

SolarMax TS-SV

330TS-SV / 360TS-SV

Bedienungsanleitung ■ Operating manual ■ Notice d'emploi
Documentación del dispositivo ■ Istruzioni per l'uso



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1 About this operating manual

1.1 Scope

This operating manual describes the operation, troubleshooting, and maintenance processes for the inverters SM330TS-SV, SM360TS-SV (TS-SV inverter) and their control unit TS-SV Master Control Unit (MCU).

1.2 Target group

This operating manual is written for the operator of the PV system and the qualified electrician.

1.3 Where to keep this manual

The system operator must ensure that this operating manual is available to those responsible for the system at all times. If this original document is lost, an up-to-date version of the operating manual can be downloaded from our website (www.solarmax.com).

1.4 Symbols used in this manual

From time to time you will see the following symbols when reading this operating manual:



DANGER

This symbol indicates that ignoring this instruction can lead directly to serious injury or death.



CAUTION

This symbol indicates that ignoring this instruction can lead to damage to your inverter or your PV power plant.



NOTE

This symbol indicates information which is especially important for operating the inverter.

2 Safety instructions



DANGER

- In daylight the PV generator supplies the inverter with a dangerously high DC voltage.
- SolarMax inverters and accessories may only be installed or opened by qualified electricians who have completely read and understood this instruction manual in advance.
- Only qualified electricians who have already completely read and understood this instruction manual in advance may install and open SolarMax inverters.
- Ignoring the installation and safety instructions shall cancel any and all warranty and liability claims.
- Touching live parts is life-threatening.
- The inverters and accessories must not be opened at any time during operation.
- Before the inverter or the MCU is opened, the DC and AC feed lines must be disconnected according to the instructions and secured against being reconnected accidentally.
- After disconnecting the inverter wait at least 5 minutes before opening the device to permit internal capacitors to discharge.

3 Description

All SolarMax inverters work completely automatically. The DC and AC power switches (Q4-Q6 and Q1-Q3) as well as the main switch (Q7) are always on during normal operation. The inverter starts when there is enough input power and continues to operate until the available input power from the PV generator drops below the necessary minimum.

The inverter is operated using the external master control unit (MCU). The MCU controls the connected inverters and is also the communications and user interface.

3.2 Operating elements

The following section describes the operating elements of the TS-SV inverter and the master control unit (MCU).

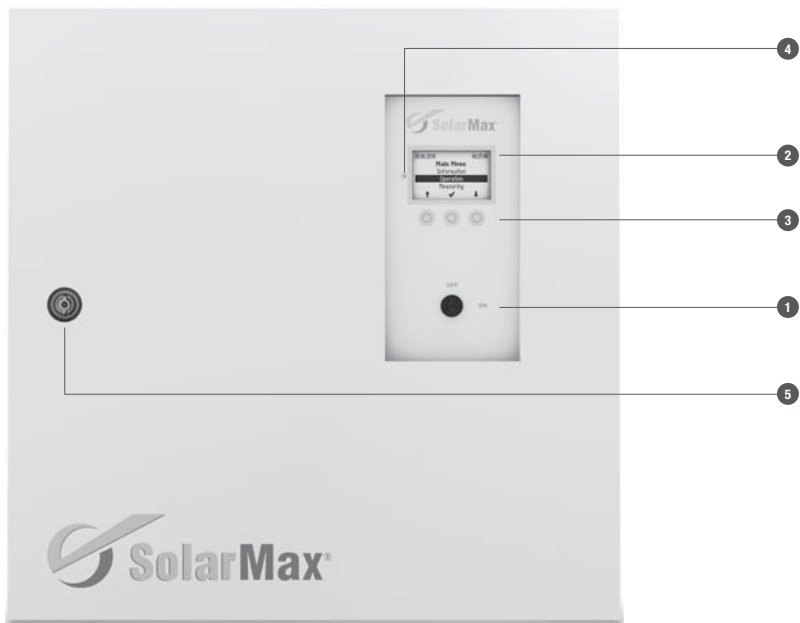
3.2.1 Inverter



Legend:

- | | |
|----------------------|----------------------|
| ① AC power switch Q1 | ④ DC power switch Q4 |
| ② AC power switch Q2 | ⑤ DC power switch Q5 |
| ③ AC power switch Q3 | ⑥ DC power switch Q6 |

3.2.2 Master Control Unit (MCU)



Legend:

- | | |
|--------------------|--------------|
| 1 Main switch Q7 | 4 Status LED |
| 2 Graphics display | 5 Lock |
| 3 Push-buttons | |

4 Operation

The inverter is operated using the external MCU. The MCU allows all the connected inverters to be operated simultaneously, only the DC and AC power switches must be operated directly on the respective inverter.

For all other functions described below the MCU is the shared interface for all the connected inverters.

4.1 How the main switch works

When you switch off the main switch Q7, turning it to the OFF position, the inverter opens the contacts of the AC protections K1, K2 and K3. This disconnects the inverter from the mains.



DANGER

If you switch the main switch Q7 to the OFF position, the inverter's components are still live! This includes the 3 power units and the filters on the input end!

4.2 How the DC and AC power switches work

The DC power switches Q4, Q5 and Q6 are used to connect or disconnect the direct current of the PV plant to the inverter. The AC power switches Q1, Q2 and Q3 connect or disconnect the inverter to or from the mains. The DC as well as the AC power switches are equipped with thermomagnetic overcurrent fuses.



DANGER

Even when the DC and AC power switches are switched off, the connections for the DC and AC feed lines in the inverter are still live!

4.3 Switching on the inverter

Procedure

Action	Reaction
1. Switch off main switch Q7 (to "OFF" position)	
2. Switch on DC power switch Q4, Q5 & Q6 (to "ON" position)	The graphics display is activated after a maximum of 20 seconds (if there is enough sunlight).
3. Switch on AC power switch Q1, Q2 & Q3 (to "ON" position)	
4. Switch on main switch Q7 (to "ON" position)	<p>After several seconds the Overview menu is displayed. The message "Startup...." appears in the "Status" line. The status LED blinks green.</p> <p>When the connected inverters have been started up and are feeding power into the mains, indicates the device status "Mains operation". The status LED glows green.</p>



NOTE

- When the inverters are commissioned the "Initial Setup" menu appears first, during subsequent start-ups the "Overview" menu; see the installation manual.
- If several inverters are connected to one MCU steps 2 and 3 must be performed for each inverter before the main switch Q7 switches on the whole system (step 3).

4.4 Switching off the inverter



DANGER

- Even when the inverter is switched off, the connections for the DC and AC feed lines in the inverter remain live!
- Before the inverter or the MCU is opened, the DC and AC feed lines must be disconnected according to the instructions and secured against being reconnected accidentally.
- After disconnecting the inverter wait at least 5 minutes before opening the device to permit internal capacitors to discharge.

Procedure

Action	Reaction
1. Switch off main switch Q7 (to "OFF" position)	Message on the graphics display is: "Main switch off". The device disconnects from the mains.
2. Switch off AC power switch Q1, Q2 & Q3 (to "OFF" position)	
3. Switch off DC power switch Q4, Q5 & Q6 (to "OFF" position)	After a short time the graphics display of the MCU is shut down.



NOTE

Steps 2 and 3 must be repeated for each inverter connected to the MCU.

4.5 Operating the graphics display








The graphics display on the front of the MCU shows the system dimensions, status information and the malfunction messages of the connected inverters. The display allows you to learn the current device status, access the integrated data logger and enter various system settings. Navigate the various menus using the three push-buttons under the display.

Since the MCU is supplied with power both from the DC end and the AC end, it is also possible to use the MCU functions at night or when the DC end is shut down. However, the inverters connected to the MCU only deliver data and measured values if the inverters are in operation (when there is enough power from the DC end).

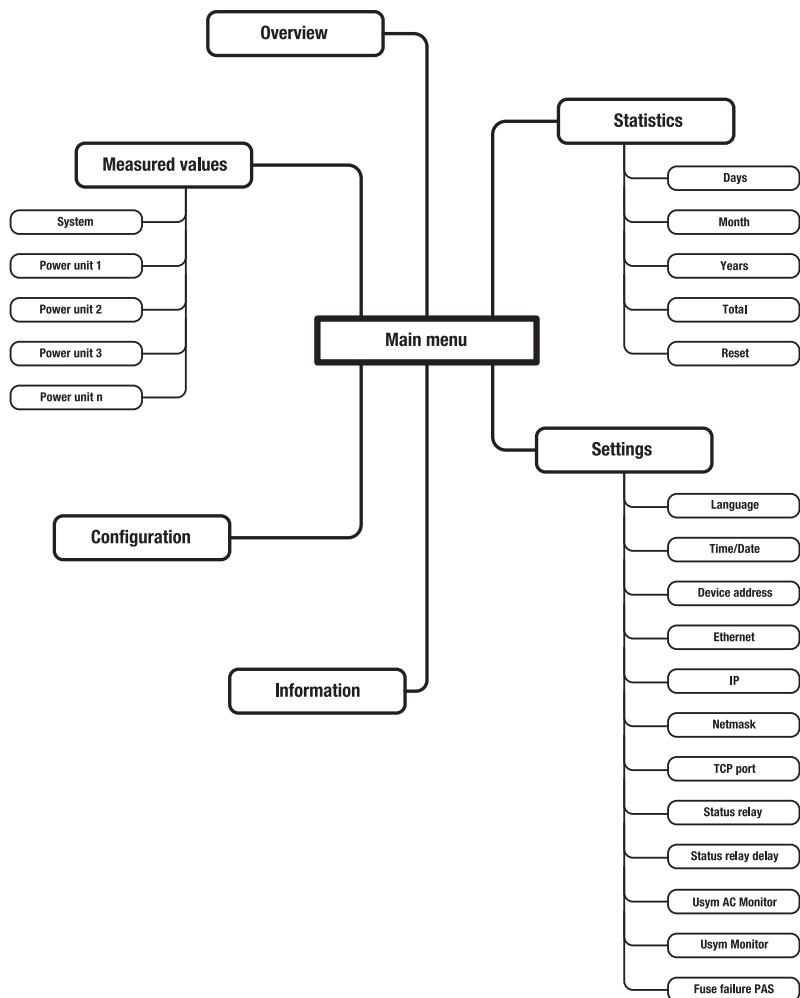
To the left of the graphics display there is a status LED indicating the device status, see 7.1 “Status messages and status LED”.

4.5.1 Menu button symbols

With the help of the symbols shown here you can navigate the various menus and functions visible in the display. The current button function changes from one menu to the next, corresponding to the symbol appearing directly over the button:

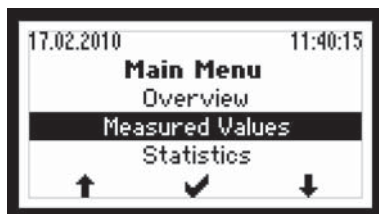
Symbol	Function
	Scroll up, increase number or next element
	Scroll down, or previous element
	Back to higher level menu
	Select next number
	Display selected submenu or confirm changes
	Launch edit mode for selection
	Abort

4.5.2 Menu structure



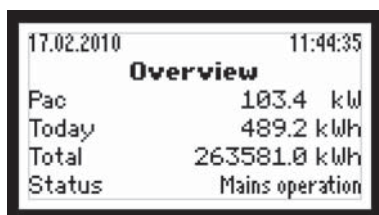
4.5.2.1 Main menu

The main menu is the starting point for all the submenus and displays, see 4.5.2 “Menu structure”. Use the arrow keys **↑** and **↓** to select a menu. Click **✓** to confirm your selection.



4.5.2.2 Overview

If none of the three buttons is pushed for 120 seconds, the display returns automatically to the Overview menu which shows the three most important values as well as the current operating status of the system (all the inverters connected to the MCU).



Operating parameters	Description
17.02.2010 (example)	Current date
11:44:35 (example)	System time
Pac	Momentary effective output
Today	Total energy fed into the mains on the current date and as of the momentary time.
Total	Total energy fed into the mains since the inverter's commissioning.
Status	For status messages and warnings of the system, see 7 “Operating status” and 8.2.2 “Warnings”.

4.5.2.3 Measured values

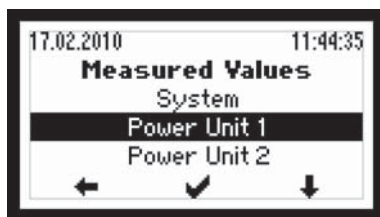
The “Measured values” menu allows the display of currently measured values in relation to the system or the power unit selected.



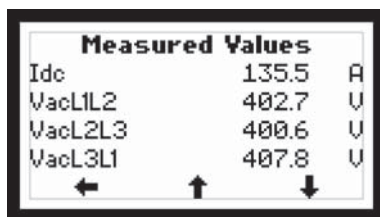
NOTE

- The number of power units listed in the “Measured values” menu depends on the number of inverters connected to the MCU.
- Three power units are displayed per inverter.
- The numbering of the power units follows the addresses allocated to the power units at the time of the installation (see Installation Manual).

en



Use the button to highlight a category. Select a category by pressing the button. In each case only four measured values are displayed at the same time.



Use the arrow buttons and to navigate the measured values. Press the left button to return to the Main menu.

The following measured values can be accessed for the system:

Measured value	Description
Vdc	DC Input voltage (only in single MPPT operation)
Idc	DC Input current (only in single MPPT operation)
Vac (L1L2, L2L3, L3L1)	Mains voltage (Phase to Phase)
Iac (L1, L2, L3)	AC Input current (per Phase)
Pac	Active output power
Q	Reactive power (+: overexcited / -: underexcited)
S	Apparent output power
Cosφ	Power factor (OEX: overexcited / UEX: underexcited)
Frequency	Mains frequency
Temperature	Highest currently measured temperature in the power unit

The following measured values are available for the relevant power unit:

Measured value/Status	Description
Vdc	DC Input voltage
Pdc	Input power at the power unit
Temperature	Highest currently measured temperature in the power unit
Fan	Operating condition of fans
Status	Operating status of the power unit (On/Off/Error)

Measured values only to be displayed with MaxTalk (menu: device/measured values):

Measured value	Description
Prel	Relative output ($P_{rel} = (P_{ac}/P_{inst\ tot}) \times 100\%$)
Vsym	Voltage of the PV generator in comparison with the earthing potential(DC+ and DC- against earth)
Vsym AC	Effective value of the AC voltage share of the DC symmetry voltage
Ief	Earth fault current




NOTE

Remember that the MCU measured values must not be used for billing purposes or calculating efficiency. Only the measured values of a calibrated electricity meter are the basis for billing purposes.

4.5.2.4 Statistics

In the Statistics menu you can access the MCU's internal data logger. The accessible statistics are for the most recent 31 days, 12 months or 10 years. The displayed statistical values each refer to the system as a whole.

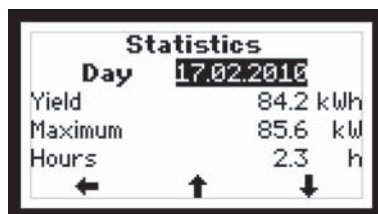


Use the  button to highlight a statistic category. Select a category by pressing the  button.

Press the left button  to return to the Main menu.

Daily statistics

This menu provides access to the data from the most recent 31 days.

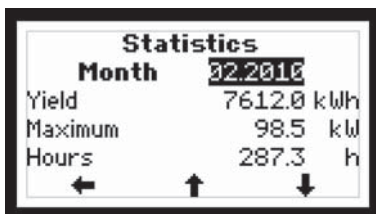





Use the buttons  and  to select a daily statistic. Press the left button  to return to the Statistics menu.

Parameter	Description (refers to the day displayed)
Yield	Total amount energy fed into the mains
Maximum	Peak value of the output fed into the mains
Hours	Total operating hours (in device status "mains operation")

Monthly statistics

This menu provides access to the data from the most recent 12 months.

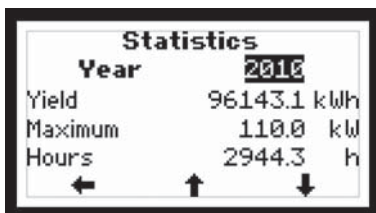





Use the  and  buttons to select a monthly statistic. Press the left button  to return to the Statistics menu.

The displayed values correspond to those in the daily statistics; but the values refer to the month displayed.

Yearly statistics

This menu provides access to the data from the most recent 10 years.

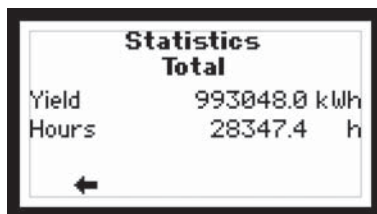


Use the  and  buttons to select a yearly statistic. Press the left button  to return to the Statistics menu.

The displayed values correspond to those in the daily statistics; but the values refer to the year displayed.

Total

This menu lists the total yield and the total number of operating hours of the inverter or the system since it was commissioned.



Press the left button  to return to the Statistics menu.

Reset

In this menu you can delete all the entries in the Statistics menu.



NOTE

Once deleted these data are irretrievably lost!



Press the  button to confirm the deletion of all the statistics entries. Use the  button to enter the Statistics menu without deleting the statistics entries.

4.5.2.5 Configuration

The “Configuration” menu contains the inverter’s available operating parameters and advanced functions. The settings displayed for the limit values and the functions depend on the country selected during initial start-up.



NOTE

MaxTalk 2 Pro, the extension to the standard MaxTalk 2 software, allows author-ised skilled workers to individually adjust the operating parameters. The required “TS series/TS-SV parameter configuration using MaxTalk 2 Pro” instruction manual can be found on our website www.solarmax.com (Downloads area). You can request MaxTalk 2 Pro from the SolarMax service centre. The contact details can be found overleaf.

Parameter	Description	Unit
Country	Country settings selected during initial start-up	-
f nominal	Mains nominal frequency	Hz
Vac nominal	Mains nominal voltage	V
Vac min 1	Minimum admissible mains voltage (first limit)	V
t Vac min 1	Release time for minimum admissible mains voltage	ms
Vac max 1	Maximum admissible mains voltage (first limit)	V
t Vac max 1	Release time for maximum admissible mains voltage	ms
Vac min 2	Minimum admissible mains voltage (second limit)	V
t Vac min 2	Release time for minimum admissible mains voltage	ms
Vac max 2	Maximum admissible mains voltage (second limit)	V
t Vac max 2	Release time for maximum admissible mains voltage	ms
Vac 10 min max	Maximum admissible average value of the mains voltage over the last 10 minutes	V
f min 1	Minimum admissible mains frequency (first limit)	Hz
t f min 1	Release time for minimum admissible mains frequency	ms
f max 1	Maximum admissible mains frequency (first limit)	Hz
t f max 1	Release time for maximum admissible mains frequency	ms
f min 2	Minimum admissible mains frequency (second limit)	Hz
t f min 2	Release time for minimum admissible mains frequency	ms
f max 2	Maximum admissible mains frequency (second limit)	Hz
t f max 2	Release time for maximum admissible mains frequency	ms
Iac max	Maximum admissible mains current (per shift)	A
Pac max	Maximum effective power to be fed	W
S max	Maximum apparent power to be fed.	VA
Island Detection	Immediate grid disconnection when island operation detected	-
OV Detection	Immediate grid disconnection with transients to Vac	-

Parameter	Description	Unit
Restart delay	Delay time before mains reconnection upon previous failure-related mains disconnection.	s
Pac Progression	Maximum increase of the effective power during mains reconnection upon previous failure-related mains disconnection.	%/Minute
Soft Start	Maximum increase of the effective power at mains connection. This gradient, if activated, is always effective, as opposed to Pac Progression (even during restart in the morning).	W/s
Mains check	Additional monitoring before connecting to the mains	-
- Vac MC max	Maximum admissible mains voltage at mains check	V
- Vac MC min	Minimum admissible mains voltage at mains check	V
- f MC max	Maximum admissible mains frequency at mains check	Hz
- f MC min	Minimum admissible mains frequency at mains check	Hz
- t MC monitoring	Duration of mains check	s
P(f)-Mode	Frequency-dependent power reduction (1/2/3/Off)	
- Reduction	Reduction of effective power Pac in P(f) mode	%/Hz
- f start	Starting frequency of the P (f) mode	Hz
- f stop	Stop frequency of the P(f) mode	Hz
- MC f max	Maximum admissible mains frequency at mains check in P(f) mode	Hz
- MC f min	Minimum admissible mains frequency at mains check in P(f) mode	Hz
- MC time	Duration of mains check in P(f) mode	W/s
- Re-increase	Maximum increase to the maximum effective power Pac max in P(f) mode.	%/Minute
Q-Mode	Reactive power mode (Off/cos ϕ /cos ϕ (Pac)/Q/Q(Vac))	-
FRT	Fault ride through function for dynamic grid support	-
- K factor	Reactive current static factor for voltage support with reactive current during mains drops	-
RC mode	Remote control by solar plant controller (Off/On/Guarded)	-
- Timeout	Maximum admissible time without control commands at remote control by solar plant controller.	s

4.5.2.6 Settings

This menu can be used to set different communication parameters and monitoring functions.

All settings can also be implemented with MaxTalk (menu: Devices/Settings).



NOTE

The term “system” comprises all TS-SV inverters connected to the MCU.

Parameter	Description
Language	Selection of the display language (German, English, French, Italian, or Spanish). The display language can be selected independently of the selected specific country settings.
Time	Setting the internal clock (RTC)
Date	Setting the displayed date
Device address	Definition of a device address between 1 and 249. For details see 5.1 “Configuration of the data communication interfaces”.
IP	Configuration of the Ethernet interface. For details see 5.1 “Configuration of the data communication interfaces”.
Netmask	
TCP Port	
Status relay delay	Setting the switching delay of the status signalling contact (status relay)
Pinst tot	Rated output power of the PV generator (entry only possible in MaxTalk). “Pinst tot” is used to calculate Prel (see 4.5.2.3 “Measured values”) and the target yield (display in the MaxWeb portal).

Status relay

The functions of the status relay or the status signalling contact can be adjusted. There are three different functional settings.

Setting	Description
Off	The status signalling contact is always open.
Grid	When the system starts grid operation, the status signalling contact of the MCU will close immediately and remains closed as long as the system feeds in. When the system no longer feeds into the grid, the status signalling contact will open upon expiration of the adjustable delay time.
Error	If a warning, malfunction or device error occurs with the system, the status signalling contact of the MCU will close after the adjustable delay time has expired (the events are listed in 8.2 “Diagnosis & corrective steps”). The status signalling contact will immediately open if the error is no longer present.

The monitoring electronics are supplied by the PV generator, in other words during the night and when the DC side is switched off, the status signalling contact is open.

Fuse failure PAS

The equipotential bonding kit (PAS) is an accessory component and serves for earthing the PV generator. The behaviour of the system during fuse failure on the equipotential bonding kit can be controlled. For this, the function “Fuse failure PAS” offers three different settings:

Setting	Description
Off	Monitoring the fuse in the equipotential bonding kit is switched off. Select this setting for test purposes only.
Warning	The warning message “Fuse failure PAS” is displayed. The system will continue to feed into the mains. The status signalling contact of the MCU will be closed (factory setting).
Error	The malfunction message “Fuse failure PAS” is displayed. The system will disconnect from the mains immediately. The status signalling contact of the MCU will be closed.



NOTE

Read the hazard warnings and instructions in the device documentation on the equipotential bonding kit before replacing the fuse.

Vsym Monitor (MaxTalk: Vsym DC Monitor)

The DC insulation monitoring (Vsym Monitor) checks the symmetry of the voltage of the PV generator regarding the earthing potential before mains activation. If the voltages (DC+ and DC- against earth) are not symmetrical or if there is a short-circuit against earth, this will be detected by the MCU. Three settings are possible:




Setting	Description
Off	The DC insulation monitoring is switched off. Switching off DC insulation monitoring is only required when using the equipotential bonding kit.
Warning	The warning message “Insulation failure DC” is displayed. The system will continue to feed into the mains. The status signalling contact of the MCU will be closed (factory setting).
Error	The malfunction message “Insulation failure DC” is displayed. The system will disconnect from the mains immediately. The status signalling contact of the MCU will be closed.

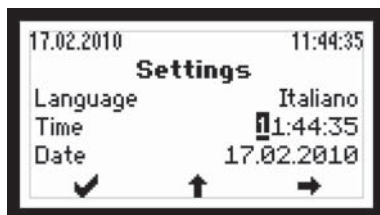
Vsym AC Monitor




The monitoring of the AC share on the DC side (Vsym AC Monitor) detects too high parasitic oscillations and capacitive leakage currents on the PV generator. Furthermore, insulation failures between the transformer and the system can be detected. Three settings are possible:

Setting	Description
Off	The AC insulation monitoring is switched off. Select this setting for test purposes only.
Warning	The warning message "Insulation failure DC" (MaxTalk: "DC insulation failure (AC)") is displayed. The system will continue to feed into the mains. The status signalling contact of the MCU will be closed (factory setting).
Error	The malfunction message "Insulation failure DC" (MaxTalk: "DC insulation failure (AC)") is displayed. The system will disconnect from the mains immediately. The status signalling contact of the MCU will be closed.

Implementing the settings

1. Select parameter using the  button; e.g. time.
2. Push the  button to switch into the editing mode.
3. Push the  button to get to the desired position of the parameter:






4. Push the  button to increase the figure.
5. Select the next position using the  button or
6. Push the  button to confirm the value and exit the editing mode.

4.5.2.7 Information

This menu contains the following information:

- Device type
- Series number
- Firmware version
- Status message and two-digit number code (if a device error occurs)
- Warning (alternating display if several warnings are active at the same time)
- Date of commissioning
- Accumulated operating hours
- Date and Time

Use the  and  keys to move through the menu. Press the left button  to return to the Main menu.

5 Data communication

For PV power plants equipped with SolarMax inverters Sputnik Engineering provides the MaxComm communications platform. This provides many ways of recording data and monitoring your PV power plant. Below is an overview of the current products.



NOTE

You can find detailed information on our website at www.solarmax.com.

MaxTalk 2.0: For occasional communication and the configuration of the inverters

If you only need to access your system data or modify your system's settings occasionally, the MaxTalk PC software is ideal for you. MaxTalk can be downloaded at no charge from our website.

MaxWeb xp: The gateway to Internet-supported communication

MaxWeb xp is a data logger, monitoring unit and web server in one. For all those who want to have their PV power plant monitored and checked reliably and professionally MaxWeb xp is the ideal solution. You can access your PV power plant from any internet-connected PC to check current measured values and yields or to modify your system settings. The data logger records operating parameters, yield values and events and communicates them automatically to the SolarMax web portal.

If there is a malfunction, MaxWeb xp sends out alarm messages by e-mail or SMS.

MaxWeb Portal: For accessible power plant data at any time

The MaxWeb Portal is the ideal complement to the MaxWeb xp data logger. When you use MaxWeb Portal you can access the data of your PV power plant from anywhere on the Internet. The MaxWeb Portal provides a wide variety of graphic and chart display options for the evaluation of your PV power plant's operating parameters.

5.1 Configuration of the data communications interfaces

In order to use the RS485 and Ethernet communications interfaces, you must enter the following settings in the “Settings” display menu:

Device address

If you connect several systems and/or MCUs to become one network, you will need a separate address for each system.



NOTE

- You can assign addresses between 1 and 249. Please make a point to remember to assign a unique address to each system in the network!
- Start the address numbering with the lowest numbers possible (if possible with 001).

When connecting to a LAN network, the following settings are required in addition to the device address:

IP

If you want to access your system from a local area network (LAN), enter here an unsigned IP address from your LAN.

Netmask

Please enter here the pertinent sub-netmask for your IP address.

TCP port

Enter your TCP port selection for communications with the system. Remember that the TCP port must be greater than 1023 since this range is reserved for predefined applications (referred to as “well known services”).



NOTE

You will find more details about data communications in the technical information “MaxComm network”. This document can be downloaded from our website at: [www.solarmax.com; downloads/data communication/MaxComm](http://www.solarmax.com/downloads/data%20communication/MaxComm).

6 Options

6.1 MaxControl

6.1.1 Scope of services

MaxControl is a service package for your solar system with SolarMax central inverters. It is based on the MaxComm communications system and includes:

- Automatic yield control including monthly analysis
- Forwarding of malfunction reports to the client via email and/or SMS
- Troubleshooting and on-site service by Sputnik Engineering
- Warranted availability of 97 % annually
- Yield shortfall payments if availability < 97 %
- Free inverter repair

6.1.2 Duration

- Two years and three months from the date of shipment.
- When the period is up the warranty can be renewed for one more year.

Remember that a MaxControl service package can only be agreed at the time the SolarMax central inverter is purchased and afterwards it is no longer possible.

The agreement is automatically renewed if you do not cancel it in writing at least one month before the end of the calendar year. The agreement can be renewed no more than eighteen times. The total term of the package is thus 25 years and three months.



NOTE

You can obtain further details about MaxControl directly from Sputnik Engineering.

6.2 Accessory components

Here is a list of other available accessory components.

MaxConnect plus

Generator connection box with integrated string monitor

MaxMeteo

Unit which records irradiation data and cell temperature of PV modules

MaxCount

Unit which records meter figures with S0-interface

MaxDisplay

Interface for large display to visualise PV power plant data

Potential equalization set

The potential equalization set enables the earthing of the PV generator

7 Operating status



NOTE

The term “system” comprises all TS-SV inverters connected to the MCU.

7.1 Status messages and status LED

The status message on the graphical display of the MCU describes the current operating status of the system. Each system status message belongs to one of the five possible operating statuses. The status LED always displays one of these operating statuses through a variety of colours. In addition to the status messages, the system can also display warnings. Warnings result from device errors or external malfunctions which, however, do not affect the mains operation of the system. Losses of yield are possible, however. Warnings have no relation to the operating status and are displayed on the graphical display alternately with the current status message.

The status messages of the “Malfunction”, “Error”, and “Blocked” operating statuses, as well as the warnings, usually require certain measures to be taken, see 8 “Troubleshooting”.

LED status	Operating status	Description
Off	-	The system is switched off > mains disconnection
Flashing green ---	Booting	The system is booting > mains disconnection
Green ——	Mains operation	Power supply (normal operation)
Flashing orange ---	-	Warning > no mains disconnection; yield losses possible
Orange ——	Malfunction	External malfunction > mains disconnection
Red ——	Error	Internal device error > mains disconnection
Flashing red ---	Locked	The system is locked > mains disconnection

7.2 Booting



Status message	Description
Irradiance too low	The solar irradiance or rather the available output is too low for mains operation.
Startup...	The system checks the internal hardware and software components before connecting to the mains.
Restart delay	The system disconnected from the mains and is delaying re-connection to the mains.
Idle	The system does not start since at least one power unit is unavailable for the MCU.

7.3 Mains operation

Status message	Description
Mains operation	The system has been connected and is feeding power to the mains.
Maximum power	The system limits the fed output to the maximum permissible output. Limiting the output can occur when the PV generator has been over-dimensioned or in the event of high irradiation.
Idc limitation	The system limits the DC input current to the maximum permissible value. This can occur if the PV generator was designed so that the current in the MPP is higher than the maximum permissible DC current of the system.
Iac limitation	The system limits the input mains current to the maximum permissible value. This can occur in response to major fluctuations in irradiation, low mains voltage, or due to an over-dimensioned PV generator.
Restart limitation	The system increases the effective power upon completion of an external limitation with a defined progression (Pac Progression and/or Soft Start).
Frequency limitation	The system limits the fed-in effective power due to an active frequency-dependent power reduction - P(f) mode.
External limitation	The fed-in effective output of the system is limited via a remote access.
Remote controlled	The system is controlled remotely by solar plant controller or by radio ripple control receiver.

7.4 Communications activity

The communications activity of the MCU is displayed via two different symbols on the graphical display.

Symbol	Description
	This symbol is displayed when the MCU sends or receives data (via RS485 or Ethernet).
	This symbol is displayed when there is an Ethernet connection (corresponds to the "Link" display on network cards).

8 Troubleshooting

Sputnik Engineering delivers only SolarMax inverters which have stood up to our extensive testing regime. Moreover, each inverter is subjected to several hours of endurance testing under full-load conditions.

This section describes in several tables all the possible error messages, their possible causes and suggestions on how to remedy them.

If despite this your PV power plant suffers a malfunction or an error we recommend these procedures:



DANGER

Work on the PV power plant and on the opened inverter must be performed solely by qualified electricians. Switch off the inverter and make sure that the DC and AC feed lines are dead before you start work on the opened device.

1. Make sure that the system and PV generator have been correctly installed.
2. Check the cable connections and follow the instructions contained in the Installation Manual.
3. Determine the cause of the malfunction by consulting the message on the graphic display unit. Section 8.2, “Diagnosis & corrective steps” explains possible ways of correcting malfunctions.
4. If you cannot correct the malfunction using the recommended procedures, or you are not sure what sort of fault is involved, please contact our SolarMax Service Centre.

8.1 SolarMax Service Center

If you have technical questions or difficulties our Service Centre would be happy to help you. If you have questions about central inverter malfunctions we need from you the following details:

- Device type
- Serial Number S/N
- Installation location
- Information about the malfunction you are experiencing (status message, etc.)

Availability

The contact details of the SolarMax Service Center can be found overleaf.

Sputnik Engineering AG
Länggasse 85
CH-2504 Biel/Bienne

8.2 Diagnosis & corrective steps

The following tables describe how to troubleshoot malfunctions. If the steps suggested do not correct the malfunction please contact the SolarMax Service Centre immediately.

8.2.1 General troubleshooting

Problem	Cause	Steps
The display remains blank	MCU or display is defective.	Notify the SolarMax Service Centre.

8.2.2 Warnings

Warning	Cause	Measure
Power unit malfunction	At least one power unit has a malfunction. The system will continue to feed into the mains.	Contact the SolarMax service centre.
Failure temp. sensor	A temperature sensor in the system has ceased functioning.	
Failure fan	The displayed fan is defective.	

Warning	Cause	Measure
Burst error	The system disconnected from the mains five times or more on the same day. The warning is displayed for the remainder of the day. The error counter will be reset when the system is restarted in the morning.	Check the status logger of your system in MaxWeb xp (if available) or check the mains parameters. If this problem occurs frequently, contact the SolarMax service centre.
Flash error	A flash error has occurred.	Contact the SolarMax service centre.
Ief too high	The earth fault current in the potential equalisation set (PAS) is too high (can only be displayed if the PAS is used). There is an insulation fault in the PV generator.	Correct the insulation fault in the PV generator.
Insulation fault DC	There is a short-circuit in the PV generator to earth.	Correct the short-circuit.
	Poor wiring of the PV generator.	Repair the wiring.
	High creeping currents in the PV generator caused by dampness.	Seal the generator connection box better and improve the insulation materials.
	Note: Check the setting of the functions Vsym Monitor or Vsym AC Monitor.	
Power unit blocked	At least one power unit is blocked temporarily.	Switch off the main switch Q7 and then switch it back on in order to remedy the blocking (or wait for the next restart of the system).
RTC error	The RTC (real-time clock) in the MCU has a malfunction, the date and time were re-set.	Set the time and date correctly (see 4.5.2.6 "Settings". If this problem occurs frequently, contact the SolarMax service centre.
Fuse failure PAS	Fuse failure in the potential equalisation set (PAS) (can only be displayed when using the PAS).	Contact the SolarMax service centre. Note: Check the setting of the fuse failure PAS function.
Temperature limitation	The feed-in power has been temporarily reduced to limit the temperature of the system.	Clean the fan grids and improve ventilation in the operations room.
Warning MaxConnect	The alarm contact X501 of the MCU was closed.	Check the generator connection box (MaxConnect) connected to the alarm contact X501.

8.2.3 Malfunctions

Status message	Cause	Measure
Vdc too high	The DC input voltage of an individual power unit or the system is too high.	Switch off all DC circuit-breakers immediately and then disconnect the PV generator from the system. Check the PV generator's dimensioning.
Vdc too low	The DC input voltage has dropped to too low a value.	Wait for the next restart of the inverter and check whether it starts mains operation.
No mains No mains BP	The AC circuit-breakers are switched off.	Switch on the AC circuit-breakers Q2, Q4, and Q6.
	There is no mains voltage or the AC feed line has been disconnected.	Check the AC feed line.
Mains error	The grid was shut down.	If this occurs repeatedly, contact the responsible grid operator.
Frequency too high Frequency too high BP	The mains frequency is outside of the f max 1 or f max 2 limit values.	
Frequency too low Frequency too low BP	The mains frequency is outside of the f min 1 or f min 2 limit values.	
Vac too high Vac too high BP	The mains voltage at the specified phase is outside of Vac max 1 or Vac max 2 limit values.	
Vac too low Vac too low BP	The mains voltage at the specified phase is outside of Vac min 1 or Vac min 2 limit values.	
Vac 10min too high Vac 10min too high BP	The maximum 10-minute average value of the mains voltage (Vac 10 min max.) is too high.	
Insulation fault DC	There is a short-circuit in the PV generator to earth.	Correct the short-circuit.
	Poor wiring of the PV generator.	Repair the wiring.
	High creeping currents in the PV generator caused by dampness.	Seal the generator connection box better and improve the insulation materials.
	Note: Check the setting of the functions Vsym Monitor or Vsym AC Monitor.	

Status message	Cause	Measure
Fuse failure PAS	Fuse failure in the potential equalisation set (PAS) (can only be displayed when using the PAS).	Contact the SolarMax service centre. Note: Check the setting of the fuse failure PAS function.
Incorr. rotation dir.	The rotational direction of the connected mains phases is wrong.	Connect the mains phases properly.
Error ext. control	The communication to the remote control is interrupted. The time limit between two control commands was exceeded.	Once the remote control re-established communication, the system will automatically continue mains operation. If this occurs repeatedly, please check the network connections.

8.2.4 Error

Status message	Cause	Measure
Device error (+ error code)	An internal fault has occurred in the system.	Check the two-digit error code displayed and contact the SolarMax service centre.

8.2.5 Blockages

Status message	Cause	Measure
Main switch off	Main switch Q7 is in "OFF" position.	Switch on the main switch Q7.
Shutdown 1	The shutdown 1 (shutdown contact 1) is activated.	Eliminate the shutdown / blocking.
Shutdown 2	The shutdown 2 (shutdown contact 2) is activated.	
External blocking	There is a 0% command from MaxRemote (based on the grid operator).	None. Wait until the grid operator suspends the blocking of the system via MaxRemote.
Program firmware	The system firmware is currently being updated.	None. The system automatically re-assumes mains operation once the firmware update is complete.
Recurring short circuit	The MCU detected several (>2) short-circuits during a certain period of time on the AC side.	Contact your grid operator in order to eliminate the cause of the short-circuits.

9 Maintenance

All SolarMax inverters work completely automatically. However, to ensure perfect operation over the course of several years, in addition to regular controls of the operating and yield data via the inverter display or remote monitor we also recommend having the simple maintenance work described below performed at regular intervals. The maintenance intervals must be set keeping the ambient conditions in mind (especially exposure to dust).



DANGER

Work on the opened inverter or MCU must be performed solely by qualified electricians. The inverter must be shut down before it is opened. Then the DC and AC feed lines must be disconnected according to the instructions and secured against any accidental reconnection.

9.1 Inspections by the plant operator

The following checks can be performed by the plant operator. If you discover problems while performing these checks, contact the electrician in charge of maintenance or our SolarMax Service Centre.

- A functional check of the inverter via the graphics display on the MCU
- On-site check of visible traces of wear and tear (damage, rain, snow, rodents, etc.)
- Cleaning and check of plant room

9.2 Maintenance by a qualified electrician

1. Switch off the inverter and make sure that the DC and AC feed lines are dead.
2. Then wait 5 minutes to give the internal capacitors time to completely discharge.
3. Open the inverter by removing the front cover plate.
4. Tighten the screws on the DC and AC terminals.
5. Carefully clean the fan and the fan screen.
6. Check if there are any foreign bodies (rodents, etc.) in the inverter and remove them.
7. Re-close the inverter.



CAUTION

Have you left any tools in the device?

8. Switch on the DC and AC feed lines and the inverter.
9. If the PV power plant has the MaxControl option, a communications test is advisable. For this purpose contact our SolarMax Service Centre.

9.3 Testing grid monitoring

With the help of the test contacts the grid monitoring of the system can be tested. The test can be carried out for both single MPPT operation and multi-MPPT operation.

The test contacts permit a separation of the measuring lines between the respective power unit and the three phase voltages U L1, U L2, and U L3. This allows for connecting an AC generator for grid simulation. A DC voltmeter can be connected to the test contacts in order to check the control voltage of the AC contactors K1, K2, or K3. The power units within the system must be tested separately. The test contacts are located on the top right in the inverter, see the Installation Manual.

Prerequisites / aids

- Sufficient solar irradiation during the test
- 3-phase AC generator
- DC voltmeter

Procedure

The following instructions describe the test for the inverter's LT1 power unit. When testing power unit LT2 or power unit LT3, please observe the corresponding information in the square brackets.



DANGER

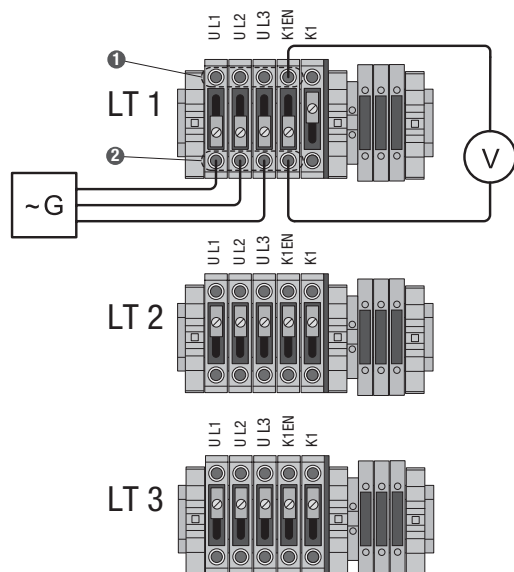
The functional test of the inverter's grid monitoring is performed using high voltages while the inverter is open. Coming into contact with exposed power lines or non-insulated electrical contacts may result in serious injury or death!

1. Switch off the system as described in 4.4 "Switching off the inverter".
2. Open the inverter to be tested and remove the covers.
3. Loosen the slide switches of the test contacts U L1, U L2, U L3, and K1EN from termi-

nal block "LT1" secured by means of slotted-head screws. [power unit LT2: terminal block "LT2"], [power unit LT3: terminal block "LT3"].

4. Slide all 4 slide switches downwards and secure the slide switches by tightening the slotted screws.
 5. Connect the three-phase AC generator to the test contacts U°L1, U°L2, and U°L3 on terminal block "LT1" [power unit LT2: terminal block "LT2"], [power unit LT3: terminal block "LT3"]. Only use the lower 4mm sockets on the test contacts.
- Remember to connect the rotational field of the generator phases to rotate clockwise.
6. Connect the DC voltmeter to measure the control voltage of the AC contactor at the upper and lower test contact K1EN.
 7. Check the wiring of the testing assembly against the following diagram:

Wiring diagram when testing power unit LT1



Legend:

① 4mm sockets to control unit of the power unit

② 4mm sockets to the AC connections

G: AC generator

V: DC voltmeter

8. Switch on the DC circuit-breaker Q4 [power unit LT2: Q5], [power unit LT3: Q6]. The other DC circuit-breakers and all AC circuit-breakers in the system remain switched off.
9. Switch on the AC generator. The external conductor voltages must correspond to the nominal mains voltage and frequency ($3 \times 280 U_{ac} / 50\text{Hz}$).
10. Switch on the main switch Q7 (on the MCU). The inverter starts and, after roughly 30 seconds, switches to (simulated) mains operation.
11. Confirm that the control voltage of the AC contactor is 24 V_{DC}.
12. Now increase the voltage or frequency of any phase up to just under the set limit (see 11.5 "Individual country settings").



CAUTION

Damage to the device possible! Never set the test voltage higher than 364 V (130 % of the nominal voltage). This may damage the inverter's measurement circuits. Sputnik Engineering assumes no liability for damages which result from incorrectly conducted tests.

13. Slowly increase the phase voltage or the frequency beyond the limit. Check whether the inverter's grid monitoring reacts appropriately: the measured control voltage of the AC contactor must drop to 0V.
The test for power unit LT1 is completed when the control voltage of the AC contactor drops.
14. Switch off the main switch Q7 (on the MCU).
15. Switch off the AC generator.
16. Switch off the DC circuit-breaker Q4 [power unit LT2: Q5], [power unit LT3: Q6] (all the DC circuit-breakers are switched off).
17. Remove the AC generator and the DC voltmeter from the inverter.
18. Slide the 4 slide switches of the test contacts back into the upper position and screw them down firmly.
19. If required, repeat the test for power units LT2 and LT3: in each case start with step 3 of these instructions. Pay attention to the information in the square brackets.
20. Remove all tools from the inverter.
21. Attach the covers and close the inverter.
22. If required, repeat the test for the remaining power units of the system.
23. Switch on the system as described in 4.3 "Switching on the inverter".
The system is back in normal mains operation.

10 Disposal

Please dispose of the inverter at the end of its service life in compliance with the disposal regulations currently valid where it is installed. You can also return the inverter at your own cost for professional disposal to Sputnik Engineering (address as stated in the section on “Troubleshooting”).

SolarMax Service Center

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Italia	+39 0362 312 279
España	+34 902 160 626
Benelux	+32 2 535 77 32
Česká Republika	+420 222 191 456
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