menu



Overview Menu Setup I



Overview Menu Setup II



Plus:	additional functions of Control Plus	E-Total… …1456.32kWh	channel name not all values are displayed at this overview
Text ...	remark, tip	::::::::::::	further lines below

Sunny Boy Control

Enhanced Data Logger for Sunny Boys Equipped with Sunny Boy Control or Sunny Boy Control Plus

User Manual | Edition 4.2 | SUNBC-14:NE0206

History of Manual Revisions

Manual number SUNBC	Edition and type of changes[1]		Comments	Author
-12:NE1799 -12:SE1799	2.0	A	Base manuals	J. Lengemann L. K. Müller
-12:NE2000	2.1	A	With firmware version 3.00 and later: User manual and installation manual were combined since menu structures for users and installers have become the same.	J. Lengemann L. K. Müller
-12:NE3400	2.2	C	With firmware version 3.04 and later: New chapter "Menu Functions for Diagnosis", new display type "ASCII text"	L. K. Müller
-14:NE0304	4.0	C	With firmware version 4.0 and later: Complete revision; manual edition number was increased to match firmware version number.	G. Salisbury
-14:NE2104	4.01	A	Page 10: Exchange of battery not permitted	G. Salisbury
-14:NE4504	4.1	A	Adjustment for firmware higher than 4.06 new chapter „Activation of external display with ‚ASCII-text'", translation of SDC parameters, minor changes, new style	D. Welzel
-14:NE0305	4.11	A	Change of specification of the input voltage for UL devices	D. Welzel
-14:NE4205	4.12	A	Wrong name of LiYCY cable	Y. Siebert
-14:NE0206	4.4	A	Change of table 7.7 and picture 7.14	B. Quanz

[1] A: Correction of errors in or improvement of manual

B: Changes resulting from added firmware features

C: Changes resulting from removed firmware features

Explanation of Symbols Used in this Manual

For efficient use of this manual and to ensure safe operation of the device during installation, operation and maintenance procedures, note the following symbols and their descriptions.

This symbol indicates information that is required for the optimal operation of the product. Read these sections carefully in order to ensure an optimal operation of the product and all its features.

This symbol indicates information that is essential for a trouble-free and safe operation of the product. Please read these sections carefully in order to avoid any damages of the equipment and for optimal personal protection.

This symbol indicates an example.

Contents

1 Introduction

Thank you very much for purchasing a Sunny Boy Control. The Sunny Boy Control collects detailed data from your PV system, enabling you to monitor system operation and performance any time.

The chapters of this manual are organized in a logical sequence, which closely follows the order of all processes and operations. After guiding you through the installation of the device, the manual provides detailed explanations on the various menu items, allowing you quick access to the most useful functions. Chapter 6 explains specific tasks, such as settings that need to be made only once by the installer.

The following is a list of the chapters in this manual.

Using the PC program Sunny Data Control, the firmware of the Sunny Boy Control can be updated easily without opening the device. The latest version of the firmware and other useful information can be found on our website: www.SMA.de.

ATTENTION!

When updating the firmware of a Sunny Boy Control from version 3.xx to version 4.xx, as well when downgrading from version 4.xx to version 3.xx, all settings and data of the device will be deleted. Save all data before starting the update.

For further information on photovoltaic system technology from SMA, please send an e-mail to hotline@SMA.de or visit our website www.SMA.de.

The Sunny Boy Control will provide you with continuous data, making sure your PV system runs efficiently.

1.1 Operation Requirements

You will need the following to operate the Sunny Boy Control.

- An electric socket
- A power supply with a frequency of 50/60 Hz and a voltage of
  - 110 ... 120 V (for UL devices) or rather
  - 110 ... 240 V (for all versions other than UL)
- For Powerline communication: a Powerline modem for each Sunny Boy

It is not normally possible to operate Powerline communication with a Sunny Boy Control at the same time as other devices that also use the power lines for data transmission but do not comply with the standardized transmission protocol, such as baby monitors. In this case, data transmission using a separate RS485 cable is required.

The following safety measures must be taken to operate the Sunny Boy Control.

1. The power outlet must be grounded.
2. The power plug has to be accessible at all times.
3. The operating environment of the device must be dry and dust-free.

1.2 Notes on Sunny Boy Control Operation

Since the Sunny Boy Control has no power switch, simply pull the power plug to switch it off.

At night, after the Sunny Boy Control has not been able to reach any connected device for 15 minutes, it goes into power-save mode. The Sunny Boy Control then wakes up every 15 minutes to check whether it can reach a connected device. If it can't, it returns to power-save mode; if it can, it resumes normal operation. You can interrupt power-save mode anytime by pressing any key. After no key has been pressed for 15 minutes, the Sunny Boy Control returns to power-save mode.

1.3 Safety Precautions

The Sunny Boy Control may only be opened by qualified personnel after it has been unplugged.

Repairs to the Sunny Boy Control may only be performed by the manufacturer.

CAUTION: Risk of fire if battery (part of the Real Time Clock) is replaced by an incorrect type. Dispose of used Real Time Clock according to the instructions.

1.4 Notes on Operating the Sunny Boy Control

The Sunny Boy Control is operated using 4 keys located below the display.

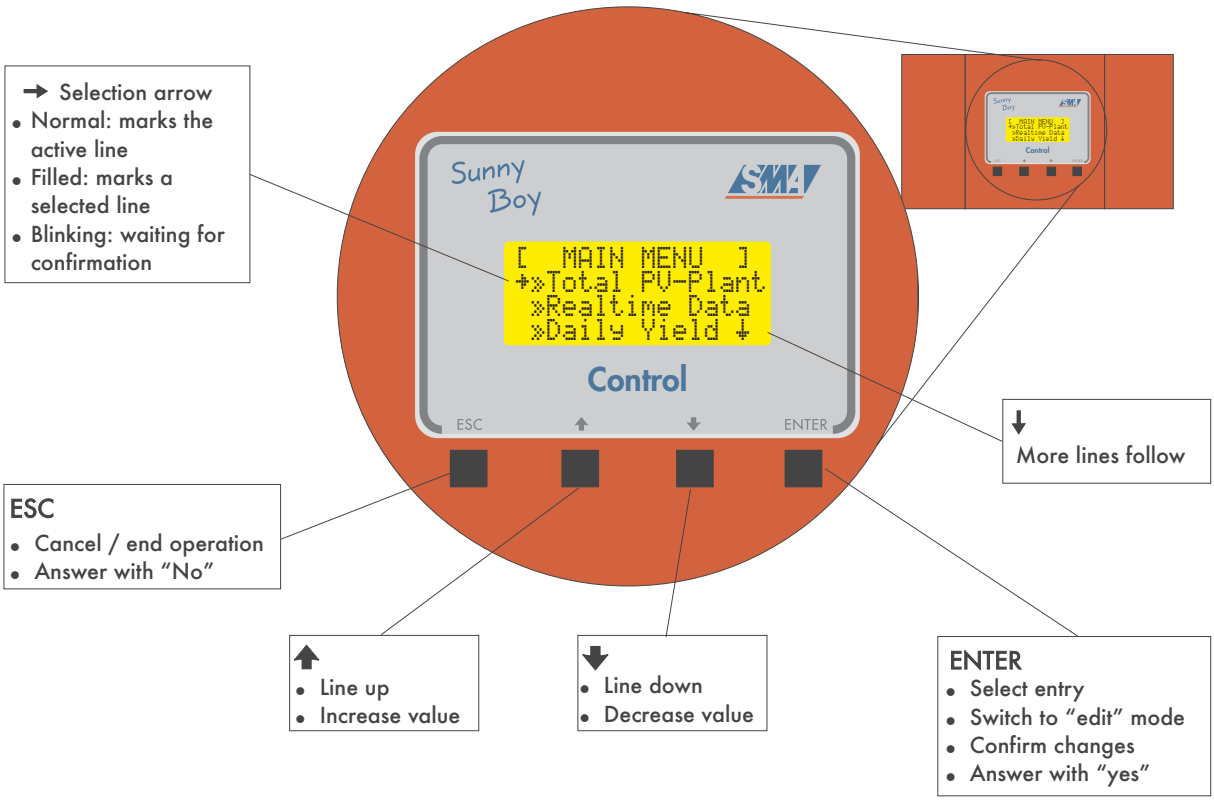


Fig. 1.1: Operation panel of the Sunny Boy Control

Scroll Arrows

When the information displayed consists of more than four lines, a scroll arrow appears in the lower-right corner of the display, indicating that further lines are available above or below.

Symbol	Explanation
↑	There are more display lines above.
↓	There are more display lines below.
↕	There are more display lines above and below.

Table 1.1: Scroll arrows and their explanations

Keys

The Sunny Boy Control has only four keys, each with several functions. The various functions assigned to a key are similar, so they are easy to remember and can be used intuitively.

Key	Function
[ESC]	- Cancels the current function. - Answers the question with "NO".
[↑]	- Moves up to the previous line. - Increases the current value.
[↓]	- Moves down to the next line. - Decreases the current value.
[ENTER]	- Selects the current menu item. - Changes to edit mode. - Confirms the change. - Answers the question with "YES".
[↑] + [↓]	- Returns to online info.

Table 1.2: Keys and their functions

Adjusting the Display Contrast

Using the following key combinations, you can adjust the display contrast at any time.

Key	Function
[ESC] + [↑]	- Increases contrast.
[ESC] + [↓]	- Decreases contrast.

Table 1.3: Key combinations for adjusting display contrast

Display Symbols

The following symbols may appear on the display.

Symbol	Explanation
→Pac...	Indicates the current line. Press **[↑]** or **[↓]** to move to another line.
+english	Indicates the current menu item or parameter. Press **[ENTER]** to select it.
+...11:20	Indicates the current setting. Press **[ENTER]** to confirm it. Press **[ESC]** to cancel it.
[MENU]	Indicates the current menu. Press **[ESC]** to leave it.
»Submenu	On the left side: Indicates a submenu.
+495619522»	On the right side: Indicates that the line continues.
Pac...	Indicates that the values appear on the next line.
.....1234W	Indicates a continuation of the previous line.

Table 1.4: Display symbols and their explanations

Press **[↑]** or **[↓]** to scroll through menus and screens. Submenus are indicated by the symbol "»" and can be selected by pressing **[ENTER]**. The symbol "»" appears at the right side of lines exceeding 16 characters to indicate that not all characters can be displayed. Enter edit mode to view these characters.

Edit Mode

The edit mode allows you to make settings or change parameters. Editable parameters are marked with the symbol "+". To enter edit mode, press **[ENTER]**.

After you have entered edit mode, the parameter starts blinking. To change its value, press **[↑]** or **[↓]**. To confirm the change, press **[ENTER]**; to cancel it, press **[ESC]**.

After a parameter has been changed in the edit mode, the selection arrow blinks until the change is again confirmed by pressing **[ENTER]** or cancelled by pressing **[ESC]**. If no key is pressed for 60 seconds, the new setting will be automatically cancelled.

2 Configuring the Sunny Boy Control

With its Plug&Play Setup, the Sunny Boy Control is easy to configure. No tools are needed. Operation is intuitive and self-explanatory.

Follow the steps in this chapter to configure the Sunny Boy Control. This needs to be done only once. After you have performed the "hardware installation" described in chapter 2.1, the following sections will guide you through the various configuration screens. Most of them can be left simply by pressing **[ESC]**.

The Sunny Boy Control needs to be configured only once. After configuring or restarting the Sunny Boy Control, the configuration screens and settings can be accessed anytime in the main menu or in the selection menu "Setup" (see chapter 6).

2.1 Switching on the Sunny Boy Control

Installing the Sunny Boy Control is as easy as connecting a household appliance. Simply insert the power plug into an electrical outlet. During initialization, "SMA" appears on the display, the Sunny Boy Control produces a sound, and the display contrast adjusts itself, darkening the display for a short while.

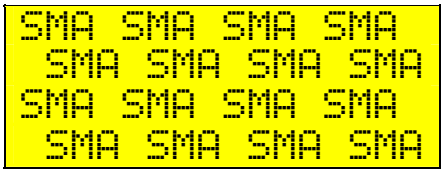


Fig. 2.1: Initialization screen of the Sunny Boy Control

The initialization process takes only about 15 seconds, after which the Sunny Boy Control displays its serial number and firmware version number for 30 seconds. Press any key to start the configuration procedure.

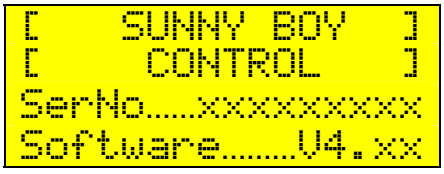


Fig. 2.2: Startup screen of the Sunny Boy Control

If your Sunny Boy Control displays a different message, refer to "Error messages" under "Troubleshooting".

2.2 Plug&Play Setup

During configuration, the Sunny Boy Control automatically starts the Plug&Play Setup, displaying the following screen.

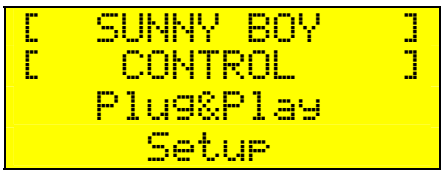


Fig. 2.3: Startup screen of the Plug&Play Setup

Set, then confirm the configuration parameters (language, date/time, and device registration) in the order of their appearance. To return to the startup screen and restart the configuration during the Plug&Play Setup, press the key combination **[↑] + [↓]** anytime.

2.2.1 Selecting the Display Language

The Sunny Boy Control supports several display languages.

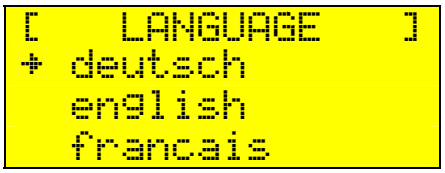


Fig. 2.4: Language options

Press [↑] or [↓] to choose your language from the list on the display, and then press [**ENTER**] to confirm your selection**.**

At this point, the selection arrow in front of the selected language blinks. Press **[ENTER]** again to confirm the selection or **[ESC]** to cancel it. To exit the menu, press **[ESC]**.

2.2.2 Setting the Date and Time

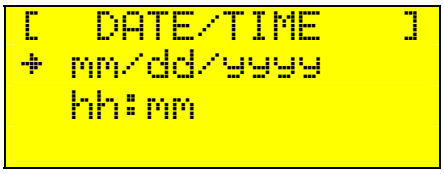


Fig. 2.5: Date and time screen

In this screen, you can set the clock and calendar of the Sunny Boy Control. Press [↑] or [↓] to select either the date field or the time field, and then press [**ENTER**]. For each digit in the date and time fields, press [↑] or [↓] to change the value.

Press [**ENTER**] to move to the next digit. After all digits have been set, the selection arrow in front of the adjusted field will blink. Press **[ENTER]** again to confirm the setting or **[ESC]** to cancel it. To exit the menu, press **[ESC]**.

2.2.3 Detecting Connected Devices

Notes on Powerline Communication

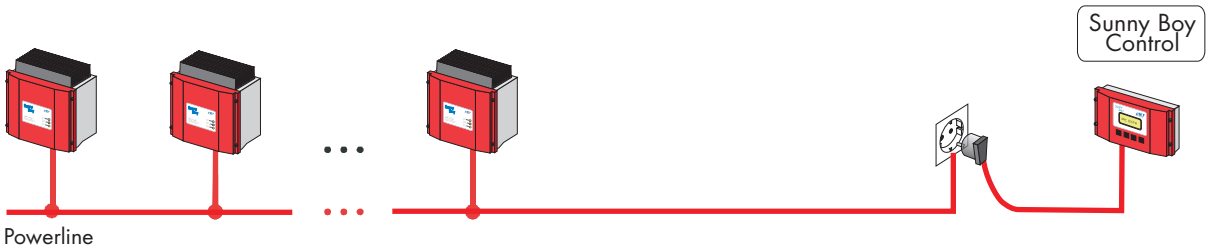


Fig. 2.6: Powerline communication between devices

The main purpose of electric wiring in a building is to supply power to various appliances. Such installations are not optimized for the transmission of high-frequency (100 kHz range) signals. To obtain interference-free communication in this frequency range, the transmission line between the Sunny Boy Control and the other devices must be carefully selected.

The transmission line should meet the following conditions.

- Use only one phase
- Be as short as possible

Make sure that all devices to be monitored by the Sunny Boy Control are connected to the same phase, preferably even to the same line. In other words, make sure that

the socket used for the Sunny Boy Control is not only on the same line (or at least on the same phase) as the other devices. It should also be as close to them as possible.

In case the Sunny Boy Control and the other devices must be connected to different phases, it may be necessary to install a phase coupler. Phase couplers are available from **SMA** and must be installed on site by a qualified technician.

Further information on optimizing the installation is available in section 9.2.2.

If there are other Powerline communication users in your neighborhood, keep a close eye on the device detection process to make sure that the Sunny Boy Control detects only devices that are yours. Otherwise, the Sunny Boy Control can be left to run the device detection automatically. In that case, all detected devices will be automatically confirmed and registered after 60 seconds. After the device detection is completed, press **[ESC]** to exit (Fig. 2.7), then **[ENTER]** to confirm (Fig. 2.8).

Automatic Device Detection

The Sunny Boy Control automatically detects all the devices it can access.

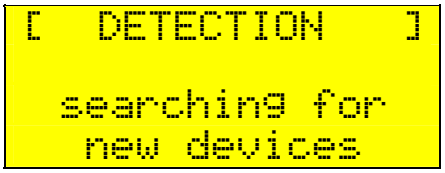


Fig. 2.7: Sunny Boy Control searching for new devices

Depending on the number of devices to be detected, this process may take several minutes. An hourglass appears in the lower-right corner of the display, showing that the program is active. The serial number of any detected device will be displayed on the bottom line.

After the detection process is completed, each device found by the Sunny Boy Control is displayed as follows in sequence.

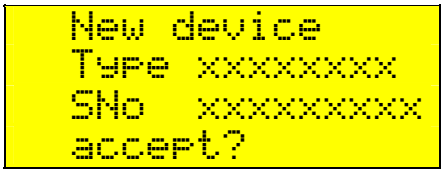


Fig. 2.8: New device found by Sunny Boy Control

At this point, compare the serial numbers of the devices found by the Sunny Boy Control with the serial numbers of your devices. Press [**ENTER**] to register a device in the

list or [**ESC**] to remove a device that you do not want to register. Note that the device will be registered automatically after no key is pressed for 60 seconds.

Once the total number of registered devices is displayed, check that the Sunny Boy Control has found all installed devices. Otherwise, press [**ENTER**] to search again.

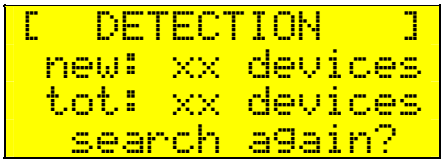


Fig. 2.9: Search result

If the Sunny Boy Control has not found all devices in one search, press [**ENTER**] to run another search.

If no key is pressed for 60 seconds, the Sunny Boy Control will automatically start a new search.

If several searches remain unsuccessful, check whether the devices to be detected are correctly installed. If the Sunny Boy Control still repeatedly fails to detect a device, refer to "Transmission Failures" in section 9.2.1.

Press **[ESC]** to complete the device detection process.

Eventually, you will be prompted to confirm the configuration. (During configuration, the new and total numbers of devices are identical.)

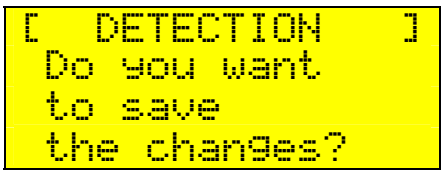


Fig. 2.10: Confirming the configuration

If you do not accept the result, press **[ESC]**.

To confirm the result, press **[ENTER]**. The Sunny Boy Control begins operating.

3 Making Connections

This chapter describes all of the connection possibilities offered by the Sunny Boy Control.

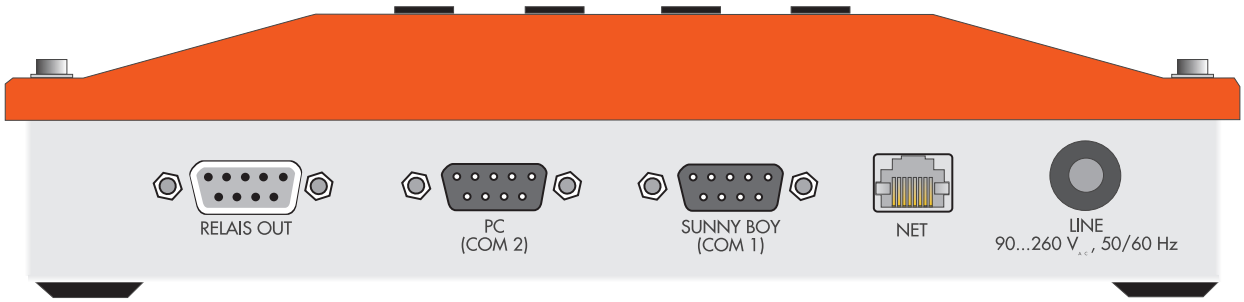


Fig. 3.1: Connectors of the Sunny Boy Control

This chapter describes all the standard connection possibilities you have with the Sunny Boy Control. The additional interfaces of the Sunny Boy Control Plus are described in chapter 7.

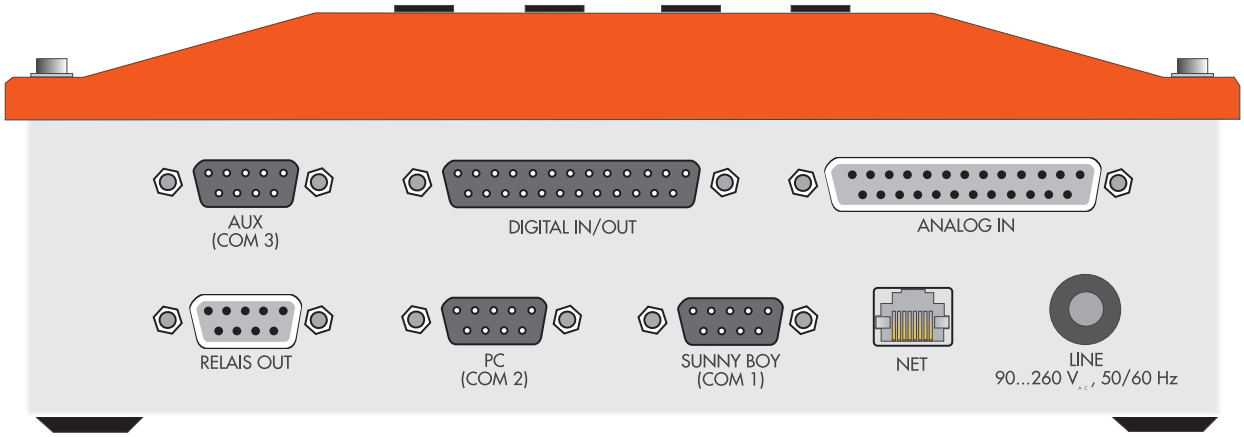


Fig. 3.2: Connectors of the Sunny Boy Control Plus

The "NET" socket you can see on the underside is without any function unless the Sunny Boy Control was equipped with a NET Piggy-Back according to your order. NET Piggy-Backs are available in the following versions:

- Analog Modem
- ISDN
- Ethernet
- GSM (mobile)

The function of the NET socket is described in a separate document which is included in the delivery in case installed.

3.1 Connection to the PV System

The jumpers of the Sunny Boy Control are set at the factory to match a particular interface.

Powerline Communication

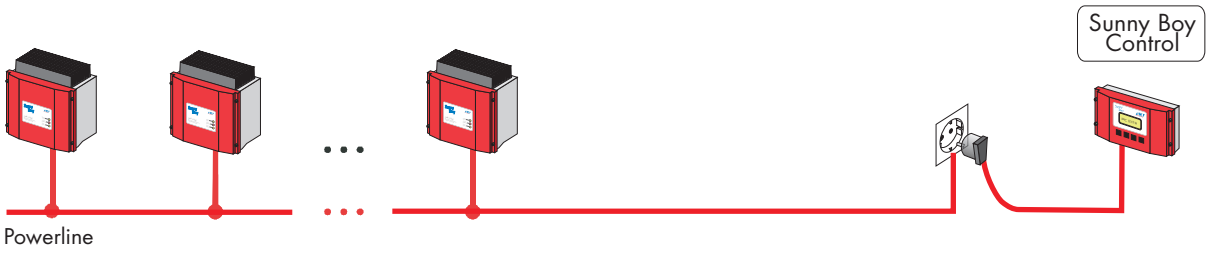
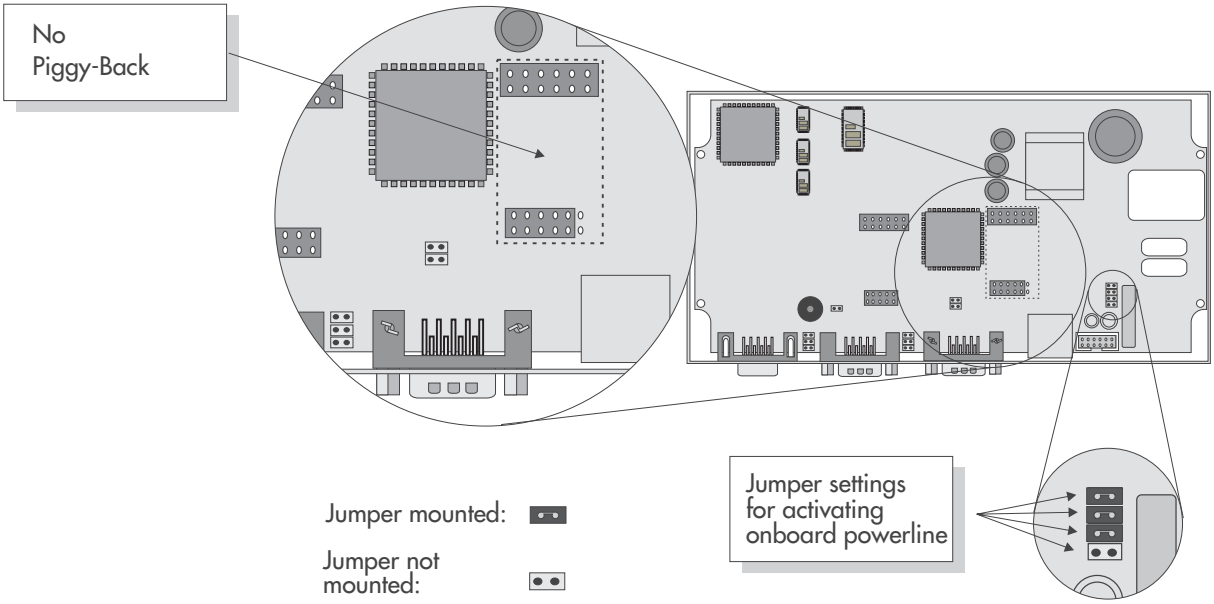


Fig. 3.3: Powerline communication

For Powerline communication with the inverters, the jumpers must be set as shown below, and no interface module (RS232 or RS485 Piggy-Back) may be installed.[1]

Jumper Settings for Powerline Communication on the COM1 Port



[1] On older models of the Sunny Boy Control Plus, these jumpers cannot be reset because the circuit board, which cannot be removed, prevents access to them.

RS485 Connection Between Sunny Boys and Sunny Boy Control

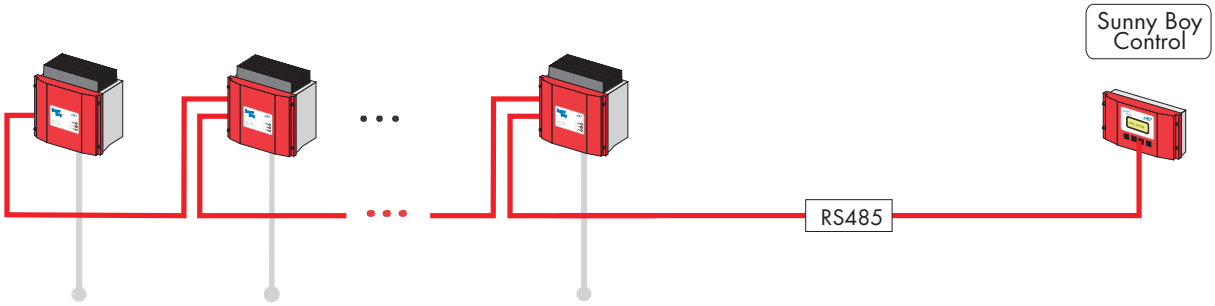


Fig. 3.4: Sunny Boys connected via RS485

Pin Assignment

The signals shown in the table below are available only when the optional RS485 Piggy-Back has been installed. The standard Sunny Boy Control does not support the "SUNNY BOY (COM1)" interface. Instead, it uses Powerline communication to communicate with the Sunny Boy inverters.

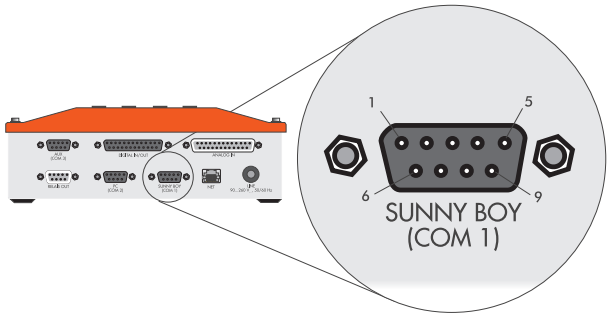


Fig. 3.5: "SUNNY BOY (COM1)" connector

120 Ω termination

Pin	RS485 signal
1	PE
2	Data +
3	Data +
4	-
5	GND
6	+5V
7	Termination -> Data +
8	Data -
9	Data -

680 Ω

680 Ω

Pull-up / pull-down resistors

Table 3.1: Pin assignment of "SUNNY BOY (COM1)" interface on RS485 Piggy-Back

Recommended RS485 Cable

For an RS485 connection, we recommend to use a so-called "LiYCY" cable, shown below.

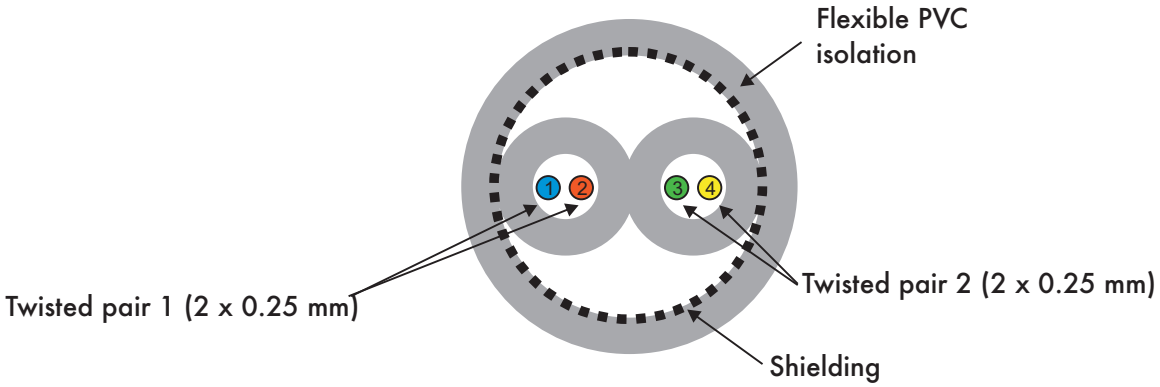
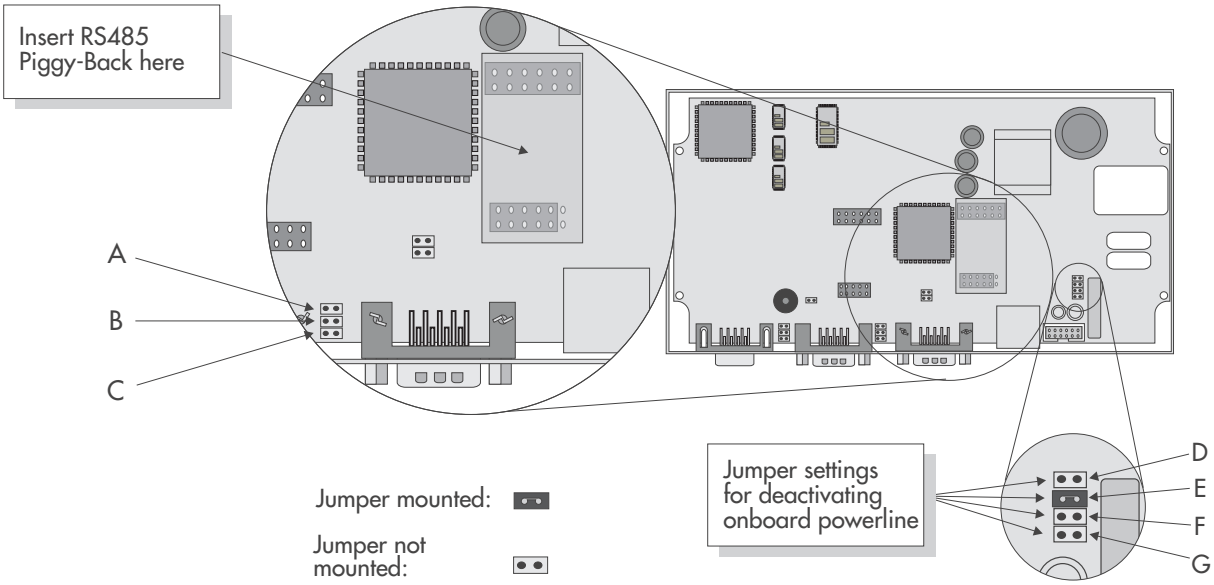


Fig. 3.6: Recommended cable for RS485 communication

Jumper Settings for RS485 Communication on the COM1 Port[1]



[1] On older models of the Sunny Boy Control Plus, these jumpers cannot be modified because the upper circuit board, which cannot be removed, prevents access to them.

Jumper A: Termination of the RS485 cable. The data cable must be terminated on both ends. If the Sunny Boy Control is at the beginning or end of the cable, the cable must be terminated by either setting jumper A or bridging pins 7 and 9 of the connector. The required resistance is 120 Ω. Basically, jumper A is a bridge between pins 7 and 9 of the connector. The default setting is "not terminated".

Jumpers B and C: Pull-up/pull-down resistances for the RS485 signal. The RS485 pull-up/pull-down resistances are achieved by either setting jumpers B and C on the Sunny Boy Control or using a cable plug with integrated resistors. The required resistances are 680 Ω. The default setting is "pull-up/pull-down activated". Only one device on the RS485 bus needs to provide the pull-up/pull-down resistances.

Jumpers D, E, F, and G: Defining the type of communication. Only jumper E is set for RS485 communication.

Establishing an RS485 connection with a Sunny Boy inverter

Use only a 2 x 2 x 0.25 mm^2 LiYCY cable for the RS485 connection.

To enable RS485 communication between the Sunny Boy and the Sunny Boy Control, all devices must be equipped with an RS485 Piggy-Back. All devices can be ordered with this option already installed, or they can easily be retrofitted using optional extension kits.

The maximum cable length for an RS485 connection is 1,200 m / 4,000 ft.

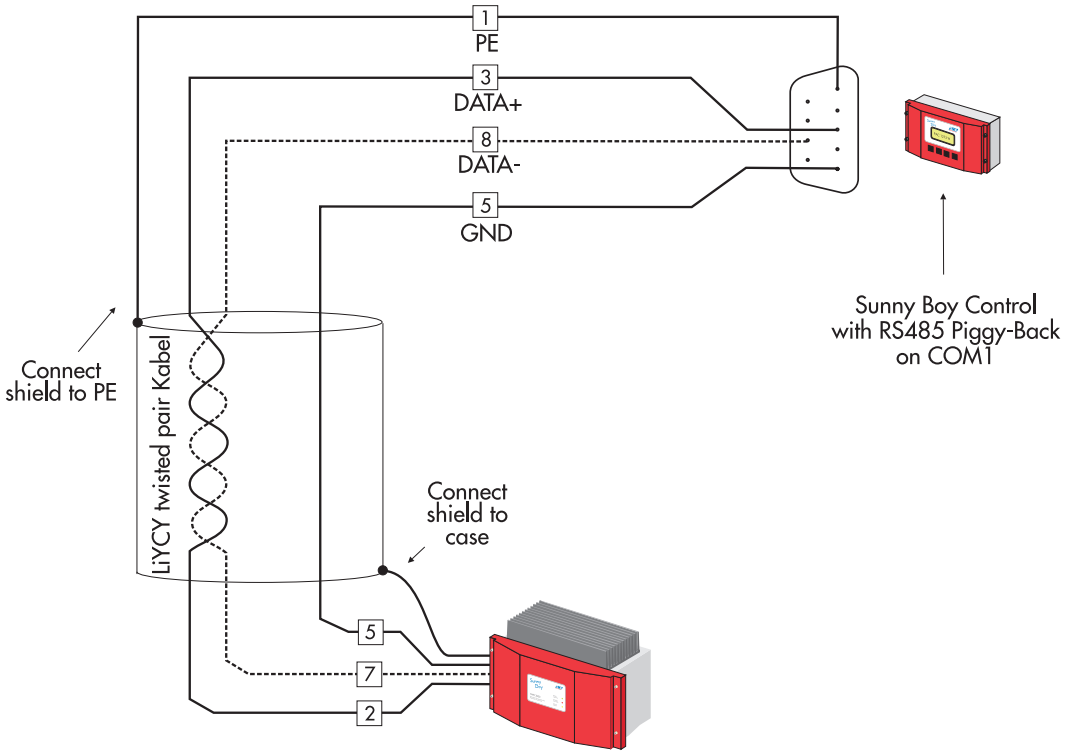


Fig. 3.7: RS485 connection between one Sunny Boy and a Sunny Boy Control

Establishing RS485 connections with several Sunny Boy inverters

The first and the last device on the RS485 bus must be terminated. This can be achieved by setting jumpers on the device, bridging pins 7 and 9 of the connector, or using a plug with a resistor.

One device on the RS485 bus must have pull-up/pull-down resistances. The Sunny Boy Control normally comes with internal jumpers set for this purpose at the factory; in that case, no further steps need to be taken.

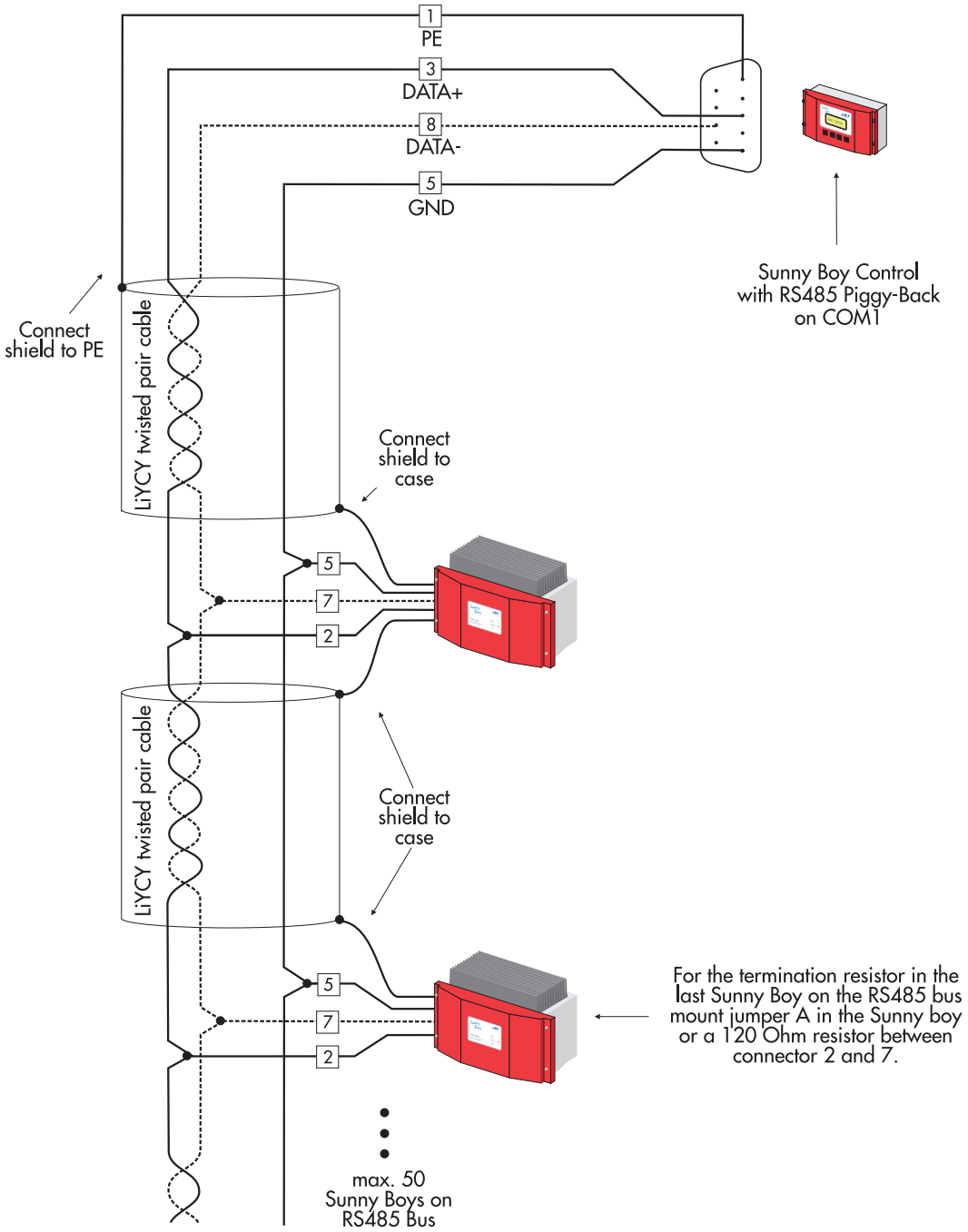


Fig. 3.8: RS485 connections between Sunny Boys and a Sunny Boy Control

3.2 Connection to a PC

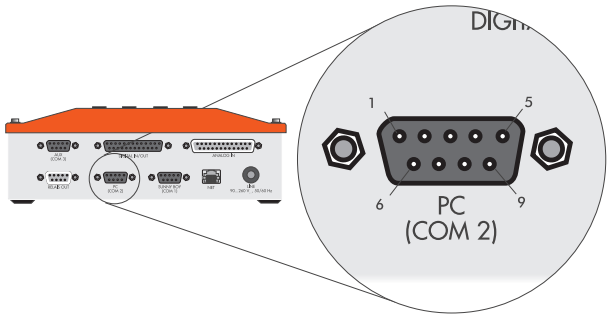
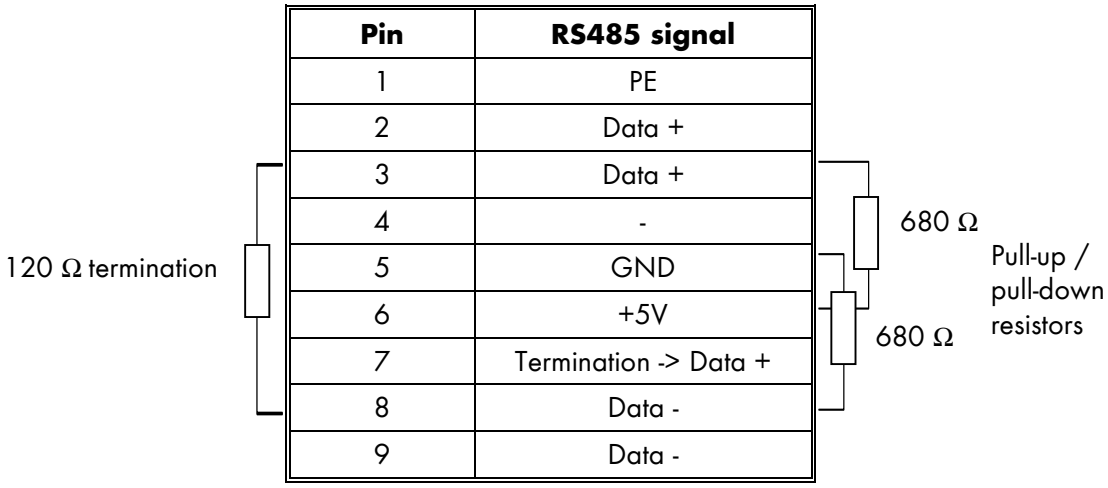


Fig. 3.9: "PC (COM2)" connector

The Sunny Boy Control is equipped with a "PC (COM2)" connector of the DB9 type. This allows for an RS232 or RS485 connection to a PC.

"PC (COM2)" Pin Assignment



Pin	RS485 signal
1	PE
2	Data +
3	Data +
4	-
5	GND
6	+5V
7	Termination -> Data +
8	Data -
9	Data -

Table 3.2: "PC (COM2)" pin assignment for RS485 connection

3.2.1 RS232 Connection to a PC

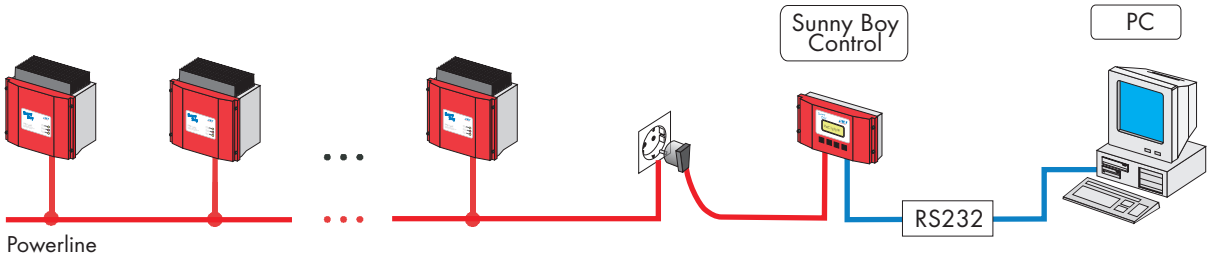


Fig. 3.10: RS232 connection to a PC

Connecting a PC to the Sunny Boy Control requires a so-called null modem cable (SMA order no. 36-5001).

The PC-to-Sunny Boy Control connection must be made using the null modem cable included with the Sunny Boy Control. This connection cannot be made using a regular one-to-one cable.

If your PC's DB9 connector (COM1) is already taken, such as by a serial PC mouse, or if it has only a DB25 connector, you will also need a DB25-DB9 adapter (SMA order no. 36-5010).

Alternatively, you can prepare your own cables according to the following tables and diagrams.

Pin assignment of a DB9-DB9 cable for a PC-to-Sunny Boy Control connection

DB9 plug			DB9 plug	
Signal	**Pin**		**Pin**	**Signal**
/RXD	2	——	3	/TXD
/TXD	3	——	2	/RXD
GND	5	——	5	GND
			1	DCD
			6	DSR
RTS	7		8	CTS
DCD	1			
DSR	6			
CTS	8		7	RTS

Table 3.3: Pin assignment of a DB9-DB9 cable for PC connection

——: These pins are connected together.
Pins 1, 6, and 8 on both ends are bridged.

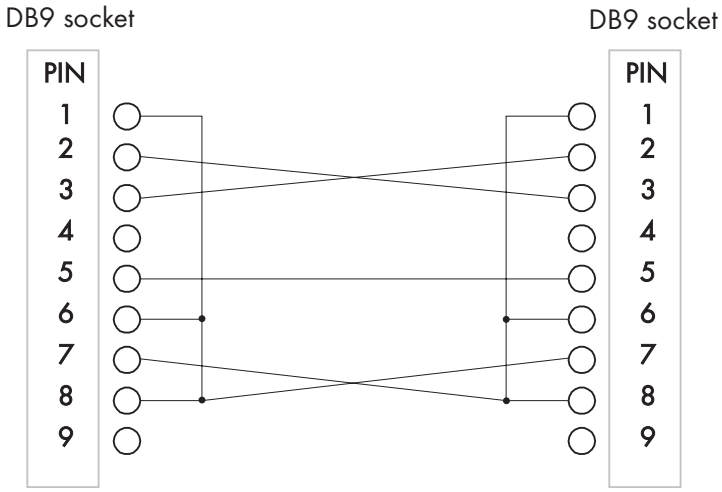


Fig. 3.11: Diagram of DB9-DB9 cable for PC connection

Pin assignment of a DB9-DB25 cable for a PC-to-Sunny Boy Control connection

DB9 plug			DB25 plug	
Signal	Pin		Pin	Signal
/TXD	3	——	3	/RXD
/RXD	2	——	2	/TXD
/TXD	3	——	3	/RXD
GND	5	——	7	GND
RTS	7	⊣	5	CTS
			6	DSR
			8	DCD
CTS	8	⊣	4	RTS
DCD	1			
DSR	6			

Table 3.4: Pin assignment of a DB9-DB25 cable for PC connection

——: These pins are connected together.
Pins 1, 6, and 8 of the DB9 plug as well as pins 5, 6, and 8 of the DB25 plug are bridged.

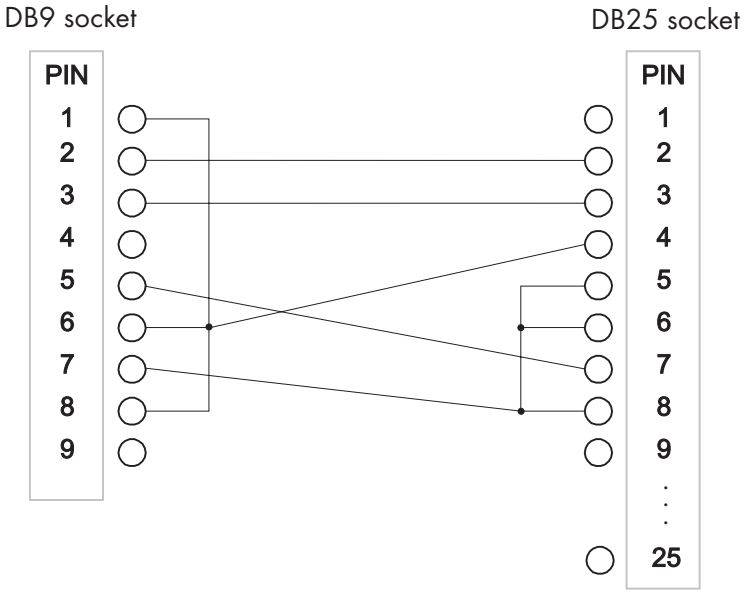


Fig. 3.12: Diagram of DB9-DB25 cable for PC connection

3.2.2 RS485 Connection Between a PC and a Sunny Boy Control

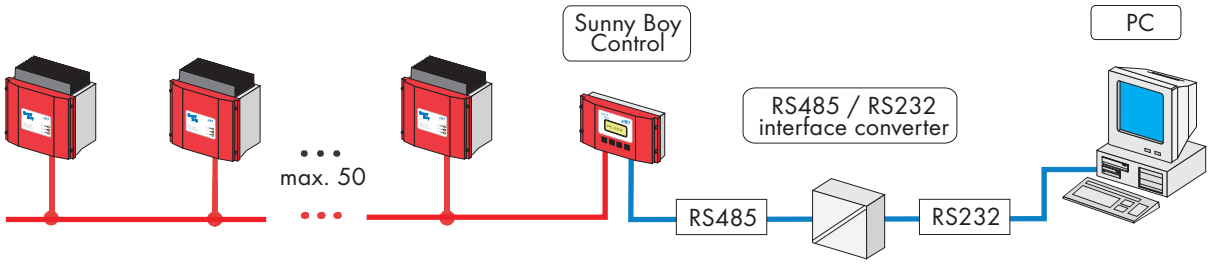
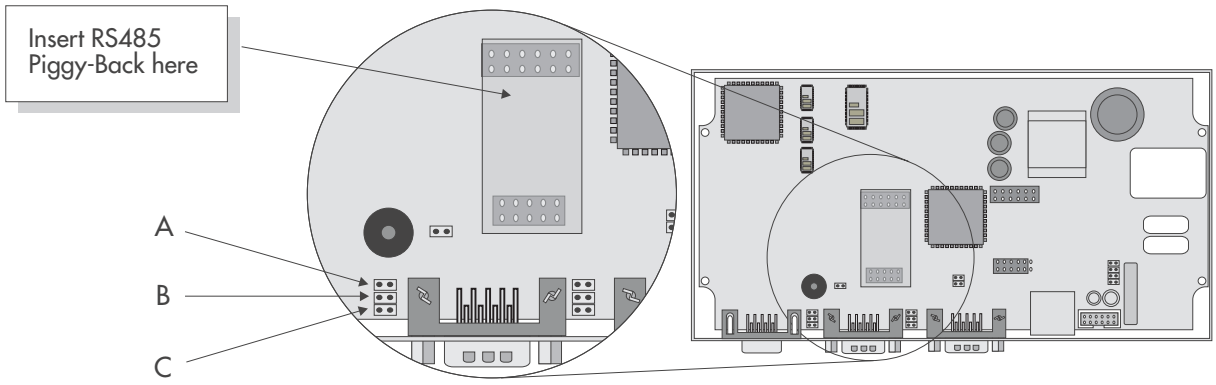


Fig. 3.13: RS485 connection to a PC

To overcome long distances, for example, it can be useful to connect an RS485 interface to the "PC (COM2)" connector of the Sunny Boy Control. Compared with RS232, which allows a maximum cable length of approx 15 m / 50 ft, RS485 allows a total cable length of 1,200 m / 4,000 ft.

To establish an RS485 connection with a PC, you will need an RS485 Piggy-Back installed to the Sunny Boy Control and an external RS232-RS485 interface converter.

Jumper settings for an RS485 connection to the "PC (COM2)" interface of the Sunny Boy Control[1]



Jumper A: Termination of the RS485 cable. The data cable must be terminated on both ends by either setting jumper A or bridging pins 7 and 9 of the connector. The required resistance is 120 Ω. The default setting is "not terminated".

Jumpers B and C: Pull-up/pull-down resistances for the RS485 signal. The RS485 pull-up/pull-down resistances are achieved by either setting jumpers B and C on the Sunny Boy Control or using a cable plug with integrated resistors. The required resistances are 680 Ω. The default setting is "pull-up/pull-down activated". Only one device on the RS485 bus needs to provide the pull-up/pull-down resistances.

[1] On older models of the Sunny Boy Control Plus, these jumpers cannot be modified because the upper circuit board, which cannot be removed, prevents access to them.

The following requirements must be met to establish an RS485 connection between the Sunny Boy Control and a PC.

- The Sunny Boy Control has an RS485 Piggy-Back connected to its "PC (COM2)" connector. (On the Sunny Boy Control Plus, the "AUX (COM3)" connector can also be used for an RS485 connection.)
- A COM port is available on the PC and an RS485-RS232 interface converter is connected to it. SMA recommends an I-7520 interface converter from IPC. SMA's Sunny Boy Hotline does not support the use of interface converters other than the recommended one.
- A suitable cable (of the LiYCY type) is correctly terminated on both ends and does not exceed a length of 1,200 m / 4,000 ft.
- The jumpers are correctly set.

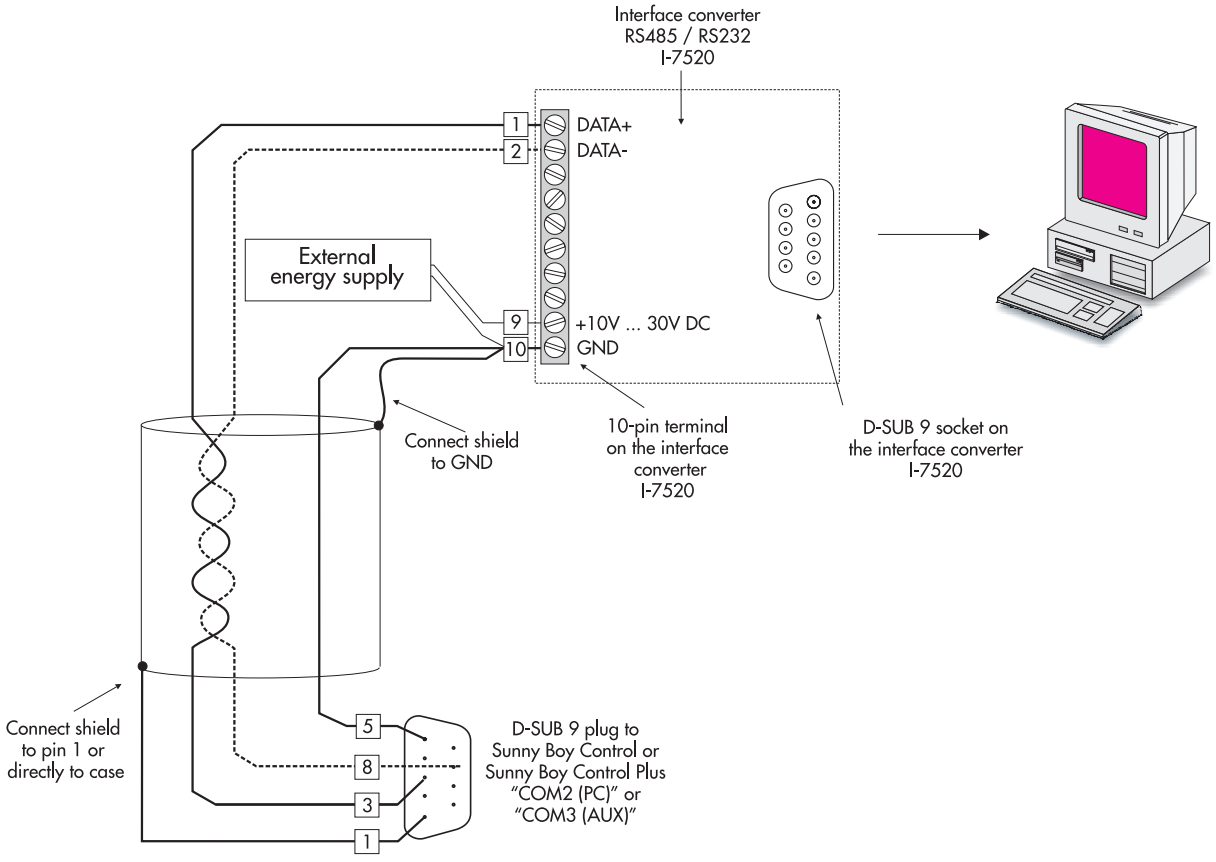


Fig. 3.14: RS485 connection between a PC and a Sunny Boy Control

3.2.3 Connection Between a PC and Several Sunny Boy Controls

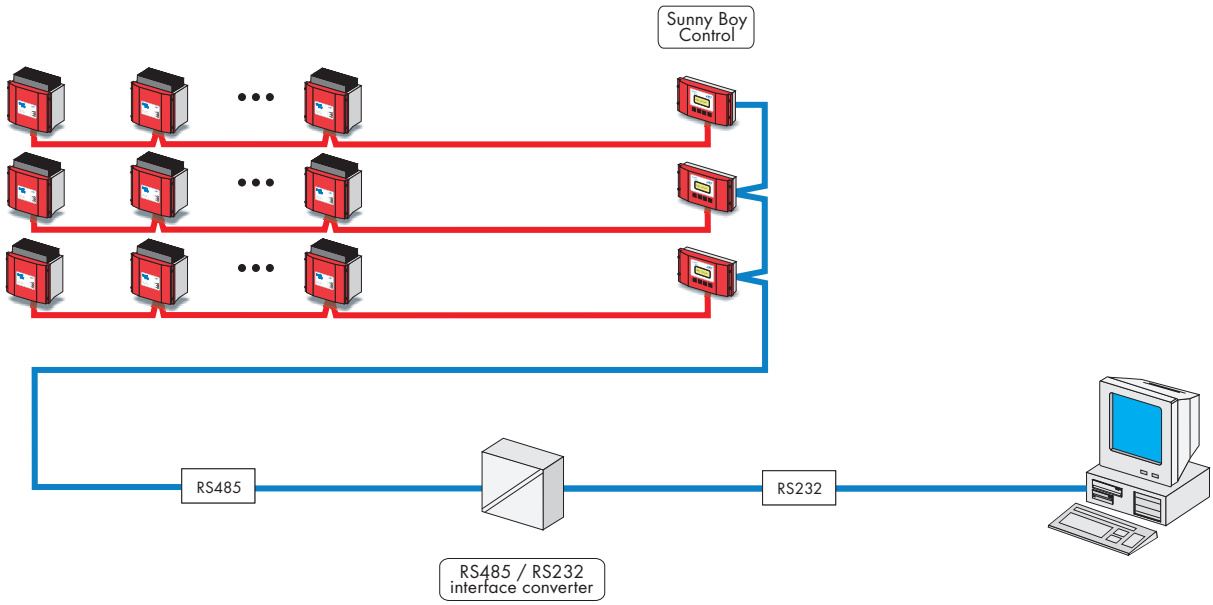


Fig. 3.15: RS485 connection between a PC and several Sunny Boy Controls

The following requirements must be met to establish a connection between several Sunny Boy Controls and a PC.

- Each Sunny Boy Control has an RS485 Piggy-Back connected to the "PC (COM2)" connector.
- A COM port is available on the PC and an RS485-RS232 interface converter is connected to it. SMA recommends an I-7520 interface converter from IPC. SMA's Sunny Boy Hotline does not support the use of interface converters other than the recommended one.
- The plug-in jumpers B and C (Pull-Up / Pull-Down resistors) may only be plugged in **one** Sunny Boy Control. In case of the usage of an I-7520 interface converter the plug-in jumpers B and C have to be removed in all Sunny Boy Control.
- A suitable cable (of the LiYCY type) is correctly terminated on both ends and does not exceed a length of 1,200 m / 4,000 ft.

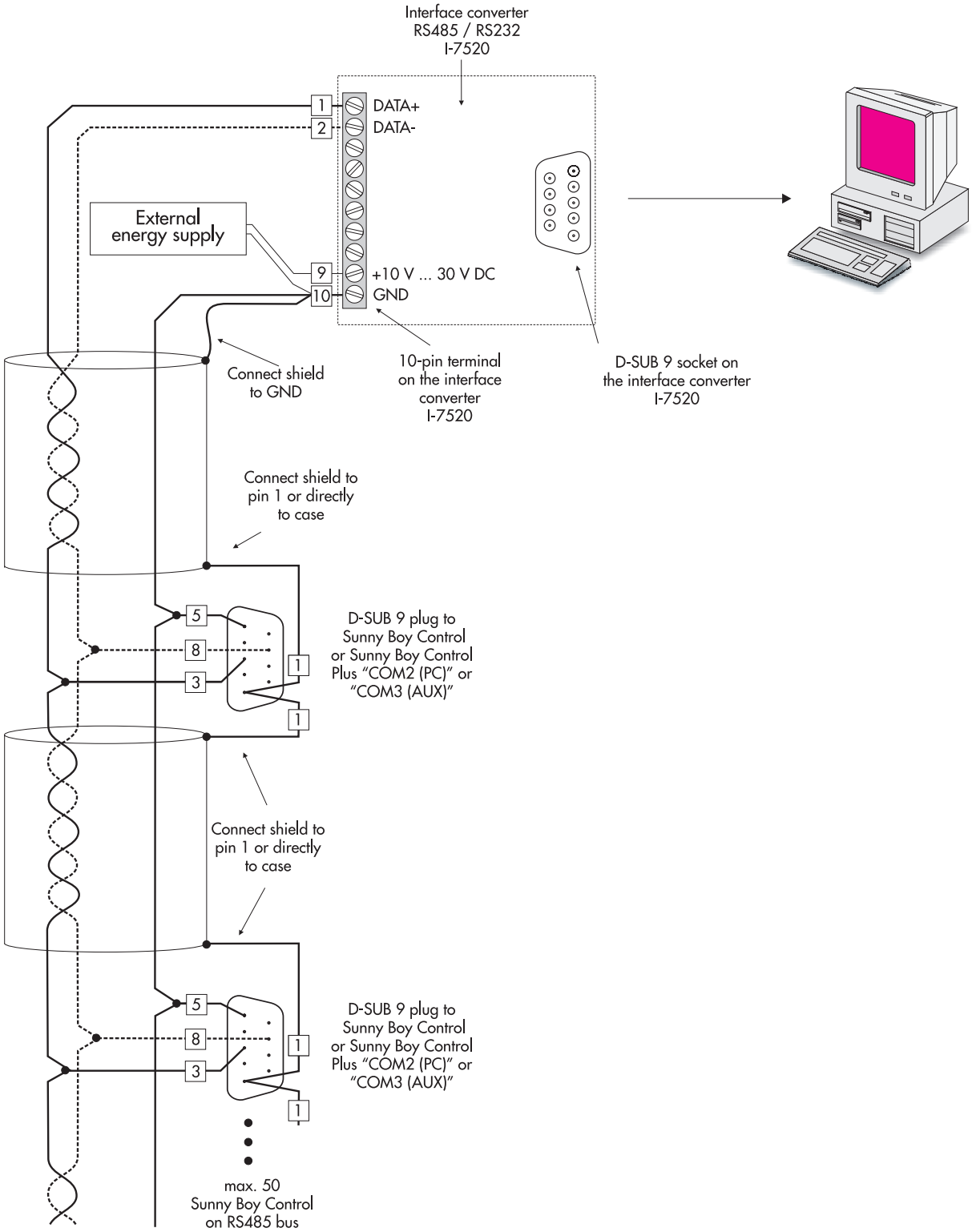


Fig. 3.16: Connection between a PC and several Sunny Boy Controls

3.3 Modem Connection

Please Note: The Sunny Boy Control can be equipped with the optional NET Piggy-Back for e-mail transmission and remote access. The NET Piggy-Back is equipped with an internal communication module for either analog, ISDN, Ethernet or GSM (mobile) transmission.

SMA recommends the usage of the NET Piggy-Back as this avoids possible compatibility problems as well as it reduces cabling and installation modems etc. Note: The NET Piggy-Back only supports e-mail transmission of status reports instead of Fax reports.

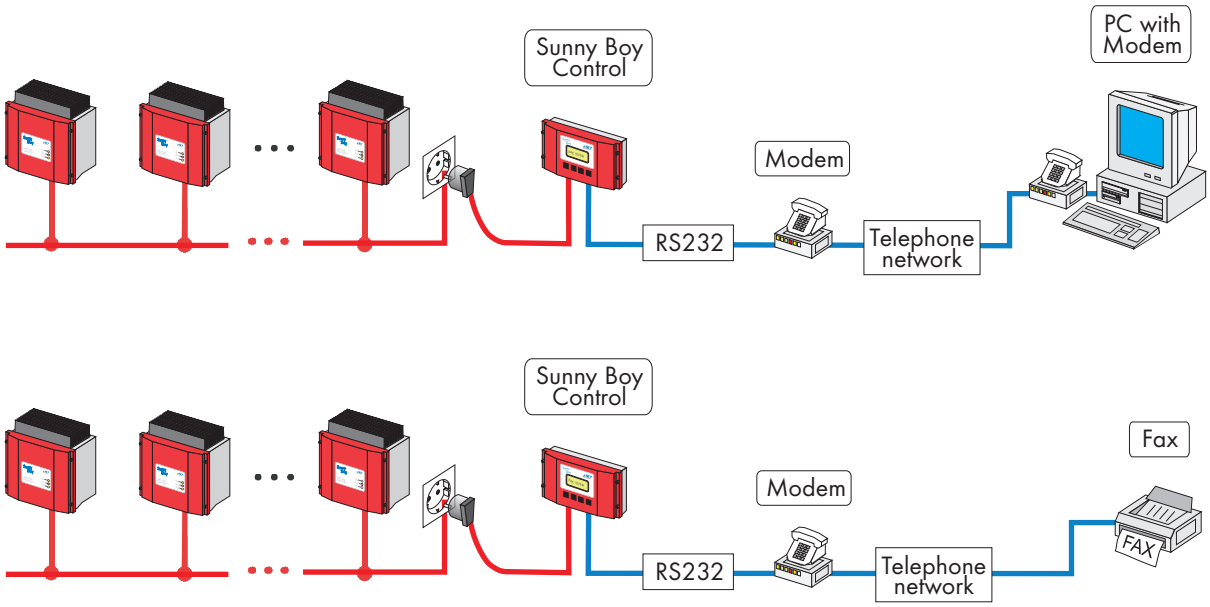


Fig. 3.17: Modem connection for remote access (top) and fax transmission (bottom)

To enable remote data acquisition using the Sunny Data Control software or fax transmission from the Sunny Boy Control, an external modem to be connected to the phone line is required. We recommend the "Microlink 56k Pro" model from Devolo. Note that the modem must be compliant with fax class 2.0 in order to communicate reliably with the Sunny Boy Control. The list of AT commands (section 10.4) and a list of recommended modem manufacturers (section 11.3) are included in the appendix.

Connecting the modem to the Sunny Boy Control

Connect the serial port of the modem (V24/RS232C) with the "PC (COM2)" port of the Sunny Boy Control using an RS232 cable.

Use the RS232 cable supplied with the modem, not the null modem cable supplied with the Sunny Boy Control (this one is used to connect to a PC).

With the PC connection cable used for data acquisition, the signals inside the cable are crossed. With the RS232 cable used for connecting the modem (also called "V24 cable"), however, the signals are "one to one". Since these cables look alike, be sure not to confuse them.

Connecting the modem to the phone and power lines

Make all necessary modem connections according to the maker's instructions. This typically consists in plugging the power adapter into an electrical outlet and plugging a phone line into the line jack on the modem and into a phone jack on the wall.

Modem detection by the Sunny Boy Control

Switch on the modem and the Sunny Boy Control. After approximately one minute, the Sunny Boy Control should automatically detect the modem connected to the "PC (COM2)" connector. Otherwise, check the modem's power and phone connections, and then turn the Sunny Boy Control on again (the automatic modem detection takes place only at power-up).

Any fax class 2 or 2.0 modem should support the default settings. Otherwise, the modem init (or initialization) string can be adjusted. See section 6.6.1 for details.

3.4 Connecting an External Display

Connecting an external display to the Sunny Boy Control is typically not a problem. The Sunny Boy Control is preset at the factory to support the following types of displays.

- DATALITE's DX Series with eight 16-character lines
- HvG's PV system display
- Siebert's PV system display or S10, S30, S70 Series
- Adaptive Micro Systems' LED displays for indoor and outdoor applications)
- EnergieCom's mipan SI with one line of 2 to 15 characters

Although the Sunny Boy Control can normally be configured for any commercially available type of display, we recommend that you consult with the Sunny Boy Hotline before making a purchase.

A number of quick installation guides for the most popular displays are available on our website www.SMA.de or www.SMA-America.com.

3.4.1 Activation of External Displays with „ASCII text“

For other display types or the user's own connections (e.g. guiding system in buildings) any desired selection of channels can be delivered in the form of an ASCII string with the 'ASCII-Text' type. Values, order, display areas and number of digits are configurable as desired. This allows the display of extended ranges for large scale plants.

The ASCII string will be delivered with 2400 Baud (no parity, 8 bits, 1 stopbit) at the activated external display interface and regularly up-dated.

Example for an ASCII string:

Start	Value 1	Value 2	Value 3	Value 4	Value 5	....	Ende
#	LLLLLL;	LLLLLL;	LLLLR;	LLRR;	LLLLRR;		CR,LF

L = Left digit of the decimal point, R = Right digit of the decimal point

Output starts with the rhombus symbol '#'. It is followed by the selected channel value according to the respective format for the number of digits before and after the decimal point (number of digits before the decimal point = total digits – digits right of decimal point). Each channel value is finished by a semi-colon. Carriage Return (CR) and Line Feed (LF) finish the ASCII string.

The output can be displayed and checked with any PC terminal program with the setting 'ASCII' and 2400 Baud (8 N1).

3.5 "Relay Out" Connection

Pin Assignment

Pin	Specification	Description
1	-	-
2	0 – 48 V AC, 0.5 A	Switching contact, contact 2-1, switch open
3	0 – 48 V AC, 0.5 A	Switching contact, contact 2-0, switch pole
4	0 – 48 V AC, 0.5 A	Switching contact, contact 2-2, switch closed
5	-	-
6	-	-
7	0 – 48 V AC, 0.5 A	Alarm contact, contact 1-1, switch open
8	0 – 48 V AC, 0.5 A	Alarm contact, contact 1-0, switch pole
9	0 – 48 V AC, 0.5 A	Alarm contact, contact 1-2, switch closed

Table 3.5: Pin assignment of "Relay Out" connector

Diagram

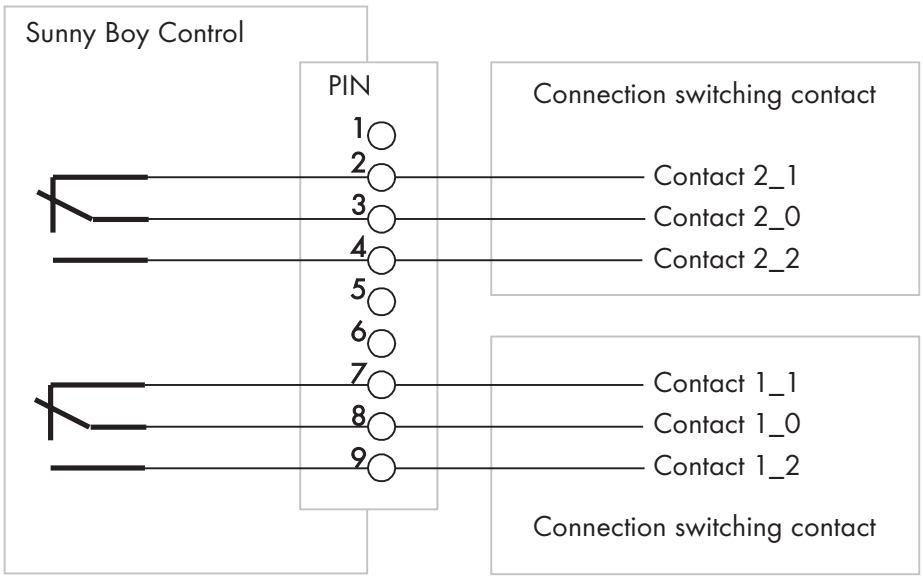


Fig. 3.18: Diagram of "Relay Out" connector

The diagram shows the switches in their default switch positions (contact 1-1, contact 2-1). The default switch position of the alarm contact can be modified in the "`Setup…Interfaces…Relais Out`" menu (see section 6.3).

3.5.1 Alarm Contact

The alarm contact is used to activate an external alarm or notification system each time the Sunny Boy Control generates an error or warning message.

Default switch position of the alarm contact	Sunny Boy Control operating condition	Switching
Contact 1-1	Power failure	Contact 1-1 (pin 7)
Contact 1-1	Normal operation	Contact 1-1 (pin 7)
Contact 1-1	Error/warning message	Contact 1-2 (pin 9)
Contact 1-2	Power failure	Contact 1-1 (pin 7)
Contact 1-2	Normal operation	Contact 1-2 (pin 9)
Contact 1-2	Error/warning message	Contact 1-1 (pin 7)

Table 3.6: Switch positions of alarm contact

The alarm contact is activated by selected events according to their tolerances (see section 6.3.3).

In addition to activating an external alarm when triggered by an error or warning message from the Sunny Boy Control, the alarm contact can also be set to activate the alarm when triggered by a power failure. This requires making contact 1-2 the default switch position of the alarm contact. However, this will also trigger the alarm during initialization of the Sunny Boy Control until it starts operating.

Example of an Alarm Contact Application

In this example, a horn is sounded whenever the Sunny Boy Control generates a message. For this purpose, "Default Switch" under "Alarm Contact" must be set to "contact 1_1".

If the horn is also supposed to be sounded in the case of a power failure, it must be connected to pin 7, and "Default Switch" under "Alarm Contact" must be set to "contact 1_2".

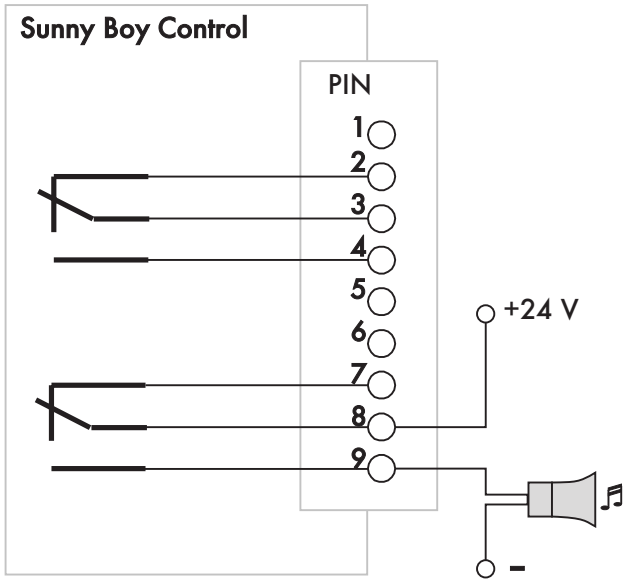


Fig. 3.19: Alarm contact application

3.5.2 Switching Contact

The switching contact is intended to operate an external load according to the load and time management settings of the Sunny Boy Control. The default switch position can be changed in the menu "Setup…Interfaces…Relais out… Switch Contact" (see section 6.3.3).

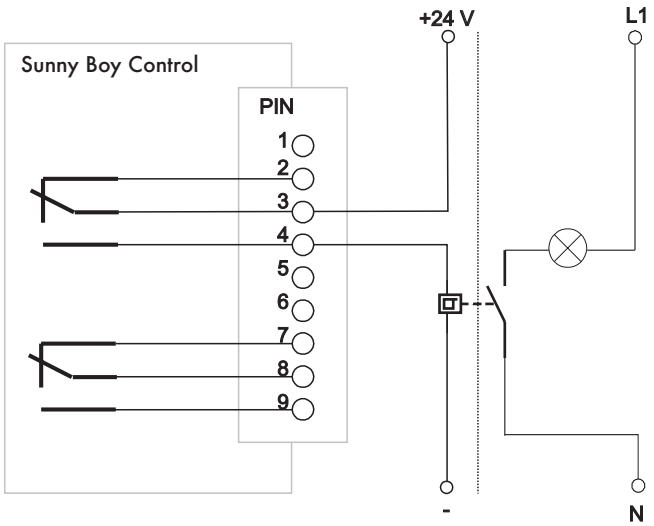
Default switch position of the switching contact	Sunny Boy Control operating condition	Switching
Contact 2-1	Power failure	Contact 2-1 (pin 2)
Contact 2-1	Normal operation	Contact 2-1 (pin 2)
Contact 2-1	Time/load event	Contact 2-2 (pin 4)
Contact 2-2	Power failure	Contact 2-1 (pin 2)
Contact 2-2	Normal operation	Contact 2-2 (pin 4)
Contact 2-2	Time/load event	Contact 2-1 (pin 2)

Table 3.7: Switch positions of switching contact

To switch an external load connected to the switching contact, an additional relay is required.

Example of a Switching Contact Application

In this example, the external load will be switched via an external relay triggered power or time management events.



In this example, the "Default Switch" is set to "contact 2-1". If the external load is also to be switched in the event of a power failure, connect the relay to pin 2 and set the "Default Switch" to "contact 2-2".

Fig. 3.20: Switching contact application

4 Menu Functions for Data Display

4.1 Startup Screen

At every startup the Sunny Boy Control performs an automatic self-test. If the self-test produces an error, it is shown in the display and, depending on the settings, the beeper or an external alarm is activated. If no errors are detected, the Sunny Boy Control will simply display its serial number and firmware version. At this point, you can press [**ESC**] to enter the main menu. If no key is pressed for 60 seconds, the Sunny Boy Control will automatically start the online info.

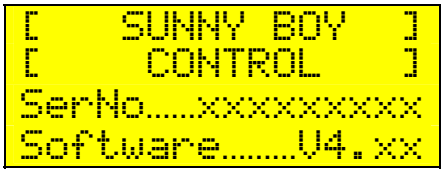
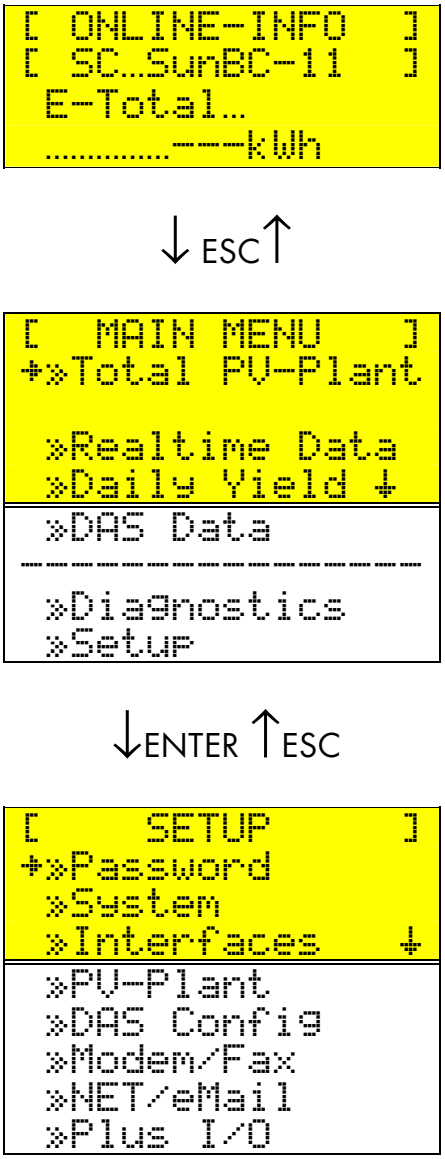


Fig. 4.1: Startup screen

If the Sunny Boy Control displays an error, refer to section “9.1 Messages and Their Causes”.

Depending on your settings, the alarm contact may be activated when an error occurs during the self-test. Refer to section “6.3.3 Alarm Contact” for details.



Cyclic display of system information, errors and warnings		Section 4.2
← Main menu of the Sunny Boy Control		Section 4.3
← Total system output		Section 4.3.1
← Current values for each device		Section 4.3.2
← Daily values for each device		Section 4.3.3
← Data archives for measuring channels		Section 4.3.4
← Switch to "Diagnostics" menu		Chapter 5
← Switch to "Setup" menu		Chapter 6
(requires password)		Section 6.1
← User-defined password for accessing menu		Section 6.1
← Language, date & time		Section 6.2
← Configuring the connectors		Section 6.3
← Detecting, registering & configuring devices		Section 6.4
← Turning archiving on/off, selecting measuring channels		Section 6.5
← Configuring external modem & system info (optional)		Section 6.6
← Configuring internal modem & system info (optional)		Section 6.7
← Configuring the Plus functions		Chapter 7

Fig. 4.2: Menu structure of the Sunny Boy Control

4.2 Online Info

"Online-Info" is the normal operating mode of the Sunny Boy Control. In this state, it cycles through various screens displaying continuously monitored system data as well as any error or warning messages occurring in case of a system malfunction.

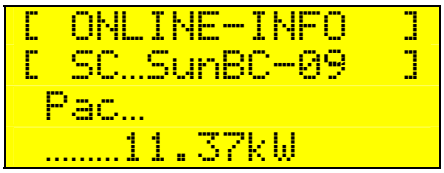


Fig. 4.3: Current total system power output in Online-Info

Although "Online-Info" automatically cycles through the different screens, it is possible to scroll through them manually by pressing [**ENTER**].

Type of screen	Content	Timespan
Startup screen	Serial number and firmware version	5 seconds (only once)
Date/Time	Date & time	5 seconds (only once)
System data	For example, system power (Pac) and daily energy (E-today)	10 seconds
Warning message	Various warnings	10 seconds
Error message	Various errors	Until acknowledged by the user

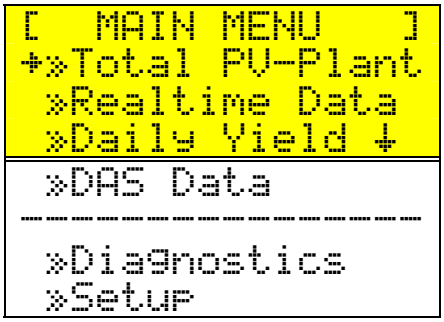
Table 4.1: Online-Info screens

Press [**ESC**] to exit "Online-Info" and go to the main menu. Error messages are suppressed while you are navigating the menus of the Sunny Boy Control.

To return to "Online-Info", press [**ESC**] (while in the main menu) or [↑] + [↓] (while in a menu). The selection of system data to be displayed in Online-Info can be reconfigured by the user. Refer to section 6.2.3 for details.

4.3 Main Menu

All Sunny Boy Control functions are available from the main menu. Press **[ESC]** anytime to return to Online-Info.



← Main menu of the Sunny Boy Control	
← Total system output	Section 4.3.1
← Current values for each device	Section 4.3.2
← Daily values for each device	Section 4.3.3
← Data archives for measuring channels	Section 4.3.4
← Switch to "Diagnostics" menu	Chapter 5
← Switch to "Setup" menu	Chapter 6

Fig. 4.4: Main menu

If no key is pressed for 60 seconds while in the main menu, the Sunny Boy Control automatically returns to Online-Info.

4.3.1 "Total Plant" function

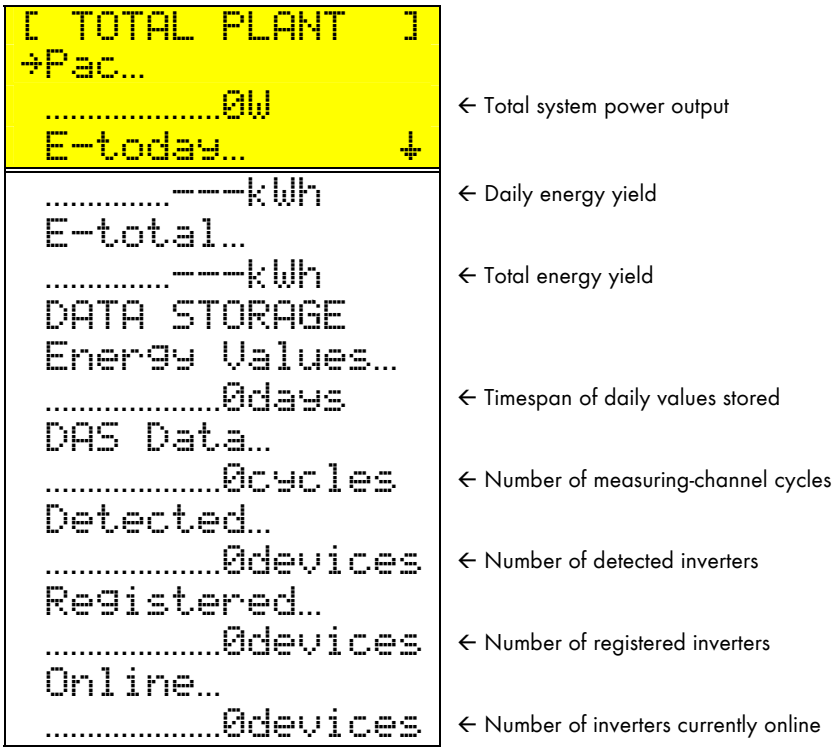


Fig. 4.5: "Total Plant" function

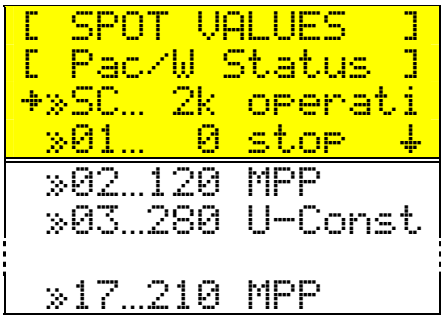
The "**Total Plant**" function gives an overview of the operating condition of your entire system.

In addition to the total (E-total) and daily (E-today) energy yields of the system, you can display the current data storage settings of the Sunny Boy Control.

Depending on the configuration, the storage capacity for the daily energy values is about one year. It is therefore recommended that you back up the acquired data at least once a year in order to avoid data loss due to insufficient memory. The maximum number of the measuring-channel cycles depends on the number of defined measuring channels. Refer to Table 10.1: "Number of daily measuring intervals" for a detailed calculation.

4.3.2 "Realtime Data" Function

With the "**Realtime Data**" function, all available data for every single device can be viewed. The following is the first screen, which indicates the current state of every device.

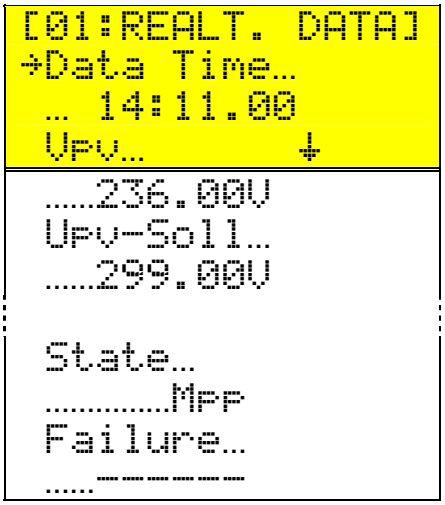


← Device ID, current power output (here: 2 kW), operating status

← Device ID, current power output (here: 120 W), operating status

Fig. 4.6: Device selection screen

Press [**ENTER**] to select a device and display all current values acquired for it. Press [↑] or [↓] to scroll through the list**.**



[Device ID: realtime data]

Fig. 4.7: Realtime data screen

4.3.3 "Daily Yield" Function

The daily energy values for every connected device are being saved for at least one year. The device ID "SC" refers to the Sunny Boy Control, which represents the entire system.

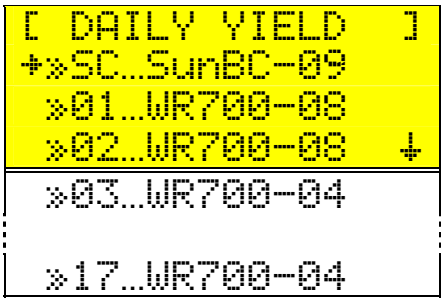


Fig. 4.8: Device selection screen

Press [**ENTER**] to select a device and display the daily energy values.

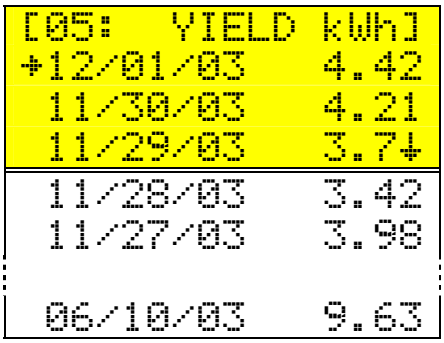


Fig. 4.9: Realtime data screen

Press [↑] or [↓] to scroll through all of the daily energy values stored for the selected device.

4.3.4 Data Archiving and Measuring Channels

So-called "measuring channels", defining which data of a device to record, can be set under "DAS Config…Chan. Select." in the "SETUP" menu. Although it is theoretically possible to store the data for every available channel of a device, data archiving should be limited to selected channels in order to increase the storage depth. A selection of the most important channels is preset for each device.

Measuring channel data is stored as an average value for the interval set under "DAS Config" in the "SETUP" menu.

If, for example, you have selected the measuring channel "Pac" and defined a 15 minute interval for it, the "Pac" channel's realtime values of each 15 minute interval will be averaged, then recorded in the system memory together with the recording time.

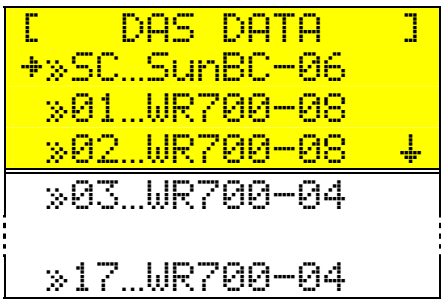


Fig. 4.10: Device selection screen

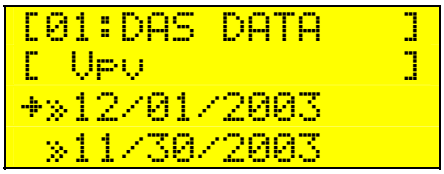
Press **[ENTER]** to select a device and display all of its recorded measuring channels.

[Device ID: archived data]

Fig. 4.11: Measuring channel selection screen

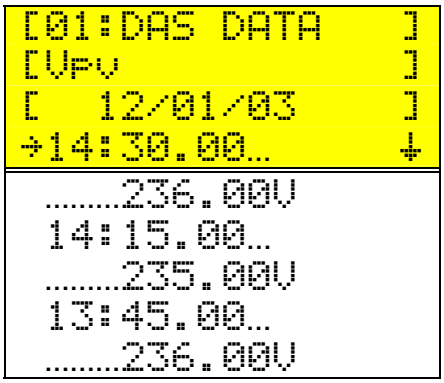
The next screen lists the days on which channel data has been archived.

For each day, the recorded values can be displayed together with their recording times.



[Device ID: archived data]
[Selected measuring channel]
← Selectable date

Fig. 4.12: Date selection screen

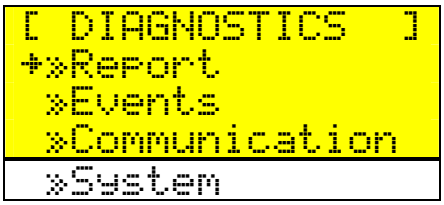


[Device ID: DAS DATA]
[Selected measuring channel]
[Selected date]
← Time at which measurement was recorded
← Value & unit

Fig. 4.13: Measuring data record

5 "Diagnostics" Function

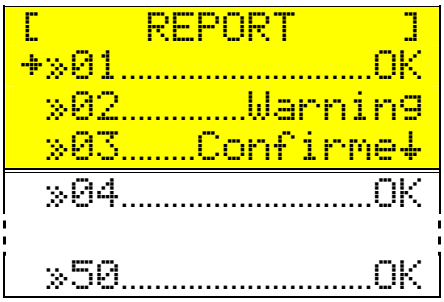
The "Diagnostics" function provides information on the status of the connected devices, enabling you to detect the cause for error messages generated by the Sunny Boy Control.



← System monitoring details — Section 5.1
← Status, warning, or error messages displayed — Section 5.2
← Analysis of the communication — Section 5.3
← Firmware version — Section 0

Fig. 5.1: "Diagnostics" menu

5.1 Report



← Device ID...device status/model/serial number
← There is a warning message for this device.
← User has acknowledged messages.
← There are no messages for this device.

Fig. 5.2: Diagnostic report selection screen

If a failure is reported for a device (Failures, Warning, Confirmed), press [**ENTER**] to select it. "Confirmed" refers to a failure that has already been acknowledged by the user.

Diagnostic Reports

The diagnostic report for a device divides the cause of a failure into the following categories: Communication, Access, Yield, and State.

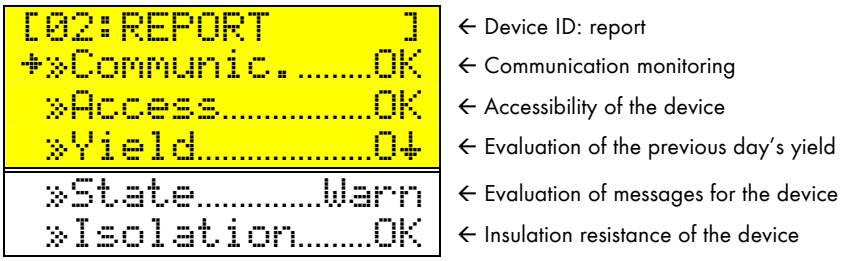
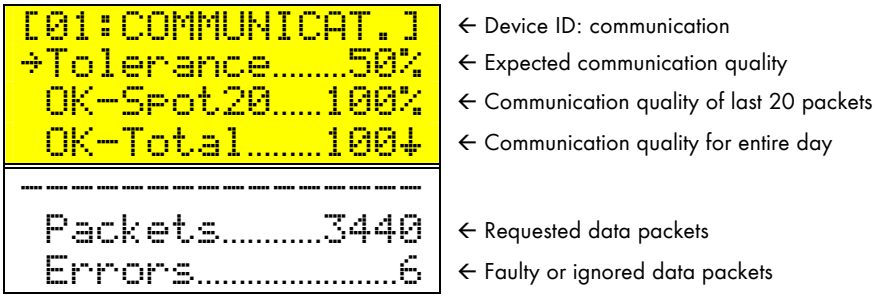


Fig. 5.3: Diagnostic report for a device

Press [**ENTER**] to make a selection and view further details as explained below.

Communication Details



Section 6.2.4

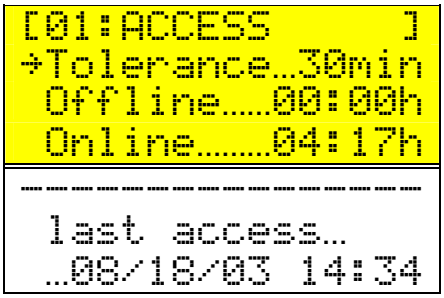
Fig. 5.4: Communication details from diagnostic report

"Tolerance" refers to the expected communication quality that was set under "Communication" in "Setup…System…Tolerances" (refer to section 6.2.4).

"OK-Spot20" evaluates the last 20 data packets. If the communication quality falls short of the set tolerance for longer than the tolerance for warning messages (15 minutes by default refer to section 6.2.4), the warning message "CommSpot20" will be generated.

"OK-total" evaluates the communication quality for the entire day. At least 100 data packets are required. The evaluation takes place at the end of the day. In case of a failure, the error message "Communication" is generated.

Access Details



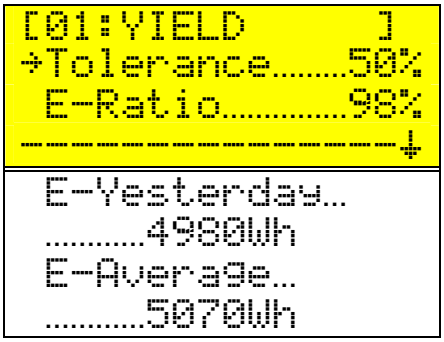
← Device ID: access
← Max. timespan during which a device cannot be accessed Section 6.2.4
← Has not been accessed for
← Operation time today
← Date & time of last access made to the device

Fig. 5.5: Access details from diagnostic report

If the "Offline" timespan (time since the device was last accessed during operation) exceeds the maximum amount set in the menu "Setup...System...Tolerances" (in other words, there is a communication failure), the "Offline" warning message is activated.

"Online" shows the operating time (availability) of the device since 12 a.m. (0:00). If a device cannot be contacted for a whole day (total communication failure), the error message "24h Offline" will be displayed.

Yield Details



← Device ID: yield
← Expected E-Ratio (refer to section 6.2.4)
← Percentage ratio between E-Yesterday and E-Average (see below)
← Energy yield of the device
← Average energy yield of a comparable device in the system

Fig. 5.6: Yield details from diagnostic report

"Tolerance" refers to the maximum error tolerance set under "Energy" in "Setup...System...Tolerances" (refer to section 6.2.4).

"E-Ratio" is derived from the values for "E-Yesterday" (previous-day energy yield of the device) and "E-Average" (previous-day mean energy yield of a compa-

rable device in the system). "E-Ratio" states the deviation percentage of "E-Yesterday" compared with "E-Average".

If "E-Ratio" falls short of the value stated for "Tolerance", the error message "Energy" is generated.

State Details

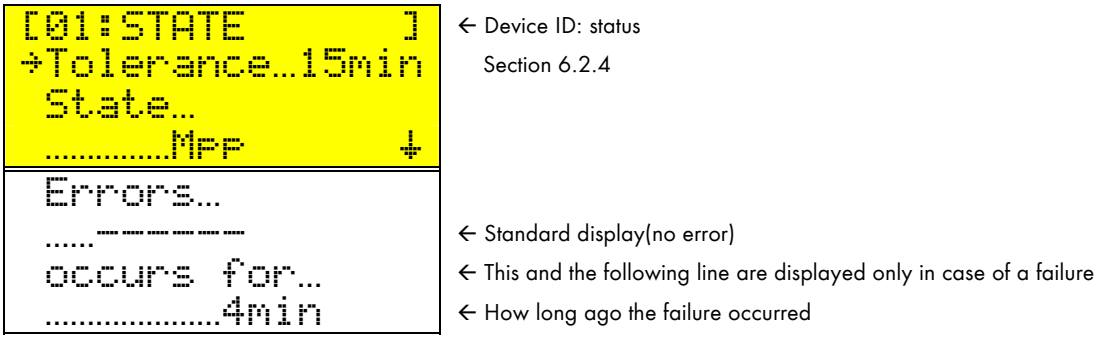


Fig. 5.7: State details from diagnostic report

"Tolerance" refers to the time span set under "Warnings" in "Setup…System…Tolerances" (refer to section 6.2.4). A warning message will be generated only if a failure lasts longer than this amount of time.

"State" and "Failures" show the current operating status of the device. If "Failures" deviates from the setting "-----" (no error), the time passed since the failure occurred is given below "occurs for". If "occurs for" exceeds the "Tolerance" value, the warning message "Device failure" is generated.

Insulation Details

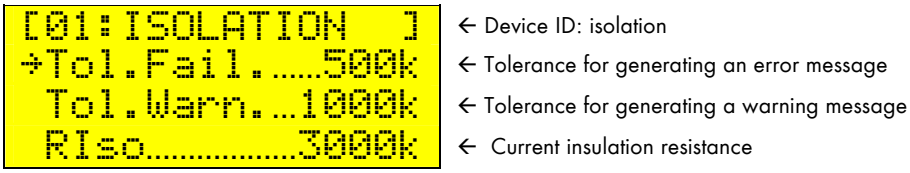


Fig. 5.21: Insulation details from diagnostic report

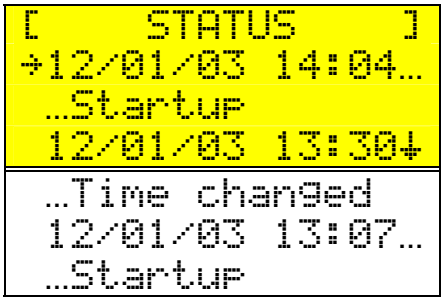
"RIso" refers to the current insulation resistance of the device. If the "RIso" value falls short of the value set for "Tol.Warn.", a warning message is generated; if it falls short of the value set for "Tol.Fail.", an error message is generated.

5.2 Events

The Sunny Boy Control logs various events together with their dates and times of occurrence. Events are categorized as "Status", "Warnings", and "Failures" (refer to Fig. 5.8: "Events" screen). Amongst others, the event log can be a useful troubleshooting tool.

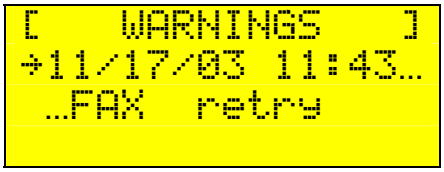
← Log of status messages generated
← Log of warning messages generated
← Log of error messages generated

Fig. 5.8: "Events" screen



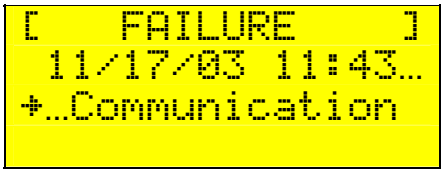
← Sunny Boy Control was unplugged/restarted
← Date/time was changed

Fig. 5.9: Status message log



← Fax transmission error

Fig. 5.10: Warning message log



← Communication error

Fig. 5.11: Error message log

When an event is preceded by a selection arrow, press **[ENTER]** to display the details for the event. Refer to section "9.1 Messages and Their Causes" for a list of details.

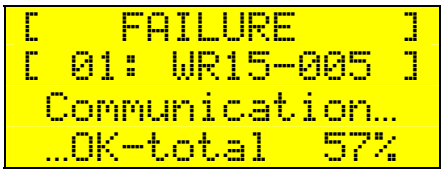


Fig. 5.12: Error message details

Press **[ESC]** to exit the event detail screen. Refer to Table 5.1: for a list of events.

Displayed message	Type of event	Explanation
System messages		
Startup	Status	Device was switched on/system was started up.
Time changed	Status	Time or date was changed by user.
Failure conf.	Status	User acknowledged error or warning message.
reset diagnosis	Status	Diagnostic data was manually reset.
System Reset	Warning	System was restarted after a failure.
Device-related messages		
Device Failure	Warning	Device reported a failure.
Yield	Error	Device yield is below tolerance.
Isolation Res.	Warning	Insulation resistance is low.
SAFETY! Iso.Res.	Error	Insulation resistance is too low.
Communication monitoring		
CommSpot20	Warning	Short interruption of communication
Offline	Warning	Device cannot be reached.
Communication	Error	Long interruption of communication
24h Offline	Error	Device could not be reached for at least 24 hours.
Fax/e-mail-related messages		
RI Plant-Info	Status	System information was sent.
RI Error/War.	Status	Error/warning report was sent.
RI Transmission	Warning	Transmission failed.
RI Transmission	Error	Transmission could not be initiated.
Monitoring messages (Sunny Boy Control Plus)		
Monitor. <MIN	Warning	Falling short of tolerance for warnings.
Monitor. >MAX	Warning	Exceeding tolerance for warnings.
Monitor. <MIN	Error	Falling short of tolerance for errors.
Monitor. >MAX	Error	Exceeding tolerance for errors.

Table 5.1: Event messages of the Sunny Boy Control

5.3 Communication Function

The "Communication" function is useful for diagnosing the communication with the Sunny Boy inverters and analyzing data transmission failures. First, press **[ENTER]** to select an inverter to be diagnosed.

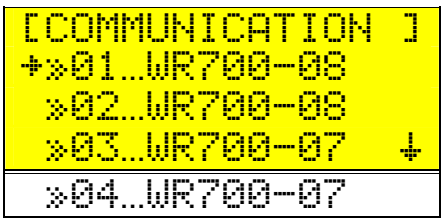


Fig. 5.13: Device selection screen

During the communication test the Sunny Boy Control interrupts its normal operation and instead sends data requests to the selected Sunny Boy. The test results are displayed as follows:

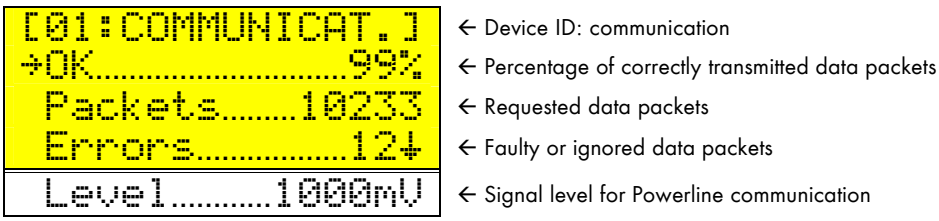
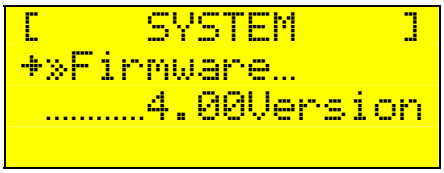


Fig. 5.14: Communication test

The continuously displayed information comprises the percentage of correctly transmitted packages (based on the last 20 data packets), the number of requested data packets, the number of errors, and (for Powerline communication only) the signal level.

5.4 System



← Version of firmware installed

Fig. 5.15: "System" screen

Description of the settings

The parameter "**Firmware**" indicates the current firmware version and cannot be adjusted.

6 Menu Functions for Configuration

The "Setup" menu contains numerous functions that are not usually necessary for the daily operation of the Sunny Boy Control.

Since configuration settings affect individual devices as well as the entire PV system, special care should be taken when making these settings.

To protect the system against unauthorized or unintended access (e.g., children), the "Setup" menu cannot be accessed as usual by simply pressing **[ENTER]**; a password must be entered.

To change system parameters of a device, the installer password must be entered. For less critical settings, the user password will be sufficient.

The normal operating mode of the Sunny Boy Control remains suspended until the "Setup" menu has been exited.

6.1 Password

Functions that affect the operation of the Sunny Boy Control are protected with the user password. (Refer also to section "6.2 User & Installer Passwords".)

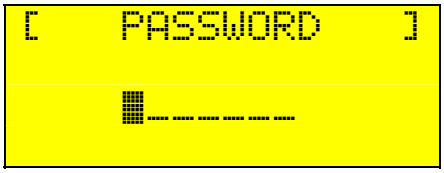
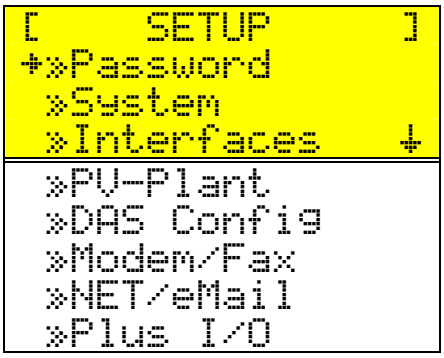


Fig. 6.1: Password input screen

More essential functions, which affect the operating safety and system configuration of the Sunny Boy Control, are protected by the installer password. After entering this password, it is also possible to set system parameters for each device. Note that certain changes to the operating parameters of a device may render the operating permission for the device invalid.

After entering either password, several sub-menus become available.



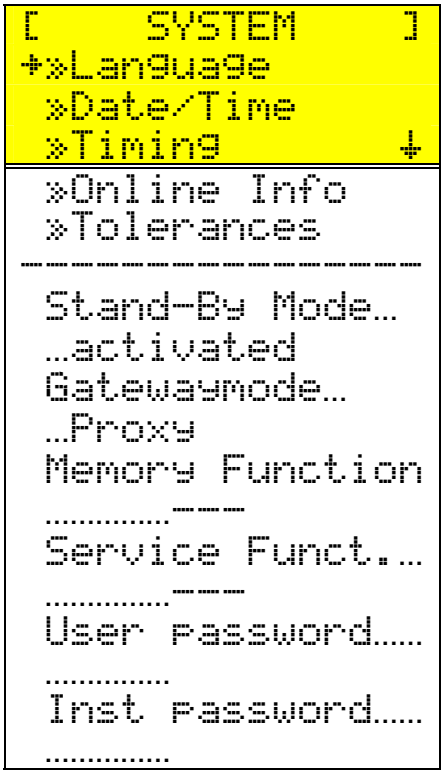
← User-defined password for accessing menu	See below.
← Language, date & time	Section 6.2
← Configuring the connectors	Section 6.3
← Detecting, registering & configuring devices	Section 7
← Turning data archiving on/off, selecting measuring channels	Section 6.5
← Configuring external modem & system info (optional)	Section 6.6
← Configuring internal modem & system info (optional)	Section 6.7
← Configuring the Plus functions	Section 6.3

Fig. 6.2: "Setup" menu

To lock the system again, call up the password protection function without entering a password. Otherwise, password protection will automatically resume at midnight or after a restart.

6.2 System

With the "SYSTEM" function, you can alter basic system settings of the Sunny Boy Control if necessary.



← Selecting the display language
← Setting the date & time
← Setting wait time and cycles — Section 6.2.2
← Configuring Online Info — Section 6.2.3
← Setting thresholds for generating messages — Section 6.2.4
← Activating/deactivating the stand-by mode
← (only with installer password)
← User password of your choice — Section 6.2.1
← Installer password of your choice — Section 6.2.1

Fig. 6.3: System settings

Description of the settings

The "Stand-By Mode" can be activated and deactivated.

The "Gatewaymode" function of the Sunny Boy Control can be set as follows:

- Proxy: Inquiries from Sunny Data Control are answered directly. No packets are forwarded to the connected devices.
- transparent: Data acquisition by the Sunny Boy Control is stopped. Packets from the PC are always forwarded directly to the connected devices.

The "Memory Function" of the Sunny Boy Control allows you to:

- save parameter settings ("save parameter")
- reset parameters to their factory defaults ("Default Param.")
- reset measuring channels to their factory defaults ("Default MesCh")
- reset "Online-Info" to its factory defaults ("Default O.Info")

With the installer function "Service Funct." of the Sunny Boy Control, you can:

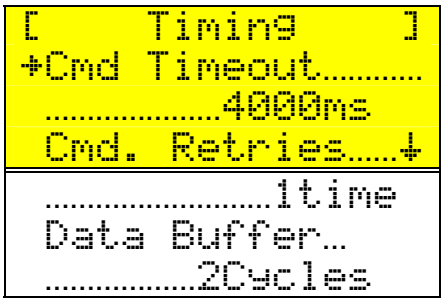
- delete archived measuring data ("del Meas.Data")
- delete archived daily energy yield data ("del Daily Val.")
- remove channel information from the devices ("del Chan.Infos")
- reset error counters and operating data ("reset op.data")
- reset the error counters only ("reset errors")
- reset the device to its factory condition ("reset system")

6.2.1 User and Installer Passwords

With the function "User password" of the Sunny Boy Control, you can set the user password.

With the function "Inst password" of the Sunny Boy Control, you can set the installer password.

6.2.2 Timing



← Max.timespan waiting for an answer from a device

← Number of packet repeats in case of an error

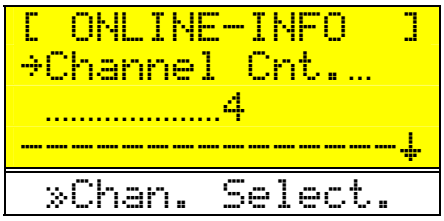
← Number of cycles for buffering the measuring data.

Fig. 6.4: Setting the timing

These parameters are tuned to work ideally with PV systems comprised of Sunny Boy inverters. For configurations that better suit Sunny Team or Sunny Island systems, refer to the corresponding user manuals.

6.2.3 Online Info

The "**Channel Cnt.**" information in the "**ONLINE-INFO**" menu tells you the total number of channels that appear in the Online Info (refer to section 4.2).

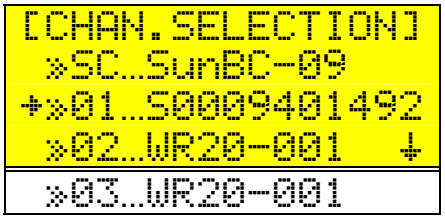


← Number of channels displayed in Online Info

← Selection of channels (see below)

Fig. 6.5: Configuring "Online-Info"

To configure "Online-Info", select the menu item "**Chan. Selct.**", and then press **[ENTER]** to confirm. You will obtain a list of all registered devices.

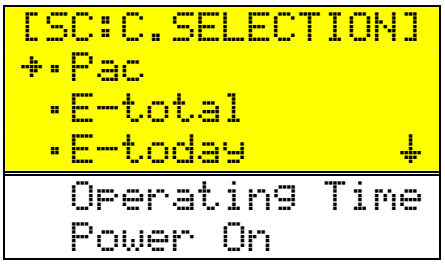


List of available devices

← Serial number or model of the device

Fig. 6.6: Selection of devices and channels

Press **[↑]** or **[↓]** to select the desired device. Every two seconds, the currently selected line also displays the serial number of the selected device. Press **[ENTER]** to display the channel list for the device.



[Device: Channel selection]

← Currently marked channel

← Currently marked channel

← Currently marked channel

↓ There are more channels further down.

Fig. 6.7: Selection of channels

Channels that are being displayed in "Online-Info" are marked with a point. To mark or unmark a channel, press **[↑]** or **[↓]** to move to the desired line, and then press **[ENTER]** to make the change.

As usual, press **[ESC]** to return to the higher-level menus. Any changes made will be saved only after confirming the query that appears when leaving the "ONLINE-INFO" menu.

6.2.4 Tolerances

In the "TOLERANCES" menu, you can set the thresholds that will cause the Sunny Boy Control to generate messages for a device (refer to section "6.3.3 Alarm Contact").

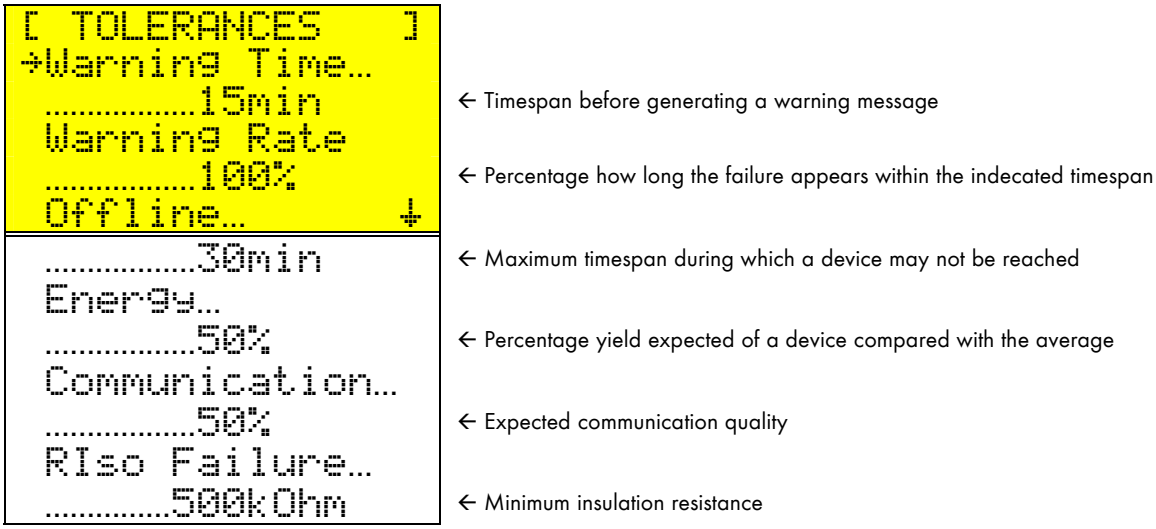


Fig. 6.8: Adjusting tolerances

Once a warning or error message has been generated for a device, you can use the diagnostic functions to troubleshoot the problem (refer to section 5).

The time value under "Warnings" indicates how long a failure must be present before the Sunny Boy Control generates a warning message.

The time value under "Offline" indicates how long in a day a device may not be accessible during operating hours (i.e., between the time the device was switched on and the time the last device is switched off). The smallest offline setting is 15 minutes.

The percentage under "Energy" indicates the minimum daily energy yield expected of a device compared with the average of all other similar devices. Since the daily energy data of the system becomes available only at the end of the day, this comparison can take place only at that time. If the daily energy yield of the device falls short of the set percentage, an error message will be generated for the device. This allows you to check whether the devices are operating well enough. It is advisable not to set the energy tolerance percentage too high, since deviations in the yield of arrays placed in different locations are normal. To obtain meaningful energy yield comparisons, the compared devices must be of the same type.

If you do not wish to monitor the energy yield of a device and want to avoid receiving error messages, set the "Energy" tolerance to 0 %.

Example of daily energy yield comparison

This system comprises 4 devices, and the energy tolerance is set to 90 %.

Device	Yield	Message	Comment
A	2.2 kWh	None	Device operating normally
B	1.7 kWh	Error	Yield below tolerance → Warning message
C	0 kWh	Offline	Device not operating → Error message
D	2.1 kWh	None	Device operating normally
System	6.0 kWh		
Average	2.0 kWh		Average device yield
Tolerance	1.8 kWh		Minimum yield expected of a device to avoid error message

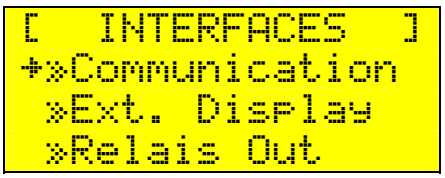
Average: 2.0 kWh
Tolerance: 90 %
=> Minimum energy yield: 1.8 kWh

Devices that have not yielded any energy by the end of the day are not taken into account when the average is computed.

The percentage under "Communication" indicates the expected minimum ratio of data packets that must have been transmitted successfully.

The value under "RIso Failure" indicates the required minimum insulation resistance, short of which an error message is generated.

6.3 Interfaces



Section 6.3.1
Section 6.3.2
Section 6.3.3

Fig. 6.9: "Interfaces" menu

6.3.1 Communication

The installed interfaces are automatically detected and can be checked under "COM1:Sunny Boy" ("SUNNY BOY" connector) and "COM2:PC" ("PC COM2" connector).

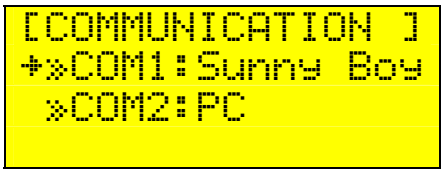


Fig. 6.10: Interface options

Powerline communication with the inverters via the COM1 port is limited to 1,200 baud. With an RS232 connection via the COM2 port, the baud rate can be manually adjusted to as much as 19,200 baud.

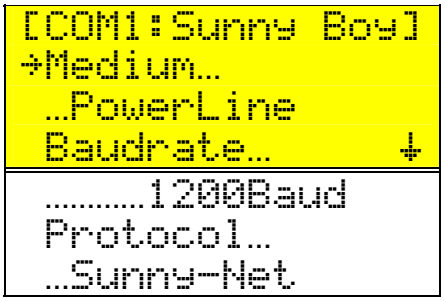


Fig. 6.11: COM1/Sunny Boy interface screen

6.3.2 External Display

Connecting an external display to the Sunny Boy Control is typically not a problem. The Sunny Boy Control is preset at the factory to support the following types of displays.

- HvG
- Siebert
- EnergieCom
- DATALITE
- ASCII-Text (for customized applications)
- Adaptive Micro Systems

Although the Sunny Boy Control can normally be configured for any commercially available type of display, we recommend that you consult with the Sunny Boy Hotline before making a purchase.

A number of quick installation guides for the most popular displays are available on our website www.SMA.de or www.SMA-America.com.

6.3.3 Relais Out

The "RELAIS OUT" menu allows you to select the desired relay contact, whose operation can then be configured.

Alarm Contact

The alarm contact can be used to activate an external signaling device such as a light or horn upon occurrence of an error message.

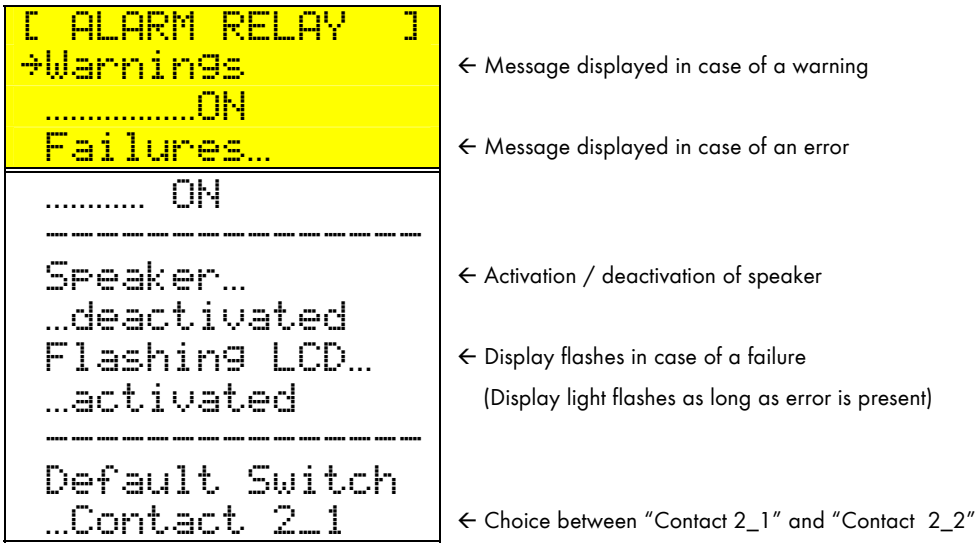


Fig. 6.12: Alarm contact screen

The alarm contact can be set to switch triggered by an error or warning message. The Sunny Boy Control's beeper can be activated in addition to the alarm contact. The beeper will be activated even if no external signaling device is connected to the alarm contact.

Switching Contact

The switching contact is used to control loads according to the current irradiation.

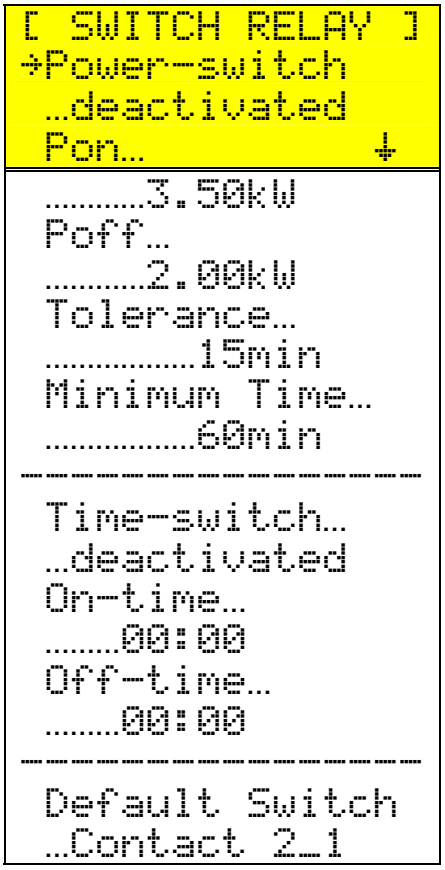


Fig. 6.13: Switching contact screen

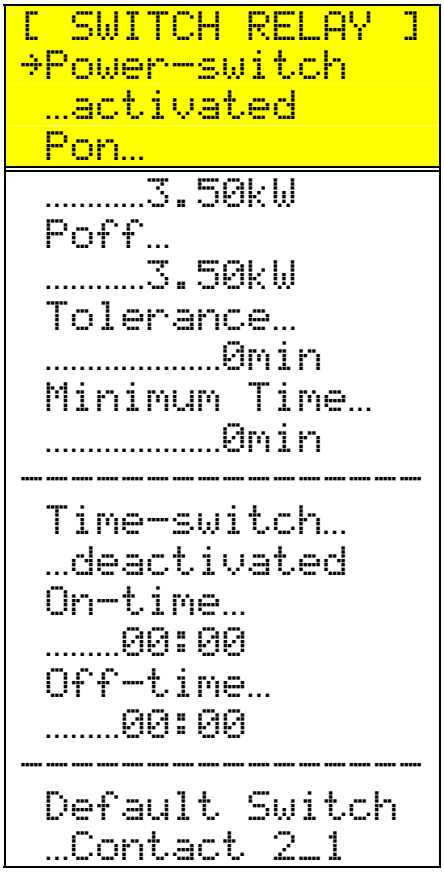
The power management function allows you to switch a load on and off based on the operating condition of the PV system. If the total system power can be sustained at a level set under "**Pon**" for a period of time set under "**Tolerance**", the load will be switched on until the power drops to a level set under "**Poff**" for the period of time set under "**Tolerance**". In any case, the load will remain switched on at least as long as set under "**Minimum Time**" (this may, for example, correspond to the duration of a washing machine cycle).

Like a timer, the time management function "**Time-switch**" switches the load on at a time set under "**On-time**" and off at a time set under "**Off-time**".

If **both** the power management **and** the time management functions are activated, priority will be given to the power management, and time management will occur **only if** the power-managed event **never** occurred.

For details on the pin assignment for the switching contact, refer to section 3.5.

Example of a water pump setup



← Switching on if output above 3.5 kW

← Switching off if output below 3.5 kW

← Switching on as soon as power output exceeds Pon

← Switching off as soon as power output falls short of Poff

← Choice between "Contact 2_1" and "Contact 2_2"

Fig. 6.14: Water pump example

In this example, the water pump will be witched on as soon as ("**Tolerance**" = 0 minutes) the system power exceeds 3.5 kW (as set under "**Pon**"), and it will be switched off as soon as the system power falls short of this value (as set under "**Poff**").

Example of a washing machine setup

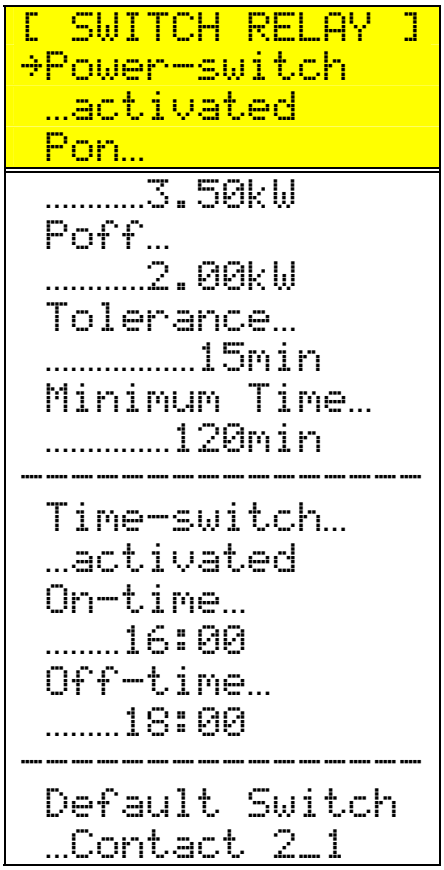


Fig. 6.15: Washing machine example

The washing machine will be switched on as soon as the system has produced 3.5 kW (Pon) for at least 15 minutes, and it will remain switched on until the system power drops below 2 kW (Poff). In any case, the machine will remain switched on for at least 120 minutes, so that the wash cycle can be completed. If "Pon" (3.5 kW) could not be reached by 4 PM, the washing machine will anyway be switched on at 4 PM, then switched off at 6 PM.

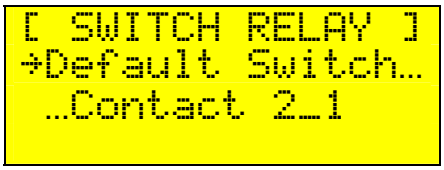
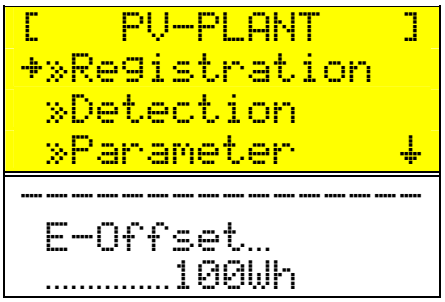


Fig. 6.16: Switching-contact screen

6.4 PV-Plant

The following menu items can only be edited after entering the installer password.



Section 6.4.1
Section 6.4.2
Section 6.4.3
see below

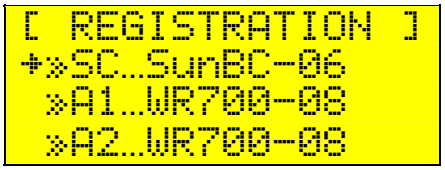
Fig. 6.17: "PV-Plant" menu

Energy Offset

To offset differences between the readings of energy counters (for example, after replacing a counter), the "**E-Offset.**" value can be added to the value computed by the Sunny Boy Control.

6.4.1 Registration

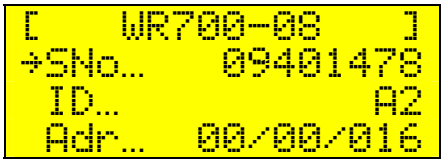
The device registration screen displays all detected devices with their ID and model information.



← Device ID, model or serial number

Fig. 6.18: Registration screen

To display detailed information on a device, such as its ID, network address, etc., select the device and then press **[ENTER]**.



[Device model]
← Serial number
← Device ID
← (Bus address/string address/device address)

Fig. 6.19: Device ID & network address

While a device's network address is unique and serves the purpose of identifying the device on the network, its ID can be freely assigned and serves the sole purpose of identifying the device in the menu structure of the Sunny Boy Control.

Device ID

To change the ID or the network address automatically assigned to a device by the Sunny Boy Control, select the item, and then press **[ENTER]**; next, press **[↑]** or **[↓]** to change the setting, then **[ENTER]** after each character.

Choosing meaningful device IDs will help identify the devices in the menus of the Sunny Boy Control (refer to Fig. 6.18). "UL", for example could stand for "upper left" or "A1" for "device 1 in area A". In addition, it could be useful to label the devices accordingly.

Note that the device ID "SC" is reserved for the Sunny Boy Control.

Special device ID "99"

To remove a device from the registration (for example, in order to replace it with another one), change its ID to "99". The device will be removed after confirmation.

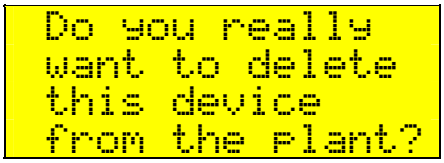


Fig. 6.20: Device removal confirmation

Removing a device by giving it the ID "99" causes all of its data to be lost.

Network address

Each device in a network must have a unique address, consisting of a bus address (0–15), a string address (0–15), and a device address (0–255).

Bus and string addresses

All devices in the system share the same bus and string addresses, which can be changed for all devices simultaneously by changing them for the Sunny Boy Control (select "SC" in Fig. 6.18). The default bus and string addresses are "00/00". Changing the bus and string addresses is only necessary in the following cases.

- Interference from a neighboring PV system

  If you detect units from other systems in the neighborhood, you should change the bus address of your system to make identification of your devices easier and avoid interference from the other systems.

- Managing a large system

  If your PV system consists of several strings controlled by several Sunny Boy Controls, each string must have a different address.

Device address

Each device in your system must have a unique device address to prevent confusion and data errors. During device detection, the Sunny Boy Control automatically assigns device addresses while trying to preserve previously assigned addresses. If a new device has the same address as another registered device, the new device is assigned a different address.

6.4.2 Detection

While the Sunny Boy Control automatically detects all accessible devices, it informs you of the progress made.

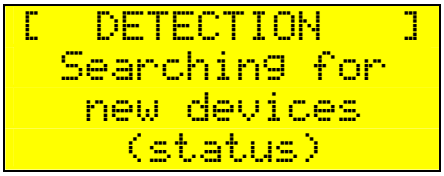


Fig. 6.21: Sunny Boy Control searching for new devices

After the detection process is completed, each device found by the Sunny Boy Control is displayed as follows in sequence.

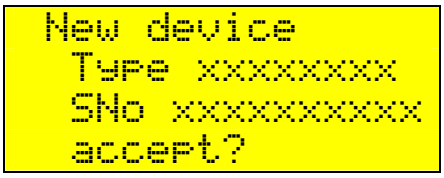


Fig. 6.22: New device found by Sunny Boy Control

Compare the serial numbers of the detected devices with the actual serial numbers of your devices (it is useful to make a list of these for reference). Press [**ENTER**] to register a listed device or [**ESC**] to remove it from the list**.**

Eventually the Sunny Boy Control asks you to confirm if all devices were found or whether the search should be repeated.

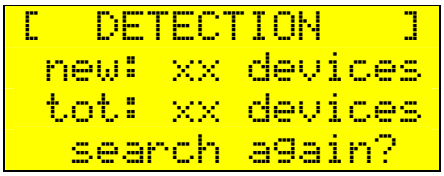


Fig. 6.23: Search result

Press [**ENTER**] to run another search. It is possible that the Sunny Boy Control does not immediately find all devices. If several search attempts are unsuccessful, check whether the missing devices are correctly installed. If the Sunny Boy Control does not detect a device after several searches, refer to "Transmission Problems" in section 9.2.

Press **[ESC]** to complete the search.

If new devices were detected, you will be prompted to confirm the new configuration.

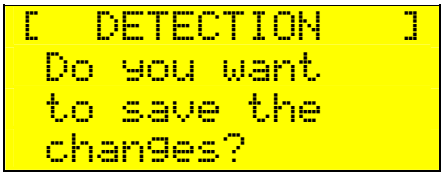
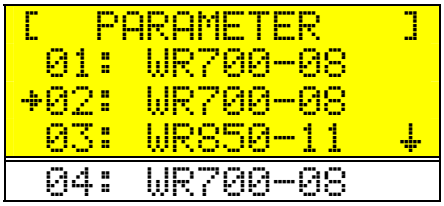


Fig. 6.24: Confirmation screen

Press [**ESC**] to cancel the configuration or [**ENTER**] to confirm it.

6.4.3 Parameter

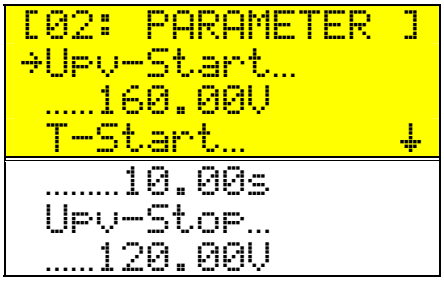
The "PARAMETER" function is used to change the default operating parameters of the connected inverters. First, select a device in the usual way.



← Device ID: device model

Fig. 6.25: Device selection screen

Sample Parameter List



← Device ID: parameter

Fig. 6.26: Parameter screen

The parameters available for the device are displayed. Press [↑] or [↓] to scroll through the different parameters. Press [**ENTER**] to select the parameter to be edited. For increased safety, the parameters can only be changed after the installer password has been entered.

Note that certain changes to the operating parameters of a device may render the operating permission for the device invalid.

6.4.4 Adding a New Device

To add a new device to an existing system, proceed as follows:

- Install the device.
- Start the device detection (Setup…PV-Plant…Detection). The new device's serial number appears on the display.
- When prompted to confirm the new device, press [**ENTER**] to add it to the system.

If the new device is not found during detection, check the cables and connections.

6.4.5 Removing a Device

To remove a device from the system, give it the ID "99" under "Setup…PV-Plant…Registration".

6.5 Data Archive (DAS Config)

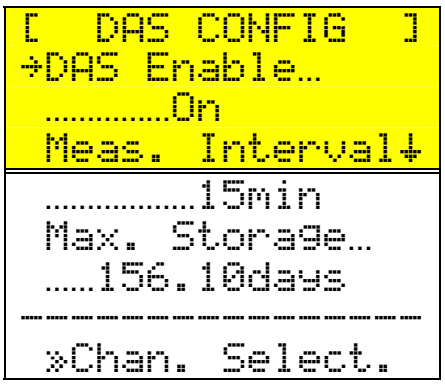
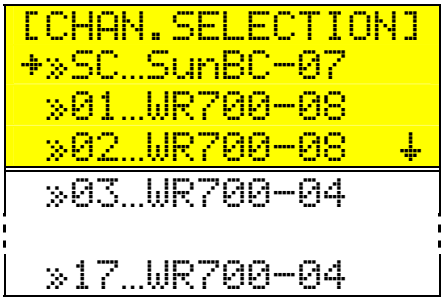


Fig. 6.27: Data archive menu "DAS Config"

If "**DAS Enable**" is set to "**Off**", no data will be archived. If set to "**On**", system data will be archived provided communication with the system is possible. If set to "Permanent", data will be archived continuously, even at night or when no device can be reached. "**Meas. Interval**" sets the measuring interval (i.e., the period of time for which measured values are averaged). The measuring interval can be set between 0 and 240 minutes. If set to 0, the spot values are stored without averaging. The minimum storage time is 5 – 60 seconds, depending on the number of connected devices. "**Max. Storage**" indicates for how long data can be stored in the memory before the oldest data will be overwritten. This value depends on the measuring interval, the number of selected channels, and the number of inverters.

Channel Selection

Measuring channels are the data channels that are selected for storage. Any data channel can be made a measuring channel. The Sunny Boy Control's default measuring channels for each device are a good selection, suitable for most applications. However, you can modify the default setting to match your requirements.



← Device ID...device model

Fig. 6.28: Device selection screen

Press **[ENTER]** to select a device and display all of its available measuring channels.

[Device ID: Channel selection]

← Measuring channel marked with a point

Fig. 6.29: Measuring channel selection screen

The measuring channels (i.e., channels selected for storage) are marked with a point. Press [ENTER] to select or deselect a channel for storage. The Sunny Boy Control can manage up to 250 channels spread freely over all of the connected devices. To obtain the best storage depth, keep the number of measuring channels as low as possible. Refer to section 9.2 for details on the storage capacity of the Sunny Boy Control.

The data archive is not affected by changes in the selection of measuring channels. When leaving the data archive function, you will be asked to confirm any changes.

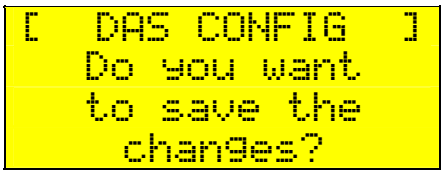
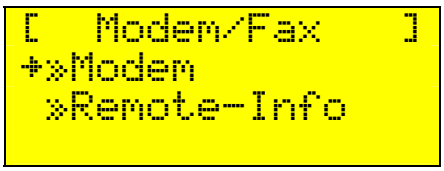


Fig. 6.30: Confirming the measuring channel configuration

6.6 Modem/Fax



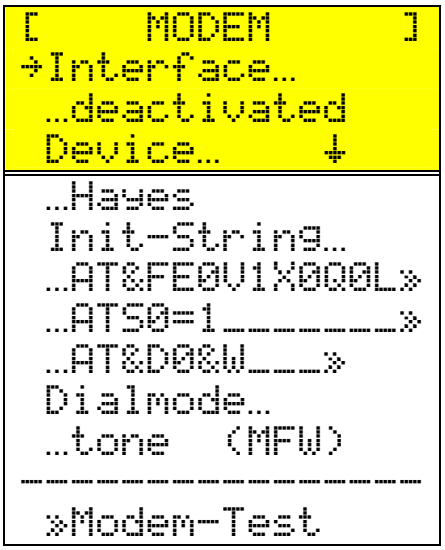
← Remote Info configuration Section 6.6.2

Fig. 6.31: Modem/Fax menu

6.6.1 Modem

About one minute after being switched on, the Sunny Boy Control automatically recognizes any modem connected to the "PC (COM2)" port. The following modem states can be displayed.

Deactivated	→	No interface selected .
Waiting	→	Wait 5 minutes for the next trial.
Searching	→	Modem is being initialized.
Operating	→	Modem was successfully initialized.
Error	→	Modem could not be initialized.



← Interface selection or modem deactivation

← Selected modem

← Modem-specific sequence

← Modem-specific sequence

← Modem-specific sequence

← Dial mode

← Modem test function (see below)

Fig. 6.32: Modem configuration screen

Theoretically, all modems support the default Hayes init string. After selecting the modem type, the init string is automatically adjusted. If necessary, select "**user definded**" to be able to modify the init string to suit a particular modem. Be sure to edit the init string very carefully, otherwise the modem initialization or data transmission may fail. In the case of older telephone systems, "**Dialmode**" can be changed from "**tone (MFW)**" to "**pulse (IWF)**".

With Siemens GSM modems, the PIN in the third init string needs to be adjusted. For better reception, it is recommended to connect a directional antenna.

Running the modem test (refer to Fig. 6.33: Modem test result) will check the init strings and make sure that the ringing tone is recognized. Modems with an unreliable ringing tone recognition will produce an "ERROR". Ringing tone recognition is irrelevant for remote data transmission. For testing fax transmission, use the "**Test-FAX**" function (refer to section "6.6.2 Remote Info").

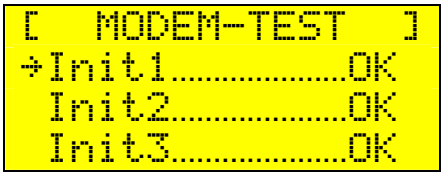


Fig. 6.33: Modem test result

In the case of an ISDN connection, the best results can be obtained with a configuration that uses the "multifunctional" setting. According to the ISDN modem manufacturer the MSN has to be entered and saved in the third AT sequence.

6.6.2 Remote Info

E-mail

Under "Remote-Info", Sunny Boy Controls equipped with a built-in NET Piggy-Back can be configured to send messages by e-mail. This will be described in a separate document.

Fax

The Sunny Boy Control can be configured to automatically send messages by fax. This requires that an external fax modem is connected to the "PC COM2" connector and to a phone line. For details on how to connect a modem, refer to section 3.3.

Remote fax transmission is activated or deactivated under "FAX-Info".

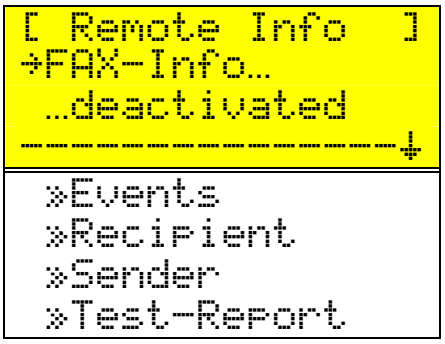


Fig. 6.34: Remote Info screen

Events

The following fax messages can be sent.

- Plant-Info: Report on system energy yields
- Errors/Warnings: Report on error and warning messages generated

Error and warning messages are always transmitted in one single report. If the warnings are set to "daily report" und errors to "hourly report", an hourly report of all errors and warnings that occurred until then will be faxed on the hour following the occurrence of an error. If only a warning occurs, a daily report will be faxed according to the time set under "**send up from**".

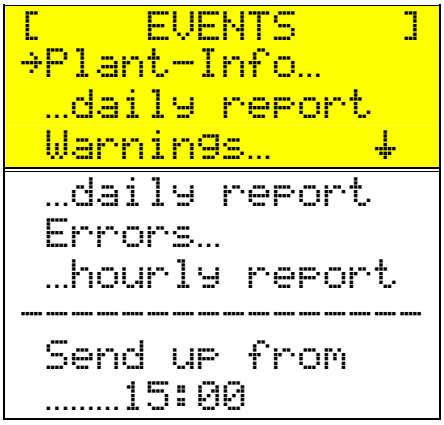


Fig. 6.35: Event configuration screen

Recipient

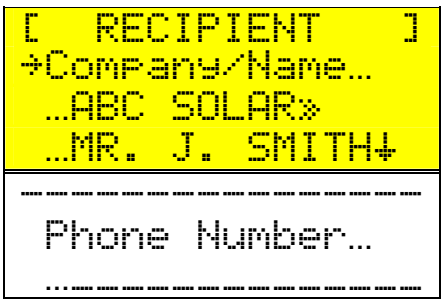
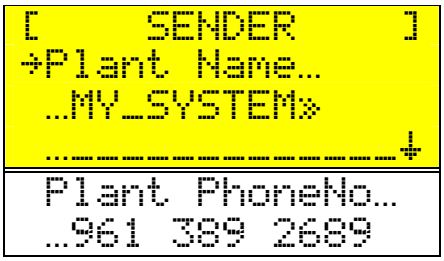


Fig. 6.36: Recipient configuration screen

Use the "Company/Name" information to make sure that the fax is being sent to the appropriate recipient. You are free to enter other relevant information instead of the names of a company and person. Enter the recipient's fax number under "Phone Number". Enter numbers as you would on a phone or fax machine, including area code etc. Entering "," will generate a dialing pause.

Sender



← Sender's fax number, appears in fax header

Fig. 6.37: Sender configuration screen

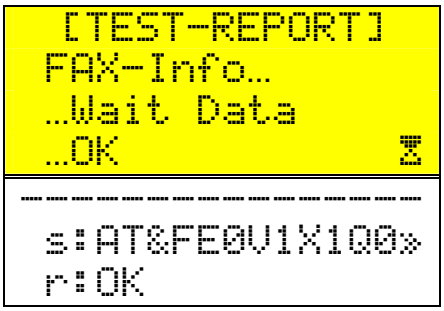
The report uses the "Plant Name" as the sender. This helps identify the systems when faxing information from several systems. The system phone number appears in the fax header, but it has no further function.

Test Report

Fig. 6.38: Sending a test message

Sending a test report can be useful in checking the configuration.

If the test report could not be transmitted, check if the modem is properly configured and whether the modem accepts the init string. You can also press **[↓]** to view the log of the sent and received sequences.



...Init Com, ...Init Modem, ...Init FAX, ...Dial, ...Send...

← If OK or ERROR is displayed, [⧗] displays the sent & received log.

← Sent sequence

← Received sequence

Fig. 6.39: Sending a test fax

The following is a sample test report.

04/01/1998 16:15 +49 561 9522422 => 295 01/01

Sunny Boy Control FAX-Information

FROM : MY PLANT

TO : XYZ-SOLARTEC
MR. SUNSHINE

D A I L Y R E P O R T 04/01/1998

P L A N T - I N F O :

ID	DEVICE	SERIAL NO.	ENERGY	ONLINE
SC	SunBC-06	0100420118	4.33kWh	
03	WR1500-2	0000404879	1.93kWh	09:24h
04	WR1500-2	0000404866	2.40kWh	09:25h

END OF FAX-INFORMATION

Fig. 6.40: Sample test report fax

If several transmission trials fail, check the entire configuration.

Sample Fax: Error/Warning Report Fax

04/02/1998 12:00 +49 561 9522422 => 295 01/01

Sunny Boy Control FAX-Information

FROM : MY PLANT

TO : XYZ-SOLARTEC
MR. SUNSHINE

H O U R L Y R E P O R T 04/02/1998 12:00

E R R O R S :

ID	DEVICE	SERIAL NO.	DATE	TIME	MESSAGE
04	WR1500-2	0000404866	04/02/98	11:43	TOLERANCE COMMUNICATION 99%
03	WR1500-2	0000404879	04/02/98	11:44	ENERGY VALUE 88%

W A R N I N G S :

ID	DEVICE	SERIAL NO.	DATE	TIME	MESSAGE
04	WR1500-2	0000404866	04/01/98	12:14	NO CONTACT SINCE 11:14
03	WR1500-2	0000404879	04/01/98	18:11	TOLERANCE COMMUNICATION SPOT20 80%
03	WR1500-2	0000404879	04/01/98	18:12	NO CONTACT SINCE 18:09
03	WR1500-2	0000404879	04/01/98	18:31	TOLERANCE COMMUNICATION SPOT20 80%
03	WR1500-2	0000404879	04/01/98	18:36	NO CONTACT SINCE 18:33
03	WR1500-2	0000404879	04/01/98	18:43	NO CONTACT SINCE 18:40
03	WR1500-2	0000404879	04/01/98	18:51	TOLERANCE COMMUNICATION SPOT20 35%
03	WR1500-2	0000404879	04/01/98	18:57	NO CONTACT SINCE 18:53
03	WR1500-2	0000404879	04/01/98	19:18	TOLERANCE COMMUNICATION SPOT20 75%

END OF FAX-INFORMATION

Fig. 6.41: Sample error/warning report fax

Sample Plant Info Fax

04/01/1998 16:15 +49 561 9522422 => 295 01/01

Sunny Boy Control FAX-Information

FROM : MY PLANT

TO : XYZ-SOLARTEC
MR. SUNSHINE

D A I L Y R E P O R T 04/01/1998

P L A N T - I N F O :

ID	DEVICE	SERIAL NO.	ENERGY	ONLINE
SC	SunBC-06	0100420118	4.33kWh	
03	WR1500-2	0000404879	1.93kWh	09:24h
04	WR1500-2	0000404866	2.40kWh	09:25h

END OF FAX-INFORMATION

Fig. 6.42: Sample plant info fax

6.7 NET/E-mail

To configure the NET/Email function, refer to the NET Piggy-Back manual (NETPB-11:EE).

7 Sunny Boy Control Plus

This chapter deals with the additional connection possibilities offered by the Sunny Boy Control Plus: AUX, DIGITAL IN/OUT, and ANALOG IN. The added monitoring capabilities are described using examples. The configuration can be either hardware-based (done on the Sunny Boy Control Plus itself) or software-based (done using the Sunny Data Control software). Both methods are also explained using examples.

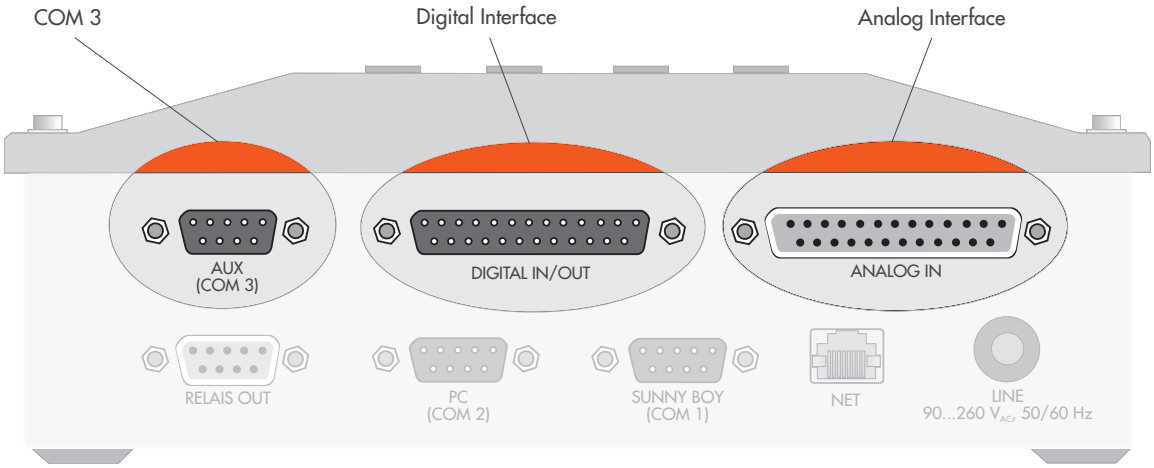


Fig. 7.1: Analog, digital, and COM3 connectors

Hardware-Based Configuration

To configure the connectors on the Sunny Boy Control Plus itself, use the menu "Setup…Interfaces".

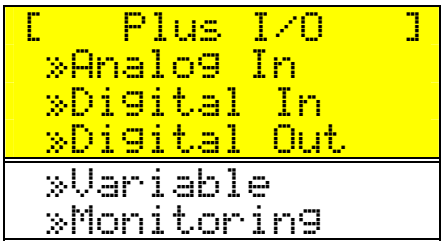


Fig. 7.2: Configuring the analog and digital interfaces

When leaving the "Plus I/O" menu, the changes made are saved after confirmation. When the analog, digital, variable, or monitoring channels are changed, the device generates a new channel description, which can be recognized by a change of the device model information (e.g., from "SBC+a4Eb" to "SBC+a4Ec").

Software-Based Configuration

The Sunny Boy Control Plus can also be configured using the Sunny Data Control software.

Parameter		
Channel	**Value**	**Description**
+a_SET Choice	–	Selecting the channel to be changed
+b_SET Help	Select with…	Help messages for different input options
+c_SET Value	–	Displaying the current setting for the selected channel
+d_SET Plus-Function	–	"store", "undo", "Profile 1-2"

Table 7.1: Configuration using Sunny Data Control

Making long character entries, such as channel names, can be much easier from a PC. The entire configuration consists of the four parameter channels shown in the above figure. The changes made must be saved using the option "store" from the "+Set Function".

7.1 Serial Connector "AUX (COM3)"

"AUX (COM3)" is the third communication port of the Sunny Boy Control Plus. As opposed to the "PC (COM2)" port. An external display or a PC can be connected here using an RS232 or RS485 cable (depending on the Piggy-Back installed).

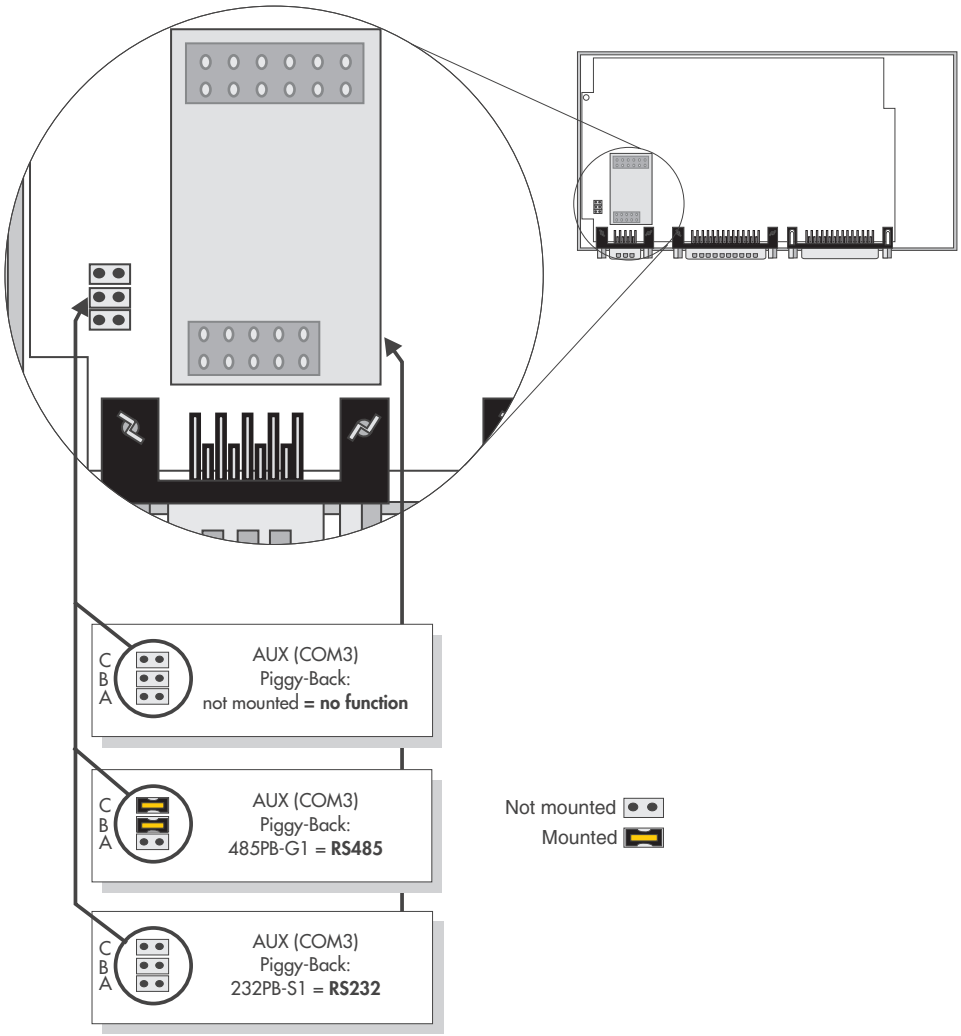


Fig. 7.3: Jumper configurations for the "AUX (COM3)" port (internal)

For the COM3 port, jumpers A, B, and C are in the opposite order of what they are for the COM1 and COM2 ports!

Jumper A: Termination of the RS485 cable. The data cable must be terminated on both ends by either setting jumper A or bridging pins 7 and 9 of the connector. The required resistance is 120 Ω. The default setting is "not terminated".

Jumpers B and C: Pull-up/pull-down resistances for the RS485 signal. The RS485 pull-up/pull-down resistances are achieved by either setting jumpers B and C on the Sunny Boy Control or using a cable plug with integrated resistors. The required resistances are 680 Ω. The default setting is "pull-up/pull-down activated". Only one device on the RS485 bus needs to provide the pull-up/pull-down resistances.

7.2 "ANALOG IN" Connector

For analog data acquisition, the Sunny Boy Control Plus offers a total of eight analog input channels, two of which are configured for temperature sensing. The optional SBCOP-ANA-KIT is a DB25 adapter to be connected to the "ANALOG IN" port and providing a terminal strip that greatly simplifies the installation and connections (refer to the quick installation guide "SBCOP-Ana-Kit-11:CD").

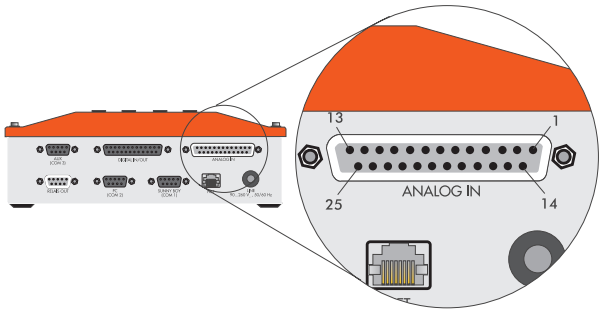


Fig. 7.4: "ANALOG IN" connector

Pin Assignment

Pin	Signal	Description	Pin	Signal	Description
1	AIN-1	Input	14	AGND	Ground
2	AIN-1B	For measuring current	15	AGND	Ground
3	AIN-2	Input	16	AGND	Ground
4	AIN-2B	For measuring current	17	AGND	Ground
5	AIN-3	Input	18	AGND	Ground
6	AIN-4	Input	19	AGND	Ground
7	AIN-5	Input	20	AIN-7-	PT100 input V-
8	AIN-6	Input	21	AIN-8-	PT100 input V-
9	AIN-7+	PT100 input V+	22	PT100-I1-	Power source I-
10	AIN-8+	PT100 input V+	23	PT100-I2-	Power source I-
11	PT100-I1+	Power source I+	24	AGND	Ground
12	PT100-I2+	Power source I+	25	N.C.	Not connected
13	N.C.	Not connected			

Table 7.2: Pin assignment for "ANALOG IN" connector

7.2.1 Analog Input Channels AIN-1–AIN-6

The analog input channels AIN-1–AIN-6 have eight variable-voltage inputs ranging between ±10 mV and ± 10 V at ±20 mA.

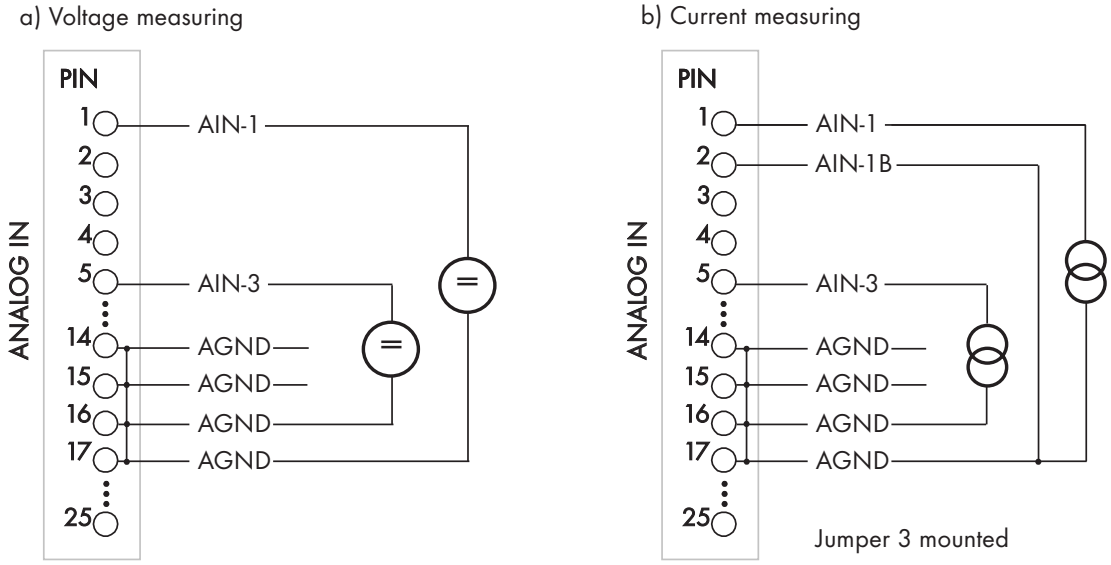


Fig. 7.5: Analog input connection examples

Connecting AIN-1 and AIN-2 to AGND configures these two channels for measuring current without having to open the device. To be able to use channels AIN-3 – AIN-6 in the same way, the device must be opened and jumpers installed inside.

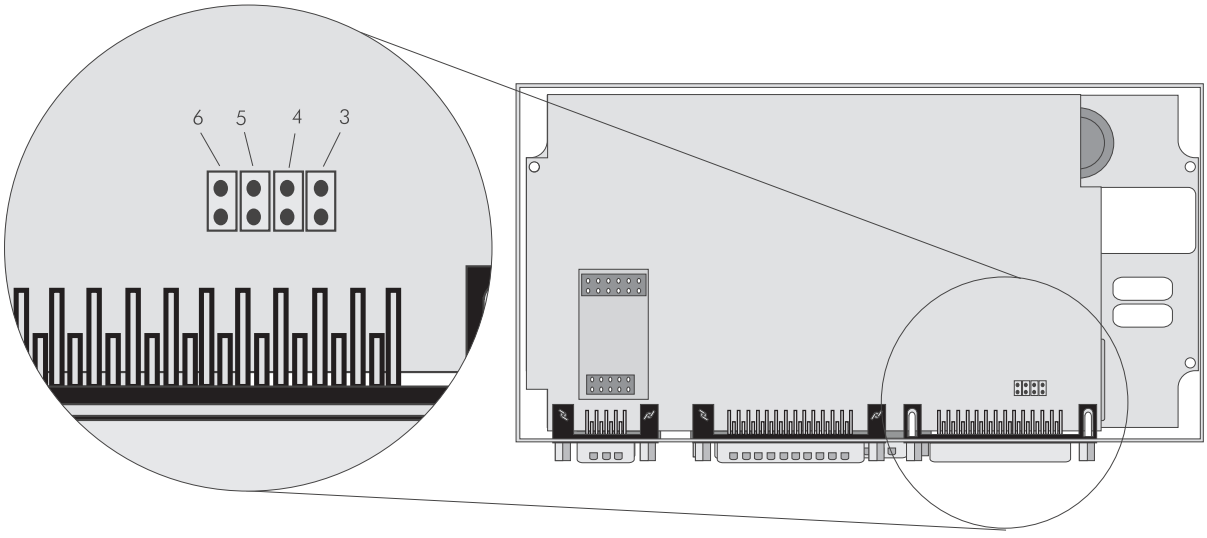


Fig. 7.6: Jumper configuration for measuring current

Hardware-Based Configuration

The analog input channels are activated by selecting a measurement range in the menu "Setup…Plus I/O…Analog In-1". The name and the unit of the channel to be displayed can be renamed according to the sensor. The value to be displayed is calculated based on the measured signal according to gain and offset.

The gain factor is obtained by dividing the display range by the measuring range. The offset is calculated by subtracting the product of the gain factor and lower end of the display range from the lower end of the measuring range.

Expressed in formulas:

M is a value measured in a range between **Ml** and **Mu** in the unit V, mV or mA, according to the selected function.
D is the value displayed in a range between **Dl** and **Du**.

Gain: **G = (Du - Dl) / (Mu - Ml)**
Offset: **O = Dl - (G * Ml)**
Displayed value: **D = (G * M) + O**

A pyranometer has an output voltage of 0–10 V. This corresponds to radiation of 0–1,350 W/m².
Ml = 0 V, Mu = 10 V, Dl = 0 W/m2, Du = 1,350 W/m²
G = (1,350 - 0) / (10 - 0) = 135
O = 0 - (135 * 0) = 0 W/m²
If M = 5 V: D = (M * G) + O = 5 * 135 + 0 = 675

A temperature sensor with a converter outputs 4–20 mA. This corresponds to a temperature range of -30–+80 °C.
Ml = 4 mA, Mu = 20 mA, Dl = -30 °C, Du = +80 °C
G = (80- (-30)) / (20 - 4) = 110 / 16 = 6.875
O = -30 - (6.875 * 4) = -30 - 27.5 = -57.5 °C
If M = 4 mA: D = (M * G) + O = 4 * 6.875 - 57.5 = -30

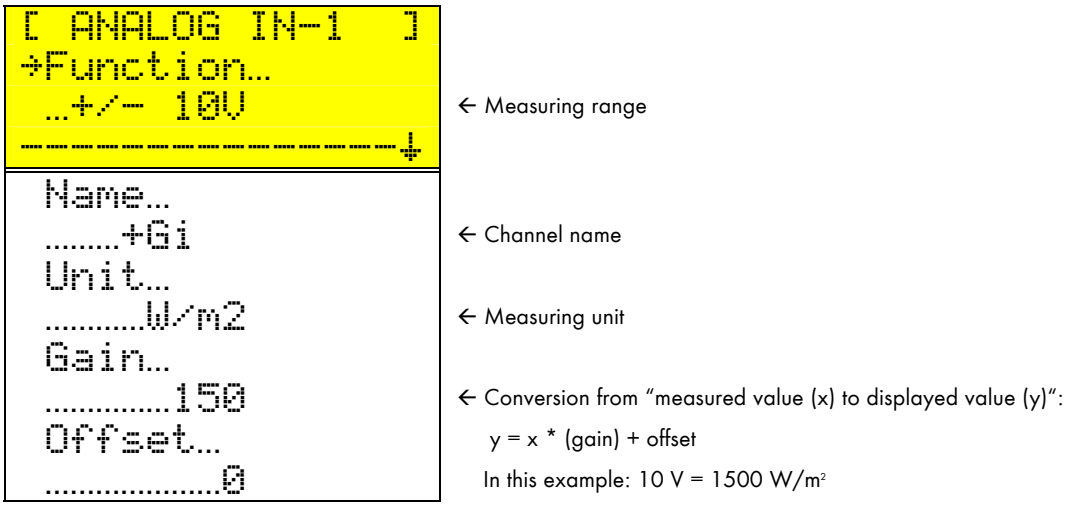


Fig. 7.7: Analog input channel configuration

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Analog In1
+b_SET Help	Fct, Name, Unit, Gain, Offset
+c_SET Value	10V, +Gi, W/m2, 150, 0

Table 7.3: Analog input channel configuration

Fig. 7.8: Pyranometer

Fig. 7.9: Reference cell

Setting	Explanation
Fct	Function of the analog input channel *Abbrev. ..... Explanation* -..... deactivated 10V ..... Measurement between -10 V and +10 V 5V ..... Measurement between -5 V and +5 V 1V ..... Measurement between -1 V and +1 V 500mV Measurement between -500 mV and +500 mV 100mV Measurement between -100 mV and +100 mV 50mV .. Measurement between -50 mV and +50 mV 20mV .. Measurement between -20 mV and +20 mV 10mV .. Measurement between -10 mV and +10 mV 20mA .. Measurement between -20 mA and +20 mA
Name	Name of the channel to be displayed
Unit	Unit to be displayed
Gain	Conversion from input value to unit of measurement
Offset	Value to be added to the value to be displayed

Table 7.4: Analog input channel settings

7.2.2 Temperature Sensing (AIN-7 & AIN-8)

The analog input channels AIN-7 and AIN-8 are designed for four-conductor temperature sensing using PT100 resistors. The necessary power is delivered by the Sunny Boy Control Plus. For temperature input channel AIN-7, the connections are made to PT100-I1+, AIN-7+, PT100-I1-, and AIN-7-. For AIN-8, the connections are made to PT-100-I2+, AIN-8+, PT100-I2-, and AIN-8- (refer to Fig. 7.10).

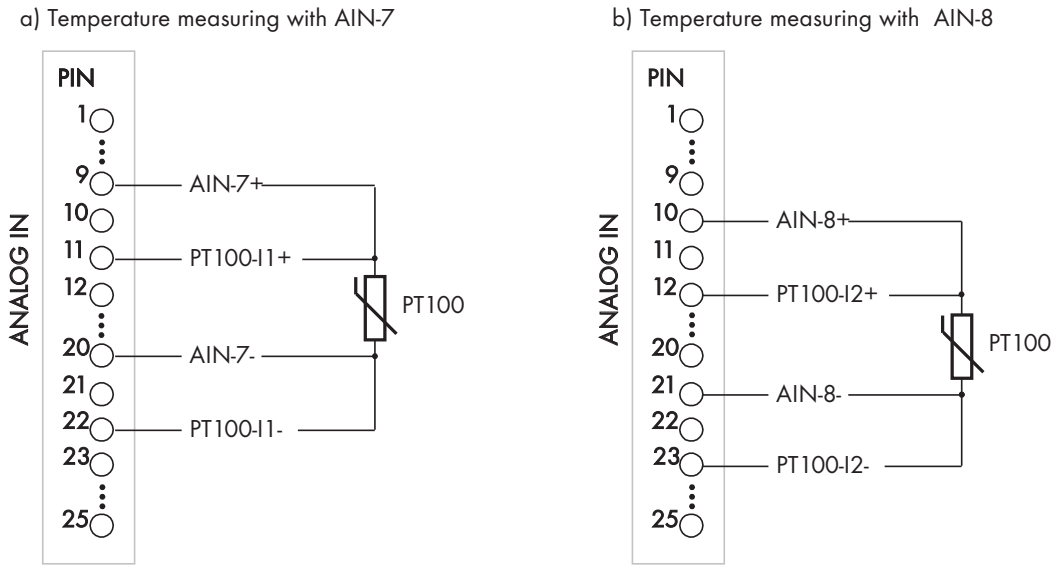


Fig. 7.10: Connections for temperature input channels AIN-7 and AIN-8

Configuration

In addition to the electrical connection, a temperature unit must be selected (Celsius, Fahrenheit, or Kelvin) to activate a temperature input.

The following screen shows the configuration of input channel AIN-7 in the menu "Plus I/O…Analog In…+AIn-7 (PT100)". The channel name is "+Tam" and the temperature unit is "Celsius". As a result, the temperature input display is "+Tam……23.13°C".

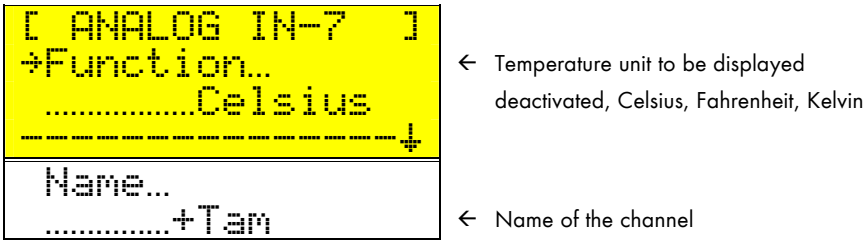


Fig. 7.11: Temperature input channel configuration screen

Same settings in Sunny Data Control on the PC:

Parameter	
Channel	**Value**
+a_SET Choice	Analog IN-7
+b_SET Help	Fct(-,C,F,K),Name
+c_SET Value	C, +Tam

Table 7.5: Temperature input channel configuration on the PC

Setting	**Explanation**
Fct	Function of the analog input channel *Abbrev. ..... Explanation* -.....deactivated C .....Temperature display in degrees Celsius F.....Temperature display in degrees Fahrenheit K .....Temperature display in degrees Kelvin
Name	Name of the channel to be displayed

Table 7.6: Temperature input settings

7.3 "DIGITAL IN/OUT" Connector

The Sunny Boy Control Plus offers eight digital input and output channels. The necessary 24 V power has to be provided by external sources. The optional SBCOP-DIG-KIT is a DB25 adapter to be connected to the "DIGITAL IN/OUT" port and providing a terminal strip that greatly simplifies the installation and connections (refer to the quick installation guide "SBCOP-DIG-KIT-11:CD").

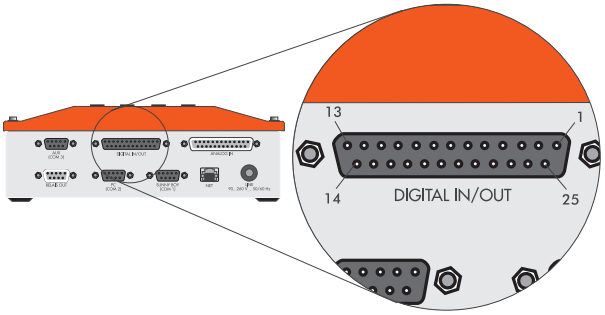


Fig. 7.12: "DIGITAL IN/OUT" connector

Pin Assignment

Pin	Signal	Description	Pin	Signal	Description
1	DIN-1	Input	14	DIN-5	Input
2	DIN-2	Input	15	DIN-6	Input
3	DIN-3	Input	16	DIN-7	Input
4	DIN-4	Input	17	DIN-8	Input
5	DGND	Ground (low signal)	18	DGND	Ground (low signal)
6	D+24V	Voltage (high signal)	19	D+24V	Voltage (high signal)
7	15VAC	AC power supply	20	15VAC	AC power supply
8	+24VDC	DC power supply	21	DGND	Ground (low signal)
9	+24VDC	DC power supply	22	DOUT-8	Output
10	DOUT-4	Output	23	DOUT-7	Output
11	DOUT-3	Output	24	DOUT-6	Output
12	DOUT-2	Output	25	DOUT-5	Output
13	DOUT-1	Output			

Table 7.7: Pin assignment for "DIGITAL IN/OUT" connector

Diagnostic Channels

The menu "**Realtime Data**" of the Sunny Boy Control Plus gives access to the diagnostic channels of the digital interface.

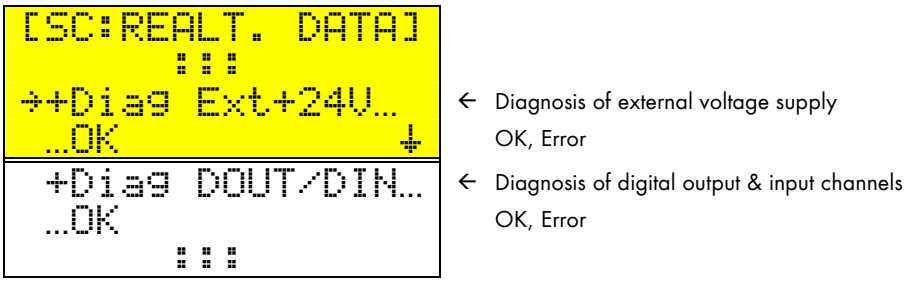


Fig. 7.13: Diagnosis of digital interface

7.3.1 24 V Power Supply

The 24 V DC power required to operate the digital channels must be supplied externally. If only a few channels are used, it may be most cost-effective to connect a small standard 15 V AC transformer to the 15VAC pins and let the Sunny Boy Control Plus convert this internally by means of a bridge rectifier. If however more channels are used, a 24 V DC power source must be connected to the +24VDC, +24VDC, DGND, and DGND pins.

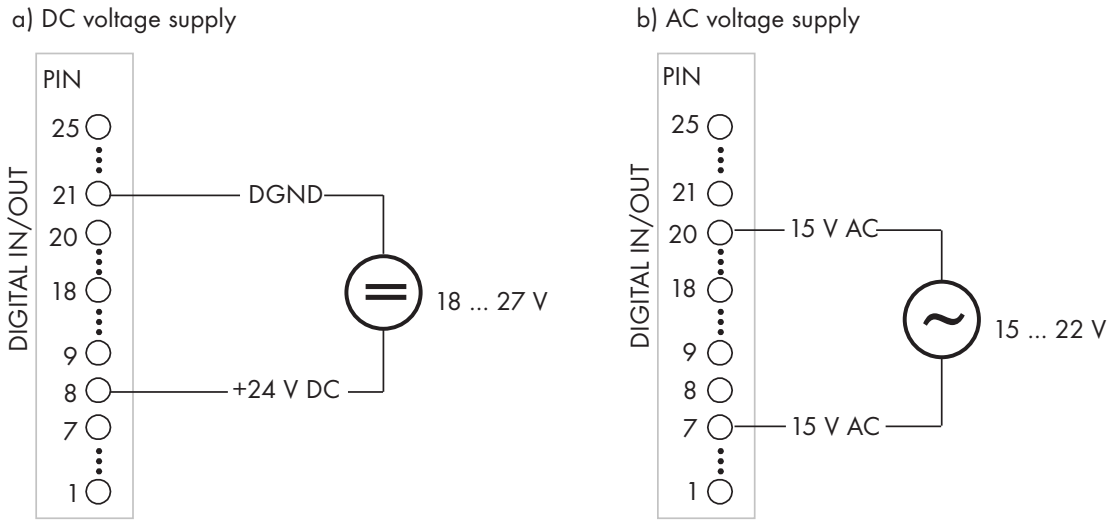


Fig. 7.14: Supplying power to the digital interface (example)

With an external 24 V DC power source, the diagnostic channel "+Diag Ext+24V" can be used to check whether the necessary voltage is being supplied.

7.3.2 Digital Input Channels (DIN-1–DIN-8)

The digital input channels are DIN 43 864-compliant S0 interfaces. This standard defines the current interface for impulse transmission between an energy (pulse) meter and an electric consumption meter.

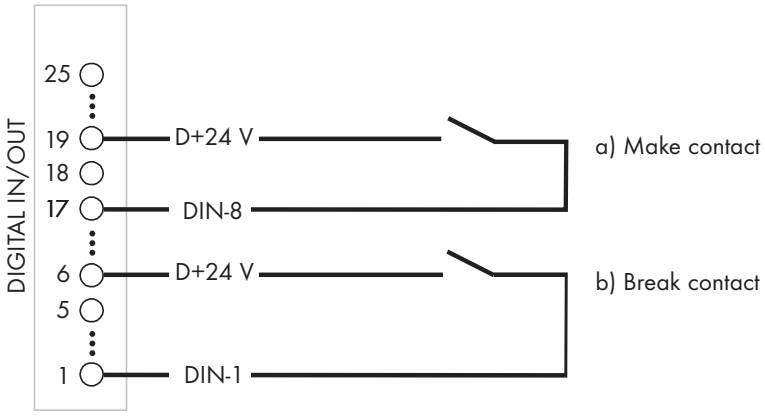


Fig. 7.15: Digital input channel application

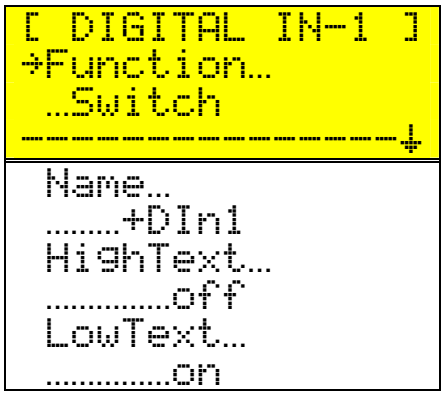
The digital input channels can be configured as pulse channels or as simple switching channels. DIN1 – DIN8 are switched to DGND for breaking contact (off) or to D+24V for making contact (on).

The power supplied to the digital input channels by D+24V is limited to a total of 0.5 A and is protected against overload and short circuits.

If the D+24V power supply is overloaded or short-circuited, the diagnostic channel "+Diag DOUT/IN" displays "Error".

Hardware-Based Configuration

All parameters for the digital and analog input channels can be configured in the menu items "Setup…Plus I/O…Analog In" and "…Digital In" of the Sunny Boy Control Plus. But these settings can also be made from a PC using Sunny Data Control (refer to chapter "8 Data Display and Configuration From a PC").



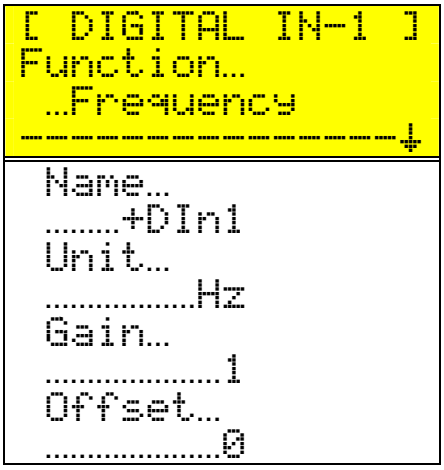
← Selecting the function of the digital channel
Switch, Trigger Low, Trigger High

← Name of the channel

← Text for the "switched on" condition

← Text for the "switched off" condition

Fig. 7.16: Configuration of digital input channels as switches



← Selecting the function of the digital channel
Frequency, Impulse cont., Impulse daily

← Name of the channel

← Measuring unit

← Conversion from "measured value (x) to displayed value (y)":
y = x * (gain) + offset

Fig. 7.17: Configuration of digital input channels as counters

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Digital In1
+b_SET Help	Fct (-, sw, trlo, trhi, impc, impd, frq), Name
+c_SET Value	-,+DIN-2

Table 7.8: Digital input channel configuration

Parameter	
Channel	**Value**
+a_SET Choice	Digital In1
+b_SET Help	Fct, Name, LowText, HighText
+c_SET Value	sw, +DIN-2, off, on

Table 7.9: Configuration of digital input channels as switches

Parameter	
Channel	**Value**
+a_SET Choice	Digital In1
+b_SET Help	Fct, Name, Unit, Gain, Offset
+c_SET Value	impc, +DIN-2, –, 1, 0

Table 7.10: Configuration of digital input channels as counters

Setting	Explanation
Fct	Function of the digital input channel *Abbrev. ..... Explanation* -..... deactivated sw ..... Switch trlo..... Trigger low, within measuring range → Switch on trhi..... Trigger high, within measuring range → Switch on impc..... Continuous impulse counter impd ..... Daily impulse counter, reset at 00:00 (midnight) frq ..... Frequency
Name	Name of the channel to be displayed
a) Only for the functions sw, trlo, and trhi:	
HighText	Text displayed with the "switched on" condition
LowText	Text displayed with the "switched off" condition
b) Only for the function frq:	
Unit	Unit to be displayed
Gain	Conversion from number of impulses to unit of measurement
Offset	Value to be added to the value to be displayed
c) Only for the functions impc and impd:	
Unit	Unit to be displayed
Gain	Conversion from number of impulses to unit of measurement
Counter reading	Current count in measuring unit

Table 7.11: Digital input channel configuration

7.3.3 Digital Output Channels (DOUT-1–DOUT-8)

The digital output channels DOUT-1 – DOUT-8 are switched to DGND. They can be configured as switches, which can be switched via the installer mode in Sunny Data Control. This allows you, for example, to switch external relays in the system from a remote PC using a modem.

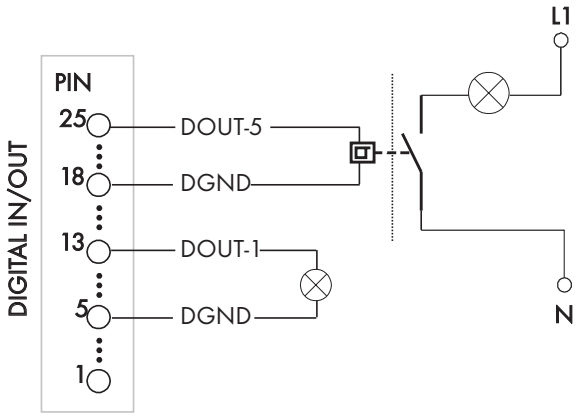


Fig. 7.18: Digital output channel application

If the digital outputs are overloaded or short-circuited, the diagnostic channel "+Diag DOUT/IN" displays "Error".

Hardware-Based Configuration

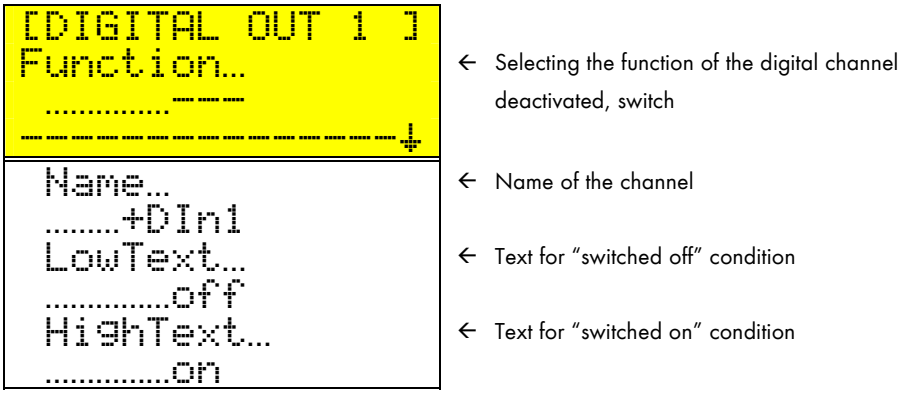


Fig. 7.19: Digital output channel configuration

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Digital OUT-2
+b_SET Help	Fct (-, sw), Name, LowText, HighText
+c_SET Value	-, +DOUT-2

Table 7.12: Digital output channel configuration

Setting	Explanation
Fct	Function of the digital output channel *Abbrev. ..... Explanation* -..... deactivated sw..... Switch
Name	Name of the channel to be displayed
LowText	Text displayed with the "switched off" condition
HighText	Text displayed with the "switched on" condition

Table 7.13: Digital output channel settings

7.4 Variables (VAR-1–VAR-16)

Sixteen variables are available to perform customized calculations. By combining any of the measured values according to specific requirements, the user can generate new data. With a variable, analog Vac and Iac measurements, for example, can produce Pac data.

The variables are calculated in the order VAR-1–VAR-16. This can be important to know when the formula for one variable contains another variable. For example: VAR-1 calculates Pac, and VAR-2 determines Eac based on VAR-1. The settings for the variables can be made in the menu "Setup…Plus I/O…Variables"

Formulas

In addition to the four basic operations, formulas can include parentheses, integrations, differentiations, and channel sums.

Allocation	Explanation
=	Marks the beginning of an allocation
+, -, /, *	Basic operations Ex.: =17*4+3
(...)	Subcalculations Ex.: =17*(4+(2*3-7))
[Name]	Value of a Sunny Boy Control Plus channel. (The channel name has to be within square brackets.). Ex.: [Pac], [Eac], [+VAR-1], [+Mess1]
[XY:Name]	Value of an inverter channel. (The channel name is preceded by the device ID. Both have to be within square brackets.) Ex.: [01:Pac], [02:Etot]
[SUM:Name]	Sum of a channel's values from all inverters Ex.: [SUM:Iac] totals the Iac values of all inverters.
=INT(...)	The result of the formula is integrated. Ex.: Eac =INT([Pac]/1000) The values are erased at the end of the day.
=DIF(...)	The result of the formula is differentiated. Ex.: Pac =DIF([Pac]/1000)
=MAX(...)	The maximum value of a formula is determined on a daily basis. Ex.: Pac-max (daily maximum power) =MAX([Pac]) (The values are erased at the end of the day.)

Table 7.14: Variable formulas

You're measuring Iac (the current in ampere) with AIN-1 and Vac (the voltage in volts) with AIN-2 on the AC side. Using two variables, Pac (the power output in watts) can be calculated, and using integration, Eac (the energy in kWh) can be calculated. One kilowatt being 1,000 watts and one hour being 3,600 seconds, Ws are converted into kWh by division through 3.6E6 (corresponding to 1000 * 3600).

AIN-1: +Iac, A
AIN-2: +Uac, V
VAR-1: +Pac, W, =[Iac]*[Uac]
VAR-2: +Eac, kWh, =INT([+Pac]/3.6E6)

Hardware-Based Configuration

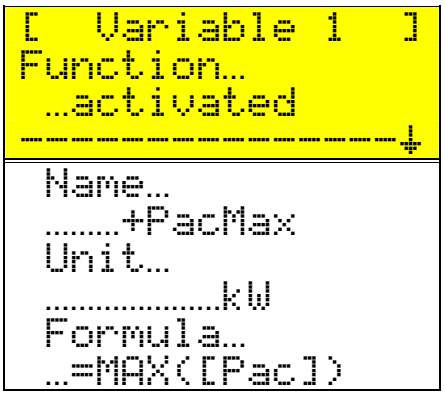


Fig. 7.20: Configuration of variables

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Variable VAR-1
+b_SET Help	Fct (-, a), Name, Unit, Formula
+c_SET Value	a, +PacMax, kW, =MAX([Pac])

Table 7.15: Configuration of variables

Setting	Explanation
Fct	Function of the variable *Abbrev. ..... Explanation* -..... deactivated a..... activated
Name	Name of the channel to be displayed
Unit	Unit to be displayed
Formula	Formula to be calculated

Table 7.16: Configuration of variables

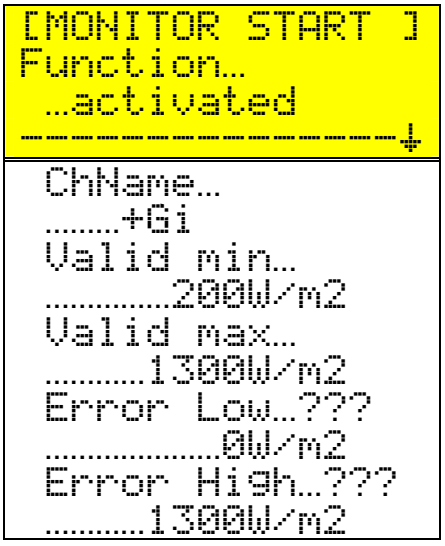
7.5 Monitoring (+MonStart & +Mon1–+Mon8)

The monitoring function enables you to customize the monitoring to match your needs. The tolerance values for generating warnings and failures can be defined for eight channels of the Sunny Boy Control Plus. As soon as this limit has been violated for longer than the set length of time (refer to "Setup…System…Tolerances"), the Sunny Boy Control Plus will generate a corresponding warning or error message. These are treated like any other warning or error message by either switching the alarm contact or faxing a report.

7.5.1 Defining the Starting Condition (MON-Start)

When the start condition (+MON-Start) is activated, error and warning messages for the 8 monitoring channels +Mon1–+Mon8 are generated only if the starting condition is met.

Hardware-Based Configuration



← Function of the monitor starting condition
deactivated, activated

← Name of the channel to be monitored (the channel's default unit for the values below is displayed; here: W/m2)

← Monitoring is active only if channel exceeds this value.

← Monitoring is active only if channel falls short of this value.

← Error if channel falls short of this value (e.g., if line is broken)

← Error if channel exceeds this value

Fig. 7.21: Monitoring channel configuration

If you would like to monitor the efficiency of a PV system, note that, due to the characteristic curve, a meaningful analysis is not possible during periods of low irradiation. It is therefore recommended that you define an irradiation range in which to perform an analysis. This is possible by using an external irradiation sensor to take analog measurements and by defining a valid value range of 200–1,300 W/m² under +Mon-Start. To guarantee usable irradiation values, sensor values beyond the set range (e.g., below 0 W/m² and above 1,500 W/m²) are defined as errors. If no

external sensor is available, the current system power (Pac) can be defined as the starting condition (e.g., 200 W < Pac < 1500 W).

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Monitor START
+b_SET Help	Fct (-, a), Name, Valid: min, max, Error: Low, High
+c_SET Value	a, +Gi, 200, 1300, 0, 1500

Table 7.17: Configuring the monitor starting condition

Setting	Explanation
Fct	Function of the variable *Abbrev. ..... Explanation* -..... deactivated a..... activated
ChName	Name of the channel to be monitored
Vaild min, max	Definition of the valid monitoring range (lower & upper end)
Error Low, High	Lower & upper limits for generating an error

Table 7.18: Configuring the monitor starting condition

7.5.2 Monitoring Channels (MON-1 – MON-8)

Eight measuring channels of the Sunny Boy Control Plus can be assigned to the eight monitoring channels. Each monitoring channel (+Mon1 – +Mon8) can be allocated different tolerances for generating warning and error messages. If all tolerances are set to 0, no monitoring will take place. By defining only "Warning Low/High" values and leaving the "Error Low/High" values on 0, the monitoring channel will generate warning messages only.

Hardware-Based Configuration

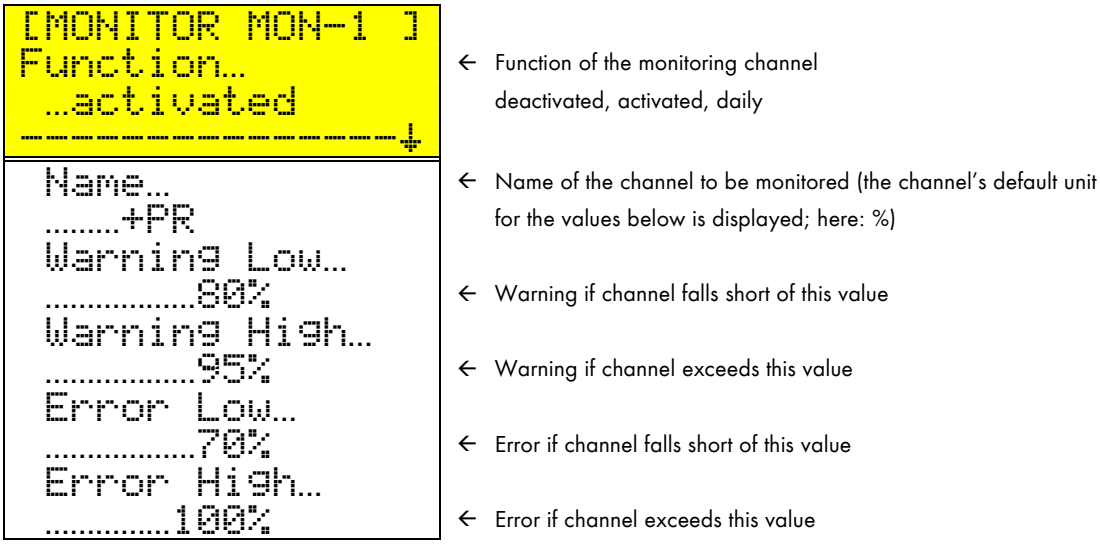


Fig. 7.22: Monitoring channel configuration

Software-Based Configuration

Parameter	
Channel	**Value**
+a_SET Choice	Variable VAR-1
+b_SET Help	Fct (-, a, d), Name, Warning: Low, High, Error: Low, High
+c_SET Value	a, +PR, 80, 95, 70, 100

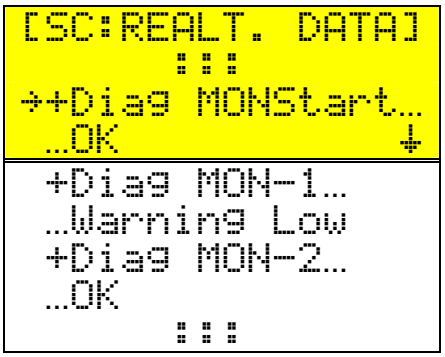
Table 7.19: Configuration of variables

Setting	Explanation
Fct	Function of the variable *Abbrev. ..... Explanation* -..... deactivated a..... activated d..... daily
Name	Name of the channel to be monitored
Warning Low, High	Lower & upper limits for generating a warning
Error Low, High	Lower & upper limits for generating an error

Table 7.20: Configuration of variables

Diagnostic Channels

For each activated monitoring channel, a diagnostic channel is automatically generated. The status of the diagnostic channels can be seen in the menu "**Main Menu…Realtime Data**". If the monitoring channel is improperly set up (e.g., the channel to be monitored does not exist), the status "**Cfg-Error**"is displayed.



← Diagnosis of the monitor starting condition "MON-Start"
OK, Cfg-Error, to low, to high, Error Low, Error High

← Diagnosis of the monitoring channel "MON-1"
OK, Cfg-Error, Warning Low, Warning High, Error Low, Error High

← Diagnosis of the monitoring channel "MON-2"
OK, Cfg-Error, Warning Low, Warning High, Error Low, Error High

Fig. 7.23: Monitoring channel diagnosis

7.6 "Profile 2" Application

Two default profiles (Profile 1 & Profile 2) can be loaded from "Setup…Plus I/O…Plus-Function". "Profile 1" deactivates the Plus functions and resets all Plus settings to their factory defaults. "Profile 2" requires only an external sensor (pyranometer or reference cell) to acquire module irradiation data. The following is an application example for "Profile 2".

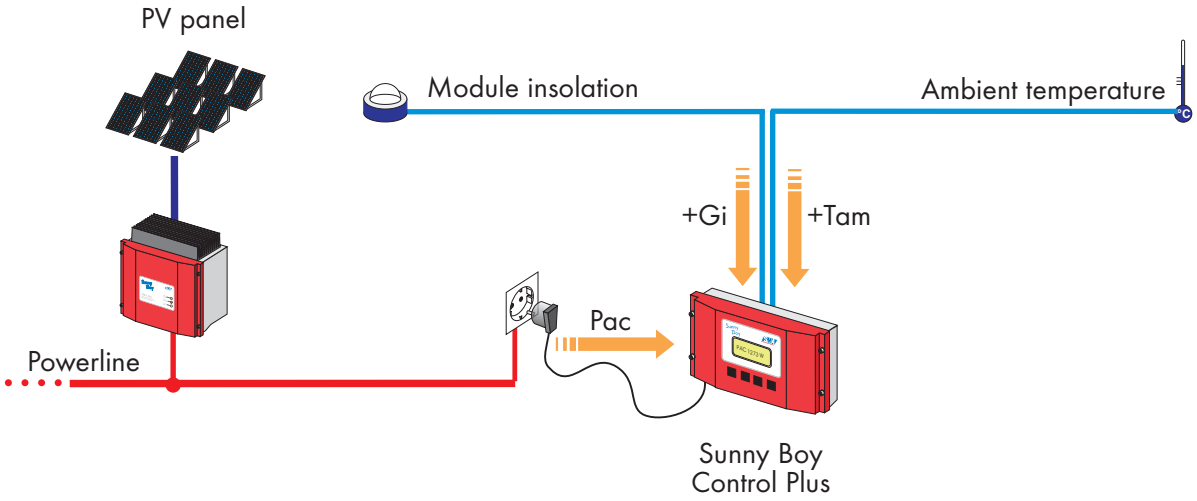


Fig. 7.24: Input parameters for "Profile 2"

The current system efficiency (+etaPV) and the daily energy yield (+PR) can be obtained by comparing and further computing the panel irradiation and the power output of the Sunny Boy inverters. These calculations require the system constants "+A" (the module surface) and "+etaM" (the module efficiency).

Parameters of Profile 2

Symbol	Explanation	Comment
Input parameters		
Pac	Total system power output	Sum of the "Pac" of all Sunny Boys (Note: Unit = kW)
+Gi	Module irradiation	Measured with pyranometer or reference cell
-+Tam	Ambient temperature	Measured with PT100
System constants		
+A	Total module surface	Surface of all modules installed
+etaM	Module efficiency	approx. 0.9*etaSTC
Secondary (derived) parameters		
+Eac	Yield	Derived from Pac
+Hi	Irradiation (energy)	Derived from +Gi
+Enom	Nominal (theoretical) yield	Derived from +Hi and +etaM
Resulting system characteristics		
+etaPV	System efficiency	Current output & input power
+PR	Performance ratio	Daily yield at nominal yield

Table 7.21: Parameters of Profile 2

After loading Profile 2, the following variables have to be adjusted to the existing system configuration.

- Gain of Analog input 1: Signal conversion to W/m², default = 150
- +A : Module surface, default = 10 m²
- +etaM: Module efficiency, default = 14 %
  (usually approx. 0.9*etaM, STC-check module specifications; STC = Standard Test Conditions)
- +Mon1: Adjust tolerances to system performance.

No further settings and adjustments are necessary. All other parameters are calculated automatically.

Analog Input Channels of Profile 2

Channel	Func-tion	Name	Unit	Gain	Offset
Analog In1	10 V	+Gi	W/m²	150	0
Analog In7	°C	+Tam	°C	-	-

Table 7.22: Analog input channel settings of Profile 2

Variables of Profile 2

Channel	Fct.	Name	Unit	Formula
Variable 1	a	+A	m²	=10
Variable 2	a	+etaM	%	=14
Variable 5	a	+Eac	Wh	=INT([Pac]*1000) / 3.6E3
Variable 6	a	+Hi	Wh/m²d	=INT([+Gi] / 3.6E3)
Variable 7	a	+Enom	Wh	=([+Hi]*[+A]) * ([+etaM]/100)
Variable 15	a	+etaPV	%	=100*(([+Pac]*1000) / ([+Gi]*[+A]*)))
Variable 16	a	+PR	%	=100*([+Eac] / [+Enom])

Table 7.23: Variable settings of Profile 2

Monitoring Channels of Profile 2

Channel	Fct.	ChName	Valid		Error	
			Min	Max	Low	High
Monitor START	a	+Gi	200	1350	0	1400

Table 7.24: Monitor starting condition of Profile 2

The starting condition states that an analysis will take place only if irradiation (+Gi) is within a range of 200–1,350 W/m². If the irradiation measured is below 0 W/m² or above 1400 W/m², an error is immediately generated.

Channel	Fct.	ChName	Warning		Failures	
			Low	High	Low	High
Monitor 1	a	+etaPV	8	13	5	14
Monitor 2	d	+PR	80	98	70	100

Table 7.25: Monitoring settings of Profile 2

The monitoring of system efficiency (+etaPV) starts as soon as the starting condition is met. Tolerance violations are signaled only if they persist longer than the tolerance time for warnings (refer to section 6.2.4). The performance ratio (+PR) is evaluated daily at 00:00 (midnight). The current value can be seen anytime on the Sunny Data Control under "**Realtime Data**" or under Single Device Information in Sunny Data Control.

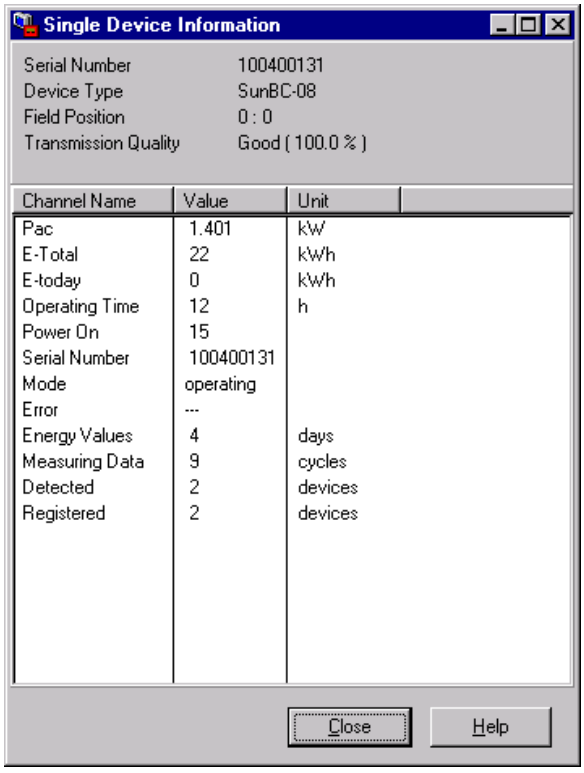


Fig. 7.25: Single Device Information example for Profile 2

8 Data Display and Configuration from a PC

On the rear side of the Sunny Boy Control, there are "COM" ports in addition to the power supply connector "LINE". A PC running Sunny Data Control can be connected to the "PC (COM2)" connector of the Sunny Boy Control. See below for details.

The Windows-based program Sunny Data Control offers a graphical user interface as well as many of the useful features typical of the Windows operating system. This program also makes it possible to update the firmware of the Sunny Boy Control (refer to Fig. 8.1).

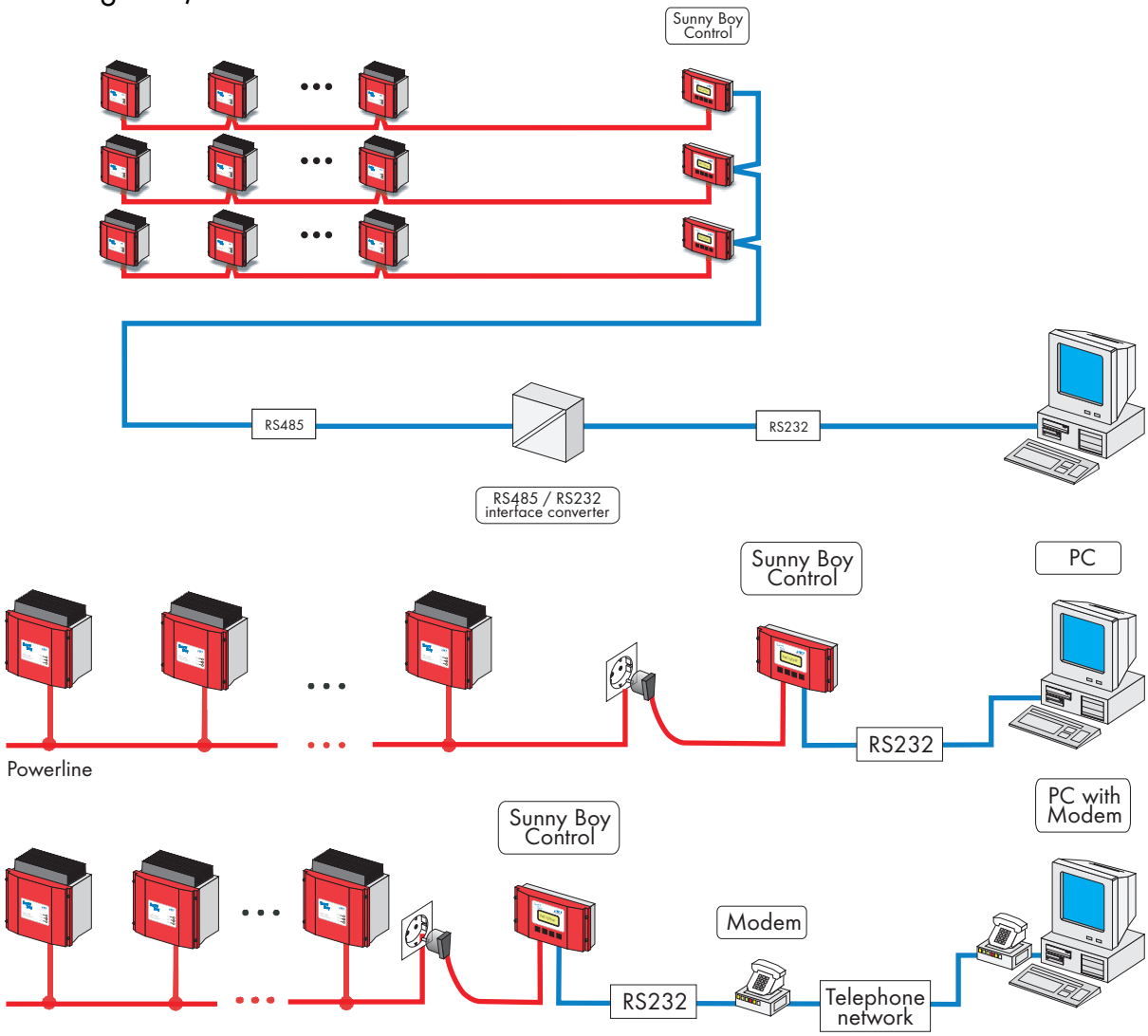


Fig. 8.1: Various configurations using a PC and Sunny Data Control

If the Sunny Boy Control is connected to a PC via a modem, the modem can also be used to transmit messages. While it will not be possible to connect to the Sunny Boy

Control while a message is being transmitted, messages are not allowed interrupt a active connection between Sunny Data Control and the Sunny Boy Control; instead, they are retained until the modem is available again.

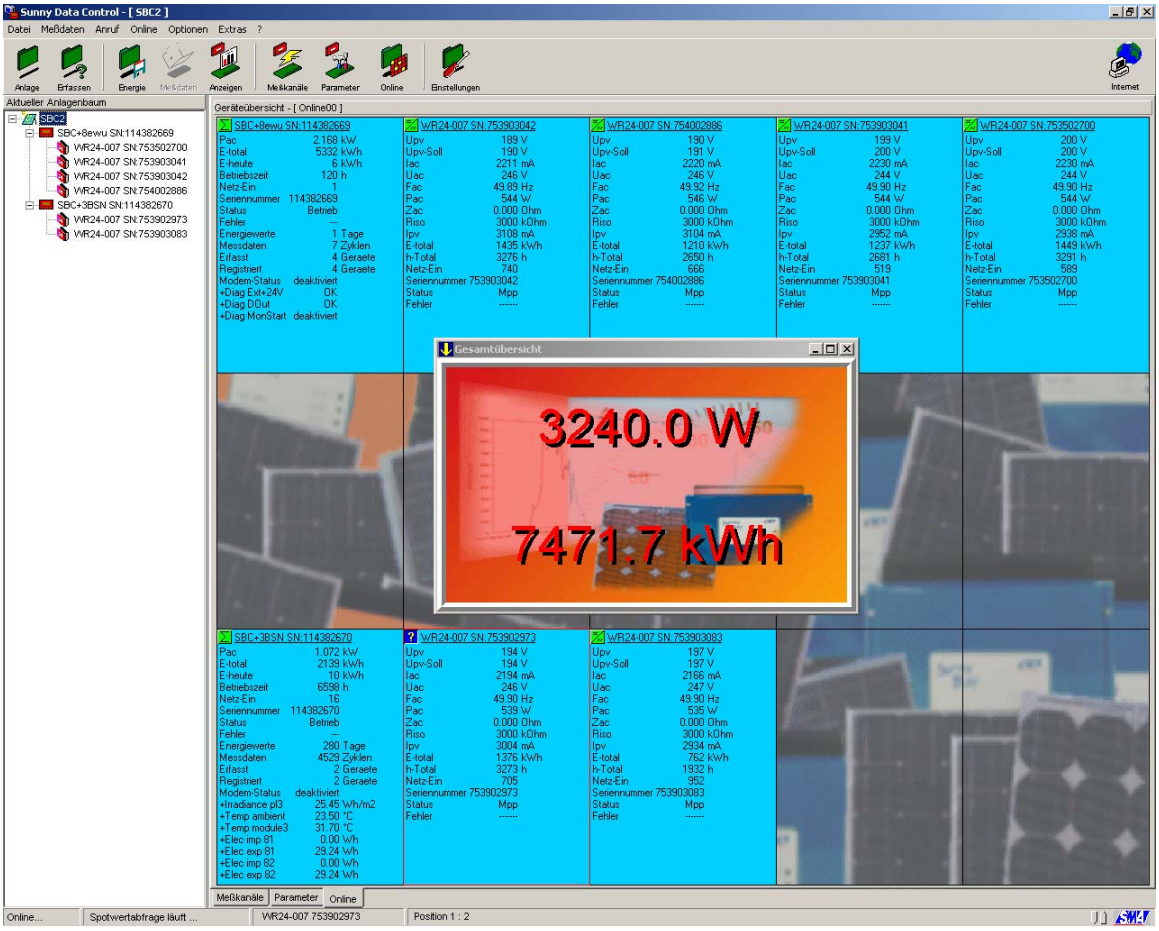


Fig. 8.2: Graphical user interface of Sunny Data Control

The daily energy value and measuring channel data from a Sunny Boy Control can be acquired and evaluated using a PC and Sunny Data Control. In addition, Sunny Data Control can be used to display and modify the configuration of a Sunny Boy Control. The Sunny Data Control functionality is independent of the type of connection between the PC and the Sunny Boy Control (serial interface, RS485, or modem). For further information on how to use Sunny Data Control, refer to the Sunny Data Control manual.

Parameters	Data	Explanation
AC_... Alarm Contact		
AC_Default Switch	Contact 1_1	Relay default switch: 1_1, 1_2
AC_Errors	ON	Alarm contact ""ON/OFF" for errors
AC_Speaker	deactivated	Beeper signals errors/warnings
AC_Warnings	ON	Alarm contact ""ON/OFF" for warnings
MK_DisplayFlash	activated	Display light flashes if error
CO_... / KO_... Communication		
CO_Buffer	2 cycles	Number of cycles for buffering the measuring data
CO_CmdRetry	1 times	Number of packet repeats in case of an error
CO_CmdTimeout	4000ms	Max. timespan that the Sunny Boy Control will wait for an answer from a device
CO_COM1	PowerLine	Type of interface for COM1
CO_COM1 Baud	1200Baud	Rate of transmission to PV system
CO_COM2	RS232	Type of interface for COM2
CO_COM2-Baud	19200Baud	Rate of transmission to PC
KO_COM1-Prot.	Sunny-Net	Transmission protocol used
KO_COM2-Prot.	Sunny-Net	Transmission protocol used
KO_COM3	RS232	Type of interface for COM3 (Plus only)
KO_COM3-Baud	19200Baud	Rate of transmission for COM3 (Plus only)
KO_COM3-Prot.	Sunny-Net	Transmission protocol used (Plus only)
KO_NET....		Refer to the NET Piggy-Back manual "NETPB-13:EE"
DA_... Data Archive		
DA_Data Reading	ON	Data acquisition "ON/OFF"'
DA_Max. Storage	51.42 days	Remaining storage capacity
DA_Meas. Interval	15.00 min	Data-archiving interval
DA_Storage	ON	"ON/OFF" when system is active, "24h" if permanent
E-Mail (refer to the NET Piggy-Back manual "NETPB-13:EE")		
ED_... External Display		
ED_InterfacePort	deactivated	Interface for external display
ED_TYPE	HvG	External display model
ES_... Switching Contact		
ES_Default Switch	Contact 2_1	Relay default switch: 2_1, 2_2
ES_Minimum Time	60.00 min	Minimum switch-on time of switching contact
ES_Poff	0.00 kW	Switch-off tolerance of switching contact
ES_Pon	0.00 kW	Switch-on tolerance of switching contact
ES_Power Switch	deactivated	Switching contact power management activated/deactivated

Parameters	Data	Explanation
ES_Time Switch	deactivated	Time management activated/deactivated
ES_Toff	0:00	Time management switch-off time
ES_Tolerance	15.00 min	Switching contact switch-on tolerance
ES_Ton	0:00	Time management switch-on time
FI_... Remote Info (some parameters optional or depend on NET Piggy-Back installed)		
General		
FI_Company/Name	COMPANY XYZ-SOLAR	Remote Info recipient, line 2
FI_Plant Name1	MY PLANT	Remote Info sender, line 1
FI_Plant Name2		Remote Info sender, line 2
FI_Plant-Info	Daily report	Remote Info Plant Info daily/activated
FI_Recipient	JOHN Q. PUBLIC	Remote Info recipient, line 1
FI_Report-Error	Hourly report	Remote Info error report
FI_Report-Warnings	Daily report	Remote Info warning report daily/deactivated
FI_Send at	18.00	Remote Info send time for daily report
Fax		
FI_FAX	activated	Remote Info activated/deactivated
FI_Phone Number		Remote Info recipient fax number
FI_Plant PhoneNo	+45 123 1234567890	Remote Info recipient ID
MO_ Modem-Init2	ATS0=1+IFC=0,0	Modem init string
MO_ Modem-Init3	ATS28=128&D0%E1&W	Modem init string
MO_... Modem (not available with use of NET Piggy-Back)		
MO_Dialmode	Tone dialing	Modem dial mode: pulse/tone
MO_Interface	deactivated	Modem interface: –, COM2
MO_Modem-Init1	AT&FE0V1X1Q0L2M2	Modem init string
MO_Type	Hayes	Modem type used
PL_... PV System		
PL_AddDevice	0	Adds device whose serial number is indicated.
PL_Auto-Install	deactivated	Activated: Sunny Boy Control automatically searches for devices.
PL_DelDevice	0	Removes device whose serial number is indicated
PL_Energy_Offset	0.00 kWh	Energy offset value for E-total
SY_... System		
SY_Firmware	4.xx Version	Installed firmware
SY_Gatewaymode	automatic	Device characteristics when forwarding packet requests
SY_Idle Mode	activated	Stand-by mode activated/deactivated

Parameters	Data	Explanation
SY_Language	english	Display language: German/English/French
SY_Memory Function	–	Reset parameters/measuring channels (user)
SY_Service Function	–	Reset system, cancel errors (Inst.)
SY_System Time	1059126885s	System time in seconds since 1/1/1970
TO_... Tolerance		
TO_Communication	50.00 %	Tolerance for communication errors
TO_Energy	50.00 %	Energy yield deviation tolerance for a device
TO_Offline	30.00 min	Offline tolerance for a device
TO_Riso Failure	500 kOhm	Minimum insulation resistance for generating warning message
TO_Warning Time	15.00 min	Tolerance for generating warning message

Table 8.1: List of parameters

Configuring "Plus" Functions

Parameters	Explanation
+a_SET Choice	Selecting the "Plus" channel to be processed
+b_SET Help	Help texts regarding user "choice"
+c_SET Value	Current setting of the "Plus" channel selected under "Choice"
+d_SET Plus-Function	Storing, canceling, loading default profiles (only for "Plus" settings)

Table 8.2: Additional parameters for Sunny Boy Control Plus

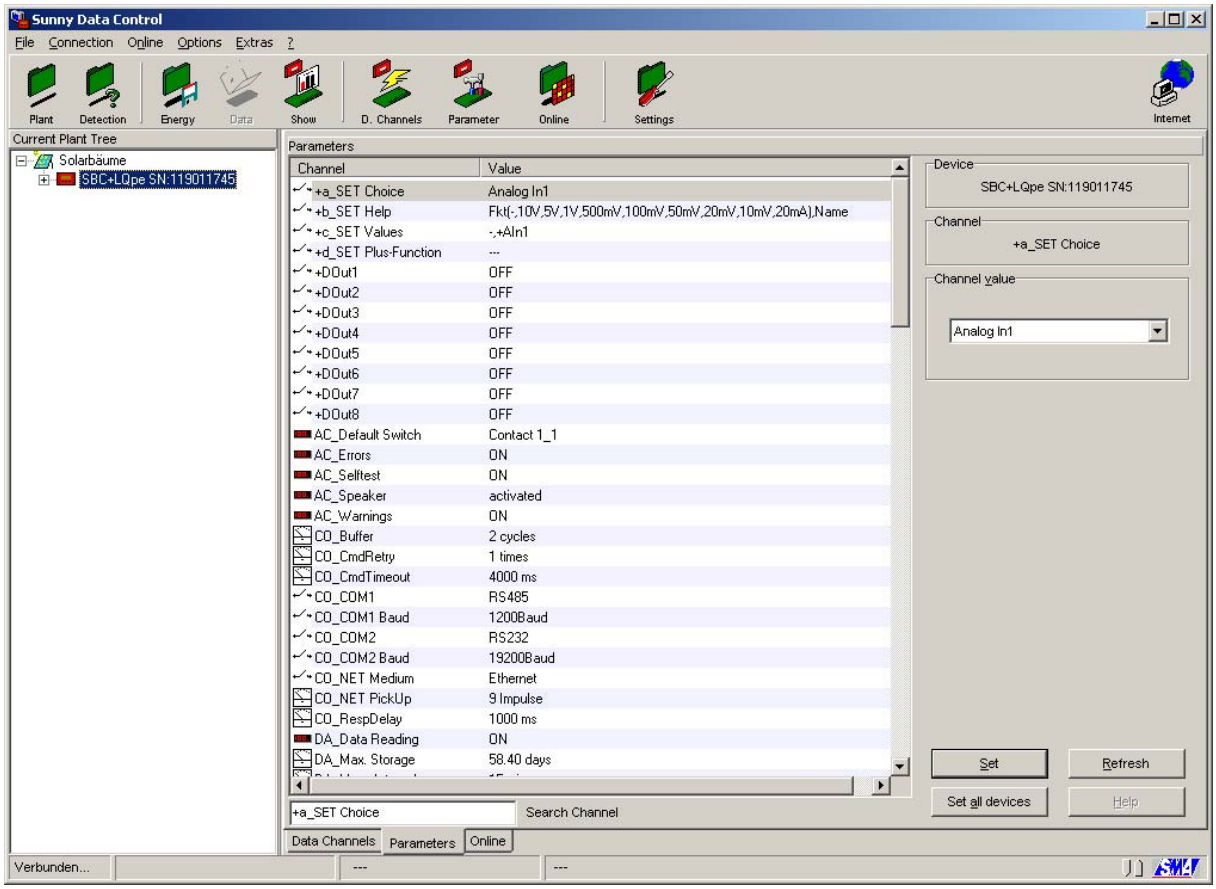


Fig. 8.3: Configuring parameters using Sunny Data Control

9 Failures

9.1 Messages and Their Causes

Refer to the following explanations whenever the Sunny Boy Control displays error or warning messages. In most cases, you will find useful advice here on how to eliminate the problem. Otherwise, you may also contact the Sunny Boy Hotline (refer to section "11.4 Contact Information" at the end of this document).

Device Failure Warning: "dev. troubled"

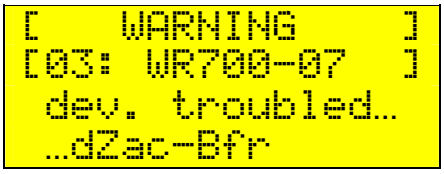


Fig. 9.1: Example of device failure

Whenever a device reports a failure, refer to the manual of the device.

Communication Warning: "Communication OK-Spot20"

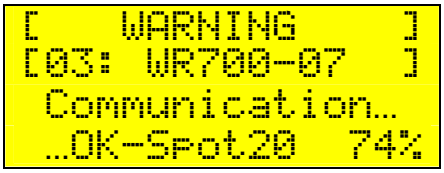


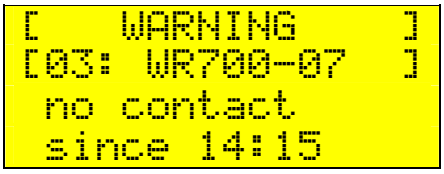
Fig. 9.2: Example of communication warning

The last 20 data packets to a device were ignored (Spot20).

Causes:

- Device defective or incorrectly installed.
- Temporary failure of data communication line
- "Communication" tolerance setting is too low (refer to section 6.3.1).

Offline Warning: “no contact since hh:mm”



Device ID: device model

← Time since which device could no longer be reached

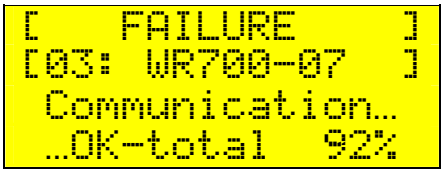
Fig. 9.3: Example of offline warning

The device has been out of reach for too long.

Causes:

- Device is defective or incorrectly installed.
- Communication is interrupted.
- “Offline” tolerance setting is too low (refer to section 6.2.4).
- Search for the cause using the function “Diagnostics…Communication” (refer to section 5.2).

Communication Failure: “Communication OK-total”



Device ID: device model

← Communication quality for entire day

Fig. 9.4: Example of communication failure

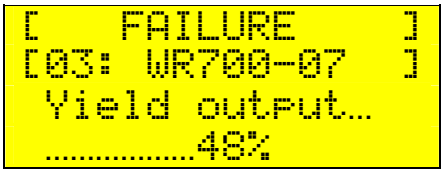
The number of communication errors exceeded the tolerance. At least 100 packets are required for processing.

Causes:

- Device defective or incorrectly installed.
- Failure of data communication line
- “Communication” tolerance setting is too low (refer to section 6.2.4).

Search for the cause using the function “Diagnostics…Communication” (refer to section 5.2).

Energy Yield Error: "Yield output xx %"



Device ID: device model

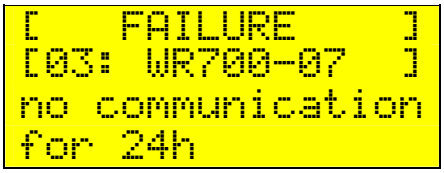
← Minimum yield expected compared with the daily system average

Fig. 9.5: Example of energy yield error

The device's energy yield was below the tolerance.

- Device defective or incorrectly installed.
- "Energy" tolerance setting is too low (refer to section 6.2.4).

24 Hour Offline Error: "no communication for 24h"



Device ID: device model

← Device could not be reached for a whole day.

Fig. 9.6: Example of offline error

The device has been out of touch for a whole day. Data processing takes place at 00:00 (midnight).

Causes:

- Device is defective or incorrectly installed.
- Communication is interrupted.
- Search for the cause using the function "Diagnostics…Communication" (refer to section 5.2).

Monitoring Warning/Error ("Plus" Function)

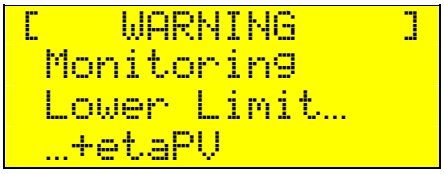


Fig. 9.7: Example of monitoring warning

If the values for the channel being monitored are out of the defined range, a message is generated. The warning/error message indicates whether the lower or upper end of the range was violated.

Fax Warning/Error: Fax message to recipient not possible

The Sunny Boy Control was not able to send the message to the recipient.Causes:

- The modem is incorrectly installed.
- The phone line is interrupted.
- The recipient is not picking up.

Check the connections and installation of the modem. (This message is not displayed on the device.)

9.2 Troubleshooting Powerline Communication

Powerline communication with Sunny Boy inverters is based on the "frequency shift keying" principle, according to which digital information is coded by shifting the frequency.

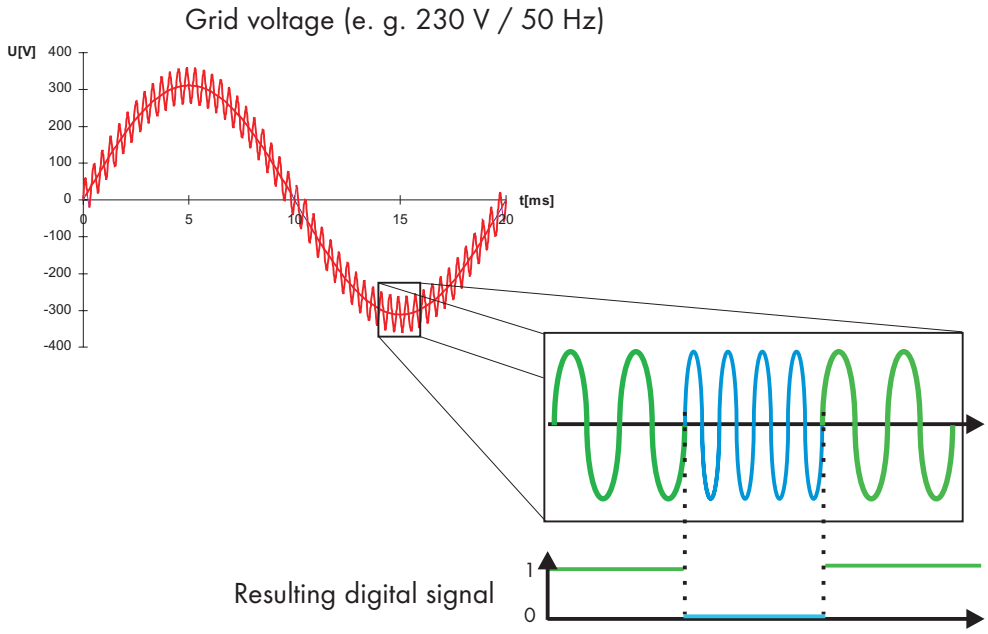


Fig. 9.8: Principle of Powerline communication

9.2.1 Transmission Failures

Causes:

- Transmission signal strongly dampened
  - Transmission line too long
  - Adverse cable layout
- Signal damping caused by other electrical devices
  - Anti-interference capacitors such as those found in fluorescent lamps
- Insufficient phase coupling
  - Sunny Boy Control and Sunny Boy inverters connected to different phases
  - Interference from external communication signals
  - Baby monitors etc. in the neighborhood
- Interference from your own communication signals
  - Baby monitor
  - Intercom etc.

All of the above sources affect the quality of the transmission, but they do not necessarily prevent Powerline communication. While in one household Powerline communication may be possible without a problem over several phases and a 90 m / 300 ft line, in another one, there may be strong interference over a single phase and a 30 m / 100 ft line.

The following sections explain the most common causes for Powerline communication failures and give possible countermeasures aimed at suppressing interference. In case of a transmission failure between the Sunny Boy Control and a connected device, refer to these sections first, and then try to find the source of the failure by carrying out the steps described in section 9.2.2.

Transmission signal strongly dampened

Most frequently, transmission failures result from a damping of the carrier signal. The reason may be that the distance between the inverters and the Sunny Boy Control is too long, but most often, it is the presence of other electric devices connected to the same line. Devices with a high input capacity can strongly dampen the carrier signal, regardless of whether the device is switched on or not. Examples of such devices are: washers, dryers, ranges, microwave ovens, PCs, and fluorescent lamps.

The easiest countermeasure is to connect the troubling device to another line and/or another phase (refer to 1. in Fig. 9.9). Another possibility is to install an anti-interference filter in the power supply line to the troubling device (refer to 2. in Fig. 9.9).

In the rare event that the cable length or layout should be the cause for the transmission failure, it may be necessary to install a separate line from the inverters to the Sunny Boy Control (refer to 3. in Fig. 9.9).

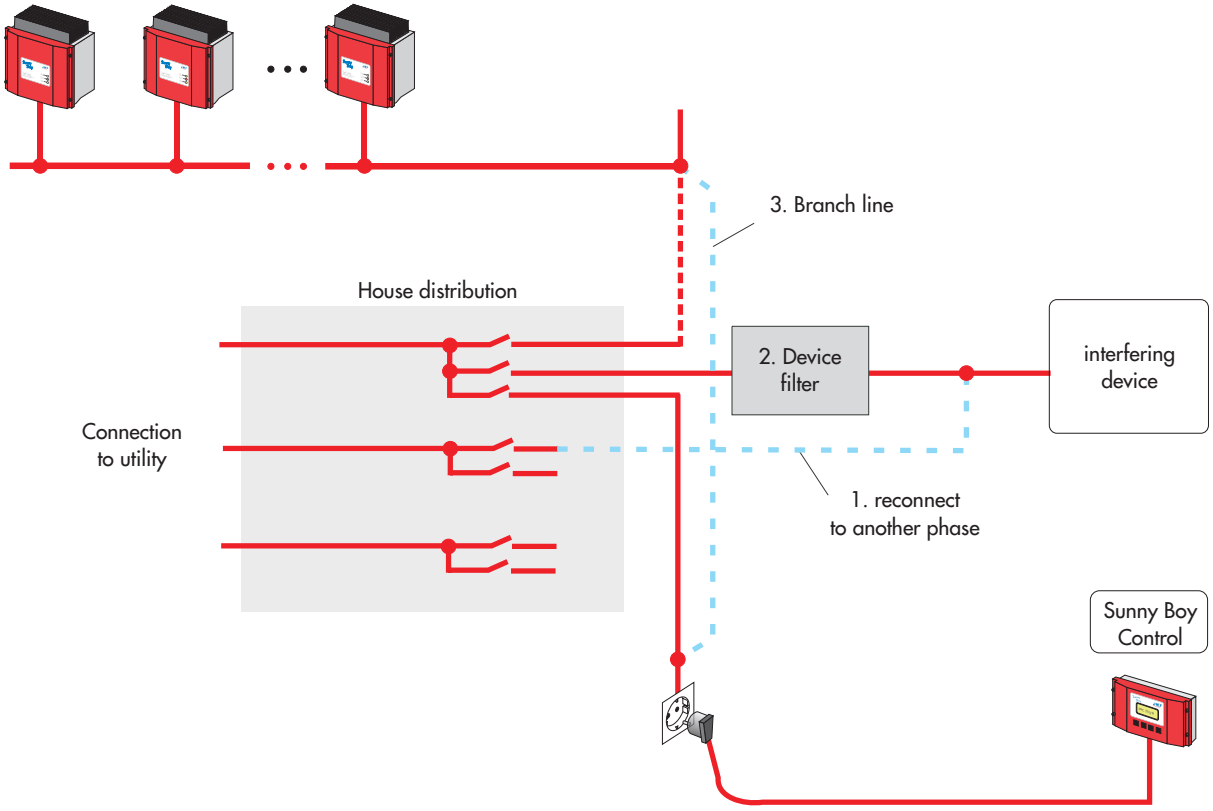


Fig. 9.9: Interference suppression in case of strong signal damping

Phase Coupling

When the communication path spans several phases, strong signal damping or a loss of communication range should be expected. If a string inverter is connected to a different phase (e.g., L2) than the Sunny Boy Control (e.g., L1), which we do not recommend, data transmission will be possible only if the phases are coupled at sufficiently high frequency. In many households, this is taken care of by three-phase appliances such as ranges, ACs, and heaters.

Although the transmission may be improved by installing a phase coupler in the power distribution, communication over several phases remains a problem due to the following:

- The detour via the phase coupler results in a longer transmission path.
- High-frequency coupling of phases boosts the damping effect of electrical devices connected to the different phases.

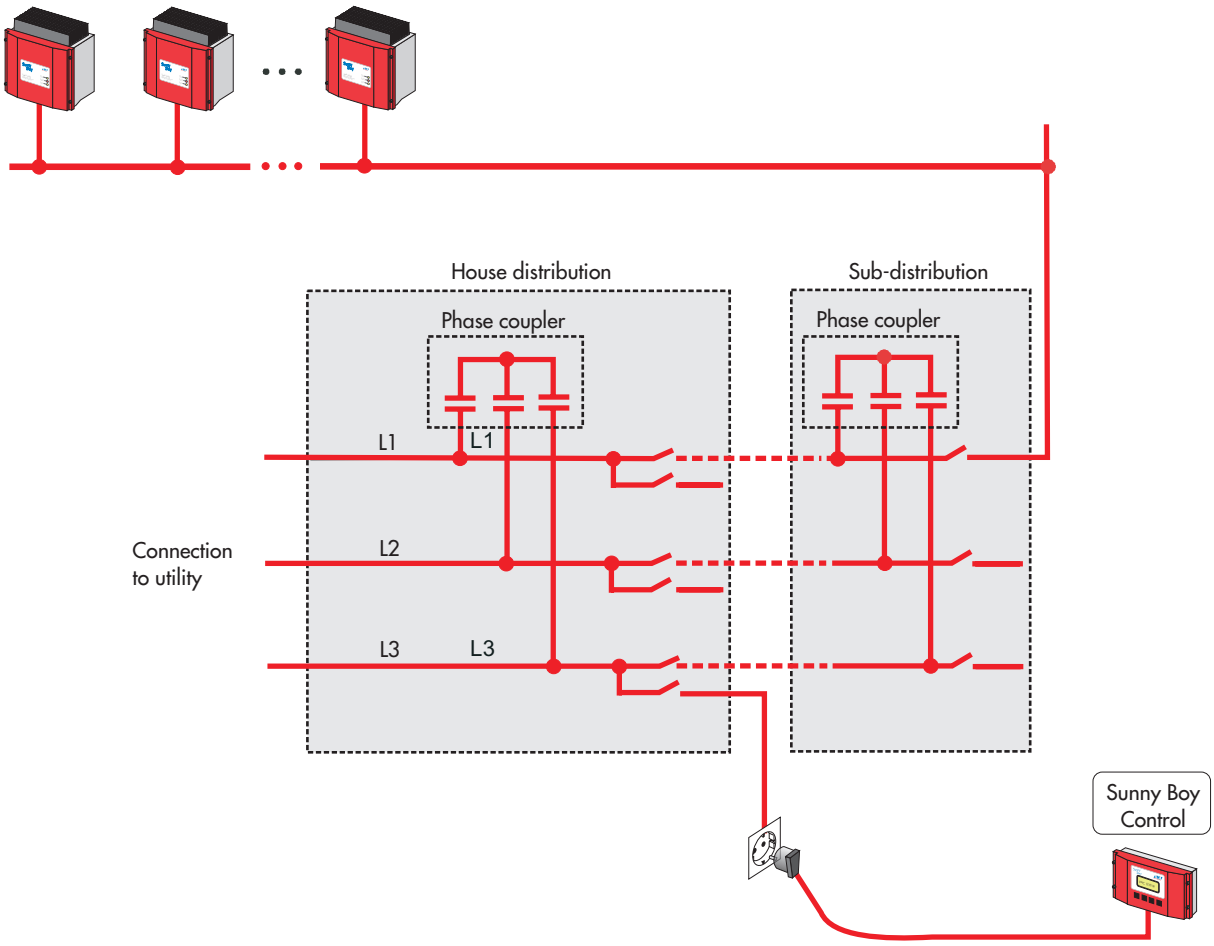


Fig. 9.10: Interference suppression in case of phase coupling

Noise Signals in the Power Distribution

Data transmission uses a frequency of 132 kHz. If other devices generate signals in the same range and above a certain level, they may interfere with the transmission. Such noise signals can come from devices in your own household (e.g., poorly filtered power converters), but also from devices in the neighborhood (e.g., high-consumption power equipment).

Interference is best eliminated by isolating its source. Connecting the source of interference to another phase may be all that is needed. Alternatively, a wave trap may be installed. Such a filter separates the part of the power network where the data transmission takes place from the part of the power network where the interference is generated. The efficiency of the wave trap can be further improved by installing a frequency damper between the wave trap and the interfering device.

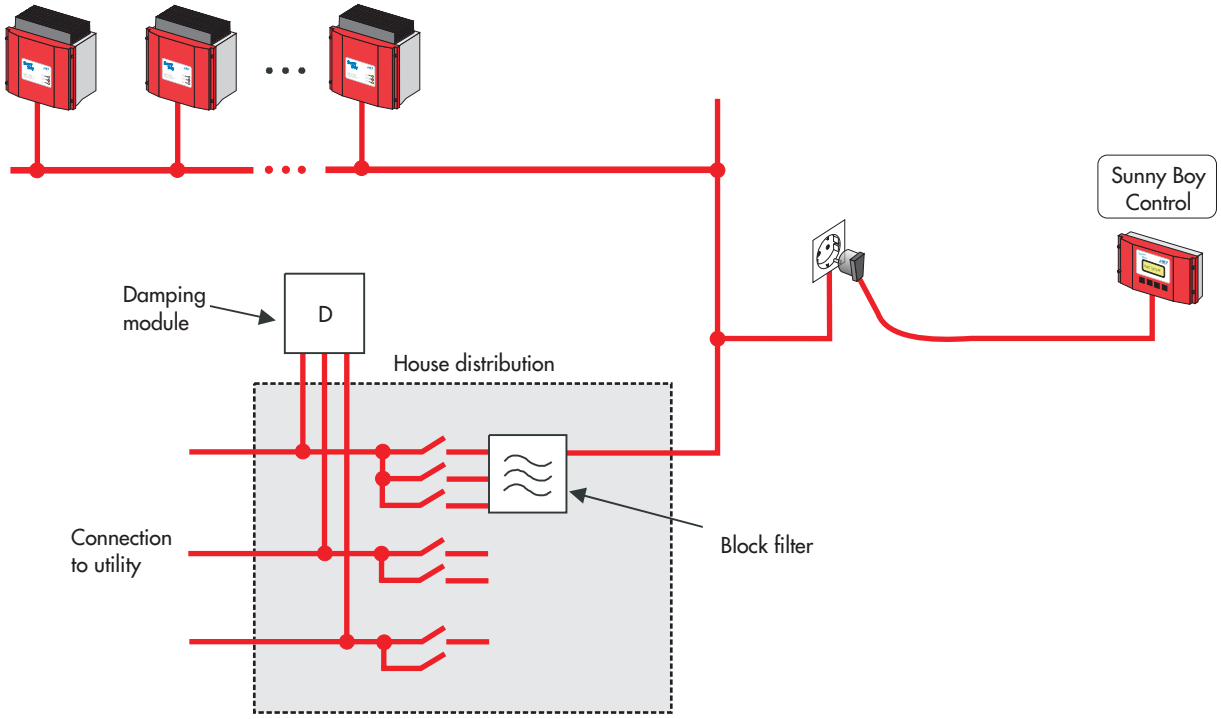


Fig. 9.11: Interference suppression in case of strong noise

Multiple communication networks using the same frequency

The Sunny Boy Control uses a carrier frequency of 132 kHz for data transmission. If other communication systems feed the same or a similar frequency into the power network, exceeding a certain level, that may disturb the data transmission of the Sunny Boy Control. Intercoms, baby monitors, etc. are possible culprits. Such devices are also likely to interfere with each other.

In this case, as with devices that generate noise, the best solution is to separate the transmission paths. However, in this case, it is not desirable to dampen the interfering signal, since all communication systems have to be allowed to operate simultaneously. Instead, at least one of the communication systems should be restricted to one phase or line. Installing a wave trap can then ensure that no high-frequency signals are entering or leaving this part of the power network. In the presence of strong phase coupling, each communication system may have to be isolated as described above. Adding frequency dampers that complement the wave trap may further improve the situation, but they should only be installed to parts of power network where no transmission signals are desired.

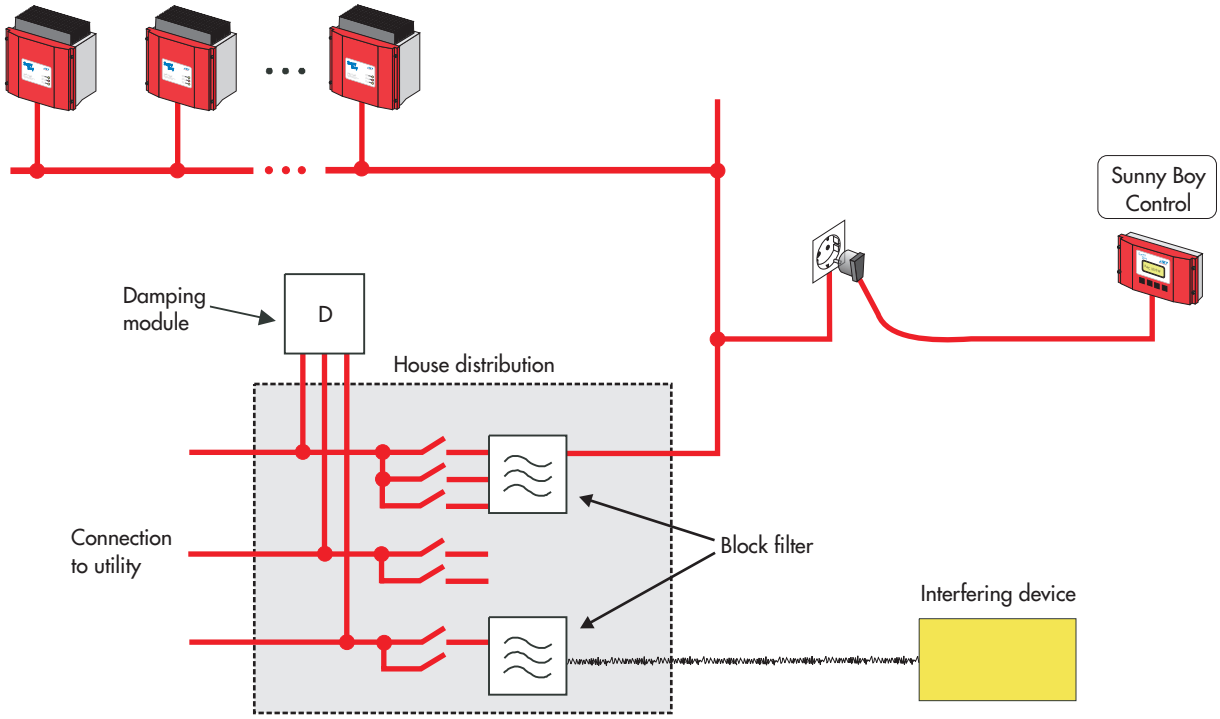


Fig. 9.12: Suppressing interference from multiple communication systems

9.2.2 Noise suppression

When Powerline communication is temporarily interrupted or cannot even be established, the causing interference has to be suppressed from the transmission line as follows:

Identify the noise source(s)

- Ideally, the starting point of this procedure should be an operational transmission. To that effect, you should disconnect all electric devices that are sharing the same line as the Sunny Boy Control. Often it is not enough to just switch them off. Do not leave out three-phase appliances. If possible, switch off the fuses of the remaining circuits in the house. Next, using an extension cord, connect the Sunny Boy Control to the outlet nearest the inverter in terms of wire length.
- Start the function "Diagnosis…Communication" (see chapter 5) and select the device to be monitored. The Sunny Boy Control now tries to communicate with the device and continuously informs you about the transmission results so that you can immediately identify transmission failures.
- Plug the extension cord into other outlets on the line that you are analyzing, gradually increasing the distance to the inverter, and each time check whether the transmission is still operational. A communication failure within a distance of less than 90 m / 100 ft to the inverter indicates interference from devices outside of the house. The countermeasure in this case consists of a wave trap installed to the main branch.
- Now switch the house circuits back on one by one and check if any communication failures occur.
- In the case of a communication failure, disconnect one by one all electric devices on the circuit that caused the failure, in order to identify the disturbing device.
- Leave any disturbing devices disconnected and continue switching circuits back on and reconnecting devices until all devices, except the disturbing ones, are reconnected.

Optimize the installation

- Check whether the interference from troubling devices can be sufficiently reduced by simply connecting them to another circuit and/or phase.
- Installing a spur line from the Sunny Boy Control to the inverter(s) can help reduce the need for costly filters in installations suffering from heavy noise.

Filter the noise

- Provide the section of the electric installation that is used for Powerline communication with a wave trap.
- Connect a suitable filter to devices that are still interfering (refer to section 11.1 Accessories").

Reduce external interference by installing a frequency damper in a section of the electric installation where no Powerline communication takes place.

Systematically following the above procedure will give you a clear overview of the number and types of noise sources interfering with your transmission.

Add-on components such as wave traps, phase couplers, filters, and dampers are commercially available products. You can purchase them either from electrical suppliers or from **SMA**. Their installation takes place in your home and must be performed by a qualified electrician.

Checking Communication With the Inverter

With the function "Diagnostics…Communication", you can analyze transmission failures between individual devices and the Sunny Boy Control. Press **[ENTER]** to select the device to be analyzed.

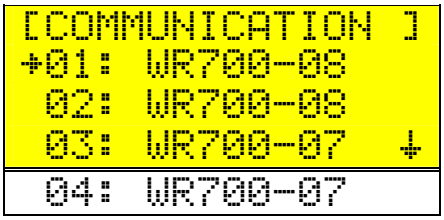


Fig. 9.13: Device selection screen

The Sunny Boy Control starts sending data inquiries to the selected device and continuously evaluates the transmission quality.

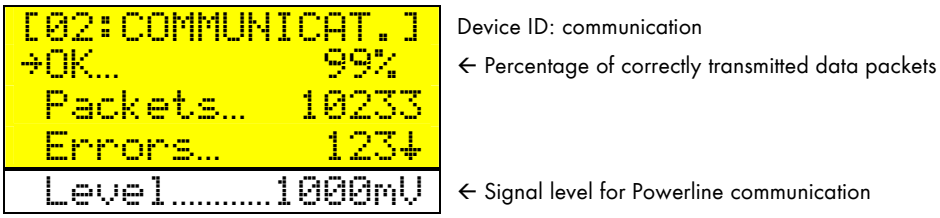


Fig. 9.14: Communication test

The continuously displayed information comprises the percentage of correctly transmitted packages (based on the last 20 data packets), the number of requested data packets, the number of errors, and the signal level.

9.2.3 Communication

Measuring communication distance

If the length of the transmission line between the devices of the plant and the device for data acquisition (PC with SWR-COM and Sunny Data or Sunny Boy Control) is unknown, this distance can be measured with a Sunny Boy Control and a PC with SWR-COM and Sunny Data. You can thus test the quality of Powerline communication before installing the system.

The Sunny Boy Control has to be plugged in the same socket as the PC with Sunny Data . Switch the data acquisition of the Sunny Boy Control off: `'Setup…System…Service Funct.: reset system'`. Confirm twice with [**ENTER**]. The Sunny Boy Control will start the Plug & Play sequence the next time it is activated.

If the Sunny Boy Control is brand-new it is sufficient to simply switch it on without any further action.

The PC with Sunny Data now has to be prepared for the test by selecting the option 'Detect SWR'. After successful detection the Sunny Boy Control is to be placed at the end of the distance to be measured. The number of packages and the resulting calculated quality of transmission in per cent can be seen in Sunny Data version 1.30 and higher under the option: 'SWR transmission statistics'.

10 Technical Data and Settings

10.1 Technical Data

Hardware

Operating voltage:	110 – 120 V, 50 – 60 Hz (for UL devices) 110 – 240 V, 50 – 60 Hz (for all versions other than UL)
Power consumption:	During operation: 4 – 6 W (*Sunny Boy Control*) 9 – 11 W (*Sunny Boy Control Plus*) (depending on the number of *Sunny Boys* connected) In stand-by mode: 3 W (*Sunny Boy Control*) 8 W (*Sunny Boy Control Plus*)
Carrier frequency for Powerline communication:	132.45 kHz
Transmission protocol:	DIN EN 50065 part 1 (VDE 0808 part 1)
Operating temperature:	-13 – 122 °F (-25 – 50 °C)
Measurements:	234 x 127 x 68 mm / 9.2 x 5 x 2.7 in. (*Sunny Boy Control*) 234 x 127 x 88 mm / 9.2 x 5 x 3.5 in. (*Sunny Boy Control Plus*)
Display:	4 x 16 characters
Weight:	1,400 g / 49.4 oz. (*Sunny Boy Control*) 1,750 g / 61.7 oz. (*Sunny Boy Control Plus*)
Protection:	IP40
Fuse:	automatic overload protection, 365 V / 90 mA

Connectors:

- Power / Powerline: 2 m / 2 yd. grounded power cord
- NET: Phone line or computer network (as per order)
- PC (COM2): RS232 or RS485 (as per order) for connection of the following: a PC, an external display or a modem
- SUNNY BOY (COM1): Optional system connection via RS485 (instead of Powerline communication)
- RELAIS OUT: Relay contacts

Additional connectors on Sunny Boy Control Plus:

AUX (COM3): RS232 or RS485 (as per order) for connection of a PC or external display

ANALOG IN:

DB25 connector

Overvoltage protection:	±15 – ±35 V
Input coupling:	DC, 1 MOhm 6 analog inputs: Measuring range (accuracy): -10 – +10 V (0.1 %) -5 – +5 V (0.3 %) -1 – +1 V (0.3 %) -500 – +500 mV (0.3 %) -100 – +100 mV (0.3 %) -50 – +50 mV (0.3 %) -20 – +20 mV (0.3 %) -10 – +10 mV (0.5 %) -20 – +20 mA (0.2 %)
2 analog inputs	PT100: 4-wire measuring Measuring range: -40 – +140 °C (1 %)
A/D converter	Resolution: 16 bit

DIGITAL IN/OUT:

DB25 connector	
External 24 V power supply:	
Input voltage:	14 – 18 V AC, max. 0.5 A *or* 18 – 27 V DC, max. 2 A (1 A per pin)
Overvoltage protection:	±36 V Reverse voltage protection
8 digital inputs:	
Compatible with SO interface	
Max. voltage:	27 V DC
Max. amperage:	27 mA DC
Max. switching frequency:	200 Hz
"Switched on" condition:	>10 V
"Switched off" condition:	< 5 V
8 digital outputs:	
Short circuit/overheat protection	
Max. output amperage:	500 mA per channel max. 2 A total
Output voltage:	18 – 24 V

10.2 Storage Capacity

The Sunny Boy Control can manage up to 50 SMA inverters of up to 10 different types (e.g., SWR700-4, SWR700-8, SWR850-8, or SWR1500-8). The storage capacity for acquired data depends on the number of inverters and on the configuration.

The storage capacity for daily yield values covers at least **one year** per inverter.

The remaining memory is used for the storage of measuring channels. The storage depth (number of days until the oldest values are overwritten) depends on the set number of measuring channels and the set measuring interval. This storage capacity is based on an average daily recording time of 12 hours.

Number of measuring intervals per day based on a daily recording time of 12 hours:

Measuring interval	5 min.	10 min.	15 min.	30 min.	60 min.
Number of daily measurements	144	72	48	24	12

Table 10.1: Number of daily measuring intervals

The combination of the number of measuring channels and measuring intervals results in the following storage capacities.

Measuring channel storage capacity									
Chan-nels	**Cycles**	**Spot values[2]**		**Measuring interval**					
		1–5 inv.	**50 inv.**	**5 min.**	**10 min.**	**15 min.**	**30 min.**	**60 min.**	**120 min.**
		Hours (approx.)		**Days**					
1	19255	27	321	134	267	401	802	1605	3209
2	15906	22	265	110	221	331	663	1326	2651
3	13550	19	226	94	188	282	565	1129	2258
4	11801	16	197	82	165	246	492	983	1967
5	10453	15	174	73	145	218	436	871	1742
10	6652	9	111	46	92	139	277	554	1109
15	4878	7	81	34	68	102	203	406	813
20	3851	5	64	27	53	80	160	321	642
25	3181	4	53	22	44	66	133	265	530
50	1702	2	28	12	24	35	71	142	284
100	882	1,2	15	6	12	18	37	73	147
150	595	0,8	10	4	8	12	25	50	99
200	449	0,6	7	3	6	9	19	37	75
250	360	0,5	6	3	5	8	15	30	60

Table 10.2: Storage depth in hours and days

Changing channels reduces the current storage capacity by approximately 0.5 % per configuration change.

If a Sunny Boy Control manages 50 devices, the preset settings (3 channels per device, 15-minute measuring interval) result in a storage depth of about 12 days.

[2] Saving time for 1–5 inverters: 5 seconds
Saving time for 50 inverters: 60 seconds

If an interval of 0 minutes is set, the Sunny Boy Control saves realtime values without averaging. Depending on the number of connected devices and selected measuring channels, this could reduce the storage capacity to just a few hours.

10.3 Default Parameter Settings

The following are the Sunny Boy Control's factory settings.

Menu "Setup...System":

Parameter	Setting
Stand-by mode	activated
Gatewaymode	automatic

Table 10.3: Default settings in the "System" menu

Menu "Setup...System...Online-Info...Chan. Select...SC...":

SC (Sunny Boy Control)
Pac
E-total
E-today
Status

Table 10.4: Preset Online-Info channels

Menu "Setup...Interfaces...Communication":

Item	Parameter	Setting
Sunny Boy (COM1)	Type	Powerline
	Baudrate	1200 Baud
	Protocol	Sunny-Net
PC (COM2)	Type	RS232
	Baudrate	19200 Baud
	Protocol	SMA-Net

Table 10.5: Default communication settings

During its self-test, the Sunny Boy Control automatically detects the installed interfaces (RS232, RS485, Powerline). Data transmission is always 8 data bits, no parity, and one stop bit. The Baud rate can be changed only for the RS232 interface.

Menu "Setup…Modem/Fax…Modem":

Interface	deactivated
Device model	Hayes
Init-String	AT&FE0V1X0Q0L2M1 ATS0=1 AT&D0&W
Dialmode	tone (MFW)

Table 10.6: Default modem settings

Menu "Setup…Interfaces…Ext. Display":

Interface	deactivated
Type	EnergieCom
Configuration	Display 01: SC:Pac 4.0 Display 02: SC:E-total 4.0 Display 03: SC:E-today 4.0 Display 04: SC:Pac 6.2 Display 05: SC:E-total 6.2 Display 06: SC:E-today 6.2

Table 10.7: Default external display settings

Menu "Setup…System":

Parameter	Setting
Measuring interval	15.00 min

Table 10.8: Default settings in the "DAS Config" menu

Menu "Setup…DAS Config…Chan. Select.":

Device	Channel	Explanation
SunBC	Pac	Total system power
SunBC	E-total	Total system yield
Each device	Pac	Current device power
Each device	Upv-Ist	PV voltage of device
Each device	E-total	Total device yield

Table 10.9: Default channel selection

Menu "Setup…System…Tolerances":

Parameter	Setting
Warnings	15.00 min
Offline	30.00 min
Energy	50.00 %
Communication	50.00 %
RIso	500 kOhm

Table 10.10: Default tolerances

Menu "Setup…Modem/Fax…Modem…Remote-Info…FAX-Info":

Submenu	Parameter	Setting
	FAX-Info	deactivated
Events	system info	daily report
	Warnings	daily report
	Failures	hourly report
	Send at	23:45
Recipient	Company/Name	ABC SOLAR MR. J. SMITH
	Area code	-
	Phone Number	-
Sender	Plant Name	MY SYSTEM
	Plant PhoneNo	+49 123 123456789

Table 10.11: Default FAX-Info settings

Restoring Factory Defaults (Reset System)

Follow these steps to restore the Sunny Boy Control's factory default settings. Because this deletes the entire configuration, it can only be performed after entering the installer password.

- Enter the installer password under "Setup…Password".
- Set the parameter "Setup…System…Service Funct." to "reset system", and then press **[ENTER]** twice.

The Sunny Boy Control deletes all data and automatically restarts in the "Plug&Play" mode.

10.4 AT Commands

The AT commands listed in Table 10.12: are the default parameters for modem initialization. They can be used to alter the init string according to specific requirements (see section "3.3 Modem Connection").

Explanation	ELSA Microlink 33K	ELSA/Devolo Microlink 56ki	Zyxel / Hayes Standard
Load factory settings	&F	&F	&F
Disable character echo in command state	E0	E0	E0
Display result code in verbose form	V1	V1	V1
Ignore dial tone/busy tone	X0	X0	X0
Return result code	Q0	Q0	Q0
Speaker on medium level (optional)	L2	L2	L2
Speaker always on (optional)	M1	M2	M2
Automatic answer after 1 ring	S0=1	S0=1	S0=1
Flow control between PC and modem disabled (no handshake)	-	+IFC=0,0	-
Ignore DTR status change	&D0	&D0	&D0
Automatic re-synchronization on	-	%E1	
Save extended configuration profile (0)	&W	&W	&W

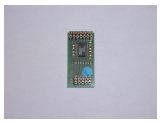
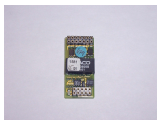
Table 10.12: AT commands

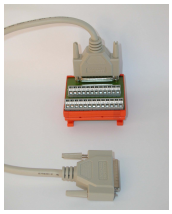
Explanation	Class2	Class2.0
Set local ID string (e.g., +49 561 9522100)	+FLID="ID-String"	+FLI="ID-String"
Set transfer parameters (196 dpi)	+FDIS=1	+FIS=1,5,0,0,0,0
Stipulate inverse bit sequence	+FBOR=1	+FEA
Set fax operation according to class 2.0	+FCLASS=2	+FCLASS=2.0
Dial Pulse	ATP	ATP
Dial Tone	ATT	ATT
Select build-up of connection	ATD	ATD
Initialization of (data) transmission	+FDT	+FDT
No further pages	+FET=2	+FKS
Interrupt existing connection	H0	H0

Table 10.13: Additional commands for fax operation (cannot be changed)

11 Appendix

11.1 Accessories (optional)

	SMA No.	Description
	**232PB-SBCO-NR**	RS232 Kit for Sunny Boy Control (COM1/COM2) and Sunny Boy Control Plus (COM1/COM2/COM3)
	**485PB-SBCO-NR**	RS232 Kit for Sunny Boy Control (COM1/COM2) and Sunny Boy Control Plus (COM1/COM2/COM3)
	**NETPB-ANA-NR**	NET Piggy-Back Analog Kit incl. Installation at SMA **(Installation only at SMA possible!)**
	**NETPB-DIG-NR**	NET Piggy-Back Digital / ISDN Kit incl. Installation at SMA **(Installation only at SMA possible!)**
	**NETPB-GSM-NR**	NET Piggy-Back GSM Kit incl. Installation at SMA **(Installation only at SMA possible!)**
	**NETPB-ETH-NR**	NET Piggy-Back Ethernet Kit incl. Installation at SMA **(Installation only at SMA possible!)**
	**SBCOP-DIG-KIT**	Digital IN/OUT terminal strip with female DB25 connector for Sunny Boy Control Plus (includes 1-to-1DB25 cable, male/female, length: 0.5 m / 1.7 ft)



SBCOP-ANA-KIT Analog IN terminal strip with male DB25 connector for Sunny Boy Control Plus (includes 1-to-1DB25 cable, male/female, length: 0.5 m / 1.7 ft)

RSU 485 RS485/RS232 converter (includes RS232 cable, length: 1.8 m / 6 ft, RS485 connector/RS232 male DB9 connector)

36-5001 1.5 m / 5 ft cable for PC connection to Sunny Boy Control, null modem cable (female DB9/female DB9)

36-5010 DB9-to-DB25 adapter (male DB9, female DB25)

SBCR-ST Relay contact connector (includes housing, DB, solder terminal)

For Home Power Installation

SMA No.	Description
60-1460	Phase coupler (3 phases) for Powerline communication
60-1461	Wave trap (1 phase, max. 63 A) for Powerline communication
SWR-PLC-FILTER	Powerline communication filter

11.2 Warranty & Liability

Should this product prove to be defective or malfunction during the warranty period, contact your dealer or installer.

Warranty

The warranty period is **24 months** from the date of purchase of the device by the end user, and ends no later than 30 months after the device was shipped by **SMA**. The warranty covers all defects caused by faults in the material and manufacture.

The warranty period for repairs or replacements provided under warranty is 12 months after delivery of the repaired/replacement device, or until the expiration of the original warranty period for the purchased device.

Proof of Purchase

For warranty service by **SMA**, the returned device must be received by **SMA** together with a copy of the dealer's invoice, and the type label on the device must be fully legible. Otherwise, **SMA** reserves the right to refuse warranty services.

Conditions

SMA will repair or replace the device at its own discretion and without issuing an invoice for labor and materials.

The returned device is to be sent back to **SMA** in the original packing or one of equal quality at the owner's expense. In case of service under warranty, **SMA** will bear the shipping costs.

SMA must be granted the necessary time to perform the warranty service.

Liability Exemptions

SMA declines any liability for direct or consequential damages due to any of the following:

- Transportation damage
- Improper installation or setup
- Unauthorized alterations, modifications, or repair
- Inappropriate use or operation
- Violation of relevant safety regulations
- Natural disasters (lightning, overvoltage, storm, fire)

SMA cannot guarantee proper transmission via Powerline communication in electric networks with high harmonic distortion or high-frequency line distortions, such as industrial power supply networks, or in the neighborhood of abnormal consumers (unshielded motors, transformers, converters, etc.). Since the simultaneous operation of baby monitors and the like may lead to occasional data transmission failures, the option of RS232 or RS485 communication via a separate data line is offered.

SMA cannot be held responsible for software malfunctions. In the event of such a fault, the purveyance of instructions on how to avoid the effects of the fault is to be considered a sufficient rectification of the fault. The customer is solely responsible for properly selecting, using, and monitoring the software as well as for the consequences of its use.

Any further claims for direct or consequential damages and reparations, even in the case of breach of contract, are excluded, except where prescribed by law.

Consequential Damages

Under no circumstance will **SMA** accept any liability for damages resulting from the use of a Sunny Boy Control**,** including but not limited to direct and indirect damages resulting from the use of the hardware, personal damages, loss of profit, interruption of business, loss of data, or financial losses.

In the case where the maker is legally compelled to accept such liability, it must be limited to the actual cost born by the claimant.

Trademarks

Sunny Boy® and SMA® are registered trademarks of **SMA** Technologie AG.

SMA recognizes all trademarks mentioned in this manual.

11.3 Suppliers

Sunny Boy Products, HvG External Displays, Sensors

Sales SMA Solar Technology,
Rosendahl Industrievertretungen,
Adolf-Dembach-Straße 1
47829 Krefeld,
Germany
Phone +49 2151 456789-0,
E-mail: info@rosendahl-energietechnik.de,
www.rosendahl-energietechnik.de

External Displays

ist EnergieCom GmbH, Tel. +49 821 34666-0, www.ist-energiecom.de

Datalite Electronics Europe, Tel. +31 35 5317547, www.datalite.nl

Siebert Industrieelektronik GmbH, Tel. +49 6806 980-0, www.siebert.de

Rico Electronic Design, Tel. +49 7651-5848, www.rico-electronic.com

Ingenieurbüro Brennpunkt, Tel. +49 30 2201-5611, www.brennpunkt-energie.de

Adaptive Micro Systems Deutschland GmbH,Tel. +49 681 90 66 629,
www.ams-e.com

Modems

devolo AG, Tel. +49 241-1827979, www.devolo.de

ZyXEL Deutschland, Tel. +49 180-5213247, www.zyxel.de

Siemens AG, www.siemens.de

Accessories for Home Power Installations

Busch-Jäger Elektro GmbH, Tel. +49 180 5669900, www.busch-jaeger.de

RS232/M-Bus Converters

Relay GmbH, Tel. +49 5251 1767-0, www.relay.de

Sensors

Ingenieurbüro Mencke & Tegtmeyer, Tel. +49 5151 963368, www.ib-mut.de

11.4 Contact Information

If you have any questions regarding the Sunny Boy Control or technical problems, do not hesitate to contact our Service Hotline. Be sure to have the following information at hand.

- Inverter model
- Serial number of the Sunny Boy
- Connected modules
- Serial number of the Sunny Boy Control
- Type of communication

Address:

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Germany

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hotline@SMA.de

www.SMA.de

CE Declaration of Conformity

for Data Logging Equipment

Product: **Sunny Boy Control**
Type: **SBCO (Sunny Boy Control),**
SBCOLI (Sunny Boy Control Light),
SBCOP (Sunny Boy Control Plus)

We declare that the above specified devices are compliant with the regulations of the European Community, in terms of the design and the version fabricated by SMA. This especially applies for the EMC Regulation defined in 89/336/EWG and the low voltage regulation defined in 73/23/EWG.

The devices are compliant with the following standards:

EMC Immunity:	DIN EN 61000-6-1: 2001
	DIN EN 61000-6-2: 2001
EMC Emission:	DIN EN 61000-6-3: 2001
	DIN EN 61000-6-4: 2001
Device Safety:	DIN EN 60950-1: 2003

The above mentioned devices are therefore marked with a CE sign.

Niestetal, 3rd of November 2004

SMA Technologie AG

Peter Drews
(Geschäftsführer)

SBC-CE-12:BE4504

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