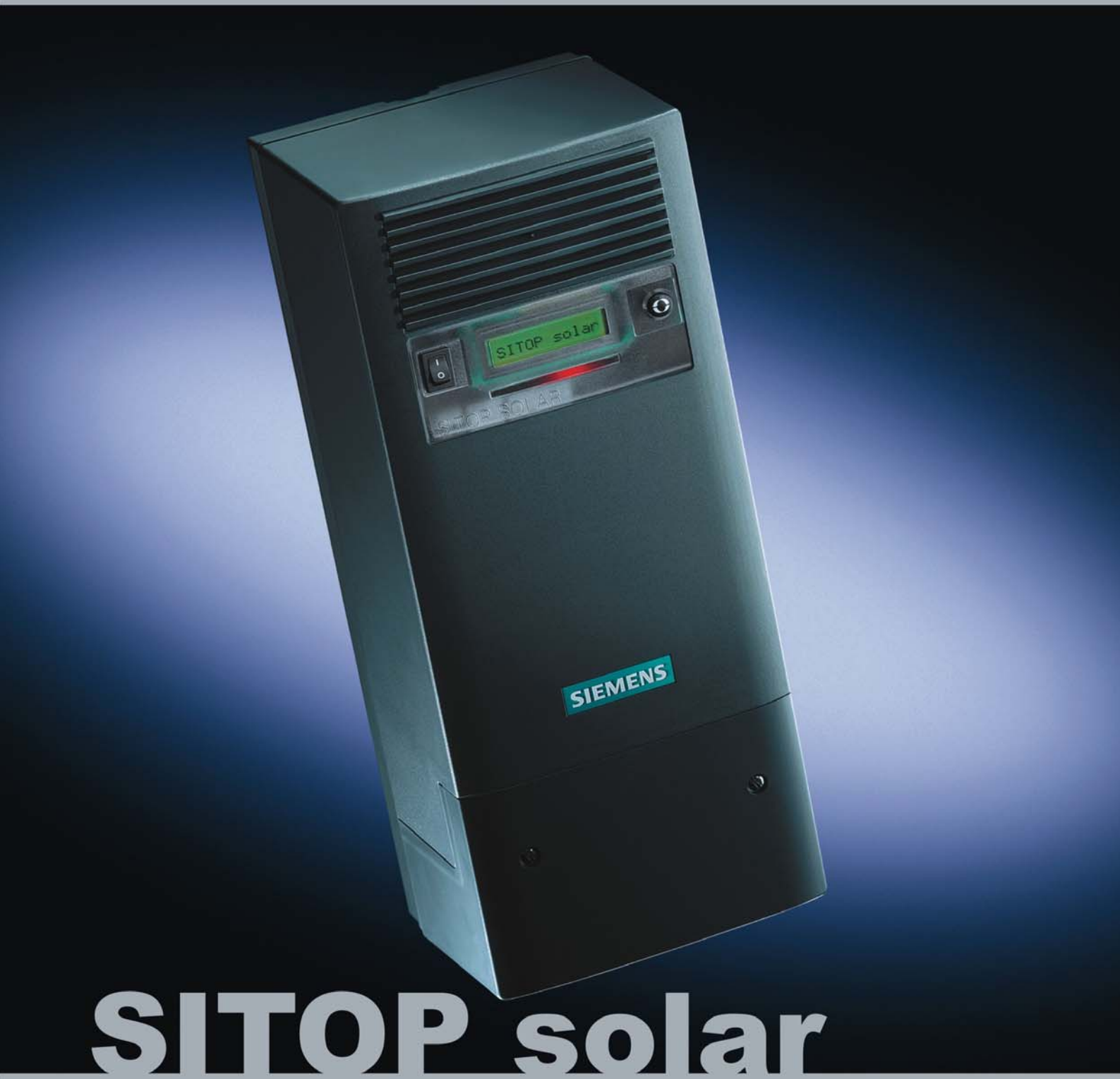
Solar Inverter



SITOP solar

SIEMENS

User's Guide Indoor (IP21)

Although we have checked this document for correspondence to the hardware and software described, differences may still exist and we do not guarantee full correspondence. The information in this publication is checked at regular intervals and any necessary corrections included in subsequent editions. Your ideas and suggestions are welcome.

SITOP solar ® is a brand name of Siemens AG.

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1 Foreword

Dear Customer,

Thank you for buying an inverter from the SITOP solar family.

We hope that the device will meet with your complete satisfaction when you use it with your solar system. Many years of experience and our know-how have gone into the development of these devices. However, it should be mentioned that an inverter is a complex electronic system which is also confronted with a wide variety of local conditions. If questions arise or a malfunction occurs, do not hesitate to call your specialized dealer. He or she will try to help you as quickly and straightforwardly as possible.

Please read this user's guide carefully to familiarize yourself with the device. The German version of the user’s guide is applicable in cases of doubt.

2 Warnings

WARNING

When this device is in operation, certain parts must carry hazardous voltage and dangerous rotating machine parts (i.e., fans).

Non-adherence to the instructions in this user's guide may cause death, severe injury and property damage.

Only qualified personnel who are familiar with all the safety information in this user's guide and instructions on installation, operation and maintenance should work on this device.

Correct and safe operation of this device is dependent on correct transportation, storage, installation and mounting as well as careful operation and maintenance.

Subject to change without prior notice. The German text applies in cases of doubt.

Definitions:

- **QUALIFIED PERSONNEL**

  For the purposes of this user's guide and the warnings on the product itself, qualified personnel are those persons who are familiar with installation, mounting, commissioning and operation of the product and who are appropriately qualified for their job. This includes:

  1. Training/instruction or authorization in turning on and off, grounding and tagging current circuits/devices in accordance with safety standards.
  2. Training/instruction in the standards of safety technology in the care and use of suitable safety equipment.
  3. Training in First Aid

- **DANGER**

  Means that death, severe injury or substantial property damage **will** occur if proper precautions are not taken.

- **WARNING**

  Means that death, severe injury or substantial property damage **may** occur if proper precautions are not taken.

- **CAUTION**

  When accompanied by a warning triangle, means that minor injury may occur if proper precautions are not taken.

- **CAUTION**

  When not accompanied by a warning triangle, means that property damage may occur if proper precautions are not taken.

- **ATTENTION**

  Means that an undesired result or state may occur if the instructions are not adhered to.

NOTE

For clarity's sake, this user's guide cannot contain complete, detailed information on all types of the product and can also not cover every conceivable situation concerning installation, operation or maintenance.

If you need additional information or special problems occur which are not covered in sufficient detail in the user's guide, you can request the necessary information from your specialized dealer.

In addition, we would like to point out that the contents of this user's guide are not part of a previous or existing agreement, promise or a legal relationship and are not intended to modify same. All obligations on the part of Siemens are based on the purchasing contract which also contains the complete and solely valid terms of warranty. These contractual warranty terms are neither extended nor restricted by the statements in this user's guide.

DANGER

When this device is in operation, certain parts must carry hazardous voltage which may cause severe injury or death. To reduce danger of death or injury, the following precautions must be adhered to.

1. Only qualified personnel who are familiar with this device and the information accompanying it may be allowed to mount, operate, trouble-shoot, correct or repair this device.
2. Mounting of the device must be in accordance with the safety regulations (e.g., DIN, VDE) and all other relevant national or local regulations. Correct grounding, conductor dimensions and short circuit protection must be provided to ensure operational safety.

3. During normal operation, all covers must be keep closed.
4. Before performance of visual checks and maintenance work, make sure that the power supply is off and located. When measurements must be made while the power supply is on, never touch the electrical connection points. Remove all jewelry from wrists and fingers. Make sure that the test equipment is in good condition and safe to operate.
5. Stand on an insulated surface when working on the running device (i.e., ensure that there is no grounding).
6. The instructions in this manual must be precisely followed and all information on danger, warnings and precautions must be adhered to.
7. This list does not contain all meausres pertinent to the safe operation of the device. If special problems arise which are not described in sufficient detail for the purposes of the buyer, contact your specialized dealer or technician.

2.1 CAUTION

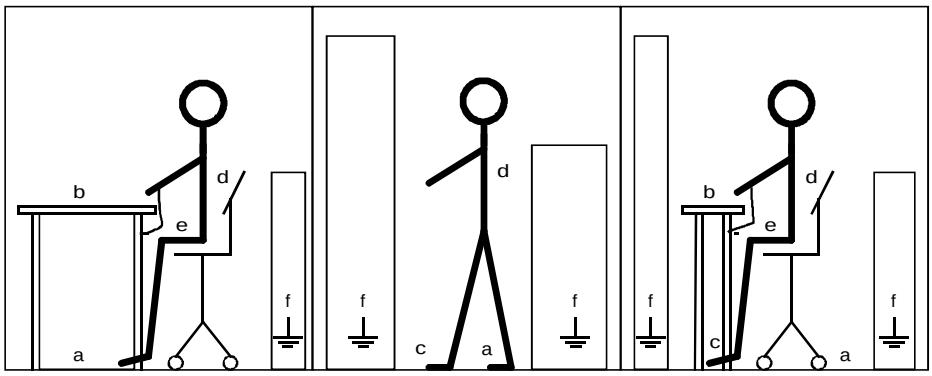
Electrostatically Sensitive Devices (ESD)

This device contains electrostatically sensitive components. These components can be easily destroyed with incorrect handling. If you have to handle electronic modules, adhere to the following notes.

- Electronic modules should only be touched when necessary work makes this unavoidable.
- When modules still have to be touched, discharge your own body immediately beforehand. We recommend touching a grounded, conductive object (e.g., wall socket protective contact).
- Modules may not come in contact with highly insulating materials (e.g., plastic foil, insulating table tops, artificial fiber clothing).
- Modules may only be placed on conductive surfaces.
- When soldering modules, the soldering iron tip must be grounded.
- Modules and components may only be stored or shipped in conductive packaging (e.g., metalized plastic boxes or metal cans).
- If packaging is not conductive, modules must be wrapped in conductive material before being packaged. This can be conductive foam rubber or household aluminum wrap, for example.

The necessary ESD protective measures are shown again in the following figure.

a = Conductive floor
b = ESD table
c = ESD shoes
d = ESD coat
e = ESD bracelet
f = Grounding connection of the cabinets



Seated Standing Standing/seated

3 Device Description

1 power switch **2 menu bottom** **3 display** **4 connection area**

SLAVE (optional) **MASTER**

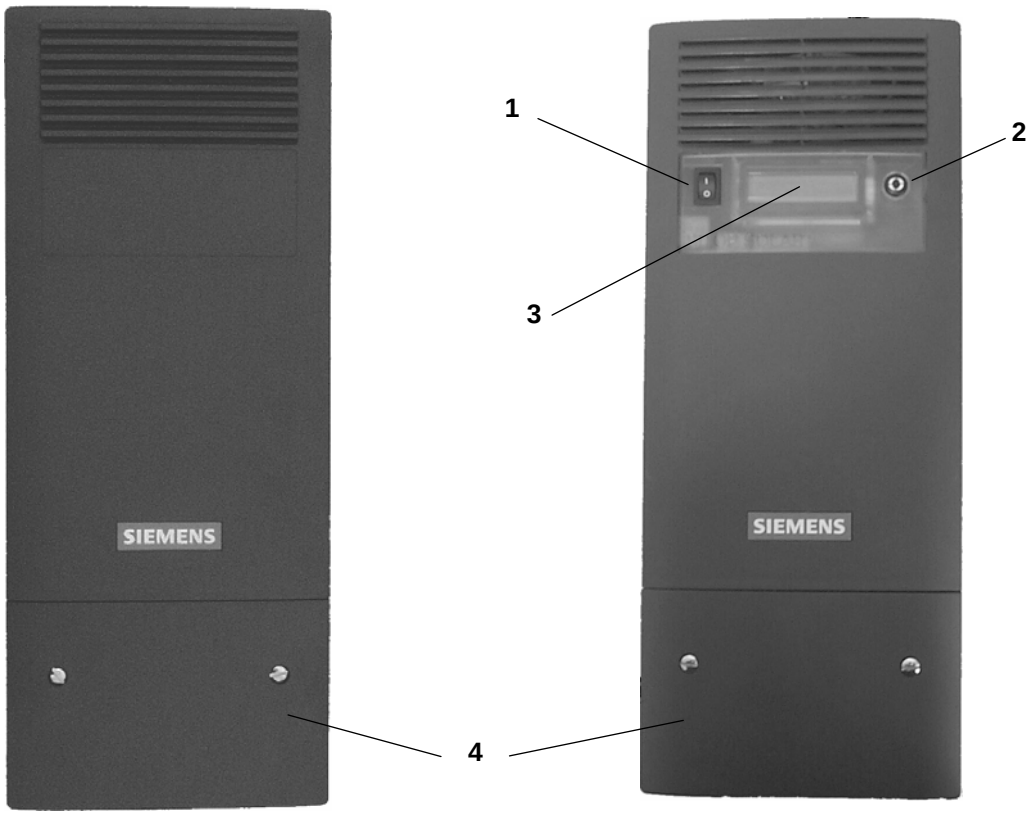
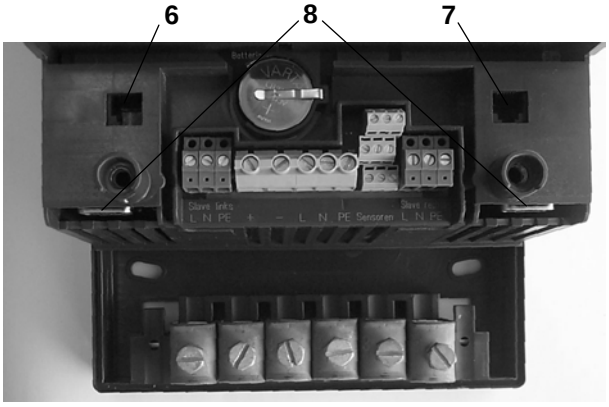


Figure 1: View of front



5) data cable slave
6) Modular jack for data cable slave left
7) Modular jack for data cable slave right
8) RS232 interface

Possible connections	DC		Master		
	+	-	L	N	PE
rigid	1.5 – 6 mm²				
flexible	1.5 – 4 mm²				

Possible connections	Slave left			DC		AC			Sensors						Slave right		
	L	N	PE	+	-	L	N	PE	7	8	9	4	5	6	L	N	PE
									1	2	3						
rigid	1.5 – 4 mm²			1.5 – 6 mm²					0.2 – 1.5 mm²						1.5 – 4 mm²		
flexible	1.5 – 2,5 mm²			1.5 – 4 mm²					0.2 – 1 mm²						1.5 – 2.5 mm²		

SLAVE (optional) **MASTER**

Figure 2: Connection areas

Terminal marking from left to right

3.1 Basic Information on the Device

PV systems can be implemented with an AC power of up to 4.6 kW when you combine different inverter. The following table gives information about the possible combination.

	1. optional devices	*2. optional devices*	*3. optional devices*
1100 Master			
1500 Master	1 x 1500 Slave	2 x 1500 Slave	
2000 Master	1 x 1500 Slave	1 x 2000 Slave	
2300 Master	1 x 1500 Slave	1 x 2000 Slave	1 x 2300 Slave

Systems with 3.8 kW can be implemented by combining a SITOP solar 2300 MASTER with a SITOP solar 1500 SLAVE.

The primary differences between a MASTER and the SLAVES are the power monitoring unit integrated in the device (ENS in accordance with DIN VDE0126-1-1) and a powerful microprocessor system for operation and control of the indicators.

The system also offers the following features.

- Own MPP tracker on the MASTER and every SLAVE for separate operation of PV generators (strings). This is a particular advantage when the subgenerators are designed differently or when different module types are used.
- Wide input voltage range for optimum flexibility when planning systems and selecting modules
- Low weight due to transformerless technology and active ventilation
- Standard integration of isolation monitoring of the solar generator
- Integrated all-current-sensitive, fault current circuit breaker (FI)
- Backlit display with 16 characters for indicating relevant measured values
- Serial RS 232 interface for easy connection of a PC or, if desired, a modem for remote polling
  The device has galvanic isolation and meets the requirements for secure electrical isolation in accordance with EN 50178.
- Powerful integrated data logger for 8 measured values
  The logger can be read with the free evaluation software ***SITOP solar log***.
- Possible connections for sensors for measuring the emission and the module temperature (ET100 or equivalent)
  In addition, the impulse output (S0 output) of a digital counter can be connected for AC power acquisition.

3.2 Physical Layout

Except for the display unit of the MASTER, the safety isolated plastic housing is identical for both MASTER and SLAVE. One SLAVE can be mounted on each side of the MASTER. The devices are easy to install on a wall (see chapter 4.2). The modular design and low weight make it easy for one person to do the job.
The removable terminal cover allows simple connection of the necessary installation lines.

3.3 How the Devices Work

Operation of the devices is always fully automatic.
The inverters convert the DC power from the solar generator into 230 V alternating current for use. This is achieved with an innovative switching technology with which the neutral conductor of the building power network is directly connected to the minus pole of the solar generator. The advantage over other transformerless switching technologies is the prevention of capacitive leakage currents and electrical 50 Hz alternating fields on the solar generator.
The voltage provided by the solar generator in the morning activates the microprocessor of the MASTER when a certain threshold value is reached. This now takes control over operation and the display becomes active. In particular, the integrated data logger which provides a review of past reactions of the entire system is managed.
When the input voltage exceeds a value stored the night before, the power network is checked and, if running correctly, a switch is made to the power network.
During operation each MASTER and each SLAVE has its own MPP tracker so that up to three different module fields are possible within a system even when they have different working voltages.
The digital data supplied to the main processor by the SLAVES and the power pack of the MASTER are shown on the display. The data on the display can be scrolled with the button.
Using the integrated interface, the data can also be presented online with a PC and the ***SITOP solar log*** software or, after the data logger is read out, stored for further processing later.
For information at a quick glance, the device offers a bar whose progress varies with the current incoming power. Similar to the running wheel of a conventional mechanical counter, this running light shows you at a glance whether the inverter is providing power to the system. In addition, the user obtains a statement as to the amount of solar power being generated.
To cool the device, a fan is turned on when the heat dissipater temperature reaches a certain value. The fan is controlled continuously via the temperature.
When the sun sets and it becomes dark, the MASTER uses the power offered by the solar generator to determine the value at which the consumption of the system is about that of the power from the solar modules. The related voltage value of the solar field is stored and controls the switch on again the next morning. After the switch off procedure, the described cycle begins again the next morning.

Integrated safety

The ENS (device for power monitoring with all-pole switches in series) integrated on the MASTER ensures the necessary safety against undesired "island power." The ENS continuously checks the network for correct voltage, frequency and impedance ratios. When illegal values are determined, a disconnection from the network is initiated. At the same time, this information is forwarded to the microprocessor and is also sent as plain text to the display.
When several MASTERS are connected in parallel on one system, make sure that the devices feed in power over different phases so that they do not interfere with each other. In addition, adhere to DIN VDE 0126 which requires that incoming power of more than 4.6 kW be distributed over several phases.
Another important part of the ENS is an all-current-sensitive FI circuit breaker which ensures fast disconnection from the 230 V building power network when leakage currents greater than 30 mA occur.
To be able to detect a defect in the installation or on the modules early, an isolation check of the solar generator is performed each time a device is connected to the public power network.

4 Mounting

Touchable voltage carrying parts can already be accessed in the terminal area.

4.1 Potential Danger from Alternating and Direct Current

As with all electrical systems, touching current-carrying parts is dangerous and can even be fatal. This device contains direct current up to 675 V as well as the power network alternating current of 230 V.

Before opening the device, turn off the inverter on the front of its housing. Be absolutely sure to disconnect on both the direct and alternating current sides.

Even after disconnection from the power, hazardous voltage is still present in the device caused by a residual charge in the internal capacitors (see chapter 4.6)!

Caution! The components of this device carry voltage. Unintentional touching of live components in the device, incorrect installation, handling or repair of the device may cause severe injury and substantial property damage.
Only appropriately qualified persons may work on this device. These persons must be familiar with all warnings and the measures described in this user's guide for installation and operation of the device or apply to today's state of technology.

Please check all connections carefully after initial installation.
Make sure that there are no flammable materials in the vicinity of the devices.
Remember that the inverter which you install will probably spend decades at the location which you select.

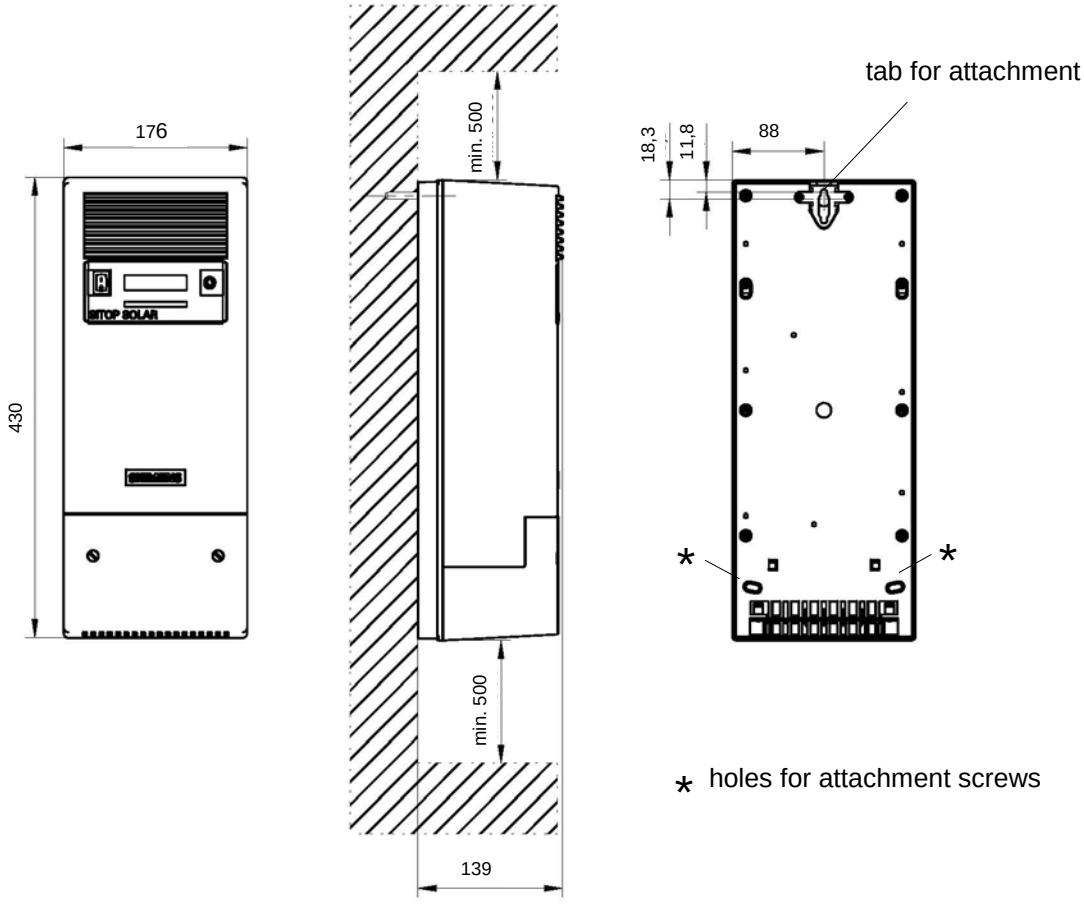
4.2 Physical Mounting

To mount MASTER or SLAVE, select a location and provide a bored hole with screw in the middle of the wall for each device. Now hang the devices on the tabs there. The holes to the left and right in the terminal area can be used as a drilling jig for the two other screw attachments.

Any SLAVES can be installed directly next to the MASTER.
Ensure that the max. distance between MASTER and SLAVE is not longer than the length of the data cable in the SLAVE.

Be sure to consider the following points when ***selecting the installation location***.

- Do not install in rooms where extremely high temperatures occur and care for enough ventilation because of the waste heat. High ambient temperatures reduce the power output. (see chapter 5.4)
- This would probably shorten the life expectancy of the device. See technical data.
- Do not install in areas where condensation can occur.
- Do not mount on flammable bases (e.g., wood or fiberboard).
- Objects which may catch fire do not belong in the vicinity of the device. Allow at least 1 m distance.
- Leave approx. 50 cm of free space above and below the devices so that air can circulate freely.



Dimensions in mm

Figure 3: Mounting drawing

4.3 Electrical Connection

After the device(s) has/have been mounted correctly on the wall, the electrical connection can be made.

4.3.1 Electrical Connection between MASTER and SLAVE Devices

This point can be omitted if you are only using a MASTER.

First, disconnect the screws of the covering plate of the connection area on the front of both housings and remove the cover.

For simple installation, disconnect the screws of the pull relief devices under the terminals and remove the terminal holders.

Run the data cable in the connection area of the SLAVE to the connection area of the MASTER and connect it there with a Western plug. A choice of right or left slave is available.

Then run a three-core AC line from the SLAVE to the MASTER. Be sure to use the same side (left or right) on the MASTER as for the data cable.

The right or left BUS slave has *no* galvanic isolation.
***Never* connect the right or left BUS slave to the public Telecom network.**
Never under any conditions connect a SLAVE directly to the public power network.
Wiring must always be made via a MASTER.

A possible second SLAVE is connected in the same way to the other side of the MASTER.

4.3.2 Connection of the Solar Generator (Applies to MASTER and SLAVES)

The solar generator must be dimensioned so that the maximum input voltage of the device cannot under any circumstances be exceeded.
Check the connection values of the generator and the device.
Remember that the no-load voltage of the solar field increases during cold weather!
Caution: See the nameplate for the maximum permissible input voltage.

Check to make sure that the solar generator does not under any circumstances exceed the permissible input voltage range of the device.
Electrolyte capacitors like the ones used in your inverter can be destroyed by explosion when overvoltage is continuous.
Before connecting the PV generator or the building power network, the device must be turned off with the power switch on the front plate. To install the direct current and alternating current line, disconnect the screws of the covering plate of the connection area on the front of the device and remove the cover.
Before connection, disconnect all lines from the power.

For simple installation, disconnect the screws of the pull relief devices under the terminals and remove the terminal holders.
First, connect the plus line of the solar generator to the appropriately marked terminal. Then repeat the procedure for the minus line. Make sure that the cables are long enough so that the terminal holders of the pull relief can be secured to the device again after installation.
The DC inputs of the MASTER and SLAVES may not be connected in parallel. **Each device requires its own string.**
Make sure that the isolating switch in the generator connection box is turned off before the cables are connected. Otherwise the input terminals may be damaged by possible arcing.
Be sure not to reverse the poles of the connections, since a connection whose poles are reversed will probably cause electrical arching when disconnected again, and this may damage the terminals.

Once ignited a direct current electrical arc never goes out by itself in contrast to alternating current. This may cause a fire.

If measurements are to be performed during commissioning, only connect/disconnect measuring instruments when the device is off. Otherwise the electronics may be damaged.

Never touch the plus pole or the minus pole, not to mention both poles together! Direct current generated by solar energy can also be hazardous and cause injury!

Now carefully screw the terminal holders to any SLAVES to ensure good physical pull relief.

4.3.3 Connection of the Power Line

Before connection to the power line, disconnect the power by removing the power fuse and providing suitable measures to prevent it from being connected again.
Then run the three-core alternating current cable through the breakthrough in the connection cover of the MASTER and connect it to the appropriately marked terminals. Make the PE connection somewhat longer than the other lines so that PE will be disconnected last in case the power line is accidentally pulled out.

Carefully screw down the terminal holders on the MASTER to ensure good physical pull relief.

The incoming power line must be equipped with a suitable circuit breaker with triggering characteristic B.

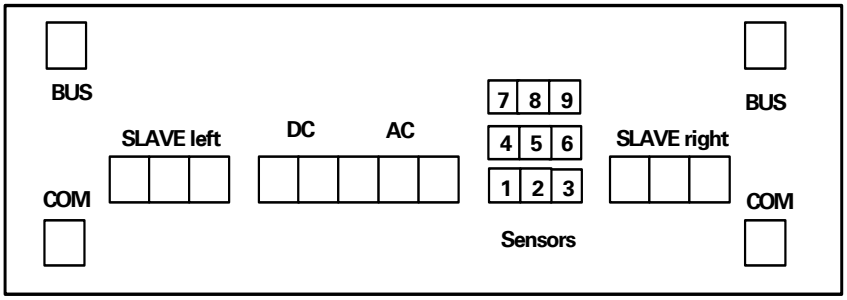
The current depends on the version.

2.3, 2.0 and 1.5 Master 16 A
1.1 Master 10 A

Arrangements with Slaves 25 A independent of version.

4.3.4 Connection of the Sensors

Terminal allocation



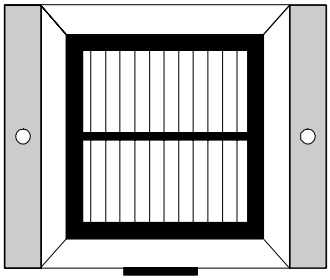
Connection area of MASTER

1	2	3	4	5	6	7	8	9
5V	GND	Free	Temperature sensor	S0	S0	Solar radiation	Free	Free

Sensor terminal

ET 100 solar radiation sensor

The ET 100 was developed especially to measure the solar radiation strength as well as to record the module temperature of photovoltaic systems. Measurement of the radiation is performed with a temperature-compensated silicium cell in pseudo short-circuit. The module temperature is determined with a temperature sensor laminated to the back of the sensor.



Technical data

Meas. signal, solar radiation	1V / [kW / m^2]
Meas. signal, module temperature	U = 1.235 V + [10 mV / °C]
Power supply	+5 V
Current consumption	150 µA
Fault solar radiation (100 - 1000 W/m^2)	+/- 5% of meas. value (max.)
Fault module temperature (-20 °C to 100 °C)	+/- 2 °C (max.)
Physical dimensions (W x H x D)	100 mm x 75 mm x 40 mm
Required meas. signal line	4-core / shield
Solar cell size	50 mm x 50 mm

This procedure produces the following measuring accuracy.

1. The radiation measurement is calibrated via a "tilt & zone" CM11 pyranometer at a minimum of 800 W/m^2. Due to the different spectral sensitivity, an error varying with the radiation conditions occurs.
2. The sensor surface (5 x 5 cm^2) is smaller in relation to the frame than a solar module. The back is encapsulated to withstand weather conditions.

Installation guidelines for the ET 100

- Mount the radiation sensor directly on the PV generator with the same alignment and angle of inclination.
- Allocation of the connection cable:
  Brown: Measuring signal, temperature sensor (10 mV / °C)
  Orange: Measuring signal, solar radiation (1 V / [1000 W / m^2])
  Red: Plus voltage (5 V)
  Black: Ground (GND)
- As connection cable to the inverter, use a 4-core, color-coded and shielded signal cable with an approx. 0. 2 mm^2 copper cross section depending on the cable length (under 30 m = 0.15 mm^2, over 30 m = 0.25 mm^2). To prevent interference, do **not** install the signal cable parallel to the power cables.
- Connect the cable directly to the inverter in accordance with the terminal allocation.

4.3.5 Connection of a digital counter

The impulse output of a digital counter is connected to the AC power acquisition on the "S0" terminals. This must be activated via the "SITOP Service Module" software. The values actually measured by the counter are not indicated on the inverter until then. The impulse constant of the current counter can be set with this software within a range from 256 to 10,000 impulse/kWh.

4.4 Commissioning

The devices have been checked at the plant and calibrated so that commissioning can be performed immediately after installation.
Proceed as shown below.

Do not turn on the device yet!

- Check screwed glands on the inverters for tightness. Check poles!
- Check all screws of the connection terminals on the installation system and on the inverters for tightness.
- Check polarity of the solar generator (+ and -) and then connect the generator.
- Check voltage of the solar generator!
- Connect power and check.
- If necessary, check voltage between L1 and N.
- Secure cover plate of the connection area with screws.

Never work on the opened device during operation!

The power switch on the front of the master is switched to "ON." When the power voltage and the voltage of the solar generator are correct, the device performs a self-test, checks the mains quality (from approx. 30 seconds to 20 minutes) and connects automatically to the power.

4.5 Country-Specific Power Monitoring

The factory setup of the devices is as follows:
After startup for the first time the German ENS set and German display language will automatically be accepted. In this case do not press the menu bottom for the first 5 second.

If you want to use the SITOP solar in a country other than Germany, you can select too the Power Monitoring from Austria, Switzerland, Italy and Spain.

Keep the menu bottom pressed when you turn on the device for the first time so long that you access the Setup menu. Press the bottom several times to choose between the countries and then keep the bottom pressed for approx. 5 seconds to accept your selection.

After the country is selected, the country's abbreviation appears permanently on the display in standby (e.g., "Sitop solar A" for Austria). This can always tell you which country-specific power monitoring is being used by the inverter.

For operation in Italy the “max. allowable frequency drift” of mains frequency can be adjusted. You need therefore the „Parametrierungssoftware“, contact your professional dealer.

4.6 Service Work/Disassembly of the Inverter

Remember that work on the device may only be performed by electro-technically qualified personnel. It is imperative to adhere to the applicable safety measures! Devices may only be repaired by authorized service providers.

If service work needs to be performed on the device, proceed in the order shown below to disassemble the device.

- Turn off device with power switch.
- Disconnect the power fuses of the incoming power lines to the device and ensure that the fuses cannot be connected again.
- Turn off DC circuit breaker of the solar generator ***for MASTER and SLAVE*** devices. Disconnect AC connection of the MASTER and protect against accidental reconnection.
- Disconnect covering plate of the connection area for all MASTER and SLAVE devices. Disconnect the lines and isolate.
- Disconnect mounting screws in the terminal area. The device can now be lifted from the wall.

⚠ WARNING
Remember that the electrolyte capacitors in the device will not be sufficiently discharged until several hours later after disassembly. Before this time they still contain hazardously high voltage on the DC connection terminals. The waiting period can be reduced to 10 seconds by short-circuiting the input terminals with a 50 Ohm/10 W resistor.

4.6.1 Replacing the Lithium Battery

The connection area of the devices contains a 3 V, type CR2450 lithium battery. This battery is used to maintain the values stored on the data logger and for the total yield and hours of operation. The battery is designed for a life of approximately 10 years. However, replacement of the battery after approximately 5 years is recommended. Be sure to have this work only performed by specialized personnel.

To replace the battery, proceed as shown below.

- Turn off device on power switch.
- Turn off DC circuit breaker in the generator connection box.
- Disconnect the power fuses of the incoming power line of the device, wait 5 minutes and take precautions to prevent accidental reconnection.
- Remove the terminal cover and then slightly lift the contact holder before carefully removing the battery. Then immediately install the new battery with the minus pole pointing towards the device.
- Screw down the terminal cover again.
- For device commissioning, see chapter 4.4

To avoid losing the values stored on the data logger, replacement of the lithium battery may not take longer than 60 seconds.

5 Reactions of the Inverter

5.1 Switch-On Procedure

Switch on procedure

This is the first operational indication of the device after correct application of the power and the solar voltage and the power switch has been turned on.
During a period of approx. 30 seconds the data logger is initialized and a self-test and a power test are performed. This may last up to 20 minutes if the inverter has been in storage for a long period.
The solar generator is checked for sufficient power output to prevent unnecessary loss due to being turned on too early in the morning. The exact point in time depends on the particular solar generator and the time of year and the local conditions. The MASTER is able to measure the solar generator during operation and adjust its on and off conditions accordingly.
After this procedure is executed successfully, the MASTER and any SLAVES connect to the power.

5.2 Normal Operation

SITOP Solar D

This is the normal display on the MASTER. The speed of the running light also gives you a quick idea of how much solar power is being fed in.

The microprocessor integrated in the MASTER now assumes control of the system and the following tasks are performed.

- Either online data or stored operational data are output via the data interface.
- A check is made to determine whether and with what power the connected SLAVES are running.
- The display together with the push button are controlled.
- The running light is activated.
- The integrated data logger is updated with new data.

5.3 Operation at Excessively High Ambient Temperatures

When the maximum heat dissipater temperature of 43 degrees Celsius is exceeded, a internally installed fan goes on to exhaust the heat loss. The switchoff point is 38 degrees Celsius. To ensure particularly low-noise operation, the speed of the fan is adjusted proportionately to the temperature of the heat dissipater.

5.4 Reaction to Too High/Too Low Temperature

When the temperature of the heat sink exceeds 85 degrees Celsius, the power fed to the power network is gradually reduced. At 100 degrees Celsius heat sink temperature the power has reached zero.
With even higher temperatures, the device goes off with an error message.

5.5 Reaction to Excess Availability of Power

If the available power of the solar generator exceeds the maximum power of the inverter, operation continues with maximum power without the output of an error message.

Caution: The maximum possible power of your solar field will not destroy your device but the highest no-load voltage under unfavorable conditions (cold and high radiation) will!

5.6 Parallel Connection of Several Inverters

When several MASTERS are in parallel operation on a system, be sure that the devices feed in at different phases to reach a balanced power-output distribution and to reduce cross influence of the power monitoring systems (ENS).
The MASTERS are equipped with two serial interfaces. This permits simple connection of the devices using a 9-pin standard RS 232 cable. A single cable from the first device is the connection to the PC. To enable the PC to distinguish between the inverters, a separate device address must be assigned to each MASTER of the system. The assignment of the device address is done with the PC and the ***SITOP solar log*** software. For more information, see the user's guide of ***SITOP solar log***.

5.7 Night and Remote Switch-On

The display of the inverter is not on during the night. No data (total yield, etc.) are visible. However, if a PC is connected directly or there is a connection via a MODEM, the device can be addressed with the ***SITOP solar log*** PC software. The display goes on and shortly thereafter "Nachtbetrieb" appears on the display.
Normal data communication via PC is now possible as well as paging through the display by hand.

After approximately 4 minutes of bottom inactivity or no data communication by the PC, the device goes off again by itself.

6 Operator Panel and Display

The display gives you information on your photovoltaic system and the inverter.
By pressing the button you can scroll through the various indicator values. While you are viewing the current values of your photovoltaic system, the running light is off.
Without pressing the button, the display returns after a short time to its basic status with the display "SITOP solar." The various measured values are presented as shown below.

6.1 Operational Indicators

The language of the display can be selected from 5 different languages (German, English, French, Spanish and Italian).
You need therefore the „Parametrierungssoftware“, contact your dealer.
All indicator values can be scrolled on the display by repeatedly pressing the button. After you have viewed the various values, you are returned automatically to the first indicator value.

Power DC 4260W

This is the first indication of the display after the button is pressed. The input power of the MASTER with any connected SLAVES is shown as a total. A separate MPP tracker on the MASTER and on each SLAVE operates the particular solar generator at maximum power.

Ma: P_DC 1420W

S1: P_DC 1430W

S2: P_DC 1430W

The total power of the system is presented decoded here. Due to the automatic recognition of the SLAVES, their values are naturally only indicated when they are actually present. With the SITOP solar 1500 master, S1 is the SLAVE which is connected to the left of the MASTER in the connection area. S2 is the value of the SLAVE connected to the right of the MASTER.
Since only one additional SLAVE can be connected with the SITOP solar 2300 master, only S1 is displayed.

Ma: U_DC 450V

S1: U_DC 450V

S2: U_DC 450V

The current voltage of the PV generator currently applied to the direct current (DC) input of the devices is indicated here. If the value of the measured input voltage is outside the limits specified in the data sheet, an error message is indicated.
Since only one additional SLAVE can be connected with the SITOP solar 2300 master, only S1 is displayed.

Power AC 3960W

This measured value indicates the currently incoming alternating current. Due to losses on the inverter, this value is less than the DC power.

DC Yield 909 kWh

The display "DC Yield" gives you information on the amount of electrical energy obtained from the solar generator since it has been in operation. However, this is not the power input into the power network (kWh) since the inverter losses are still included in this value. A memory on the device ensures that the data are retained after the device is turned off.
Remember that the stored "DC Ertrag" value will be lost when the voltage of the installed lithium cell becomes too weak. See also chapter 4.5.1 on replacing the lithium battery.

AC Yield/d 25.4 kWh

The electrical energy fed into the power network during a day is totaled and indicated as the daily yield. The highest value can be expected during the evening before the system is switched off. This value can still be called even at night ("Night mode"). When a digital counter is connected to the sensor terminals of the impulse output (S0 interface), the AC yield is indicated with the accuracy of the connected counter.

AC Yield 874 kWh

This display gives you information on the electrical energy fed to the network since the device has been in operation. Remember that this display is not a calibrated measured value and thus may differ from the counter of the power provider. This value can also be lost during high electrical interference (e.g., during a thunderstorm). This value may also be lost when the voltage of the installed lithium cell becomes too weak. See also chapter 4.5.1 on replacing the lithium battery.
When a digital counter is connected to the sensor terminals of the impulse output (S0 interface), the AC yield is indicated with the accuracy of the connected counter.

Peak/d 5220 W

The indication of daily peak performance tells you which maximum PV generator power was generated on the current day by the device. The indication of this value is designed as a purely peak value memory so that you will see higher performance as the nominal performance of your PV generator during the transitional times of year due to radiation values above 1000 W/m^2. Some of these high radiation values are caused by reflections in cloud layers.
A lower module temperature also contributes to high yields during these times of year.

Remember that the values stored in the data logger are always the average value over a 10-minute interval and are thus usually lower values than the peak value.

Time/d 12.3 h

Specification of the switchon duration of the inverter refers to the current day. The highest values are naturally achieved during the summer months.

Time/tot 1890h

This display shows you the operating time of the device since its first commissioning. The hours of operation are always incremented when the MASTER is in operation. Remember that this value can be lost during high electrical interference (e.g., during a thunderstorm). This may also occur when the voltage of the installed lithium cell becomes too weak. See also chapter 4.6.1 on replacing the lithium battery.

U-DC too low...

This display appears when the solar voltage just covers the power consumption of the inverter. There is no mains supply.
If the solar voltage continues to drop, the device switches off.

Possible causes:

1) Twilight/bad weather: The generated solar voltage of the modules is too low.
2) Good weather: There is probably a defect in the photovoltaic system.

Other actions:

1) No action
2) Please contact your installation technician or distributor. The DC voltage of the modules and the DC wiring must be checked. If sufficient voltage is applied to the modules and the wiring is okay, the master inverter may be defective.

6.2 Fault Messages

Below are the primary fault messages displayed by the device when a malfunction occurs.

U-DC too high!

When the maximum input voltage of the device is exceeded, the inverter is not connected. If the input voltage exceeds this value during operation, the device is turned off.
Possible causes: Generator is dimensioned incorrectly.

Other actions:

- **Immediately disconnect the U-DC cable from the device!!**
- **Measure voltage on the input terminals.**

Fault mains freq.

If the permissible tolerances of the mains frequency are exceeded, the fault message appears and the device switches off.

Possible causes:

1) The device has detected a mains frequency outside the permissible tolerance. Possible causes are mains fluctuations. It is advisable to wait a little while. The device should go back on mains supply after a few minutes.
2) If the fault message occurs very frequently or permanently, the mains quality may be poor or the device may be defective.

Other actions:

1) No action
2) Please contact your installation technician or distributor. The mains frequency must be checked.

Impedance leap

This fault message appears if the mains impedance increases abruptly by at least 1 ohm.
The device should go back on mains supply after a few minutes.

Possible causes:

1) The device has detected an impedance jump outside the permissible tolerance. Possible causes are mains fluctuations. It is advisable to wait a little while. The device should go back on mains supply after a few minutes.
2) Defective mains connection (loose contact).
3) If the fault message occurs very frequently or permanently, the mains quality may be poor or the device may be defective.

Other actions:

1) No action
2) The incoming power line (e.g. AC mains terminals) must be checked.
3) Please contact your installation technician or distributor. The mains impedance must be checked.

Fault U mains

The mains voltage is outside the permissible range. The upper and lower limits are exceeded.

Possible causes:

1) The device has detected a mains voltage outside the permissible tolerance. Possible causes are mains fluctuations. It is advisable to wait a little while. The device should go back on mains supply after a few minutes.
2) If the fault message occurs very frequently or permanently, either the mains quality is poor or the device is defective.

Other actions:

1) No action
2) Please contact your installation technician or distributor. The mains voltage must be checked.

IDC mains too high

The direct current portion fed into the power network is greater than permitted (see VDE 126 1A).

Possible cause: Defect on the power pack, for instance

Further actions: Contact your installation technician or your distributor/dealer.

Z mains too high

The mains impedance is checked before connecting. If it is above 3 ohms, the device does not go on mains supply.

Possible causes:

Defective mains connection.

Other actions:

Please contact your installation technician or distributor. The main terminals must be checked for correct connection (tight fit, adequate cross section) and not only on the inverter but on the whole installation.

FI fault

After connection or during operation the permissible fault current on the solar generator side is exceeded.

Possible causes:

The leakage current of the solar generator to GROUND is too high or the capacity of the solar generator to GROUND is too high.

Other action:

If the fault is permanent, please contact your installation technician or distributor. The insulation of the solar generator to PE must be checked.

Insulation fault

Before connection the measured insulation resistance of the solar field to PE is less than permitted (at least 700 kOhm)

Possible causes:

Mechanical damage of the solar generator or penetration of the solar modules or connectors by moisture.

Other actions:

Visual inspection of the solar generator and its wiring. If moisture has penetrated, the fault message disappears again after evaporation. If moisture can be ruled out, the system must be checked by the installation technician.

Excess temp.!

At temperatures over 100 °Celsius, the device goes off with this message.

Possible cause:

Device is defective. Automatic power control is not working.

Further actions:

Contact your installation technician or your distributor/dealer.

ENS Fault...

Faulty state of the ENS (national mains monitoring) which triggers a general reset, however, after 5 minutes.

Possible causes:

1) Internal fault (e.g. ENS relay sticking, test current for FI measurement missing)
2) Defective ENS hardware

Other actions:

1) Switch off the device, wait 30 secs. And switch back on.
2) Please contact your installation technician or distributor.

Battery empty …

The battery is used to maintain the stored data in the data logger and about the total yield and hours of operation. By empty battery, these data get lost.

Possible cause:

Battery voltage is less than 2.7 V.

Further actions:

Replace the battery as described in chapter 4.5.1.

Always also document all switchoff events on the internal data logger where they can be read when necessary with ***SITOP solar log***.

6.3 Activation and Deactivation of the Running Light

When your inverter is delivered, the running light below the display has already been activated at the plant. If you want to deactivate it, keep the push button to the right of the display pressed for 5 seconds.
If you want to activate the running light again, hold the button down again for 5 seconds.

7 *SITOP solar log* Evaluation Software

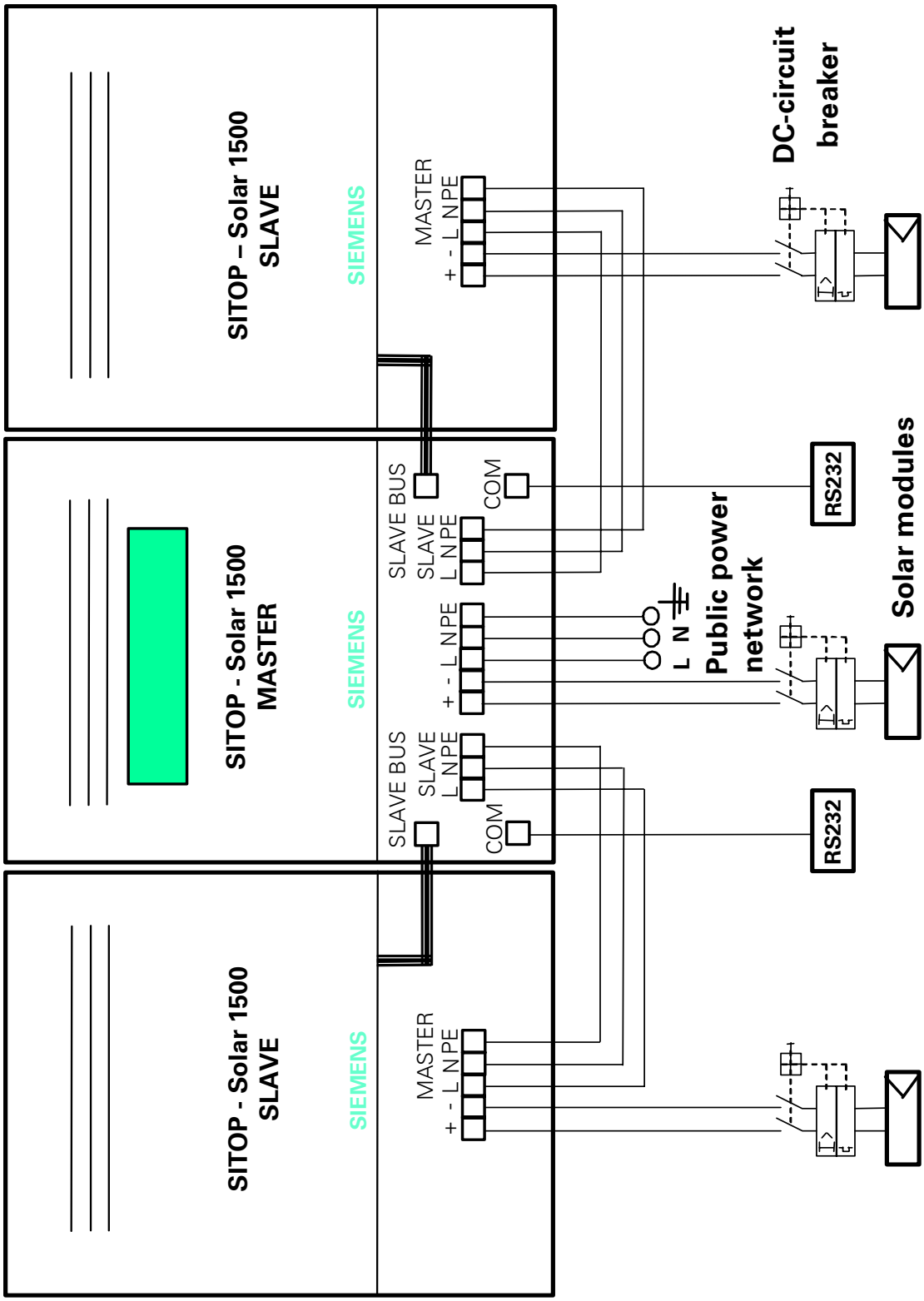
The ***SITOP solar log*** software for downloading and the description of the software are located on the Internet under:

www.siemens.de/sitop/solar

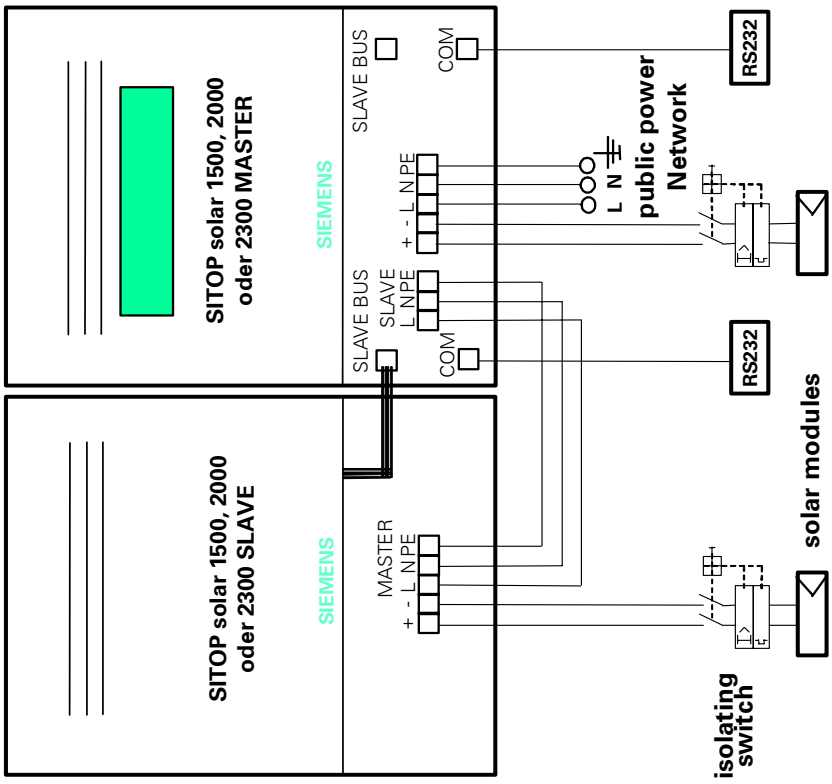
in the Support section.

8 Block Circuit Diagrams

8.1 Block circuit diagram 1500 MASTER with 2 x 1500 SLAVEs



8.2 Block circuit diagram 1500, 2000 or 2300 MASTER → 1500 , 2000 or 2300 SLAVE (see Section 3.1 for possible combinations)



Technical data	SITOP solar 2000 MASTER	SITOP solar 2300 MASTER
Basic electrical data		
Nominal continuous power (AC)	2000 VA	2300 VA
Max. power (AC)	2600 VA	3000 VA
Rec. max. generator nominal power (STC)	2600 Wp	3000 Wp
MPP-range	200 - 630 V DC	200 - 630 V DC
Max. no-load voltage of solar generator	675 V DC	675 V DC
Max. input current DC	10 A	10 A
Own consumption/f feedin starting at	< 9 W	< 9 W
Nighttime consumption	< 1 W	< 1 W
Nonlinear distortion factor of the fed current (Pn)	< 5%	< 5%
Type power network input	Single-phase	Single-phase
ENS/ fault-current monitoring (FI)	SX25FI-P / yes	SX25FI-P / yes
cos phi of input current	~ 1	~ 1
max. efficiency	94%	94%
European efficiency	93%	93%
Permissible ambient temperature	-10 to + 55 degrees C	-10 to + 55 degrees C
Rel. humidity	< 95%	< 95%
Dimensions in mm (H x W x D)	430 x 175 x 135mm	430 x 175 x 135mm
Housing protection rating	IP 21	IP 21
Weight	5.7 kg	5.7 kg
Noise level	< 35dBA	< 35dBA

Technical data	SITOP solar 1100 MASTER	SITOP solar 1500 MASTER
Basic electrical data		
Nominal continuous power (AC)	1100 VA	1500 VA
Max. power (AC)	1400 VA	1800 VA
Rec. max. generator nominal power (STC)	1400 Wp	1800 Wp
MPP-range	200 - 630 V DC	200 - 630 V DC
Max. no-load voltage of solar generator	675 V DC	675 V DC
Max. input current DC	6 A	8 A
Own consumption/f feedin starting at	< 7.5 W	< 7.5 W
Nighttime consumption	< 1 W	< 1 W
Nonlinear distortion factor of the fed current (Pn)	< 5%	< 5%
Type power network input	Single-phase,	Single-phase
ENS / fault-current monitoring (FI)	SX25FI-P / yes	SX25FI-P / yes
cos phi of input current	~ 1	~ 1
max. efficiency	94%	94%
European efficiency	92.5%	92.7%
Permissible ambient temperature	-10 to + 55 degrees C	-10 to + 55 degrees C
Rel. humidity	< 95%	< 95%
Dimensions in mm (H x W x D)	430 x 175 x 135mm	430 x 175 x 135mm
Housing protection rating	IP 21	IP 21
Weight	5.7 kg	5.7 kg
Noise level	< 35dBA	< 35dBA

Technical data	SITOP solar 1500 SLAVE	SITOP solar 2000 SLAVE	SITOP solar 2300 SLAVE
Basic electrical data			
Nominal continuous power (AC)	1500 VA	2000 VA	2300 VA
Max. power (AC)	1650 VA	2200 VA	2500 VA
Rec. max. generator nominal power (STC)	1800 Wp	2600 Wp	3000 Wp
MPP-range	200 - 630 V DC	200 - 630 V DC	200 - 630 V DC
Max. no-load voltage of solar generator	675 V DC	675 V DC	675 V DC
Max. input current DC	8 A	10 A	10 A
Own consumption / feedin starting at	4 W	4 W	4 W
Nighttime consumption	< 1 W	< 1 W	< 1 W
Nonlinear distortion factor of the fed current (Pn)	< 5%	< 5%	< 5%
cos phi of input current	~ 1	~ 1	~ 1
max. efficiency	95%	95%	95%
European efficiency	93.7%	94%	94%
Permissible ambient temperature	-10 to + 50 degrees C	-10 bis + 55 Grad C	-10 to + 55 degrees C
Rel. humidity	< 95%	< 95%	< 95%
Dimensions in mm (H x W x D)	430 x 175 x 135mm	430 x 175 x 135mm	430 x 175 x 135mm
Housing protection rating	IP 21	IP 21	IP 21
Weight	5 kg	5kg	5 kg
Noise level	< 35dBA	< 35dBA	< 35dBA

10 Warranty

If you have a warranty claim, contact your installation technician or your dealer.

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