SolarMax S-Serie
20S / 35S

Gerätedokumentation ■ **Instruction manual** ■ **Documentation d'appareil**
■ **Documentación del dispositivo** ■ **Documentazione dell'apparecchio**

TÜV
Rheinland
Product Safety

BAUART
GEPRÜFT

TYPE
APPROVED

⊞ SWISS QUALITY

SolarMax®
by Sputnik Engineering

Contents

1 About this instruction manual

This instruction manual contains a description of the 20S and 35S SolarMax central inverters. It tells you how to install, commission and operate the inverters.

Familiarize yourself with inverter functions and characteristics before you begin the installation work. Carefully read the safety instructions in this manual. Ignoring the safety instructions can result in serious injuries or death.

1.1 Target group

This instruction manual is for the fitter (or the responsible electrician) and the operator of the PV plant.

1.2 Where to keep this manual

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

1.3 Symbols used in this manual

From time to time you will see the following symbols when reading this instruction 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

The central inverters of the S series contain the latest technological advances and have been built and tested to meet currently valid product safety standards. However, ignoring the safety instructions contained in this instruction manual can endanger the user, a third party or property. The qualified electrician and the operator of the PV power plant can reduce these risks to a minimum by following the safety instructions at all times.

> ⚡ **DANGER**
>
> ■ Ignoring the installation and safety instructions invalidates any and all warranty and liability claims.
>
> ■ It is the responsibility of the qualified electrician to ensure that applicable local installation and safety instructions are followed.
>
> ■ SolarMax inverters may only be installed and opened by qualified electricians who have already completely read and understood this instruction manual.
>
> ■ The device may only be opened in exceptional cases and briefly for operating the AC and DC circuit breakers. All cover plates must be installed before the device is switched on at the main switch (next to the display).
>
> ■ Capacitors take five minutes to discharge completely.
>
> ■ Touching live parts can result in death.

2.1   Appropriate use

The central inverters of the S series are designed exclusively to convert the direct current generated by PV modules into alternating current which conforms to the parameters of the public grid. Any other use is contrary to the purpose for which the inverters were designed. Sputnik Engineering accepts no liability for damages resulting from using inverters for purposes other than this. Any modifications to the inverter performed by the system operator or the electrician without a review and approval by Sputnik Engineering are prohibited.

3   Description

3.1   SolarMax device configuration 20S/35S
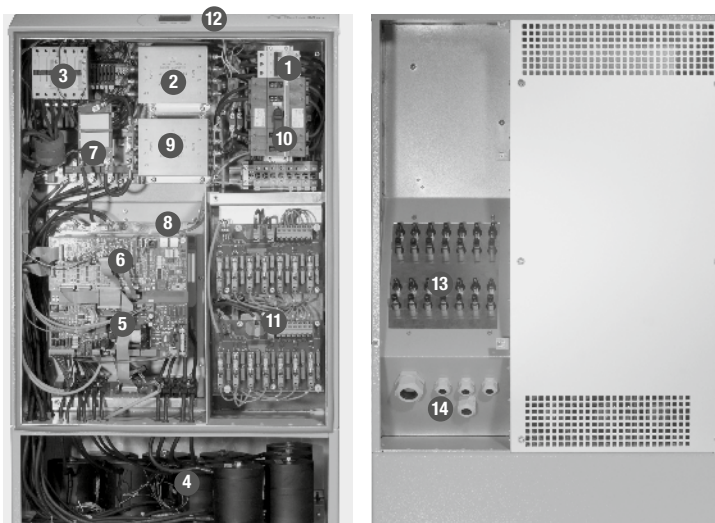
Front view   Rear view

Legend:

No.	ID	Description
1	Q2	AC circuit breaker
2	N2	EMC filter, AC
3	K1, K2	Mains contactors
4	Lx	Inductors
5	SU40	Printed circuit board; power supply for electronic components
6	TMS40	Printed circuit board; control unit; measurement signal acquisition
7	CM40	Printed circuit board; current measurement
8	PU40	Power unit with heat sink
9	N1	EMC filter, DC
10	Q1	DC circuit breaker
11	FU40	Printed circuit board with fuses for connecting the strings
12	DCU	LCD graphics display
13	MC4	String terminals with MC4 plug connectors
14	M20, M25, M40	Cable glands for AC, DC, and comm cables

3.2 Schematic circuit diagram SolarMax 20S
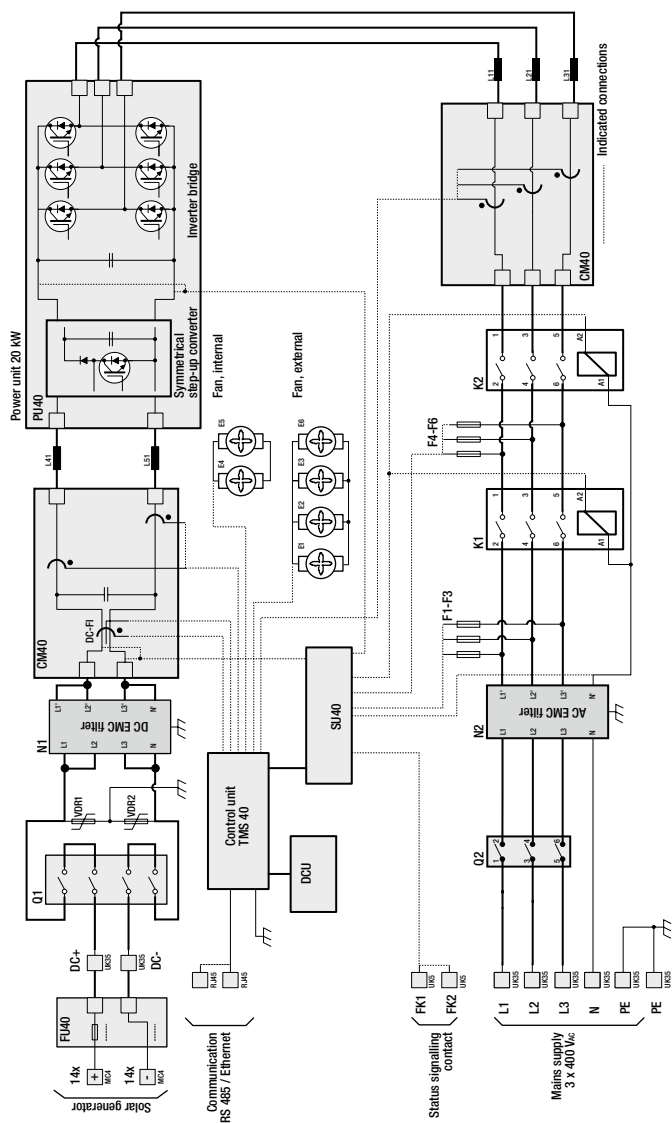
3.3   Schematic circuit diagram SolarMax 35S
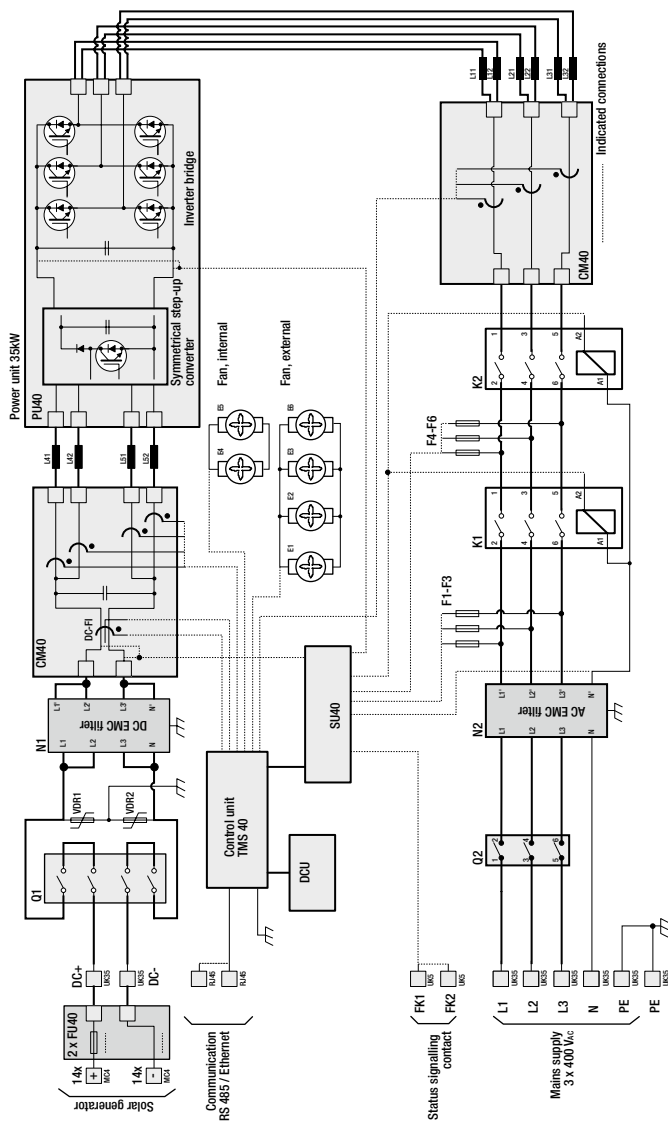
3.4   Control functions

SolarMax inverters feature state-of-the-art measuring and control electronics. With its dual processor technology, the SolarMax complies with stringent safety standards. While the main processor generates the PWM signals, the auxiliary processor continuously monitors the correct function. The safety parameters are always monitored by both processors.

Main processor functions:

- Mains monitoring (overvoltage, undervoltage, mains frequency)
- Mains synchronisation and sinusoidal current control
- Maximum power point tracking (MPPT, optimum operating point search)
- Control of inverter bridge and voltage booster
- Output limitation for oversized solar generator
- Output current limitationg
- Monitoring of power electronics
- Control of graphic LC display
- Fault current monitoring
- Monitoring of redundant mains contactors

Auxiliary processor functions:

- Mains monitoring (overvoltage, undervoltage, mains frequency)
- Monitoring of power electronics
- Monitoring of heat sink temperature
- Fault current monitoring
- Monitoring of redundant mains contactors

Communication processor functions:

- A third processor handles communication via the serial RS485 interface and Ethernet.

3.5 Heat sink temperature limit

For safety reasons the heat sink temperature is limited to 85 °C. At ambient tempera-
tures of more than 45 °C the heat sink temperature may reach 80 °C. In this event the
maximum inverter output is reduced temporarily. If the temperature rises above 85 °C the
device switches off automatically in order to prevent thermal overload.

3.6 Integrated overvoltage protection

On the DC side, the central inverter has a 750 V over-voltage arrestor from positive and
negative pole against ground in each case.

4 Installation

4.1 Siting

SolarMax central inverters must be sited properly in order to ensure maximum opera-
tional safety and efficiency. The SolarMax inverter must be covered and protected from
flooding and direct sunlight. Due to the associated noise emissions, the inverter should
not be installed in the close vicinity of habitable rooms or offices.

The transformation of DC voltage into AC voltage generates heat that has to be dissipated.
If required, the heat sinks are cooled with internal fans. The heated air is ejected at the
rear.

Please note the following during transportation and installation:

- The SolarMax inverter should only be transported vertically (in normal position). Never
  transport it on its side or upside down!
- During transportation and intermediate storage the specified ambient conditions (tem-
  perature and relative humidity) must be observed. Prolonged unattended outdoor stor-
  age of the SolarMax inverter should be avoided.
- The device must be protected from unauthorised access.
- The ambient temperature should be between 0 and 30 °C. The maximum permissible
  ambient temperature is 60 °C.
- In order to ensure adequate cooling, the back of the unit should be kept free. The dis-
  tance to the wall should be at least 30 cm.
- If the device is installed in a small plantroom, additional ventilation must be provided
  (800 m^3/h for SolarMax 20S, 1.200 m^3/h for SolarMax 35S). The additional ventilation
  may be temperature-controlled. It should be activated when the air temperature in the
  plant room exceeds 30 °C.

- In order to avoid unnecessary contamination of the heat sinks and fans, the inverter should only be operated in environments with minimum dust levels. Rooms with significant dust formation (e.g. joinery or metal workshops or similar) are not suitable.
- The device is splashproof (IP54) and may be installed outdoors, although it must be protected from sun and rain.
- Due to operational noise emissions (65 dBA @ PRated) installation in living spaces or offices is not recommended.
- The device must be accessible at least from the front for maintenance and repairs.

4.2 Casing dimensions SolarMax 20S/35S
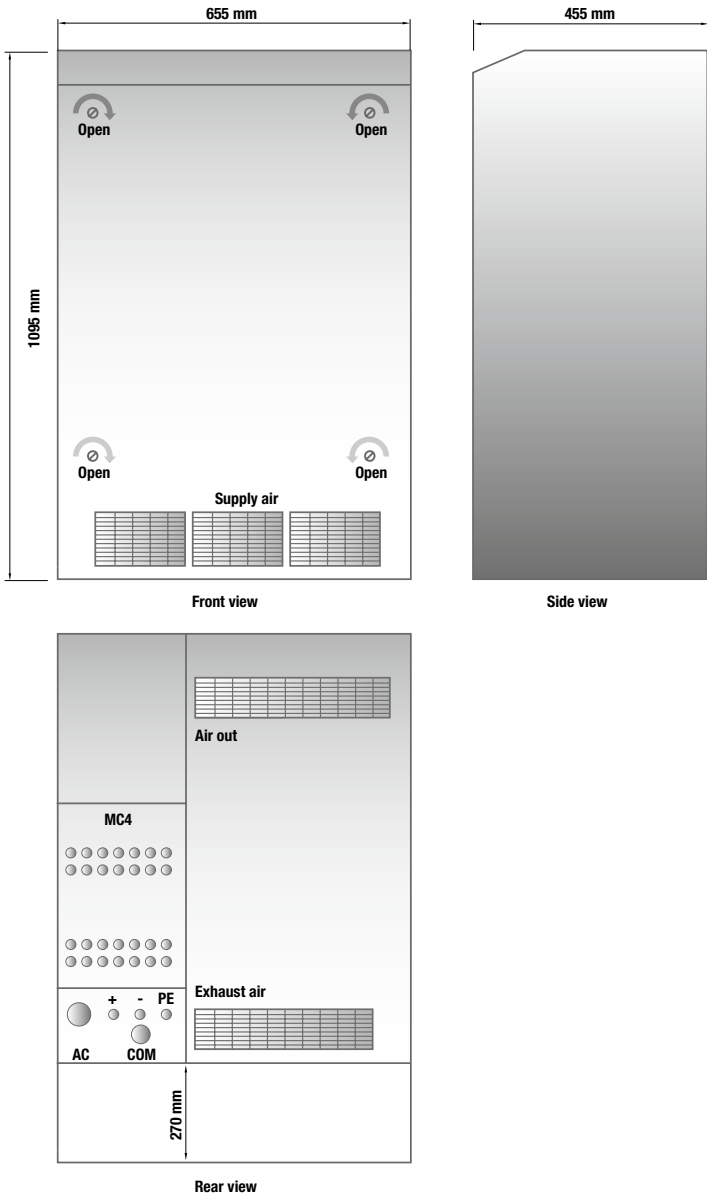
655 mm

1095 mm

Open   Open

Open   Open

Supply air

Front view

455 mm

Side view

Air out

MC4

+   -   PE

AC   COM

Exhaust air

270 mm

Rear view

4.3   Electrical connection

■ AC and DC cables must be suitable for the expected voltages, currents and ambient conditions (temperature, UV, etc.).

■ The personal protection regulations must be followed when the inverter is connected to the AC system.

■ Ensure that the wires are connected properly.

■ Double-check the polarity before connecting the MC4 connectors or the DC terminals.

■ Ensure that the DC cables are laid so as to avoid short-circuits and earth leakage along their complete length as far as the terminals.

4.3.1   Mains fuses and cable cross-sections

Solarmax	20S	35S
Mains fuses characteristic D	40 A	63 A
Recommended DC cable cross-section with MaxConnect	min. 16 mm^2	min. 25 mm^2
Recommended DC cable cross-section with MC4 connectors	min. 2.5 mm^2 per string	min. 2.5 mm^2 per string
Recommended cable cross-section AC	Min. 10 mm^2	Min. 16 mm^2

We recommend using larger conductor cross sections in order to minimise line losses.

4.3.2 Installation aids

⚠️ **DANGER**

Before working on connection terminals the DC and AC supply lines must be discon-
nected.

The terminals are accessible at the front by opening the front panel. To feed the cables
into the terminals release the two retaining screws in the aluminium plate below the DC
disconnecting switch and lower the swing with the string fuses. The terminals and cable
glands are then conveniently accessible. The AC cable must be fed through the M40
cable gland at the rear. The DC connection can be established either via the integrated
MC4 connectors and MC4 sockets or via the M20 cable glands. A third M20 cable gland
is available for an additional earthing cable. A further M25 cable gland can be used for a
maximum of two communication cables.

Purpose	Component	Cable cross-section
DC input + PE	3x M20 cable gland	6-15 mm
AC output	1x M40 cable gland	20-33 mm
Communication	1x M25 cable gland	5-7 mm

Sealed inserts for all cable glands are included. If the glands are not used, these inserts
must be used in order to ensure that the casing remains splashproof.

Before connecting the strings, ensure that the SolarMax specifications (max. voltage
900 V, max. current 10 A/string, polarity) are adhered to over the whole temperature
range of the PV system.

⚠️ **CAUTION**

In order to keep the device watertight, individual round cables only may be fed through
the cable glands in combination with the associated rubber insert. Improper installa-
tion may invalidate the warranty.

A cable gland can be used for up to two communication cables if the respective sealing
plugs are removed.

4.3.3 MC4 terminals

A	String 1	String 2	String 3	String 4	String 5	String 6	String 7
DC-	⊙	⊙	⊙	⊙	⊙	⊙	⊙
DC+	⊙	⊙	⊙	⊙	⊙	⊙	⊙

⚠ **Never disconnect under load!**

B	String 1	String 2	String 3	String 4	String 5	String 6	String 7
DC-	⊙	⊙	⊙	⊙	⊙	⊙	⊙
DC+	⊙	⊙	⊙	⊙	⊙	⊙	⊙

Max. 900 V_{DC}
Max. 10A / String

The SolarMax 20S has 7 string terminals (A), the SolarMax 35S has 14 (A+B). Each string is protected with a fuse. Further information can be found in section 8.3.

4.3.4 Terminals SolarMax 20S/35S

		DC+	DC-	PE	PE	L1	L2	L3	N
		⊘	⊘	⊘	⊘	⊘	⊘	⊘	⊘
⊘	⊘								
UK5	UK5	UT35	UT35	UT35	UT35	UT35	UT35	UT35	UT35
⊘	⊘	⊘	⊘	⊘	⊘	⊘	⊘	⊘	⊘

Status signalling contact FK1, FK2 **Solar generator** **Mains supply 3 x 400 Vac**
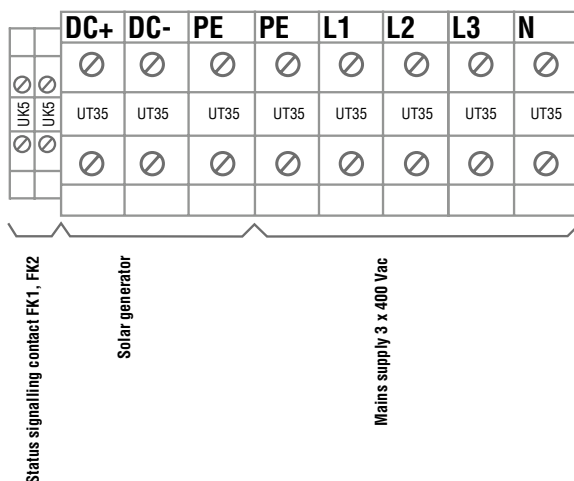
On the AC and DC side wires and strands with a maximum cross-section of 35 mm² can be used, for the status signalling contact up to 4 mm².

4.3.5 Status signalling contact

The status signalling contact is used for remote monitoring. The potential-free relay contact enables the status of the inverter to be monitored. The contact is connected to the terminals from the front of the unit (see section 5.1).

The functionality of the status signalling contact can be set in the Settings menu as follows:

Setting	Function
Off	The status signalling contact is always open.
Mains	In mains mode the status signalling contact closes immediately and is opened again with the set delay as soon as the device is no longer in feed mode.
Error	The status signalling contact closes after the set delay time if a malfunction, fault or alarm occurs during this time. The relay opens immediately when the fault is no longer present.

The electronic monitoring system is supplied from the solar generator, i.e. the status signalling contact is open during the night and when the DC side is switched off.

The events that may trigger the status signalling contact are listed in section 7.6 "Status messages".

Status signalling contact specifications
Contact voltage-free, not protected
max. switching voltage: 250 V_{AC} / 100 V_{DC}
max. switching current: 5 A_{eff} @ 250 V_{AC} cos phi 1 or 30 V_{DC}
continuous current: 2 A_{eff}

4.3.6 Communications sockets

The inverters in the SolarMax S series have two RJ45 sockets for data communications within a MaxComm network:

- The left-hand RJ45 socket (RS485/ETHERNET) can be used both as a RS485 and as an Ethernet interface, the desired function can be toggled in the "Settings" menu. The Ethernet interface is used for connecting an inverter directly to a PC or to MaxWeb xp. However, if both sockets are configured as RS485 interfaces, a network of several RS485 nodes can be set up.
- The right-hand RJ45 socket (RS485) is only a RS485 interface. The RS485 interface is used for connections with other SolarMax inverters or accessories with the Max-Comm interface.

5 Commissioning

After you have tested all the electrical connections and ensured that they are all firmly secured, the inverter can be commissioned. In particular you must ensure that all the terminals are tightened, the protective line connection is correctly made and the polarity of the PV generator is correct.

⚠ **CAUTION**

Before you switch on the inverter, fit all the available protective covers.

5.1 Commissioning (Initial Setup)

If the inverter is being commissioned the initial setup will start automatically. This procedure must only be carried out once as part of the commissioning process.

1. **Switching on the inverter**
   Switch on the inverter as described in section 5.2.

2. **Selecting the display language**
   In this step select the language in which the following information and texts in the display will appear.

3. **Selecting the individual country settings**
   The individual country settings permit making such settings as the required mains voltage and mains frequency range used in the country of installation. The selection of the country of installation is independent of the selected display language.

4. **Date and time**
   Set the local time and current date. The date set is stored as the commissioning date and can be accessed later in the "Information" menu.

5. Confirming the entries

Now confirm the completion of the initial setup with the button ✔ .

<div>

⚠ **CAUTION**

The individual country settings (step 3) must be entered with extreme care. Once the initial setup is completed the selections are permanently set and can no longer be modified. A wrong selection can lead to problems when operating the inverter and result in the license to operate being revoked by the local grid operator.

</div>

<div>

ⓘ **NOTE**

You can change all the settings in the initial setup (with the exception of the individual country settings) at any time in the "Settings" menu.

</div>

5.2   Switching on and off

All SolarMax inverters operate fully automatically and maintenance-free. AC and DC circuit breakers remain switched on at all times. In the morning the SolarMax inverter will switch on as soon as sufficient power is available and continue to operate until the evening. The electronic system is supplied directly from the solar generator voltage. During the night the SolarMax inverter is disconnected from the mains.

<div>

⚠ **DANGER**

The inverter should only be opened briefly for switching on and off. During operation the device must be fully closed.

</div>

Switching on:	The LCD should become active after 20 seconds max. (provided minimum irradiance is available).
1. Set the DC circuit breaker to "ON" 2. Set the AC circuit breaker to "ON" 3. Immediately close the SolarMax front lid 4. Switch on the external AC isolator (fuse)	After a few seconds the "Overview" menu will appear on the LCD. The Status line shows the message "Startup..." After about 1 minute the SolarMax inverter will have found the MPP (maximum power point). During commissioning, the initial setup must be completed (section 5.1).
Switching off:	After a short time the LCD will switch off.
1. Switch off the external AC isolator (fuse) 2. Open the front lid 3. Set the AC circuit breaker to "OFF" 4. Set the DC circuit breaker to "OFF"	

The SolarMax may only be opened for service work and with the AC feed line disconnected. During operation the device must be fully closed.

6 Auto Test

The Auto Test function is required according to the Italian DK5940 standard. It enables verification of the voltage and frequency monitoring function. The Auto Test option is only available in the main menu if „IT" (Italy) was selected as the installation location during Initial Setup (section 5.1).

The Auto Test functionality and procedure is described below.

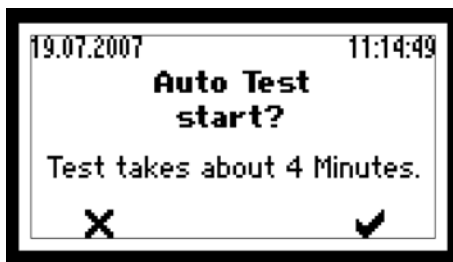## 6.1 Auto Test definition according to DK5940 (Italy)

During the Auto Test procedure in mains mode the trigger threshold for AC voltage and frequency monitoring is varied linearly with a ramp of $\leq$ 0.05 Hz/s and $\leq$ 0.05 Vn/s (Vn = 230 V_{AC}). At some point during the test the threshold will coincide with the current measured value, leading to triggering of the monitoring intervention. After each test step the values of the trigger thresholds, delay times, current measured frequency and AC voltage values, and the standard threshold trigger value are displayed.

6.2 Start Auto Test

To start the Auto Test the inverter must be installed as described in section 5. The Auto Test can be activated only if there is sufficient irradiance and the inverter is connected to the mains and is in feed mode.

1. Wait until the inverter has connected itself to the mains.

2. Select Auto Test in the main menu.

3. Answer the question whether the Auto Test should be executed with YES.


```
19.07.2007                    11:14:49
              Auto Test
                start?
       Test takes about 4 Minutes.
       X                        ✔
```

4. The Auto Test now runs automatically.

┌─┐
│ i │ **NOTE**
└─┘

If a fault occurs during the tests or the irradiance is too low, the Auto Test is aborted
and the message „Auto Test aborted" appears in the display together with an associ-
ated error message.

6.3   Procedure

Maximum voltage

1. The set voltage monitoring threshold Uac max is displayed.
2. The threshold value is decremented linearly until it reaches the current value of the
   highest phase of the mains voltage and mains monitoring is triggered.
3. The trigger value, the delay time, the current value and the default voltage monitoring
   value (Uac max) are displayed.
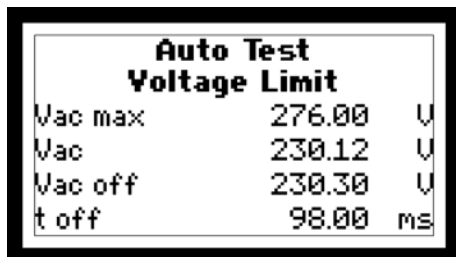
Minimum voltage

1. The set voltage monitoring threshold Uac min is displayed.
2. The threshold value is incremented linearly until it reaches the current value of the highest phase of the mains voltage and mains monitoring is triggered.
3. The trigger value, the delay time, the current value and the default voltage monitoring value (Uac min) are displayed.

```
         Auto Test
       Voltage Limit
Vac min         184.00    V
Vac             230.12    V
Vac off          -.--     V
t off            -.--     ms
```

Maximum frequency

1. The set threshold of the frequency monitoring f max is displayed.
2. The threshold value is decremented linearly until it reaches the current mains frequency value and mains monitoring is triggered.
3. The trigger value, the delay time, the current value and the default frequency monitoring value (f max) are displayed.

```
         Auto Test
      Frequency Limit
f max           50.30     Hz
Frequency       50.03     Hz
f off           50.02     Hz
t off           91.00     ms
```

Minimum frequency

1. The set frequency monitoring threshold f min is displayed.

2. The threshold value is incremented linearly until it reaches the current mains frequency value and mains monitoring is triggered.

3. The trigger value, the delay time, the current value and the default frequency monitoring value (f min) are displayed.

After the Auto Test is concluded the inverter returns to normal operation.

7   Operation and fault display

7.1   Graphics display

The graphics display at the front is used to display SolarMax system parameters, status information, and fault messages, thereby offering the user convenient options for obtaining information about the device status and for setting parameters.

The graphics display is backlit in order to improve readability under adverse light conditions. The backlight switches on whenever one of the three keys is pressed, and remains on for 180 seconds after the last key activity.

7.2   LED display

In addition to the graphics display, an LED display is available for indicating the device status (green, red or orange).

LED display	Device status	Description
Off	Offline	Device is switched off
Green flashing	Startup	Device starting (initialisation, self-test, restart delay)
Green	Online	Device feeding
Orange	Malfunction	Malfunction (e.g. mains monitoring, overtemperature)
Red flashing	Error	Device error / fault
Green/red flashing	Alarm	Alarm messages see section 8.2

7.3   Menu key symbols

Seven symbols are used for menu prompting.

Symbol	Function / Description
↑	Scrolling upwards / increment number, or next element
↓	Scroll down or previous element
←	Back to higher-level menu
→	Select next number
✔	Shows the required submenu or stores any changes
↵	Starts edit mode for the selection
✗	Cancel

7.4   Menu structure

The following submenus can be called up from the main menu:

■ Overview

■ Measurement readings

■ Statistics

▮ Days
▮ Months
▮ Years
▮ Total
▮ Reset

■ Configuration

■ Settings

           ❚ Language
           ❚ Time
           ❚ Date
           ❚ Device address
           ❚ Ethernet
           ❚ IP
           ❚ Netmask
           ❚ TCP port

■ Auto Test*

■ Information

* Only with country setting IT (see section 6)

Use the arrow keys ⬆ and ⬇ to select the required menu. Use the ✔ key to switch to the selected menu.
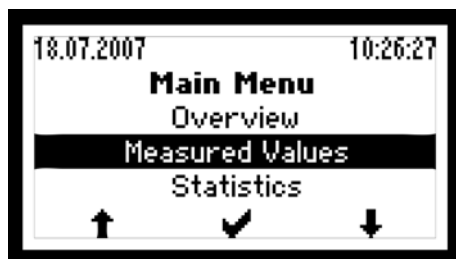
Overview

If none of the three keys is pressed for 120 seconds the display automatically switches to the Overview menu, which shows the three main parameters and the operating status.
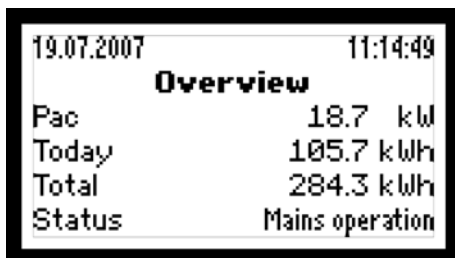
```
19.07.2007              11:14:49
              Overview
Pac                   18.7  kW
Today              105.7 kWh
Total              284.3 kWh
Status           Mains operation
```

Measurement readings

The following measurement readings can be displayed:

- Udc   ➡   current solar generator voltage
- Idc   ➡   current solar generator current
- Uac (L1, L2, L3) ➡   current mains voltage
- Iac (L1, L2, L3) ➡   current infeed current
- Pac   ➡   current inverter output
- Frequenz   ➡   mains frequency
- Temperatur   ➡   heat sink temperature
- Fan (on/off)   ➡   fan on or off

A maximum of four measured values can be displayed simultaneously. Use the arrow keys ⬆ and ⬇ to switch to other values. Use the ⬅ key to switch back to the main menu.

```
        Measured Values
VL1   231.2 V   IL1   27.3 A
VL2   230.8 V   IL2   27.5 A
VL3   231.6 V   IL3   27.1 A
Pac                 18.7  kW
         ⬅        ⬆        ⬇
```
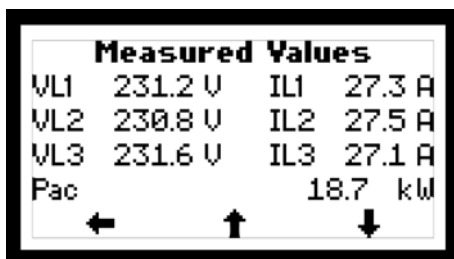
Long-term measurement readings

The following long-term measurement readings can be displayed:

■ Days

■ Months

■ Years

■ Total

■ Reset

Use the arrow key ↓ to select the required menu. Use the ✔ key to switch to the selected menu. Use the ← key to switch back to the main menu.
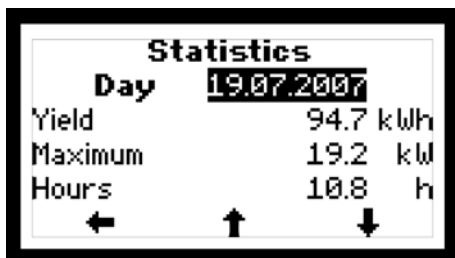
➡ Daily yield
➡ Maximum power fed to the grid
➡ Operating hours

Use the arrow keys ↑ and ↓ to display the yields for the last 31 days. Use the ← key to switch back to the Statistics menu.

```
       Statistics
   Month      07.2007
Yield          1859.0 kWh
Maximum          20.8   kW
Hours           298.1    h
     ←        ↑        ↓
```
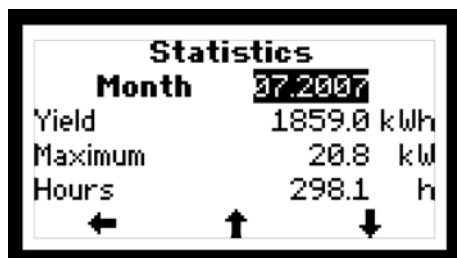
➡ Monthly yield
➡ Maximum power fed to the grid
➡ Operating hours

Use the arrow keys ↑ and ↓ to display the yields for the last 12 months. Use the ←
key to switch back to the Statistics menu.

```
       Statistics
   Year         2007
Yield        22896.3 kWh
Maximum         22.0   kW
Hours         3564.9    h
     ←        ↑        ↓
```

➡ Annual yield
➡ Maximum power fed to the grid
➡ Operating hours

Use the arrow keys ↑ and ↓ to show the yields for the last ten years. Use the ← key
to switch back to the Statistics menu.

```
       Statistics
        Totals
Yield        22896.3 kWh
Hours         3564.7    h

     ←
```

This screen shows the total yield and the operating hours of the inverter since it was com-
missioned. Use the ← key to switch back to the Statistics menu.

```
19.07.2007                 11:14:49
            CAUTION!
        Reset all statistic
             entries?

    ✗                      ✔
```

Use the ✔ key to confirm resetting of all statistics. Use the ✗ key to exit the menu without resetting the statistics.

Configuration
The following limit values and operating parameters cannot be modified via the graphics display, because they are part of the country-specific settings.

Country	The installation country set during commissioning is displayed here
Uac min	Minimum permissible mains voltage
Uac max	Maximum permissible mains voltage
Uac 10min max	Maximum permissible mean value of the mains voltage over the last 10 minutes
Iac max	Maximum mains current
Ierr max	Maximum permissible fault current (rms value) on the DC side
Pac max	Maximum AC output that can be fed in
f max	Maximum permissible mains frequency
f min	Minimum permissible mains frequency
Restart delay	Grid feeding delay after disconnection from the mains
df/dt max	Maximum permissible mains frequency variation per second

```
┌─────────────────────────────────────┐
│          Configuration              │
│  Vac min              184.0    V    │
│  Vac max              264.5    V    │
│  Vac 10min max        253.0    V    │
│  Iac max               22.0    A    │
│        ←           ↑          ↓     │
└─────────────────────────────────────┘
```
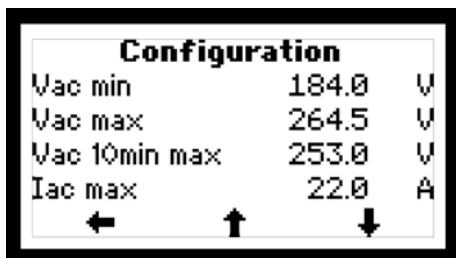
Use the arrow keys ↑ and ↓ to display any value. Use the ← key to switch back to the main menu.

Settings
The following settings can be implemented via the graphics display:

Language	Language selection: German, English, French, Italian or Spanish
Time	Internal clock setting
Date	Current date setting
Device address	Enter a device address between 1 and 249. If several inverters are connected to form a network, each device must have a different address
Ethernet	Switches the Ethernet interface on or off
IP	Ethernet interface configuration (see section 9.1)
Netmask	Ethernet interface configuration (see section 9.1)
TCP port	Ethernet interface configuration (see section 9.1)
Status relay	Defines the function of the status signalling contact (see section 4.3.5)
Status relay delay	Delay time setting for the status signalling contact

```
19.07.2007                    11:14:49
            Settings
Language                       English
Time                          11:14:49
Date                        19.07.2007
      ←           ↵            ↓
```

Use the arrow key ↓ to select the required parameter. Use the ↵ key to switch to edit mode for the selected parameter. Use the ← key to switch back to the main menu.


```
19.07.2007                    11:14:49
            Settings
Language                       English
Time                          ▮1:14:49
Date                        19.07.2007
      ✔           ↑            →
```

In edit mode each digit is modified individually. Example: use the ↑ key to increment the selected digit. Once the right value has been selected use the → key to switch to the next digit and increment it with the ↑ key. Once all digits have been set, exit edit mode with the ✔ key.

Information

This menu shows the following information:

- ■ Device type (SM20S, SM35S)
- ■ Firmware version
- ■ Date of commissioning
- ■ Web address (www.solarmax.com)

```
         Information
Device type            SM20S
Build                1.5.1275
Startup            18.07.2007
Website     www.solarmax.com
      ←
```
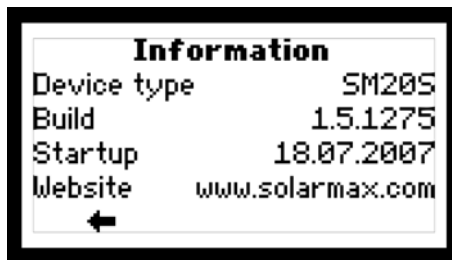
Use the ← key to switch back to the main menu.

7.5   Communication activity

If the symbol in the top line of the display is lit the inverter has received data.

Symbol	Mode	Function / description
		No communication (no symbol is displayed)
⟲	Comm	Communication activity; this is displayed if the inverter has received data (synonymous with the activity display of network cards)
E	Ethernet	Ethernet is displayed if Ethernet mode is activated

7.6   Status messages

The following table shows the possible status messages, subdivided into four categories:

Startup LED: green flashing	Irradiance too low	The solar radiation is too low; feed mode is not possible.
	Startup...	In this state the inverter checks all requirements that must be satisfied in order to enable secure feed mode.
	Restart in	After a shutdown this value indicates the number of seconds after which feed mode will resume.

Mains operation LED: green	Maximum output	The inverter limits the output to the maximum power of the device (this may happen if the solar generator is oversized).
	Mains operation	The inverter is connected the mains and is operating in feed mode.
	Idc limitation	The inverter limits the solar generator current to the maximum permissible value (this may occur if the solar generator is designed such that the current at MPP exceeds the maximum permissible input current of the inverter).
	Iac limitation	The inverter limits the mains current to the maximum permissible value (this may occur in the event of strong irradiance fluctuations or if the solar generator is oversized).

8   Troubleshooting

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

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. Check whether the inverter and PV generator have been correctly installed.

2. Check the cable connections using the instructions and information contained in the "Commissioning" section of this manual.

3. Determine the cause of the malfunction by checking the message in the graphic dis-play unit. The "Diagnosis and corrective steps" section explains how malfunctions can be corrected.

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

Monday to Friday from 8.00 am to 5.00 pm

Calls from:

Germany	+49 180 276 5 276
Switzerland	+41 32 346 56 06
France	+33 4 72 79 17 97
Italy	+39 0362 312 279
Spain	+34 902 16 06 26
Belgium	+32 2 535 77 32
Czech Republic	+420 222 191 456
United Kingdom	+44 208 973 2556
Other countries	+41 32 346 56 06
Fax	+41 32 346 56 26
Email	hotline@solarmax.com

Sputnik Engineering AG
Höheweg 85
CH-2502 Biel-Bienne

8.2   Diagnosis & corrective steps

Malfunction: no display on the graphics display	
Possible cause	Measures
DC isolator switched off.	Switch on DC isolator.
Irradiance too low.	Wait until irradiance is high enough.
Strings interrupted.	Rectify interruption.
Internal fault.	Notify SolarMax hotline.

Malfunction: (LED orange) Status message: Udc too high	
Possible cause	Measures
The solar generator voltage exceeds the permissible value (see technical data).	Disconnect DC side immediately; check module configuration.
Status message: Mains currents asymmetrical	
Phase currents are asymmetric.	Check AC terminals or notify SolarMax hotline.
Status message: Ierr too large	
Fault current to ground is too high.	Check generator and DC cabling.
Status message: No mains	
AC isolator is open.	Close AC isolator.
AC feed lines are disconnected.	Connect AC lines and close all isolators.
Status message: Frequency too high / too low	
The AC mains frequency is outside the tolerance.	Wait until the AC grid has stabilised. The frequency change may have been induced by the utility company!
No mains, or mains voltage interrupted.	Check AC connection.
Status message: Mains fault	
The utility has switched off the grid, the SolarMax has disconnected itself from the grid.	Wait until the grid is available again.
Status message: Poor mains quality	
Poor, strongly fluctuating voltage quality.	Wait until the mains quality improves.
Status message: Vac too high / too low	
The mains voltage is too low or too high. The SolarMax has disconnected itself from the grid.	Wait until the mains voltage has normalised.

Malfunction: (LED orange)	
Status message: Udc too high	
Possible cause	Measures
Status message: Overtemperature	
The ambient temperature is too high.	Clean the ventilation grilles and ensure adequate distances from obstacles (approx. 30 cm) front and back and/or improve room ventilation.
Insufficient air circulation.	
Status message: Insulation fault	
Poor DC cables.	Improve cabling.
High leakage currents in the solar generator system (moisture).	Improve sealing of the connection and insulation.

Fault: (LED flashing red)	
Status message: Device fault	
Possible cause	Measures
Internal error.	Notify SolarMax hotline.
Status message: Overvoltage	
Power unit overvoltage.	Notify SolarMax hotline.
Status message: Overcurrent	
Power unit overcurrent.	Notify SolarMax hotline.

Alarm: (LED green/red flashing)	
Alarm message: String fuse failure	
Possible cause	Remedy
Fuse failure on PCB FU40.	Replace the fuse on PCB FU40 with the same type.
Alarm message: Failure fan 1...6	
The indicated fan is faulty.	Contact SolarMax hotline.
Alarm message: Temperature limitation	
The heat sink temperature is too high.	Clean the ventilation grilles and ensure adequate distances from obstacles (approx. 30 cm) front and back and/or improve ventilation.
Alarm message: Temperature sensor failure	
A temperature sensor is faulty.	Contact SolarMax hotline.

The following error messages can be displayed only during SolarMax initialisation. They indicate a device fault:

Fault	Remedy
SUPPLY FAULT	Contact the SolarMax hotline.
ADC REFERENCE ERROR	
ERROR EEPROM	
CONFIGURATION ERROR	

8.3   Fuse failure in individual strings

A maximum of 7 strings can be connected to the SolarMax 20S and 14 to the SolarMax 35S. Each input has its own fuse. The integrated fuse failure detection triggers an error message on the display. The inverter remains in service.

The red control LED on PCB FU 40 (see section 3.1) next to each fuse enables fast and convenient fault detection.

⚠ **DANGER**

- Before changing the fuse, de-energise the SolarMax on the DC side and the AC side!
- The DC circuit breaker (Q1) inside the device does not disconnect the fuses from the PV system.
- Disconnect the DC side in the terminal box of the PV system or remove the MC-4 connectors.

8.4   Maintenance

The SolarMax inverters generally operate maintenance-free. However, during strong solar radiation we recommend checking the AC output in the LC display at regular intervals.

The cumulative operating and kilowatt hours provide additional information about the performance of your PV system.

9 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.

---

i	**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 the data of your inverters occasionally or modify your inverter's settings, 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. On the Internet you can access your PV power plant from any PC with an internet connection to check current measured values and yields or to edit the settings of your inverters. 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.

SolarMax web portal: For accessible power plant data at any time

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

9.1   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 inverters into one network you must assign each device its own address.

> ⓘ **NOTE**
>
> ■ You can assign addresses between 1 and 249. It is very important to remember to give a unique address to each individual device in the network!
>
> ■ Start the device address numbering with the lowest numbers possible (if possible with 001).

IP

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

Netmask

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

TCP port

Enter the TCP port for communications with the inverter. 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**
>
> For more details about data communications you can visit the download page of our website at www.solarmax.com.

10 Options

10.1 MaxControl

10.1.1 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

10.1.2 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 twenty years and three months.

ⓘ NOTE

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

10.2 Accessory components

Here is a list of other available accessory components.

- **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

11 Disposal

At the end of its service life please dispose of the inverter according to the relevant disposal regulations applicable for the installation location. Alternatively you may return the inverter to Sputnik Engineering for proper disposal (the address can be found in the section "SolarMax Service Center"). Please note that there is a charge for this service.

12 Technical data

12.1 Technical data

		SolarMax 20S	SolarMax 35S
Input values	Maximum PV genera-tor output power [1]	24 kW	45 kW
	MPP voltage range	400...800 V	
	Maximum DC voltage	900 V	
	Maximum DC current	48 A	78 A
	Number of MPP-Trackers	1	1
	Connection type	7 x MC4 connectors with integrated fuses	14 x MC4 connectors with integrated fuses
		3 screw terminals 35 mm^2, bushing 3 x M20 for cable diamater 6-15 mm	
Output values	Rated output power	20 kW	35 kW
	Maximum apparent output power	22 kW	38.5 kW
	Nominal mains voltage	3 x 400 V	
	Maximum AC current	31 A	54 A
	Mains nominal frequency / range	50 Hz / 45…55 Hz	
	Power factor (cos phi)	> 0.98	
	Distortion factor at rated power	< 3 %	
	Connection type	5 screw terminals 35 mm^2, bushing 3 x M20 for cable diamater 20-33 mm	
	Grid connection	Three-phase (with neutral conductor)	
Efficiency	Maximum efficiency	96.6 %	96.8 %
	Europ. efficiency	95.5 % @ 600 V_{DC} 96.0 % @ 700 V_{DC}	95.5 % @ 600 V_{DC} 96.1 % @ 700 V_{DC}
Power input	Own consumption, night	2…7 W	
Ambient conditions	Protection type compliant with EN 60529	IP54	
	Ambient temperature range	-20 °C…+ 60 °C	
	Ambient temperature range at rated power	-20 °C…+ 45 °C	
	Relative humidity	0…98 % (no condensation)	
Configura-tion	Display	Graphic LC display with backlight and status LED	
	Data logger	Data logger for energy yield, peak output and operating duration for the last 31 days, 12 months and 10 years	

		SolarMax 20S	SolarMax 35S
Standards & guidelines	CE-compliant	Yes	
	EMC	EN 61000-6-2 / EN 61000-6-3	
	Standard / guideline compliance	VDE 0126-1-1 / DK 5940 / RD 661	
	Device safety	TÜV "Type approved" compliant with EN 50178	
Interfaces	Data communication	RS485 / Ethernet	
	Status signalling contact	Potential-free terminal contact pair (Configurable function)	
Weight & dimensions	Weight	98 kg	125 kg
	Dimensions in mm (W x H x D)	655 x 1090 x 455	
Warranty		Standard 2 years / extension to 5, 10 or 12 years possible	

[1] Recommended overdimensioning 15 % (ISE Fraunhofer study)

12.2   Efficiency

Characteristic efficiency curve for the SolarMax S series
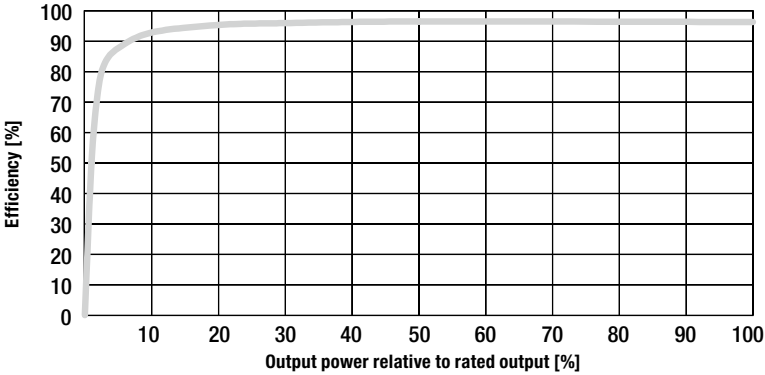
Efficiency SolarMax 20S

Pac [W]	P$_{relativ}$ [%]	η(500Vdc) [%]	η(600Vdc) [%]	η(700Vdc) [%]
1000	5	85.2	86.0	88.9
2000	10	90.7	91.5	93.5
4000	20	94.0	94.7	95.6
6000	30	95.2	95.7	96.4
10000	50	95.7	96.5	96.6
20000	100	95.8	96.3	96.6
European efficiency		**94.8**	**95.5**	**96.0**

Legend:

P$_{relativ}$ Ratio between output power and rated output [%]

η$_{(VDC)}$ Efficiency at associated input voltage [%]

Efficiency SolarMax 35S

Pac [W]	P$_{relativ}$ [%]	η(500Vdc) [%]	η(600Vdc) [%]	η(700Vdc) [%]
1750	5	86.3	87.7	89.1
3500	10	91.0	91.8	93.0
7000	20	94.1	94.7	95.4
10500	30	95.2	95.9	96.4
17500	50	95.8	96.5	96.8
35000	100	95.6	95.9	96.5
European efficiency		**94.9**	**95.5**	**96.1**

Legend:

P$_{relativ}$ Ratio between output power and rated output [%]

η$_{(VDC)}$ Efficiency at associated input voltage [%]

12.3 Configurable limit values and operational settings

In the SolarMax S series the following parameters can be set manually via the interface with the MaxTalk software. The settings are password-protected. A password application form can be ordered via the SolarMax hotline. The password is only made available to installers who sign the form. The password is not made available to private individuals or system operators.

Parameter	Unit	CH	DE	ES	IT	FR	B	GR	CZ	PT	ROW
$U_{AC\,MAX}$	V	264	264	253	264	264	253	264	264	264	264
$U_{AC\,MIN}$	V	184	184	196	186	196	207	184	196	196	196
$U_{AC10\,MIN\,MAX}$	V	253	253	-	-	264	253	-	253	253	253
f_{MAX}	Hz	50.2	51.5	51	50.3	50.5	50.5	50.5	50.5	51	51
f_{MIN}	Hz	47.5	47.5	49	49.7	49.5	49.5	49.5	49.5	47	47
df/dt_{MAX}	Hz/s	-	-	-	-	-	-	-	-	-	-
$I_{ERR\,MAX}$	mA	300	300	300	300	300	300	300	300	300	300
$I_{AC\,MEAN\,MAX}$	A	1	1	1	0.5 % of $I_{AC\,MAX}$	1	1 % of $I_{AC\,MAX}$	0.5 % of $I_{AC\,MAX}$	1	1	1
Restart delay	s	0	0	180	0	0	0	180	0	0	0
Disconnection time	s	0.2	0.2	0.2	0.1	0.2	0.12	0.2	0.2	0.2	0.2
$P_{AC\,MAX}$ SM20S	kW	22	22	22	20	22	22	22	22	22	22
$P_{AC\,MAX}$ SM35S	kW	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
$I_{AC\,MAX}$ SM20S	A	31	31	31	31	31	31	31	31	31	31
$I_{AC\,MAX}$ SM35S	A	54	54	54	54	54	54	54	54	54	54

The set values can be queried via the display in the Configuration menu (see section 7.4 "Menu structure").

13 Guarantee

Guarantee

Sputnik Engineering AG (hereafter: Sputnik) guarantees full function and lack of defects of its technical devices for a guarantee period specifically defined for each type of device. This guarantee period starts to run at the moment the goods leave Sputnik's factory. Exceptionally, in case of sale of goods to natural persons for non-commercial / private purposes, the guarantee period starts to run only from the time of delivery to the end-Buyer.

Duration of guarantee:

- *two years* for all central inverters and accessories;
- *five years* for all string inverters.
- In case a different guarantee period is defined in the device's data sheet, the content of the data sheet precedes these GCBD.

This guarantee applies only in case of malfunctions/defects which have been discovered and notified to Sputnik within the guarantee period. The original invoice respectively the delivery receipt serve as proof for the relevant point of time. In all cases of guarantee, Sputnik must be notified of the inconformity clearly and in writing within the guarantee period.

In guarantee cases, the malfunctioning/defective device will be repaired or replaced by Sputnik-service personnel within a reasonable time, in either case free of charge, unless this is impossible or disproportionate.

Replacement or repair shall be deemed to be *disproportionate* if it imposes costs on Sputnik which, in comparison with the alternative remedy, are unreasonable, taking into account:

- the value the goods would have if there were no lack of conformity,
- the significance of the lack of conformity, and
- whether the alternative remedy could be completed without significant inconvenience to the buyer.

"Free of charge":

- The guarantee covers only the costs for labor and materials used by Sputnik to bring the devices back to full function either in *Sputnik's factory or on-site by Sputnik-service personnel.* All other costs, especially shipping costs, travel and hotel expenses for on-site repairs by Sputnik-service personnel as well as costs of repairs by the buyer himself or other persons are not covered by the guarantee and go to the expense of the buyer or the distributor, unless otherwise specified in a written agreement.
- In case of sale of devices to natural persons for non-commercial / private purposes within the EU and Switzerland, shipping costs as well as travel and hotel expenses for on-site repairs by Sputnik-service personnel are also covered by the guarantee. However, Sputnik covers only the shipping and travel expenses for the distance between Sputnik and the official Sputnik distributor, from which the defective/malfunctioning device was bought. Furthermore, Sputnik will not cover shipping costs, travel and hotel expense if the sales point of this official Sputnik distributor is located in overseas territories of the EU or outside of the EU / outside of Switzerland.

In any case, guarantee-services of Sputnik are only free of charge if Sputnik has been contacted *in advance* and has agreed to the services to be provided.

In a guarantee case, the buyer may require an appropriate reduction of the price or have the contract rescinded:

- if the buyer is entitled to neither repair nor replacement, or
- if Sputnik has not completed the remedy within a reasonable time, or
- if Sputnik has not completed the remedy without significant inconvenience to the buyer.

The buyer is not entitled to have the contract rescinded if the lack of conformity is minor.

Especially in the following cases, this guarantee does not apply and any liability of Sputnik is excluded:

- **unauthorized technical intrusions, modifications or repairs of the devices by the buyer himself;**
- **use of devices for purposes they are not intended for, incorrect or unreasonable manipulation, incorrect or unreasonable installation, especially if the installation is made by non-authorized electricians;**
- **influence of foreign substances/bodies or superior force (lightning strike, overvoltage, floods, etc.);**
- **transport damage and other damage, which has occurred after the point of time in which the risk has passed to the buyer, as well as damage caused by incorrect packaging by the buyer.**

This guarantee is compatible with the *„Directive 1999/44/EC of the European Parliament and of the Council of 25 May 1999 on certain aspects of the sale of consumer goods and associated guarantees"*. Any legal rights under applicable national legislation within the personal, objective or geographic scope of this directive are not affected.

Servicing- and Guarantee-Extensions

Extended servicing and guarantee performances will - as the case may be - provided by Sputnik according to a separately concluded agreement.

Limitation of Liability and Warranty

To the maximum extent legally possible, any further liability of and/or alternative claims of warranty/ guarantee against Sputnik are excluded. For commercial users, compensatory claims for loss of gain are also excluded.

Applicable Law

Unless explicitly agreed upon otherwise in writing, and as far as not in conflict with compulsory law, the material provisions of the UN-Convention on Contracts for the International Sale of Goods (CISG) apply.

Jurisdiction

Unless explicitly agreed upon otherwise in writing, and as far as not in conflict with compulsory law, the exclusive place of jurisdiction for all conflicts with Sputnik based on contractual, non-contractual and/or other types of claims lies in Biel, Switzerland.

21 January 2010

Certificate

Declaration of conformity

EC Declaration of conformity

for grid-connected photovoltaic inverters

SolarMax 20C / 20S / 25C / 30C / 35C / 35S / 50C / 80C / 100C / 300C

made by

Sputnik Engineering AG
Höheweg 85
CH-2502 Biel/Bienne

This declaration is our confirmation that the products specified above conform to the following directives:

■ EMC Directive 2004/108/EC
■ Low Voltage Directive 2006/95/EC
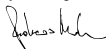
The products comply with the following standards:

	SM20C	SM20S	SM25C	SM30C	SM35C	SM35S	SM50C	SM80C	SM100C	SM300C
EMC Emission										
EN 61000-6-3: 2001 + A11: 2004		x				x				
EN 61000-6-4: 2001	x	x	x	x	x	x	x	x	x	x
EMC Immunity										
EN 61000-6-1: 2001	x	x	x	x	x	x	x	x	x	x
EN 61000-6-2: 2005	x	x	x	x	x	x	x	x	x	x
Utility Interference										
EN 61000-3-11: 2000	x	x	x	x	x	x				
EN 61000-3-12: 2005	x	x	x	x	x	x				
Equipment safety										
EN 50178: 1997	x	x	x	x	x	x	x	x	x	x

The products specified above hence bear the CE mark.

The declaration of conformity loses its validity if the product is misused or modified without proper authorisation.

Biel/Bienne, 26.10.2010   **Sputnik Engineering AG**

Andreas Mader

2010/11 en

SolarMax®
by Sputnik Engineering

⚠

Länderspezifische Zertifikate und Konformitäten können im Downloadbereich unter www.solarmax.com eingesehen werden

Country-specific certification and conformities can be found and downloaded at www.solarmax.com

Les certificats et déclarations de conformité spécifiques à chaque pays peuvent être consultés dans la zone de téléchargement, à l'adresse www.solarmax.com

Certificados y documentos de conformidad específicos del país pueden verse en la zona de descarga en www.solarmax.com

I certificati e le dichiarazioni di conformità nazionali si possono consultare nella rubrica „Downloads" del sito www.solarmax.com

SolarMax Service Center

Deutschland	+49 180 276 5 276
Schweiz / Svizzera / Suisse	+41 32 346 56 06
France	+33 4 72 79 17 97
Italia	+39 0362 312 279
España	+34 902 160 626
Benelux	+32 2 535 77 32
Česká Republika	+420 222 191 456
United Kingdom	+44 208 973 2556
Other countries	+41 32 346 56 06
Fax	+41 32 346 56 26
E-Mail	hotline@solarmax.com

2011/02 en

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