REFU*sol* – solar inverter

REFU*sol* 008K to 20K

REFU*sol* 023K-460VAC

REFU*sol* 020K-SCI

Operating instructions

Version 11.3

REFUsol

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1 Regarding these operating instructions

The operating instructions form a part of the product

⇒ Read the operating instructions before using the product.

⇒ Keep the operating instructions readily available with the device for the entire life expectancy of the product.

⇒ Provide access to the operating instructions to all future users of the device.

1.1 Symbols and Markup

☑	Pre-condition
⇒	One-step operating instruction
1.	Multiple-step operating instruction
•	Bulleted list
Highlighting	Highlighting within a text
↳	Result

1.2 Warning notices

1.2.1 Lay-out of a warning notice

 **WARNING TEXT**	**The type and source of danger are described here.** ⇒ Measures for avoiding the danger are shown here.
Example	
 **DANGER**	**Death or severe injury to persons due to high discharge current when opening the device.** ⇒ It is essential to ensure an earthing connection has been established prior to connection to the supply current circuit.

1.2.2 Categories of warning notices

There are three categories of warning notices

 **DANGER**	"DANGER" designates a safety notice, disregarding which will lead directly to death or severe bodily injury being sustained!

 **WARNING**	"WARNING" designates a safety notice, disregarding which can lead to death or severe bodily injury being sustained!
 **CARE**	"CARE" designates a safety notice, disregarding which can lead to material damage or light bodily injuries being sustained!

1.3 Notices

Notice: A **notice** describes information which is important for the optimum and cost-effective operation of the equipment.

2 Safety notices

2.1 Proper usage

The **REFU*sol*** 008K-023K referred to in these operating instructions as the inverter, is a solar inverter, which transforms the direct current generated by the PV generator (photovoltaic modules) into alternating current and feeds this to the public power supply network. The inverter has been constructed according to the current state of technology and in line with the rules of technical safety. Any use beyond this is not deemed to be proper. The manufacture will not accept liability for any damages resulting from this and the user alone will bear all responsibility.

2.2 Qualification of personnel

Only suitably trained and qualified personnel are allowed to work on this inverter. Personnel are regarded as being qualified if they are sufficiently familiar with the assembly, installation and operation of the product as well as with warnings and safety measures according to these operating instructions.
Furthermore, they will have been trained, instructed or authorised to switch electric circuits and devices on and off, to earth these and to identify them for their designated purpose in line with working requirements. They must be in possession of suitable safety equipment and be trained in first aid.

2.3 Dangers arising from misuse

 **DANGER**	**Danger to life from electric shock** ⇒ Device may only be installed and serviced by qualified specialist technical personnel. ⇒ Use only moduls class A according to IEC 61730. ⇒ The PV-generator must be free of ground potential. ⇒ Don´t overload the DC-connections (max. 25 A per connector, max. 41 A in sum, see chap. 3.6, p. 15. ⇒ Before connecting or disconnecting the DC plug always make DC switch to OFF. ⇒ Individual string connections cannot be de-energized by an external DC switch. The reason is, that there takes place a compensation voltage within the unit. ⇒ Each power cable must be fitted with a suitable circuit breaker. ⇒ Never switch a consumer between inverter and line protection. ⇒ Access to the disconnecting devices must always be free. ⇒ Mount connections carefully.

 **DANGER**	**Danger to life from electric shock** **After the device has been switched off, the interior may still contain life-threatening voltage.** ⇒ Do not open inverter.

 **DANGER**	**Danger to life from high discharge current** ⇒ It is essential to ensure an earthing connection has been established prior to connection to the supply current circuit!

 **WARNING**	**Danger of bodily injury through crushing, shearing, cutting, striking.** ⇒ Assembly of the device with two persons.

2.4 Protection against touching electrical parts

 **WARNING**	**Danger to life, danger of injury due to high electrical voltage** ⇒ Installation of the inverter must only be carried out by trained specialist personnel. In addition, the installer must be accredited by the responsible energy provision company. ⇒ Operation, maintenance and/or repair of the inverter must only be carried out by personnel trained and qualified to work with electrical devices. ⇒ General assembly and safety stipulations relating to working on high current facilities must be followed. ⇒ Before switching on, a check must be made to ensure that the plugs are firmly in place (locking). ⇒ The plugs of the PV generator must only be pulled out once when the DC circuit breaker is positioned at "OFF". The feeder must be isolated and secured against switching on again before the power plug is pulled out.

2.5 Protection against touching hot parts

 **CARE**	**Danger of burns through hot surfaces and housings.** The upper part of the housing as well as the refrigeration unit can reach a surface temperature of 75 °C with a surrounding temperature of 45 °C. ⇒ Do not touch housing surface near to hot sources of warmth. ⇒ Allow the device to cool down for 15 minutes before touching the surface of the device.

2.6 Protection during handling and assembly

WARNING

Danger of injury with improper handling through crushing, shearing, cutting, striking and raising.
The weight of the inverter amounts to 41,5 kg!

⇒ Follow the general instructions for assembly and safety whilst handling and setting up.

⇒ Use suitable assembly and transportation equipment.

⇒ Avoid pinching and crushing by taking suitable precautions.

⇒ Only use suitable tools. Use special tools where this is prescribed.

⇒ Use lifting equipment and tools in a technically correct manner.

⇒ If necessary, use suitable protective equipment (for example, goggles, safety shoes, protective gloves).

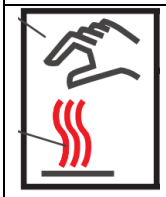
⇒ Do not stand under hanging loads.

⇒ Remove any liquids escaping onto the floor immediately to avoid the danger of slipping.

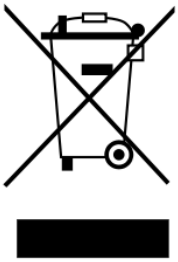
2.7 Note before starting up

- In the event of installation in France, the device must be provided with the warning sticker laid down by UTE C 15-712-1. The warning sticker is included in the delivery.
- Problem-free and safe operation of the inverter is conditional upon due and specialised transportation, storage, assembly and installation as well as careful operation and maintenance.
- Only use accessories and spare parts approved by the manufacturer.
- Adherence must be ensured to the prescriptions and stipulations regarding safety of the country in which the inverter is to be used.
- The environmental conditions stated in the product documentation must be observed.
- Starting up is to be prohibited until the entire equipment corresponds to the national stipulations and safety rules regarding use.
- Operation is only permitted with adherence to the national EMC prescriptions for the present use case.
- The manufacturer of the equipment or machine is responsible for ensuring adherence to the thresholds required by the respective national stipulations.
- For European countries is to note when using the inverter the EC Directive 2004/108/EC (EMC Directive).
- The technical data, connection and installation conditions are to be taken from the product documentation and must be observed under all circumstances.
- Switching off of the inverter must first be effected on the AC side via the circuit breaker. Switch-off is then to be effected on the DC side via the DC circuit breaker, should maintenance work need to be carried out on the DC side. This ensures the life expectancy of the DC circuit breaker is increased.
- It is not necessary to switch off the inverter via the DC circuit breaker overnight, as the inverter switches off completely as soon as no DC voltage is present at the input.
  If no switch-off is effected via the DC circuit breaker, the inverter switches on automatically in the morning when the PV generator supplies sufficiently high voltage. This means that the maximum output is generated.

2.8 Additional symbols and warning on the inverter

	This symbol indicates that the user manual must be read before the unit is put into operation.
	Hot surface! The housing may become hot during operation.
	Discharge of the unit for longer than 15 minutes.
 **WARNING Dual Supply**	Do not work on this equipment until it is isolated from both the mains and on-site generation supplies.

2.9 Disposal



Dispose of the packaging and replaced parts according to the rules applicable in the country where the device is installed.

Do not dispose of the inverter with normal domestic waste.

The inverter complies with the RoHS Directive. That means that the device can be delivered to local sites for the disposal of household appliances.
REFU*sol* GmbH takes the inverter completely back. Please contact the Service!

3 Description of the device

3.1 REFUsol 008K to 023K

The REFU*sol* inverter is a three-phase solar inverter without a transformer, which has a particularly high efficiency at any operating point and is suitable for the connection of a PV generator with a power of 8 kW up to 24 kW. Heat is dissipated only by convection, with an internal temperature monitor protecting the device against exceeding the permissible ambient temperature. The inverter is designed such that the device does not have to be opened for assembly and connection work. All electrical connections are exclusively made with lockable connectors. The device features an integrated DC isolating switch according to EN 60947-3, which considerably reduces the overall installation work. The inverter provides the usual communication interfaces RS485 and Ethernet. An illuminated graphical display shows the development of the feed power and other operating data in a clearly arranged manner. An 8-key control panel below the display provides excellent and comfortable control and navigation features. Based on its design in protection class IP 65, the inverter can be installed at almost any outside location.

Figure No. 1 REFU*sol* 008K to 023K

3.2 Special REFU*sol* 020K-SCI

The availability of silicon carbide and other optimizations allow the REFUsol 020K-SCI a capacity up to 20 KW AC. The unit is extremely quiet. The peak efficiency is 98.7%.

3.3 Scope of Delivery

The scope of delivery of the REFU*sol* includes a wall-mounting bracket and an enclosed bag 0030532 containing:

- 1 x 5-pin contact insert, IP67, VC-TFS5-PEA
- 1 x adapter housing, IP67, VC-K-T3-R-M25-PLOMB
- 1 x cable gland, Schlemmer-Tec, M25x1.5/21532
- 2 x cross-recessed flat-head screw, M5x20 => for mechanically securing the device in the wall bracket
- 1 x warning label in according UTE C 15-712-1 for installing in France (Use only in France)

The Wall mounting screws are not included.

The IP67 VC-K-T3-R-M25-PLOMB adapter housing allows sealing according to DK4940.

The seal is run through a hole in the screw (below the screw head of the adapter housing) and the opening provided and attached to the housing of the device.

3.4 Outside Dimensions

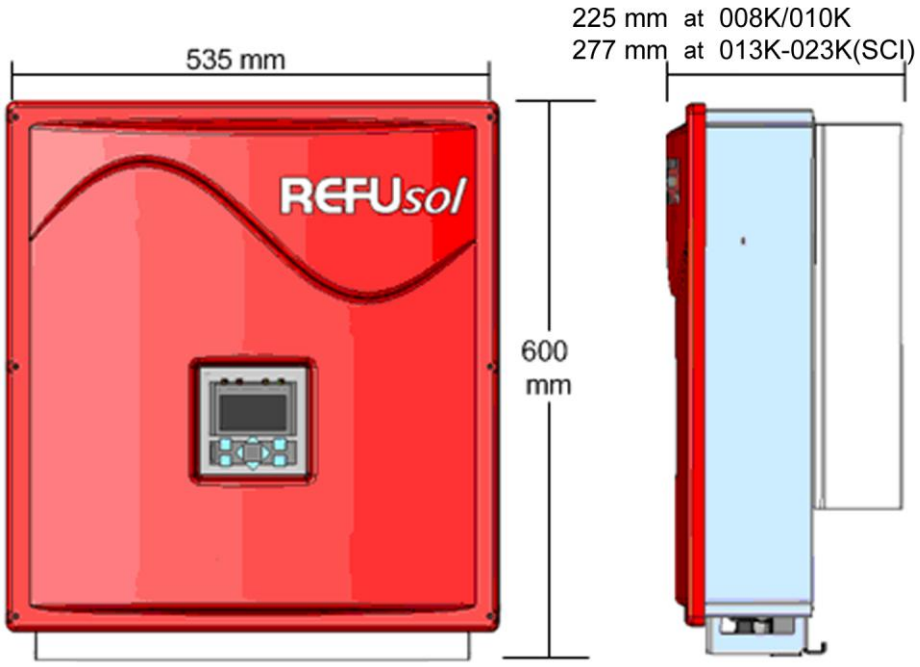


Figure No. 2 Housing dimensions

3.5 Block Diagrams

3.5.1 REFUsol 008K – 010K

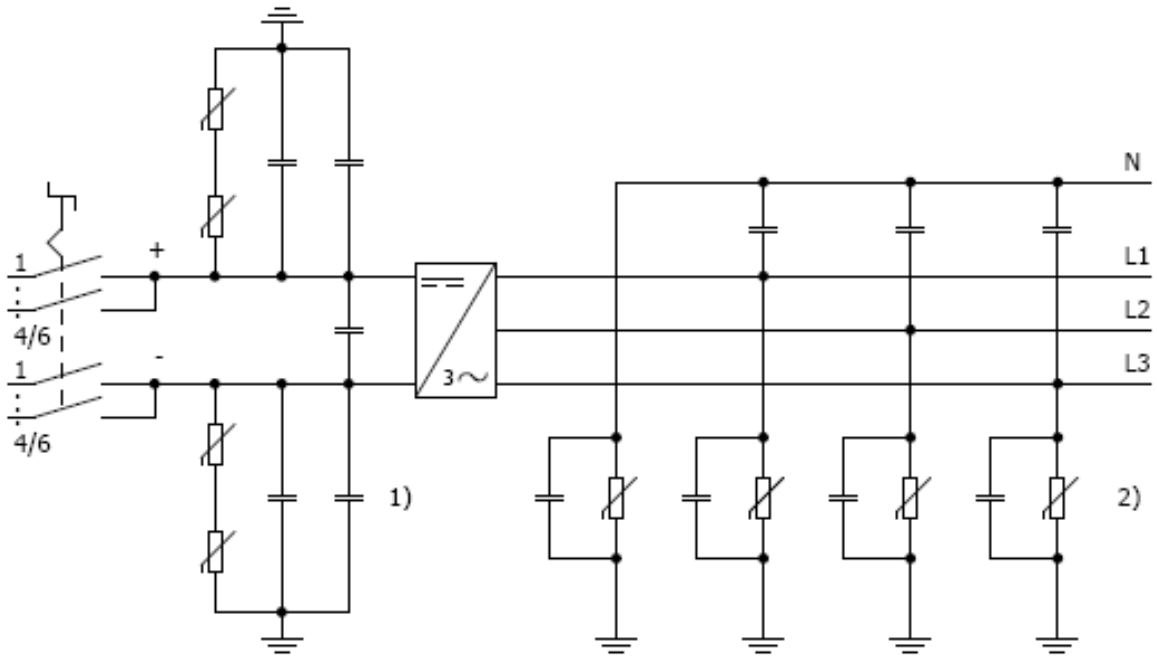


Figure No. 3 Block diagram of the REFU*sol* 008K/010K

1) DC overvoltage protection, type 3
2) AC overvoltage protection, type 3

3.5.2 REFU*sol* 013K - 023K, 020K SCI

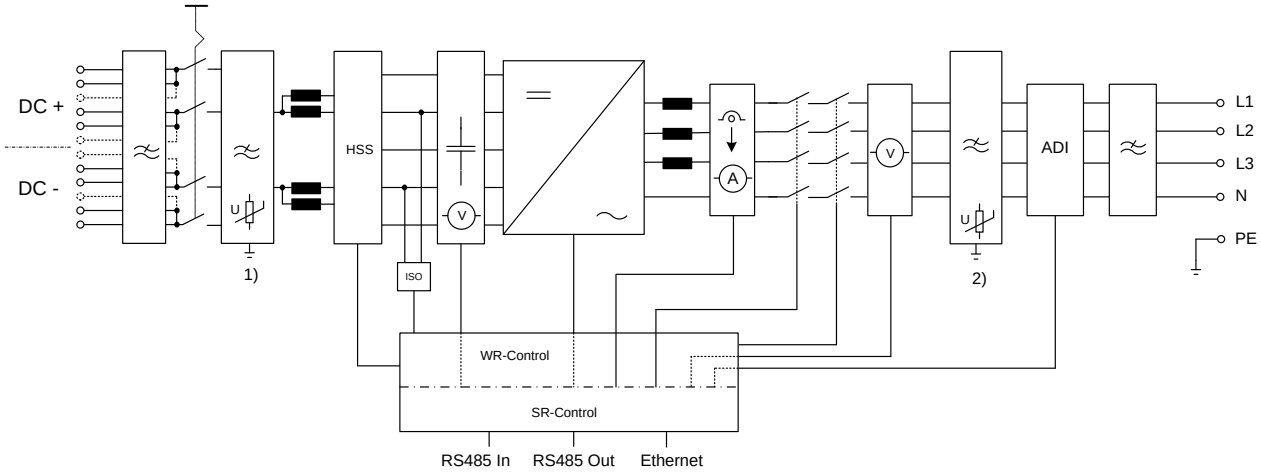


Figure No. 4 Block diagram of the REFU*sol* 013K-023K, 020K SCI

1) DC overvoltage protection, type 3
2) AC overvoltage protection, type 3

3.6 DC Connector

The PV generator may not exceed the following operational characteristics under any circumstances!

Device type	008K+	010K+	013K+	017K+	020K+	023K-460 VAC	020K-SCI
Max. DC voltage at each input	1000 V						
Max. current for each DC input pair (008K to 013K) and DC input triplet (017K to 020K), respectively	23 A	25 A					
Max. DC current at the input across all connections	23 A	25 A	31 A	41,8 A		41 A	41,5 A

Note: Not observing the requirements may resulting a malfunction and damage to the DC-Circuit breaker and thus the warranty deemed void!

Note: Should all DC inputs not be occupied, then the open inputs are closed with MC4 closure caps. By Not observing these requirements the IP65 protection class can not be guaranteed! Both caps (+/-) can be ordered at any time under the part no. 0028991 and 0028992 from Refus*ol* GmbH.

Note: The positive or negative pole of the PV generator must not be grounded, otherwise a loss of power is possible with the modules.

To keep the maximum current allowed of 25 A at the DC Circuit breaker contacts, observe the following input assignments.
The maximum DC current may not be exceeded.

3.6.1 Connections 008K

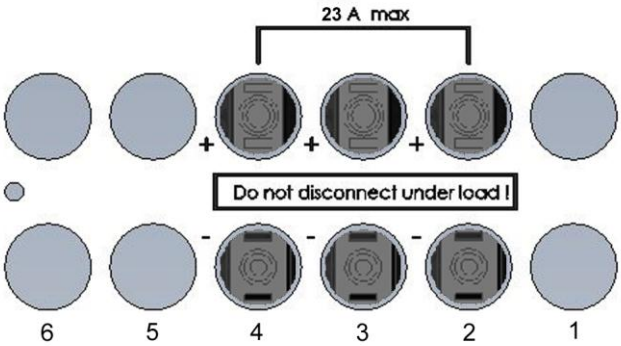


Figure No. 5 Connections 008K

3.6.2 Connections 010K

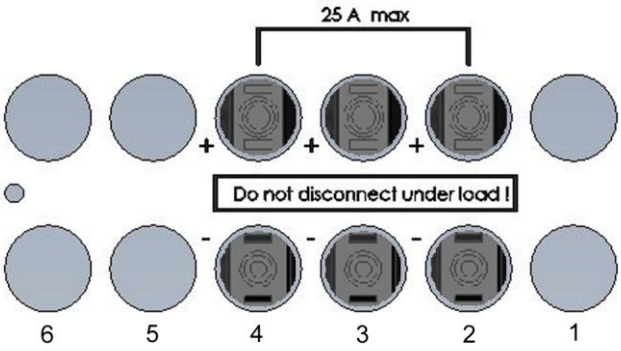


Figure No. 6 Connections 010K

3.6.3 Connections 013K

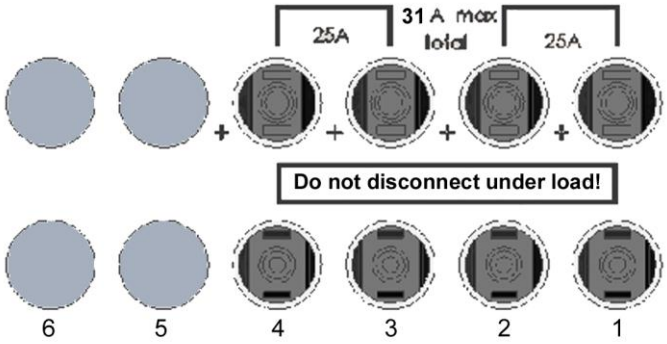


Figure No. 7 Connections 013K

Depending on the number of connection lines, the inputs must be justified as follows:

2 PV connecting lines → inputs 1 and 3 or inputs 2 and 4

3 PV connecting lines → inputs 1, 2 and 3 or inputs 1, 3 and 4

4 PV connecting lines → inputs 1, 2, 3, 4

3.6.4 Connections 017K/020K/023K-SCI

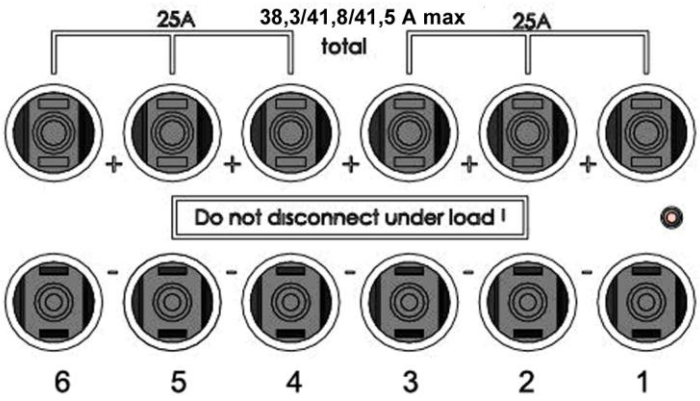


Figure No. 8 Connections 017K/020K/023K/020K-SCI

Depending on the number of connection lines, the inputs must be justified as follows:

3 PV connecting lines → inputs 1, 2, 4 or inputs 1, 4, 5

4 PV connecting lines → inputs 1, 2, 4, 5 or inputs 2, 3, 5 and 6

If several PV connecting lines are available, the connections can be made as desired.

3.7 Reverse Current through Defective Modules

Reverse currents are fault currents that only occur in PV systems comprising parallel strings. Given short circuits of individual modules or cells in a module, or a double ground fault, the open circuit voltage of the string in question can drop (e.g. due to defective modules or parts of modules) so far that the intact parallel strings will drive a reverse current through the defective string. This may result in strong heating and therefore to a destruction of the string.
What is more, the reverse current may cause secondary damage.

To prevent such damage to PV systems, appropriate precautionary measures should be taken.
There are the following two cases:

1. The PV system is designed such that the reverse current which is flowing in case of a failure and consists of the sum of the short-circuit currents of all intact strings in the worst case does not result in the destruction of the damaged string and therefore in secondary damage either. The decisive factor here is the current carrying capacity of the system components (connectors, lines) and the reverse current carrying capacity of the modules. The appropriate data can be found in the manufacturer's data sheet. In this case, it is not necessary to take any further measures.
2. The PV system is designed such that the reverse current flowing in case of a failure exceeds the destruction limit. In this case, each string must be separately protected by a string fuse connected in series with the other string fuses. In case of a failure, this isolates the string from the intact strings so that destruction is prevented.

3.8 Control Panel

The graphical user interface which is integrated on the front of the device and comprises 128 x 64 pixels can be used to display the development of interesting data, such as the feed power. The parameters required are selected and entered on the 8-key control panel the control panel is illuminated on pressing a key and turns dark automatically.

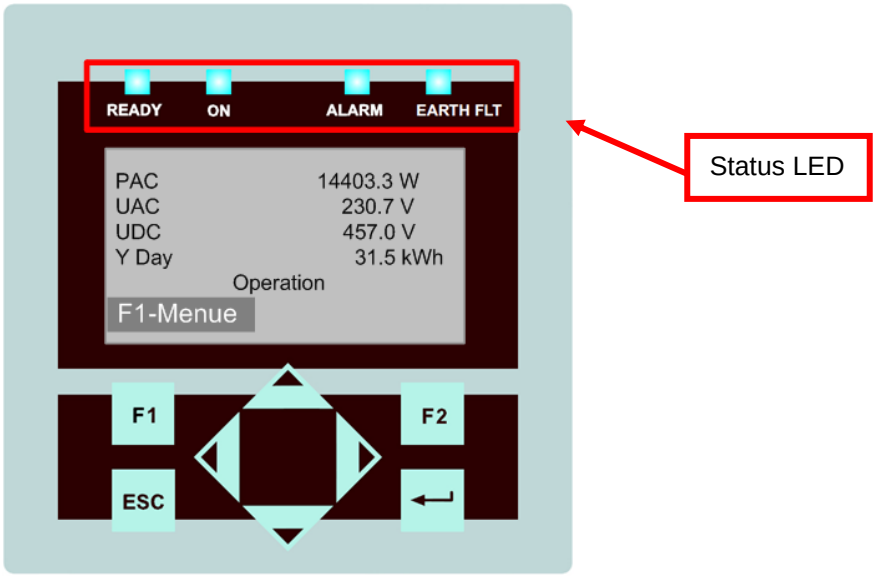


Figure No. 9 Control panel

F1: Display the menu.

◄►: Function in the menu: jump to the first or last menu item.

Function while parameters are edited: digit to the left, digit to the right (decade jump).

▲▼: Select the menu.

ESC: Acknowledge failures and delete entries.

↵ : Confirm the selected menu and entered data.

Note: Under certain weather conditions, condensation may form in the display. This is normal and causes no malfunction of the inverter.

3.9 Internal Data Logger

The inverter features an internal data logger that allows measured values to be simultaneously recorded in the form of parameters. The data logger is implemented as a ring buffer. If this buffer is full, the oldest data is overwritten. With the default setting on delivery, the data logger logs 16 measuring channels.

Recording cycle	Storage time
1 minute	6 months
2 minutes	12 months
5 minutes	2,5 years
10 minutes	5 years

4 Installation

4.1 Requirements for installation

 **DANGER**	**Danger to life due to fire or explosion.** ⇒ Do not mount the inverter in hazardous areas. ⇒ Do not mount the inverter in hazardous areas. Comply with fire protection class F30. ⇒ Do not mount the inverter in areas where highly flammable materials developed. ⇒ Do not cover cooling fins of the heat sink.

 **WARNING**	**Accident risk** ⇒ Free and safe access must be guaranteed to the equipment for Installation and service activities.

 **CAUTION**	**Damage by affecting the convection and of possible overheating.** ⇒ When mounting multiple equipment above the other, the additional ventilation REFUpowercap semiconductor module must be used. For more information on REFU*powercap* see chapter 8.6, page 66.

The following requirements must be followed to the installation:

- Only vertical mounting is allowed, otherwise the cooling of the device is not ensured (convevtion).
- Don´t expose the inverter to direct sunlight.
- For mounting a solid wall or metal structure is necessary. The weight of the device, depending on the type is up to 41.5 kg. Relevant building regulations are complied with.
- Keep a sufficient distance from flammable materials.
- In order to provide the necessary heat dissipation, the following minimum distances to walls and ceilings, or other devices shall be observed:

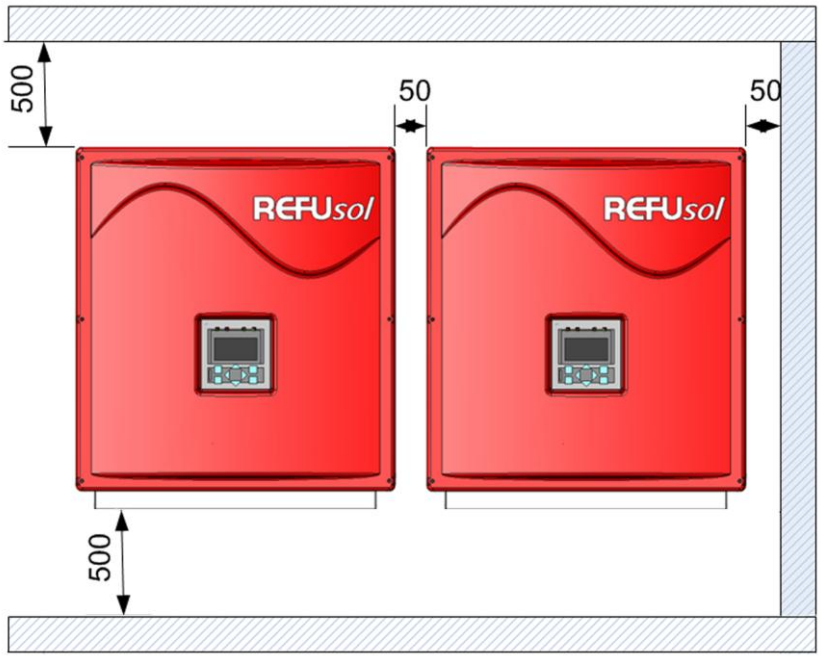


Figure No. 10 Minimum distances

The device is best operated when the display is at about eye level.
The IP65 protection allows a mounting outdoors.

4.2 Transport

The devices must be transported under clean and dry conditions, if possible in their original packaging. The transport temperature must be between –25 °C and +70 °C. Permissible variations in temperature may not exceed 20 °C per hour.

4.3 Storage

The devices must be stored in clean and dry rooms, if possible in their original packaging. The storage temperature must be between –25 °C and +55 °C. Permissible variations in temperature may not exceed 20 °C per hour.

Note: The inverter contains electrolyte capacitors. They can be stored energized at a storage temperature of ≤ 40 ° C maximum 1 year.

If the storage time of one years has been exceeded, please contact the REFU*sol* Service before connecting the REFU*sol* to your system!

4.4 Unpacking the Device

Note: After Unpacking the inverter, moisture and dirt can penetrate into the open inputs and outputs of the box. Therefore, unpack the device only when it is connected to. Failure to comply with this requirement will void the warranty!

The inverters are loaded at their head and packed upside down facilitate transport. You will therefore see the bottom side of the device (connectors) after having opened the package. Take the device at the two holding grips that are visible on the side and remove it from the packaging. When being unpacked, the device keeps the packaging grid locked in place on its housing. The packaging grid can be used to deposit the device on the floor. This prevents the cover from being damaged.

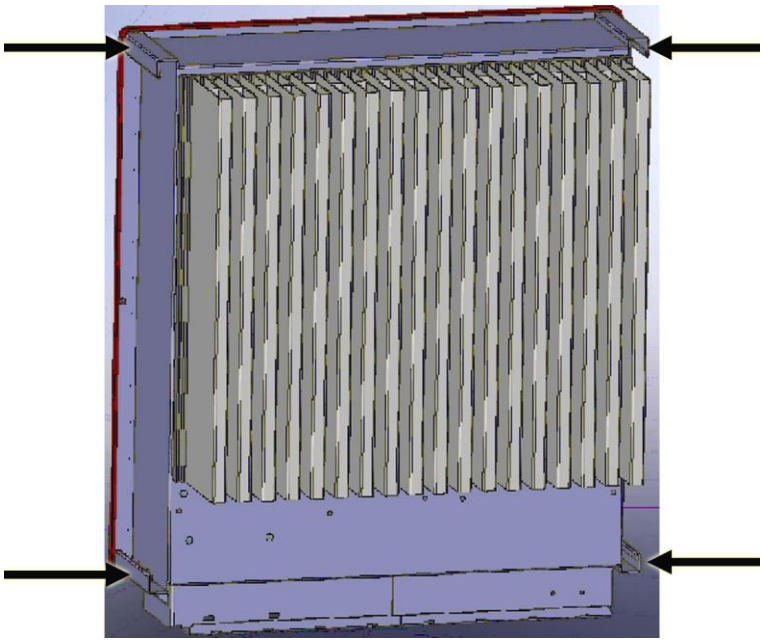


Figure No. 11 Rear panel positions of holding grips

4.5 Mounting

⇒ Check delivery, before mounting (see chapter 3.3, page 13).

CAUTION	**Injury or property damage** ⇒ Hold in no case the device on the cover. ⇒ When fixing the wall plate, observe the weight of the inverter of 41.5 kg. ⇒ Do not open the inverter. Opening the inverter will void the warranty.

The installation is done with the supplied with the wall mount.

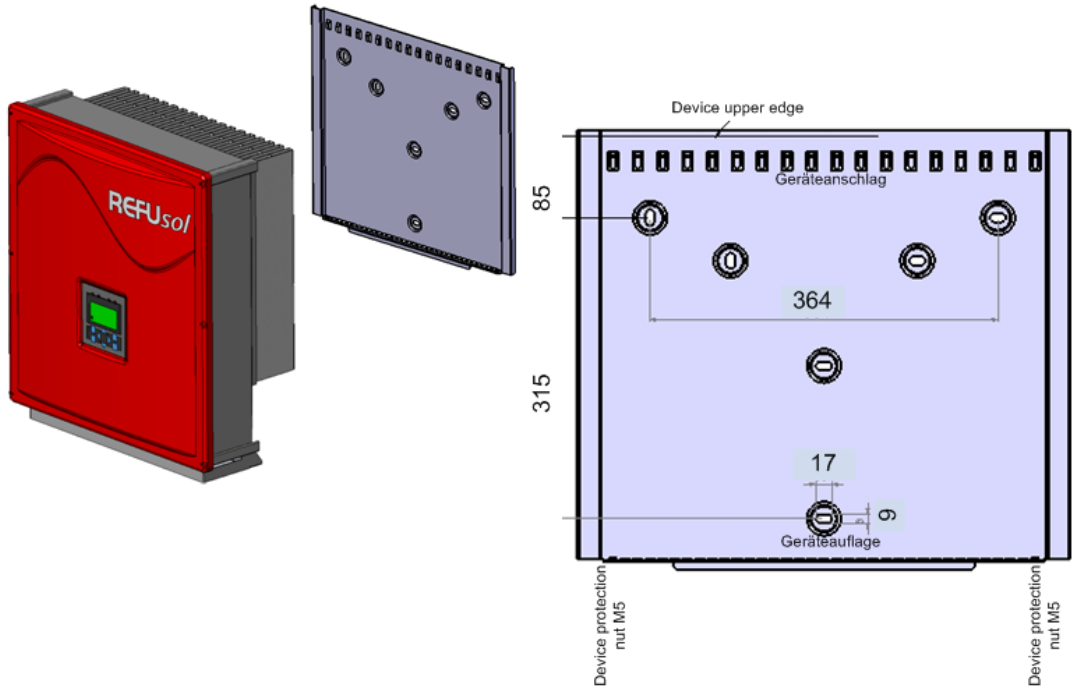


Figure No. 12 Mounting the inverter

1. To mark the positions for the holes the wall bracket can be used as an aid.
2. Fasten the mounting plate using the holes in the outer wall. The screws for wall mounting are not included. It must be used screws with a diameter of 6 mm screws and washers.
3. Insert cooler top into the deepening of the device holder. Push upwards the inverter until the stop of the device. Put on the cooler bottom on the wall Mount. It is important to ensure that the rib profile is locked behind the nuts.
4. Secure the inverter with the screws (M5x20) in these nuts. Alternatively, the inverter can (4 mm diameter frame) to be secured against theft with a padlock. By the construction of wall mount the inverter in the bracket is automatically centered.
5. To avoid adhesive residue on the inverter, remove the screen protection immediately after installation.

4.6 Connectors on the Device

The following figure shows the connectors of the inverter on its bottom side.

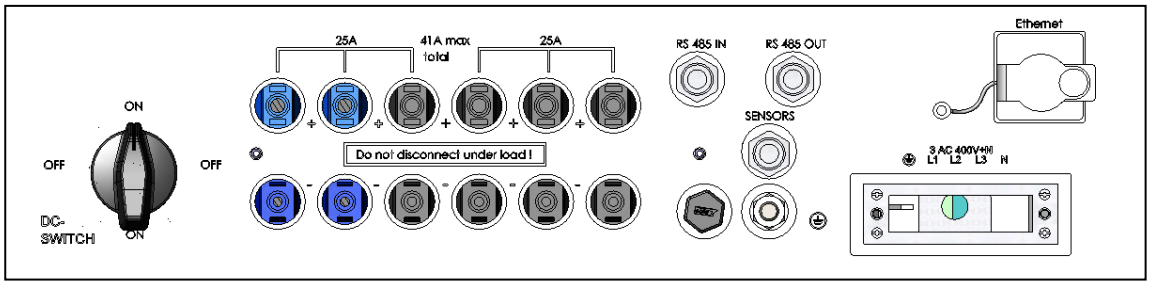


Figure No. 13 Device connectors

As seen from left to right there are the following connectors.

- 3/4/6 pairs of PV generator connectors
- SENSORS (connection: radiation and temperature sensors)
- RS 485 connectors (IN and OUT)
- Ethernet interface port
- Power connection

4.7 Grounding

DANGER

Risk of death by electric shock.

The inverter must be connected to the ground stud. Otherwise, a voltage gradient may develop, which may result in electric shock!

The inverter features a threaded bolt below the power supply port on the connection side for additional grounding. Grounding is intended to ensure optimum overvoltage protection. That is why the ground wire cross-section must be chosen in excess of the cross-section of the power supply line by a factor of one (at least 10 mm²). In addition, ensure that the ground wire is placed as far away from and not directly in parallel to the power supply line.

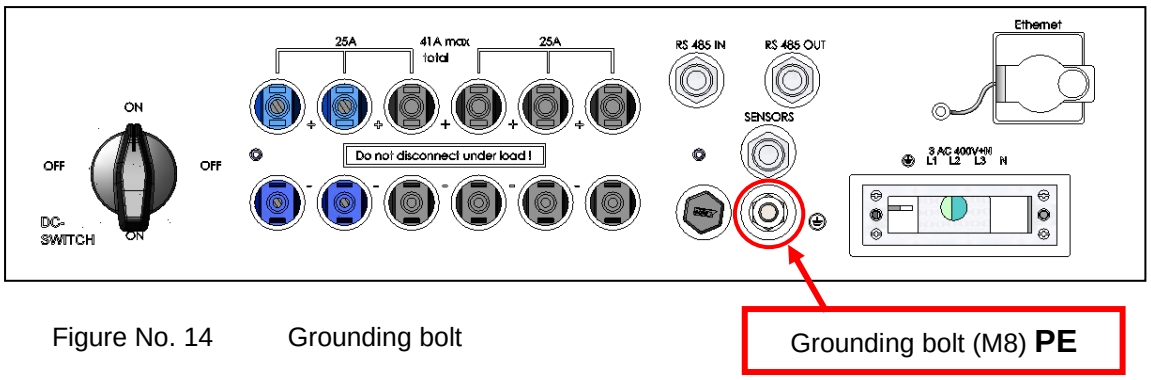


Figure No. 14 Grounding bolt

4.8 Residual Current Protective Device

Since February 2009, RCDs (residual current protective devices) have been prescribed for receptacle circuits of up to 20 A in interior rooms and of up to 32 A in outside areas which are used by electrotechnical non-professionals.

Note: The photovoltaic power supply inverters without transformers meet the fault protection requirements according to DIN VDE 0100-712, IEC 60364-7-712:2002 and CEI 64-8/7 and can be operated with a type A residual-current circuit breaker without any functional impairment of the protection or the inverter. The rated leakage current should be at least 100 mA per inverter.

4.9 DC - Connection PV - Generator

Danger to life due to high voltages in active PV strings.

DANGER

⇒ Before connecting the PV strings, connect the inverter to the power supply network and to the ground bolt to ensure that the device is safely connected to the protective conductor. Connect the PV strings to the inverter only in the de-energized state.
Live PV strings can be under lethal voltages.

⇒ Individual string connections cannot be de-energized by an external DC switch. The reason is, that there takes place a compensation voltage within the unit.

- The DC connection is effected with MC4-plugs and sockets. For more information see the table below.
- Before connecting the PV strings an insulation measurement is carried out. Whenever it is switched on, the inverter automatically checks the insulation of the PV generator. If the insulation is defective, the inverter switches off automatically. In this case, it is absolutely mandatory that the insulation fault of the PV generator be repaired before the PV generator is connected to the inverter.
- Be absolutely sure to verify proper polarity when connecting the PV strings. Any inappropriate connection of individual strings may damage the module strings.
- The connections must be secured against unintentional removal.
- The connection has to be strictly done according to chapter 3.6. By non-observance the DC-disconnector can be destroyed.

4.10 DC-Connecting Line

Please note the following information (plug type, cross section) regarding the DC power cable.

Denomination	Type	Item No. MultiContact	Diameter wire insulation in mm	Cable cross section in mm²
Connector plug	PV-KST4/6I-UR	32.0015P0001	3 -6	4 - 6
Connector plug	PV-KST4/6II-UR	32.0017P0001	5,5 - 9	4 - 6
Connector socket	PV-KBT4/6I-UR	32.0014P0001	3 - 6	4 - 6
Connector socket	PV-KBT4/6II-UR	32.0016P0001	5,5 - 9	4 - 6

Note: In order to ensure the degree of protection IP65, plug connectors and power supply connection cable must be matched to each other and all unused connectors shall be fitted with blanking plugs. Use only the original components of Multicontact! Observe the manufacturer's installation instructions Multicontact! Use the crimping pliers PV-CZM-19100 from Multicontact to strike the crimp on the site.
Non-compliance may void the warranty!

4.11 Power Connection

 **DANGER**	**Electric shock and fire caused by high leakage current!** ⇒ Before connecting the supply circuit, establish a ground connection by the marked ground bolt.

Note: In order to ensure the degree of protection IP65, plug connectors and power supply connection cable must be used and connected according to the wiring instructions of the manufacturer. To protect against the ingress of moisture and dirt the unused inputs and outputs must be sealed.
Non-compliance may void the warranty!

The following mains systems are suitable:

TN-C-Net	suitable
TN-C-S-Net	suitable
TN-S-Net	suitable

The mains connection must be made with a 5-wire cable. For safety, the PE conductor must be connected in each case.

The power supply line must be equipped with an appropriate line protection. More information regarding the power connection you will find in Chapter 10 the Technical Data. Reducing factors must be taken into account if circuit breakers are connected in series. Always observe the following standards:

DIN VDE 0298-4	Types of cable placement and current-carrying capacity
DIN VDE 0100; Part 430	Protective measures: protection of cable and cords against over current
DIN VDE 0100; Part 410	Protective measures: protection against electric shock

Also observe the following requirements specified by the local network operator:

- Pertinent technical and special rules and regulations
- The installation approval must be submitted.

 **CAUTION**	**Risk of death by electric shock.** ⇒ Before connecting the inverter to the AC network, isolate the power connection, verify that the system is de-energized, and protect the circuit breaker against reactivation.

- Check the line voltage, which may not exceed 265 V (phase against neutral conductor). If the line voltage is higher than 265 V, contact your local network operator.

- It is not allowed to measure the AC side by inserting probes in the AC inlets, because this damage the plug contacts.
- Apply the power cable to the supplied connector as illustrated, connect the power cable to the inverter and fasten the connector.

Note: When using wire end ferrules with isolating collar, make sure you do not introduce the insulation of the wire end ferrule into the clamping area of the terminal.

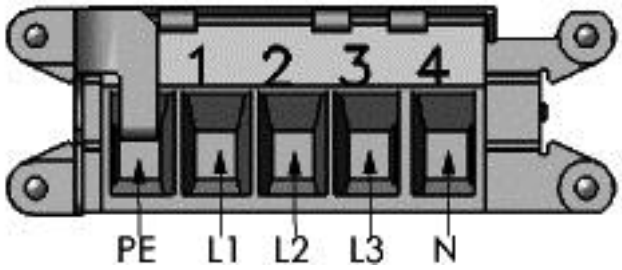


Figure No. 15 Power connection

4.12 Power Supply Line

Select the cross-section of the power supply line such that line losses are as low as possible. However, observe the following points:

- The system installer must choose according to the application (installation and wiring method) and by national regulations, the cable material.
- Due to the construction, the recommended feed line for all cross-sections is a fine-strand line.
- You must use copper lines.
- The cables must be mounted in the correct position in the mains plug to minimize the lateral forces acting on the plug.
- When using cables 16 mm² rigid wires are not recommended.

The table below shows the maximum line lengths by using a REFUsol 023K in relation to the conductor cross-section with a voltage drop of <= 1%.

Line cross section	6.0 mm²	10.0 mm²	16.0 mm²
Max. line length	30 m	50 m	70 m

Note: To ensure protection class IP65, the connectors and power supply lines must be matching each other.

4.12.1 Installation supplíed mains plug

The supplied standard connector housing can be due to the gland, the connection of 5 x 5 x 4 mm² up to 16 mm² cables. The maximum outer diameter of the connecting line may be 30.3 mm (eg Lapptherm 145, 5x6 mm²).

⇒ Bend the cable.

⇒ Strip the cable as shown in Figure.

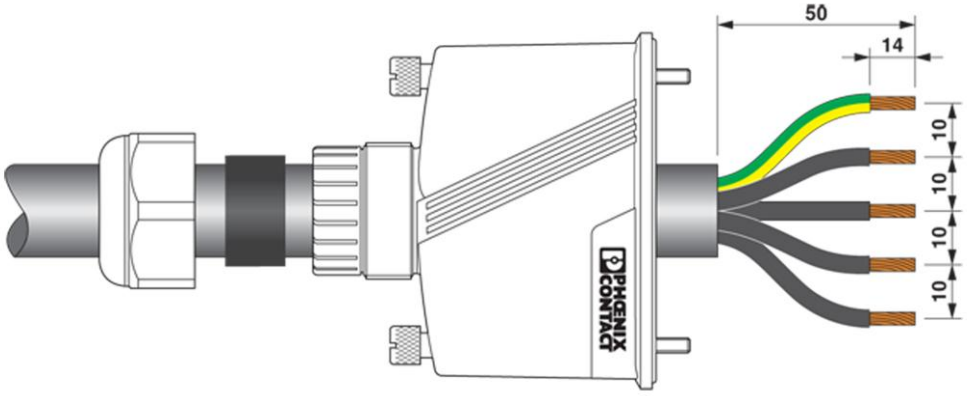


Figure No. 16 Preparation connector cable

⇒ Screw plug

⇒ Observe the tightening torques as shown in Figure.

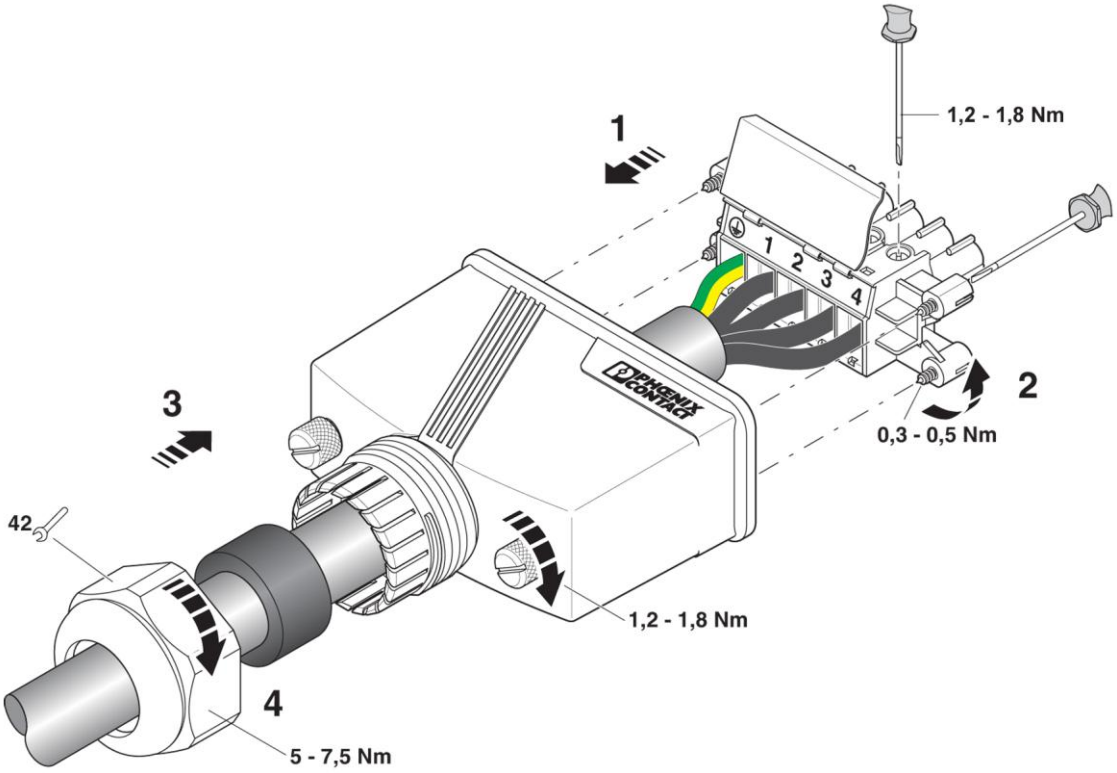


Figure No. 17 Screw connector

⇒ Determine diameter.

⇒ Seal connection.

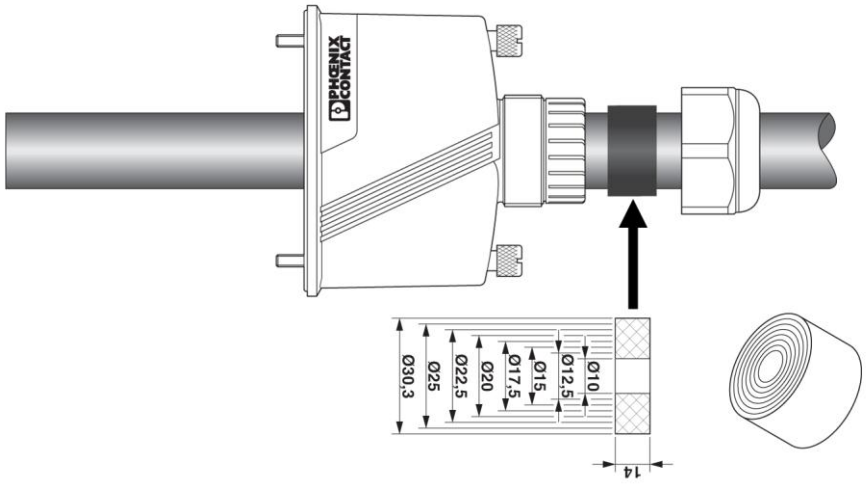


Figure No. 18 Diameter

4.13 Grid line inductance

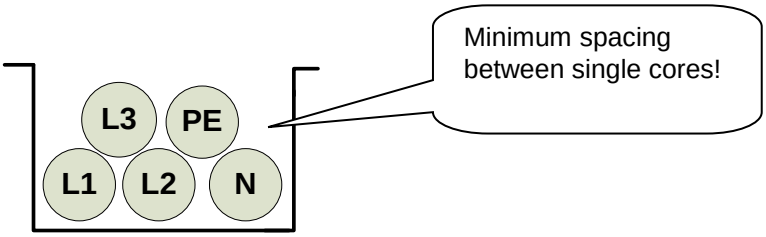
For better efficiency, large line cross-sections and single wire cables are increasingly used for power supply lines, especially if local conditions require long supply lines.

The considerable line lengths between REFU*sol* and the transformer station result in a high cable inductance and therefore an increased line impedance. This presents high resistances for harmonics of the fundamental frequency (50 Hz) of the line voltage and causes voltage distortions in the inverters as well as error messages with regard to:

- controller voltage,
- line frequency,
- line overvoltage
- Sometimes increased operating noise of the transformers.

To avoid these disadvantageous conditions, twisted lines should be used for power supply if possible. If laying of twisted lines is not possible, the following requirements must be met for single cores:

- The spacing between single cores may not be too large.
- It is not allowed to lay single cores in closed, magnetically conducting materials (e.g., sheet steel pipe).
- If laid in open cable ducts, single cores should be laid such that the spacings between them are as small as possible



- Single cores should not be laid along magnetic materials.

Note: The sum total of the ohmic and inductive voltage drops on the power supply line at nominal load should not exceed 1% of the line voltage. It must be ensured that the line inductance remains < 30 µH.

4.14 Interface Port RS485

RS485 OUT		RS485 IN	
Pin 1	Bus termination+	Pin 1	Reference +
Pin 2	RS485+ OUT	Pin 2	RS485+ IN
Pin 3	RS485- OUT	Pin 3	RS485- IN
Pin 4	Bus termination –	Pin 4	Reference –

* Bus termination (wire jumper)

The RS485 interface supports the USS protocol (Universal Serial interface protocol) which can be used for transmission of data, for example, to a data logger of a remote monitoring system.

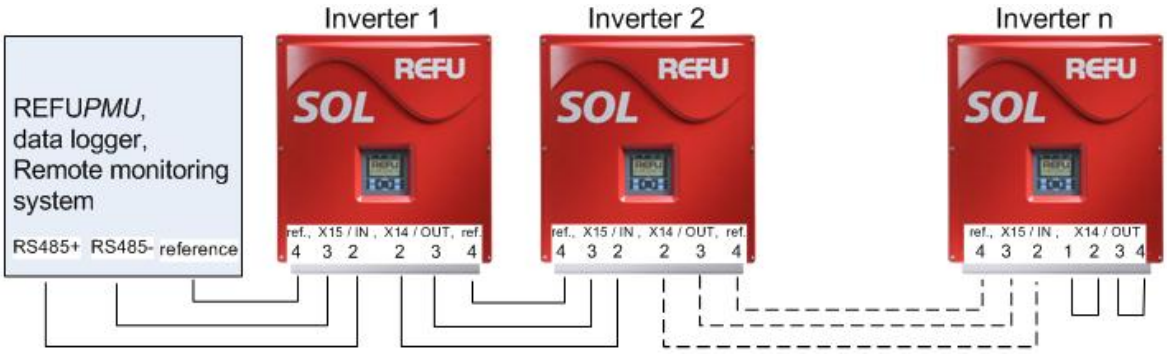


Figure No. 19 Standard interface connection

When using this interface, please note that each device using the bus requires a unique address.

Bus termination is made by means of wire bridges on X14 to the last bus user (inverter “n“).

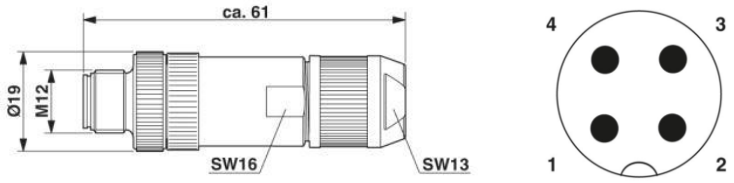


Figure No. 20 Connector M12 x 1 straight, shielded;
pole arrangement: male M12, 4 pins, A-coded, view of male connector side

Note: To ensure the IP65 and the required conformity and told EMC standard household to be used for connecting the RS485 interface of the plug PhonixContact, type M12MS SACC-4SC SH and a shielded cable. The outer diameter of the cable must not exceed 8 mm. Non-compliance can result in damage to the inverter and void the warranty!

The connector pair can be ordered with part number 0033270 at sales @ refusol.

4.15 Interface Ethernet

To connect the Ethernet interface use an Ethernet cable with S / FTP (shielded foiled twisted pair) and the connector type of PhonixContact Quickon VS-08-RJ45-5-Q/IP67.

Note: To ensure IP65 protection rating, it is mandatory to use aforementioned plug type!

Non-compliance can result in damage to the inverter and void the warranty!

The plug can be ordered under item number 0028943 at REFUsol GmbH.

5 Commissioning

Before commissioning the inverter, be sure the following steps have been completed:

☑ Confirm the correct power supply connection

☑ Confirm the correct connection of PV strings

☑ Confirm that connectors are protected such that they cannot be pulled off inadvertently

 **DANGER**	**Risk of electric shock.** ⇒ Before switching on the device, check whether the connectors are securely fitted (locked). Do not pull off the connectors of the PV generator before you have met the following requirements: ⇒ Set the DC isolator on the inverter to "OFF". ⇒ Check whether the DC cables of the PV generator are de-energized. ⇒ Enable the power supply line and protect the voltage supply against being reactivated.

 **DANGER**	**Risk of electric shock and fire caused by high leakage current.** ⇒ Before connecting the device to the supply circuit, establish a groun connection.

5.1 Turn on the Device

1. Verify that the device is connected to line voltage. If not, insert the external power fuse or turn on the circuit breaker.
2. Set the DC isolating switch on the inverter to the ON position. The inverter will not start running with connected PV field before the DC isolator is switched on.

Note: The control panel is only active with activated DC voltage. The control panel, including its staus indicators, display and operator keys, is only active with activated DC voltage because the electronics of the inverter is exclusively supplied from the DC side.

5.2 Setting the Country Code and the Menu Language

The country code defines the country-specific network monitoring parameters. The menu language is automatically set when the country code is selected. Thereafter, the menu language can be selected as desired at any time, independent of the country code set in the menu.

The country code is not set on delivery.

 **CAUTION**	**The selected country code can only be changed by Service personnel!** After having set and confirmed the country code, you cannot change it yourself any longer. This is also applicable to devices which are or were in operation. According to a new rule, the country code can now only be changed by Service personnel.

 **CAUTION**	**Cancellation of the operating licence!** If the inverter is operated with a wrong country code, the electric supply company may cancel the operation licence. It is not allowed to put the inverter into operation before the overall system complies with the national rules and safety regulation of the application.

Note: We do not assume any liability for any negative consequences of an incorrectly set country code!

Setting the country code

Immediately after the DC voltage has been activated, the following window appears on the screen, requesting you to set the country code. You can select the country desired from the list. The term “country code” as such is not displayed in the menu. The display will be illuminated after you have pressed the first key.

1. Use the “▲” and “▼” keys to select the country code which is specific for your country and your location.

- When you select the country code, you automatically select the menu language at the same time.

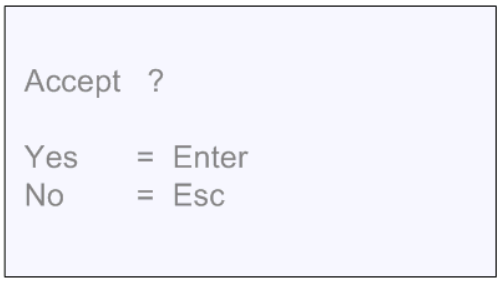
- The menu language can be changed in the menu at any time.

2. Press “ ↵ “ to confirm.

Note: If network conditions are difficult at a location in Italy, you can select the "Italia Option" setting, provided this has been specifically approved by ENEL.

Accepting the country code

The display will show a safety prompt asking you whether you wish to accept the country code. After having accepted the country code, it is no longer possible to change it.



Confirm the country code only if you are absolutely sure.

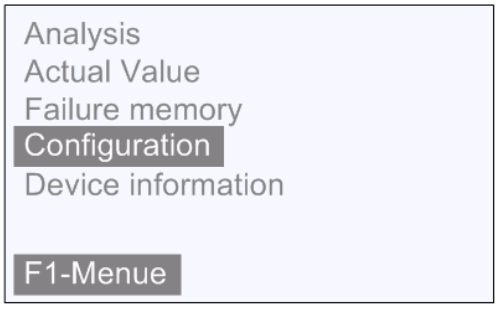
- If you are not sure, press "ESC" to cancel your selection. In this case, you cannot put the device into operation and using the menu is not possible any longer.
- If you wish to accept the country code, press "↵" to confirm.

Changing the menu language

The language selected does not affect the country code in any way. Proceed as follows to change the menu language:

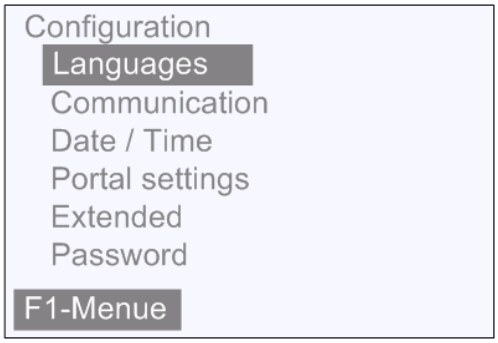
1. Press "F1" to open the menu.

2. Use the "▼" and "▲" keys to select the forth menu item: Configuration.



3. Press "↵ "to confirm.

4. Use the "▼" and "▲" keys to select the first menu item: Languages.



5. Press “↵ “ to confirm.
6. Use the “▼” and “▲” keys to select the desired menu language.
7. Press “↵ " to confirm.

   The menu switches to the language selected.

   The display will be empty at first.
8. Press “ESC” to return to the menu.

5.3 Activating the Device

☑ Solar modules are exposed to sufficient sunlight.

☑ Country code is set.

⇳ It results in the following sequence:

- Self-test:
  - ⇨ All status LEDs are lit for approx. 6 seconds
- The initialization cycle is started:
  - ⇨ The "Ready" status LED is flashing
  - Display:
  - ⇨ PAC Feed power in watts (W)
  - ⇨ UAC Line voltage in volts (V)
  - ⇨ UDC Solar cell voltage in volts (V)
  - ⇨ State Initializing
- Initializing has been completed:
  - ⇨ The "READY" status LED emits steady light
  - Display:
  - ⇨ PAC Feed power in watts (W)
  - ⇨ UAC Line voltage in volts (V)
  - ⇨ UDC Solar cell voltage in volts (V)
  - ⇨ Switched off
- Power-up starts if the solar cell voltage is >350 volts:
  - ⇨ The "READY" status LED is lights, the "ON" status LED is flashing
  - Display:
  - ⇨ PAC Feed power in watts (W)
  - ⇨ UAC Line voltage in volts (V)
  - ⇨ UDC Solar cell voltage in volts (V)
  - ⇨ Activating
  - ⇨ This process can take up to one hour while the device is commissioned; during normal operation, it takes up to 3 minutes.

- Feed mode:
  - ⇨ The "ON" status LED emits steady light; the "READY" status LED turns dark.
  - Display
  - ⇨ PAC Feed power in watts (W)
  - ⇨ UAC Line voltage in volts (V)
  - ⇨ UDC Solar cell voltage in volts (V)
  - ⇨ Y DAY Yield of the day in kWh
  - ⇨ State Operation

5.4 Navigation on the Control Panel

Navigation display:

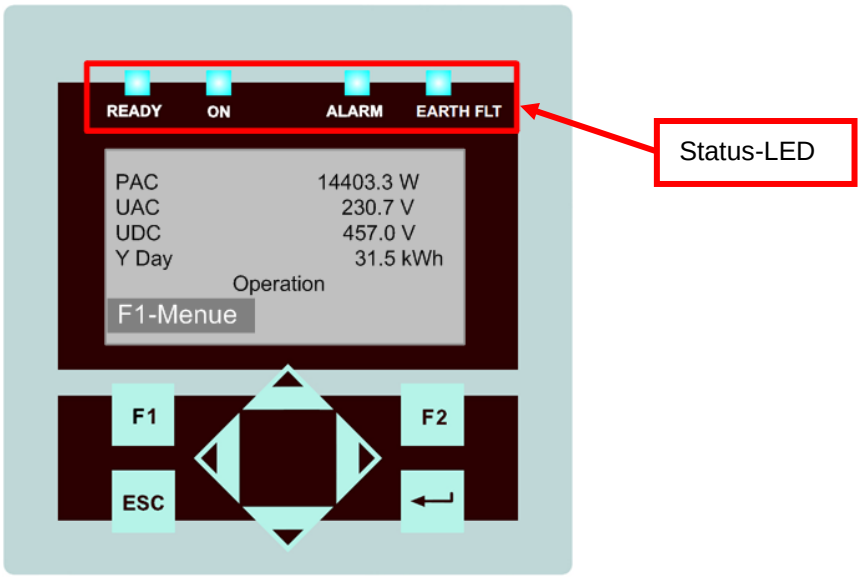


Figure No. 21 Display Navigation

F1: Display the menu

◄►: Function in the menu: navigation through the menu level (previous menu, next menu)

Function while parameters are edited: digit to the left, digit to the right (decade jump)

▲▼: Select the menu level (level up, level down)

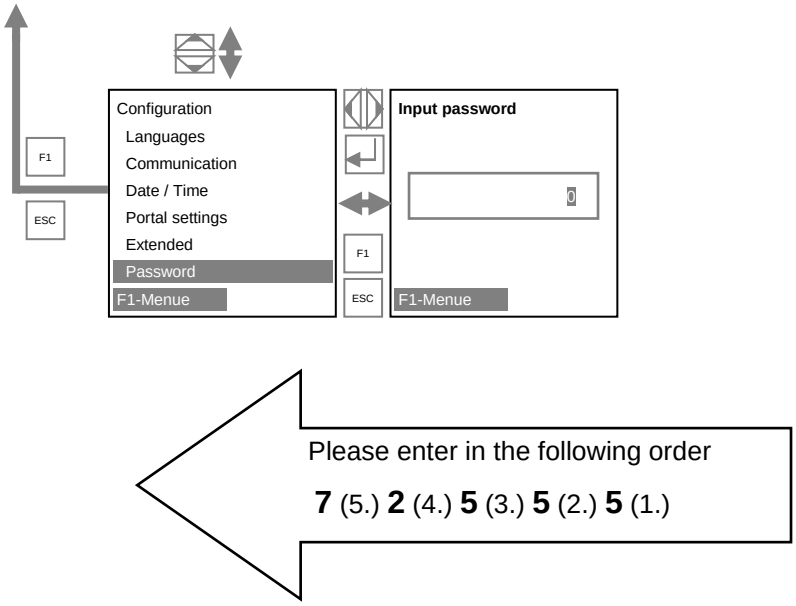
ESC: Acknowledge failures and exit from menu-level, exit from input level without acknowledge

↵: Confirm the selected menu and entered data

5.5 Password Entry

For the configuration and parameterization often the customer password **72555** is required!

Password entry as follow:



Basic screen display:

Figure No. 22 Operating mode display

PAC = current feed power

UAC = line voltage

UDC = solar cell voltage in volts (V)

y day = yield of the day in kWh

Graphical display:

Press the ◄ arrow key once to display the development of the day's feed power.

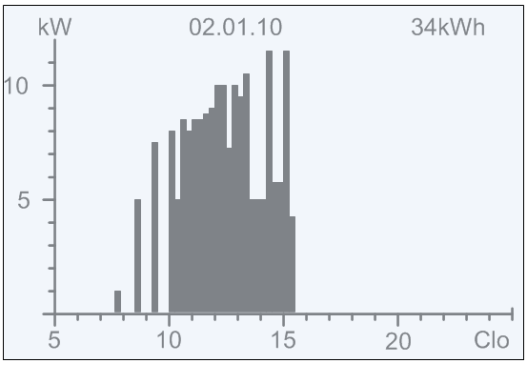


Figure No. 23 "Today's" feed power display

Press the ▼ arrow key to display the development of the previous days.

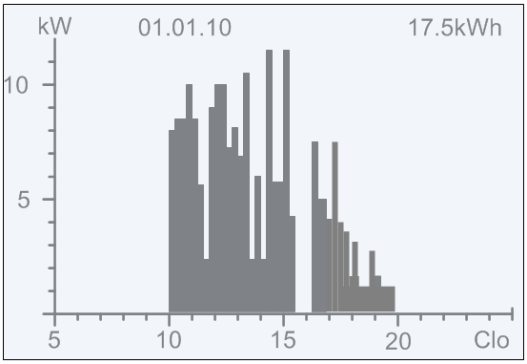


Figure No. 24 "Yesterday's" feed power display

Press the ESC key to return to the basic screen display.

Yield data display:

Press the ► arrow key to display the current yield data and the operating hours having currently elapsed.

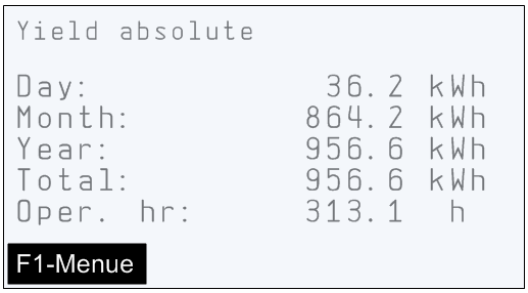


Figure No. 25 Yield data absolute

Standardized yield data display:

Press the ►arrow key, then the ▼arrow key to display the development of standardized yield data.

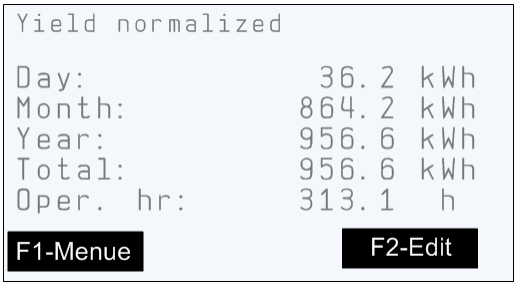


Figure No. 26 Standardized yield data display

Press the ESC key to return to the basic screen display.

Input of standardized data:

To obtain the standardized yield data, press the F2 key and enter the connected PV generator power under parameter P1155 as follows:

keys:◄►: Press the ◄ key => selects the digit to the left of the decimal point

Press the ► key => selects the digit to the right of the decimal point

key ▲: Whenever you press this key, the number at the digit selected is incremented by 1.

key ▼: Whenever you press this key, the number at the digit selected is decremented by 1.

Figure No. 27 Standardized data input display

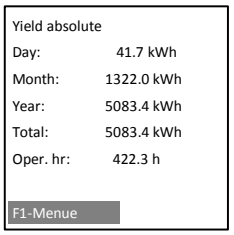
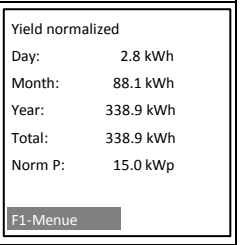
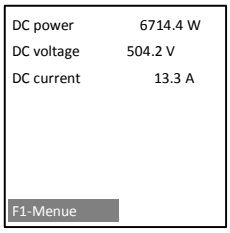
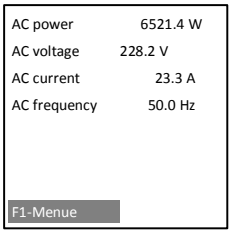
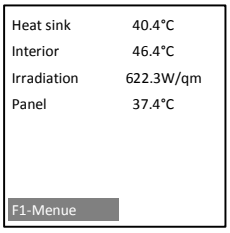
Press the ESC key, the previous “normalized yield” level will displayed.

Press the F1 key to display the menu.

Press the ↵ to apply the set value. However, this requires that the password is correct.

5.6 Menu Structure

In the following the screen display and setting options on the screen are presented in the context.
To see navigation, see chapter 3.8, page 17.

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Display or Action
Analysis	Yield absolute			
	Yield normalized			
Actual values	DC			
	AC			
	Sensors			
Failure memory			Display of the error history e.g. undervoltage. With ◄► you can navigate between the display of the date and the error number.	
Configuration	Land use	„List of countries“		
	languages	„List of languages“		
	Limit PAC			Limit PAC
	External shut-			Entering the sen-

Level 1 menu	Level 2 menu	Level 3 menu	Level 4 menu	Display or Action
	down			sor
	Communication	USB	Protocol	Protocol (See: *1)
		Ethernet	Subnet mask	Input Subnet mask
			Standard gateway	Input Standard gateway
			Protocol-Port	Protocol-Port
			DNS-adress	Input DNS-adress Standard: 0.0.0.0
		RS485	USS-Adresse	Input USS-adress (See:*2)
			Protocol	Input Protocol
			Baud rate	Input Baud rate
	Datum / Uhrzeit			Input Date / Time
	Portal settings	Activation		Activation: 0 = OFF 1 = ON
		Send configurati-on	0 = no configuration data in queue 1 = Configuration data is being sent	
		Server IP	Display of the server IP address	
		Server Port	Display of the port number of the web-server	
		Portal Testfunction	If you enter "Yes" a data packet to the web server (portal) is sent. There is no feedback. To check, contact service.	
	Password		Input password	
	Extended	XModem Update	If you enter „Yes“ follow update	
		Numerical list	Display all internal parameters (for service)	
Device information	Version number	Display Version number		
	Country	Display Country		
	Current language	Display „Current language“		
	Device type	Display „Device type“		
	Serial number	Display „Serial number“		

Detail – Erklärungen

***1. Communication via Ethernet**

Protocol:

Eingabe 0 oder 1

0 = RTP–Protocol

1 = USS– and RTP–Protocol

Protocol–Port:

Input 1024….65535; default 21062

Port number is required for communication via Ethernet

***2. Communication via RS485**

USS–Adress:

Input 1–31

Adresse ist notwendig um über RS485 mit dem Wechselrichter zu kommunizieren.

Note:

The new address is only active when the inverter is restarted.

Query protocol over Ethernet:

Input 1 or 3

1: USS- and RTP–Protocol

3: MeteoControl©

6 Configuration

6.1 Reduction of the power output

Proceed as follows in order to limit the power output of the inverter::

1. Enter the customer password "72555".

2. Using the F1 key, select the menu item Configurations and confirm with the key ↵.

3. Select the sub-menu "PAC reduction" and confirm with the key ↵.

4. Enter the inverter power output desired and confirm with the key ↵. An input of 70, for example, means that the inverter will only deliver 70 % of its possible power output.

5. Switch off inverters with DC circuit breakers for 30-60 seconds.

6. The amended input value will be adopted when the device is switched back on again

6.2 Input of cos φ

The specification of the cos φ is set via the configuration tool REFUset. REFUset can be downloaded free of charge from www.refusol.com.

6.3 Communication via Ethernet

USS address: Is factory-set and cannot be changed.

Protocol: Input 0 or 1

0 = RTP protocol

1 = USS and RTP protocol

Protocol port:

Input 1024….65535; default setting 21062.

The port number is required for communication via Ethernet.

6.4 Communication via RS485

USS – adress:

Input 1 – 31

This address is required for communicating with the inverter via RS485

Note: If you change this parameter (address) and wish to save it, you must restart REFU*sol*®! The new address will only be active thereafter.

Protocol polling via Ethernet:

Input 1 or 3

1: USS and RTP protocol

3: MeteoControl©

Baud rate: 57600 (pre readjusted)

Data bits: 8

Stop bits: 1

Block check: CRC16

6.5 Portal monitoring

Input 0 or 1

0 = Portal monitoring not activ

1 = Portal monitoring activ

For using the portal monitoring REFU*log* the portal monitoring have to be set active.

6.6 Sending Config

Input 0 or 1

0 = no Config data in the waiting queue

1 = Config is sent.

6.7 Server IP

Display of IP adress

6.8 Server port

Display of the port number of the web server.

6.9 Portal test function

Input: “yes”

A data package is sent to the web server (portal).

There is no feedback!

Please contact the Service to learn whether the data package was sent successfully.

6.10 REFU*set*

REFUset is a configuration tool, which allows further configurations. REFUset can be downloaded free of charge from www.refusol.com.

7 Troubleshooting

7.1 Self-test Error Messages

After the initialization routine, the system runs through a self-test. The individual parts of the system, such as firmware and dataset, are checked and data is read in from the power control board. If an error continues to be ascertained, possible Remedial measures must be taken according to the type of error.

7.2 Transient Failure

In certain operating states the inverter goes temporarily offline.

Unlike failures, "transient failures" are automatically acknowledged by the inverter which attempts to restart once the error no longer exists.

A transient failure is indicated by the red LED alarm on the control panel flashing and remains stored in the error memory even in the event of a power failure. See the Faults section.

7.3 Faults

Permanently programmed and parameterizable limit values are continuously monitored during ongoing operation. In order to be protected, the inverter power section is isolated from voltage supply if a limit value is exceeded or if a failure occurs. However, the DC and AC voltages may still be available. The corresponding fault message appears in the display.

The fault is indicated on the control panel by the red "Alarm" LED emitting steady light.

Fault messages are stored in the fault memory, where they will remain even in the event of a power failure. The fault memory can be called up via the display. The last 100 faults are recorded in the fault memory. The latest fault is kept at memory location S0, the oldest at S100. A new fault is always stored to memory location S0. When this happens, any fault already at memory location S100 will be lost.

7.4 Fault Acknowledgement

After shutdown due to a fault, the device remains locked against reactivation until the fault is acknowledged. It is not possible to acknowledge the fault while the cause of the fault still exists. The fault can only be acknowledged after the cause of the fault has been eliminated.

⇒ To acknowledge the fault message, press the ESC key or turn the inverter off with the DC switch and wait min. 30 seconds to turn the inverter ON again.

7.5 List of Fault Messages

Error code	Error message	Description	Action
0x000000	Error management	Error may have been acknowledged although this was not permissible. No other explanation can be provided for error.	Restart.
0x0A0000	FPGA firmware	Incorrect FPGA version	Please arrange for Service to perform an update.
0x0A0001	Regulator voltage 1	Regulation error in positive boost converter	Wait for the regulator to become stable again. If this takes more than 2–3h, please contact Service.
0x0A0002	Regulator voltage 2	Regulation error in negative boost converter	Wait for the regulator to become stable again. If this takes more than 2–3h, please contact Service.
0x0A0003	Regulator voltage 3	Asymmetry low: Difference between the two solar voltages is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0004	Regulator voltage 4	Asymmetry high: Difference between the two boosted DC link voltages is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0005	Regulator voltage 5	The positively boosted DC link has dropped below the mains peak value.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0006	Regulator voltage 6	The negatively boosted DC link has dropped below the mains peak value.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0007	Regulator voltage 7	The positive solar voltage has dropped below the limit value.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0008	Regulator voltage 8	The positive solar voltage is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A0009	Regulator voltage 9	The negative solar voltage has dropped below the limit value.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A000A	Regulator voltage 10	The negative solar voltage is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly:

Error code	Error message	Description	Action
			please contact Service.
0x0A000B	Regulator voltage 11	The positively boosted DC link voltage is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A000C	Regulator voltage 12	The negatively boosted DC link voltage is too high.	If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service.
0x0A000D	Grid overvoltage	A grid overvoltage has been detected.	If the inverter is detecting a grid overvoltage: check line voltages (with a true RMS measurement device). If you consider the line voltages to be in order, contact Service.
0x0A000E	Grid undervoltage	Grid undervoltage has been detected. Grid voltage dip	As long as the inverter is detecting a grid undervoltage: check line voltages (with a true RMS measurement device). As long as you consider the line voltages to be in order, contact Service.
0x0A000F	Grid overvlt. l2l	Grid line-to-line overvoltage detected	As long as the inverter is detecting a grid line-to-line overvoltage: check the line-to-line voltages (with a true RMS measurement device). As long as you consider line-to-line voltages to be in order, contact Service.
0x0A0010	Grid undervlt. l2l	Grid line-to-line undervoltage detected	As long as the inverter is detecting a grid line-to-line undervoltage : check line-to-line voltages (with a true RMS measurement device). As long as you consider the line-to-line voltages to be in order, contact Service.
0x0A0011	Grid frequency FLL	A grid error has been detected (FLL).	Check grid frequency and grid instantaneous voltage. Service, if the grid frequency is within the normal range.
0x0A0012	Overfrequency	The grid frequency has exceeded the limit value.	As long as the inverter is detecting an overfrequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service.
0x0A0013	PM isolation RCD CR	Control and regulation unit has detected residual current.	Check system isolation. If you consider the system isolation to be in order, contact Service.

Error code	Error message	Description	Action
0x0A0014	No country code	No country code has been set, or code invalid.	Please contact Service.
0x0A0016	Underfrequency	The grid frequency has dropped below the limit value.	As long as the inverter is detecting underfrequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service.
0x0A0017	Invalid country	Invalid country code	Please contact Service.
0x0A0018	Voltage error max	The nominal grid voltage was below the limit value of the voltage average monitor for too long.	As long as the inverter is detecting the voltage error max: monitor line voltages (analyse grid). As long as you consider the line voltages to be in order, contact Service.
0x0A0019	Voltage error min	The nominal grid voltage was above the limit value of the voltage average monitor for too long.	As long as the inverter is detecting the voltage error min: monitor line voltages (analyse grid). As long as you consider the line voltages to be in order, contact Service.
0x0A0100	Fault message PS	Fault message from power section	Additional faults with the same time stamp are present. See fault memory.
0x0A0102	Overtemperature PS 1	Cooler overtemperature (right)	Check temperature of direct surroundings and reduce this as required.
0x0A0103	Overtemperature PS 2	Interior overtemperature (left)	Check temperature of direct surroundings and reduce this as required.
0x0A0104	Overtemperature PS 3	Interior overtemperature (right)	Check temperature of direct surroundings and reduce this as required.
0x0A0105	Overtemperature PS 4	Cooler overtemperature (left)	Check temperature of direct surroundings and reduce this as required.
0x0A0106	Supply voltage PS	Supply voltage at the power section is too low.	Please contact Service.
0x0A0108	Grid frequency PS	Power section has detected under/overfrequency.	As long as the inverter is detecting a PS grid frequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service.
0x0A0109	Grid overvoltage PS	The power section has detected a grid overvoltage.	As long as the inverter is detecting a grid overvoltage: check line voltages (with a true RMS measurement device). As long as you consider the line voltages to be in order, contact Service.
0x0A010A	Grid undervoltage PS	The power section has detected a grid undervoltage.	As long as the inverter is detecting a grid undervoltage: check line voltages (with a true RMS measurement device). As long as you consider

Error code	Error message	Description	Action
			the line voltages to be in order, contact Service.
0x0A010C	PM isolation PS	Power section detects isolation error on activation.	Check system isolation. If you consider the isolation resistance to be in order, contact Service.
0x0A010D	RCD fault	The power section has detected residual current. Isolation error during operation.	Check system isolation. If you consider the isolation impedance to be in order, contact Service.
0x0A010E	Device fault PS	Power section hardware shutdown	Note: When did the error occur (precisely: day, kW output, time).
0x0A0110	Solar voltage PS 1	Power section overvoltage shutdown in positive DC link	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0111	Solar voltage PS 2	Power section overvoltage shutdown in negative DC link	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0113	Country code PS	Country code does not correspond to country sub-code.	Please contact Service.
0x0A0114	PM isolation RCD PS	The isolation impedance of the photovoltaic module is too low.	Check system isolation. If you consider the system isolation to be in order, contact Service.
0x0A0115	RCD warning	The power section has detected residual current during operation.	Check system isolation. If you consider the system isolation to be in order, contact Service.
0x0A0116	R-detect	R-detect failed	Please contact Service.
0x0A0117	Isolation test unit	DC discharge is taking too long.	Please contact Service.
0x0A0118	Voltage offset PS	Offset adjustment values between power section and control and regulation unit divergent	Please contact Service.
0x0A0119	Current transdcr. PS	Current transducer could not detect any current flow.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A011A	Activation PS 1	DC discharge is taking too long.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A011B	Activation PS 2	DC link voltage drop during activation	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A011C	Activation PS 3	Target value for balancing is invalid.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A011D	Activation PS 4	Balancing has failed.	Please contact Service.
0x0A011E	Activation PS 5	Uploading of DC links has failed.	Please contact Service.

Error code	Error message	Description	Action
0x0A011F	Parameter error PS 5	Faulty reading or writing process in power section memory	1.) Switch off device with DC disconnector. 2.) Wait until the display has turned off completely. 3.) Switch on device with DC disconnector. If this does not rectify the error, contact Service.
0x0A0120	Communication PS	Communication malfunction between power section and control and regulation unit	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0121	DC component	The DC component on the grid side is too high.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0130	PS elements	Faulty configuration of elements for the power section	Please contact Service.
0x0A0131	Array Overvoltage	Switching the combine relay has failed. Possible array overvoltage.	Please contact Service.
0x0A0150	Overtemperature 2	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0151	Overtemperature AC1	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0152	Overtemperature AC2	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0153	Overtemp., inner	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0154	Overtemperature DC1	The cooler temperature at the positive boost converter exceeds the limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0155	Overtemperature DC2	The cooler temperature at the negative boost converter exceeds the limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0156	Overtemperature U	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.

Error code	Error message	Description	Action
0x0A0157	Overtemperature V	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0158	Overtemperature W	The temperature has exceeded the parametrised limit value.	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A0159	Fault fan 1	Fault message from fan 1	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A015A	Fault fan 2	Fault message from fan 2	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A015B	Fault fan 3	Fault message from fan 3	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A015C	Fault fan 4	Fault message from fan 4	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A015D	Fault fan 5	Fault message from fan 5	Check the inverter for heat build-up or blockage of the cooler ribs and rectify as required. If this does not correct the problem, contact Service.
0x0A015E	NTC wire break	Cooler sensor has detected a wire break.	Contact Service.
0x0A015F	NTC short circuit	Cooler sensor has detected a short circuit.	Contact Service.
0x0A0160	Preload error	Error has occurred during preload.	The DC +/− may be interchanged. Please check the DC wiring. If you consider the wiring to be in order, contact Service.
0x0A0161	Overcurrent BC pos.	Hardware shutdown caused by overcurrent in the positive circuit of the boost converter	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0162	Overcurrent BC neg.	Hardware shutdown caused by overcurrent in the negative circuit of the boost converter	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0163	Overcurrent U phase	Hardware shutdown caused by U-phase overcurrent	Do nothing. The inverter will acknowledge the error auto-

Error code	Error message	Description	Action
			matically. If problem occurs repeatedly, contact Service.
0x0A0164	Overcurrent V phase	Hardware shutdown caused by V-phase overcurrent	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0165	Overcurrent W phase	Hardware shutdown caused by W-phase overcurrent	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0166	Overvolt. DC-l. pos.	Overvoltage has been detected in the positive DC link voltage.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0167	Overvolt. DC-l. neg.	Overvoltage has been detected in the negative DC link voltage.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0A0168	String error	Input current groups connected incorrectly	The DC +/− may be interchanged. Please check the DC wiring. If you consider the wiring to be in order, contact Service.
0x0A0169	Iso wire break	Isolation sensor has a wire break	Contact Service.
0x0A016A	Phase Unbalance	Unbalanced power delivery.	Contact Service.
0x0A016B	Overcurrent string 1	Overcurrent string 1	Contact Service
0x0A016C	Overcurrent string 2	Overcurrent string 2	Contact Service
0x0A016D	Overcurrent string 3	Overcurrent string 3	Contact Service
0x0A016E	Overcurrent string 4	Overcurrent string 4	Contact Service
0x0A016F	Malfun. DC contactor	DC contactor defective	Contact Service
0x0A0170	Malfun. AC contactor	AC contactor defective	Contact Service
0x0A0171	Malfun. RCD sensor	RCD sensor defective	Contact Service
0x0A0172	P24V PS aux. supply	P24V supply voltage at the power stack is too low.	Please contact Service.
0x0A0173	P5V PS aux. supply	P5V supply voltage at the power stack is too low.	Please contact Service.
0x0A0174	P15V PS aux. supply	P15V supply voltage at the power stack is too low.	Please contact Service.
0x0A0175	Symmetry relay	Symmetry relay error	Please contact Service.
0x0A0176	Switch-on condition	Switch-on condition is not fulfilled	Wait for the switch-on condition.
0x0A0177	fan E1-E5		Verify the fan E1-E5,remove any blockage,clear the fault or call service
0x0A200D	Overtemperature 6	Device temperature too high	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0B0001	System 1	Error in error management system	Contact Service.
0x0B0002	System 2	Error memory is full.	Contact Service.
0x0B0003	System 3	Error acknowledgement has failed.	Contact Service.

Error code	Error message	Description	Action
0x0D0001	System error	A connection to the power section could not be established during the firmware update.	1.) Switch off device with DC disconnector. 2.) Wait until the display has turned off completely. 3.) Switch on device with DC disconnector. If this does not rectify the error, contact Service.
0x0D0002	PS bootloader	Power section bootloader faulty	One of the power section's two bootloaders is faulty. This text is displayed for information purposes only. The inverter will continue to function. Please contact Service and arrange for a firmware update to be performed.
0x0D0003	System restart	System has been restarted to enable a firmware update to be performed.	This text is displayed for information purposes only. If an update is not performed, please contact Service.
0x0E0001	Overcurrent ph. L1 1	Overcurrent phase L1	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0002	Overcurrent ph. L2 1	Overcurrent phase L2	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0003	Overcurrent ph. L3 1	Overcurrent phase L3	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0005	Overcurrent ph. L1 2	Overcurrent phase L1	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0006	Overcurrent ph. L2 2	Overcurrent phase L2	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0007	Overcurrent ph. L3 2	Overcurrent phase L3	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0009	Overcurrent ph. L1 3	Overcurrent phase L1	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E000A	Overcurrent ph. L2 3	Overcurrent phase L2	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E000B	Overcurrent ph. L3 3	Overcurrent phase L3	A short circuit may be present. Please arrange for an electrician to check this, or contact

Error code	Error message	Description	Action
			Service.
0x0E000D	Phase temperatures	Temperature difference between the phase modules is too high.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0013	Preload	Preload cannot reach the preload voltage.	The DC +/− may be interchanged. Please check the DC wiring. If you consider the wiring to be in order, contact Service.
0x0E0015	Preload protection	Preload protection cannot be switched.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0016	Main contactor DC	DC contactor cannot be switched.	Please contact Service.
0x0E0017	Main contactor AC	AC contactor cannot be switched.	Please contact Service.
0x0E0018	Overtemperature 4	Overtemperature at microcontroller	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0019	Grid voltage 2	Nominal grid voltage is outside of the grid limits.	Arrange for grid instantaneous voltage to be checked by an electrician if the error message remains active. If the grid instantaneous voltage is within the normal range, contact Service.
0x0E001A	Solar cell voltage 1	The measured DC link voltage of the power section is too high.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E001B	Solar cell voltage 2	The measured solar voltage of the power section is too high.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E001C	Supply voltage	Faulty supply voltage at the power section	This error typically occurs shortly before the element ‘goes to sleep’ or shortly after it ‘wakes up’. Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E001D	Overtemperature 5	Overtemperature at controller	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E001E	Communication CR	Communication malfunction between control and regulation unit and power section	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.

Error code	Error message	Description	Action
0x0E001F	Parameter error	Faulty reading or writing process in power section memory	1.) Switch off device with DC disconnector. 2.) Wait until the display has turned off completely. 3.) Switch on device with DC disconnector. If this does not rectify the error, contact Service.
0x0E0020	System	Finite state machine installed incorrectly	1.) Switch off device with DC disconnector. 2.) Wait until the display has turned off completely. 3.) Switch on device with DC disconnector. If this does not rectify the error, contact Service.
0x0E0021	Grid error MSD	An external MSD error is active at digital input X17 Pin1.	Arrange for nominal grid voltage to be checked by an electrician if the error message remains active. If the nominal grid voltage is within the normal range, contact Service.
0x0E0022	AC switch	AC switch has not been switched on.	Switch on AC switch.
0x0E0023	Overtemperature 8	Transformer too hot	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0024	Overcurrent DC	An overcurrent has occurred on the DC side.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0025	Overtemperature 7	Overtemperature at power section	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0026	Transformer magnet.	Transformer magnetisation has failed.	Do nothing. The inverter will acknowledge the error automatically. If the error is not acknowledged automatically, contact Service.
0x0E0027	DC-current msrt.	Faulty DC-current measurement	Do nothing. The inverter will acknowledge the error automatically. If the error is not acknowledged automatically, contact Service.
0x0E0028	Country of use inv.	The country that has been entered does not exist.	Please contact Service.
0x0E0029	Grid error 1	The grid is experiencing an MSD error.	Arrange for an electrician to check the grid instantaneous voltage and grid frequency. If you consider them to be in order, contact Service.

Error code	Error message	Description	Action
0x0E002A	Power classes	Faulty parametrisation	Please contact Service.
0x0E002B	Isolation 1	Isolation measurement has detected an isolation error before activation.	Arrange for the system's isolation to be checked by an electrician. If you consider the isolation to be in order, contact Service.
0x0E002C	Isolation 2	Isolation measurement has detected an isolation error during operation.	Arrange for the system's isolation to be checked by an electrician. If you consider the isolation to be in order, contact Service.
0x0E002D	AC-current msrt.	Faulty AC-current measurement	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E002E	Grid error 2	Grid monitoring function has detected an error.	Arrange for an electrician to check the grid instantaneous voltage and grid frequency. If you consider them to be in order, contact Service.
0x0E002F	DC voltage 1	The maximum deviation of the DC link voltages has been exceeded.	Please contact Service.
0x0E0031	Lightning arrester	Lightning arrester defective	Please contact Service.
0x0E0032	Grid error SVM	The control limit of the space vector modulation has been exceeded.	Arrange for an electrician to check the grid instantaneous voltage and grid connection. If you consider them to be in order, contact Service.
0x0E0033	DC voltage 3	DC link voltage too low	Arrange for an electrician to check the solar voltage. If you consider it to be in order, contact Service.
0x0E0034	Error cooler pump	Cooler pump is not functioning correctly.	Please contact Service.
0x0E0035	Overcurrent 5	Overcurrent has been detected.	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0036	Overcurrent 6	Overcurrent has been detected.	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0037	DC voltage 4	The maximum deviation of the DC link voltages has been exceeded.	Please contact Service.
0x0E0038	Grid error	Grid monitoring function has detected an error.	Arrange for an electrician to check the grid instantaneous voltage and grid frequency. If

Error code	Error message	Description	Action
			you consider them to be in order, contact Service.
0x0E0039	Overtemperature	Mains line choke cores are very hot as very little cooling air is available.	Visual check: cooling circuit air supply. If the blockage cannot be rectified, contact Service.
0x0E0050	Overcurrent 1	Overcurrent grid	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0051	Overcurrent 2	Overcurrent power section 2	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0052	Overcurrent 3	Overcurrent power section 1	Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service.
0x0E0053	Overcurrent 4	Overcurrent DC	A short circuit may be present. Please arrange for an electrician to check this, or contact Service.
0x0E0100	Fault message PS	Fault message from power section	Additional faults with the same time stamp are present. See fault memory.
0x100001	Ethernet connectn. 1	A connection to the ethernet could not be established.	Inspect ethernet connection: check IP address, subnet mask, server address and server port.
0x100002	Ethernet connectn. 2	Loss of ethernet connection	Check ethernet connection.
0x100003	Ethernet connectn. 3	No 100Mbit/s ethernet connection is available.	A 100Mbit/s ethernet connection is required. Check that your network is transmitting at 100Mbit/s.
0x100004	DNS error	The name resolution of the port address failed. However, the data was successfully transmitted.	Correct the DNS server address for the inverter.
0x100010	Portal error 1	General error in data transfer	Contact Service.
0x100011	Data logger error 1	General error in data storage module.	Contact Service.
0x100012	Data logger error 2	General error in data storage module.	Contact Service.
0x100013	Watchdog error	Internal protection function was triggered.	Contact Service.
0x100014	MMU memcpy	Internal protection function was triggered.	Contact Service.
0x20002	DC voltage 2	DC link voltage too high: The DC link voltage is above the max. limit.	Check DC voltage.
0x20003	Anticlockws.rot.fld.	The clockwise rotating field of the voltage supply is faulty.	Create clockwise rotating field.
0x20004	Overcurrent	The mains current is above the max. AC-current limit in one of the three phases.	Do nothing. The inverter will acknowledge the error automatically. If problem occurs

Error code	Error message	Description	Action
			repeatedly, contact Service.
0x30002	Parameter error 1	A defective parameter file was found when the special functions were initialised.	Please arrange for Service to perform an update.
0x30005	Parameter error 2	No parameter file was found when the special functions were initialised.	Please arrange for Service to perform an update.
0x30006	Parameter error 3	The number of parameters does not correspond to the number of parameters in the file system.	Please arrange for Service to perform an update.
0x40001	Internal communictn.	Timeout between control and regulation unit card and power section	If problem occurs repeatedly, contact Service.
0x40010	System error 1	Operating system crash	If problem occurs repeatedly, contact Service.
0x50000	System error 2	Initialisation has failed.	Restart inverter. If this does not rectify the error, contact Service.
0x60001	Incorrect time	Inverter is feeding in with incorrect time as real-time clock has not been initialised.	Set correct time.
0x70000	Update registration	An additional update could not be registered.	Wait until the current update is complete.
0x70001	Update in progress	An update is already in progress.	Wait until the update is complete.
0x80001	Incorrect time	Initialisation of real-time clock has failed. This prevents data logger from functioning.	Set correct time.
0x90001	System restart	The inverter has been restarted.	This text is displayed for information purposes only.
0x90002	Program CRC error	Checksums do not correspond.	Please arrange for Service to perform an update.
0x90003	CR watchdog reset	System reset performed by watchdog.	If problem occurs repeatedly, contact Service.
0x90004	RAM error 1	RAM error detected in a safety-critical variable	Please arrange for Service to perform an update.
0x90005	MMU exception	Program memory protection fault	Please arrange for Service to perform an update.
0xA10000	Default power	Event: Power reduction was requested.	None
0xA10001	Default cos phi	Event: Adjustment of the fed-in reactive power was requested.	None
0xA10002	Default p activation	Event: The power reduction functionality was activated or deactivated.	None
0xA10003	Activation cos phi	Event: The functionality for specifying the reactive power default value was activated or deactivated.	None

Error code	Error message	Description	Action
0xA20000	SCB comm. failure	Indicates communication failure of a string connection box (SCB).	Check whether all connected SCBs are operational (green flashing LED in SCB). Check CAN wiring. Restart SCB.

8 Options

8.1 Radiation and temperature Sensor

A radiation and temperature sensor can be optionally connected for recording the solar radiation incidence and the module temperature. We recommend using the type Si-13TC-T-K. REFU part no. 0030628. The scope of delivery of the radiation and temperature sensor includes the sensor plug. The sensor plug can also be separately ordered from REFU*sol* GmbH under part no. 0030616.

The sensor comes with a 3 meter UV-resistant connecting line (5 x 0.14 mm²). The line can be extended with a 5 x 0.25 mm² shielded line, max. 100m.

More information about the technical data of the sensor you will find in technical data, sensor, p. 72.

Si-13TC-T-K pin assignment			REFU*sol* pin assignment: Sensor
Red	RD	Supply voltage (12–24 VDC)	Pin 1
Black	BK	GND	Pin 2
Orange	OG	Measurement signal for incident light (0–10 V)	Pin 3
Brown	BN	Measurement signal for temperature (0–10 V)	Pin 4
Gray	GY	Shielding	Pin 5

Note: The shield of the sensor line must be applied to PIN 2 and PIN 5!

The outer diameter of the connecting cable can be max. 8mm.

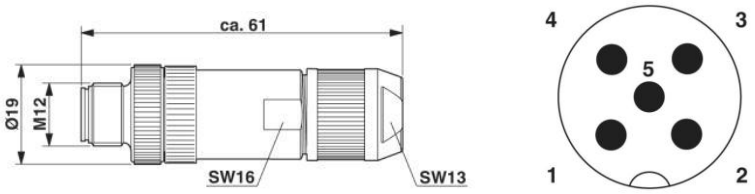


Figure No. 28 Connector M12 x 1 straight, shielded; pole arrangement: male M12, 5 pins, A-coded, view of male connector side, Phoenix nomination: SACC-M12MS-5SC SH

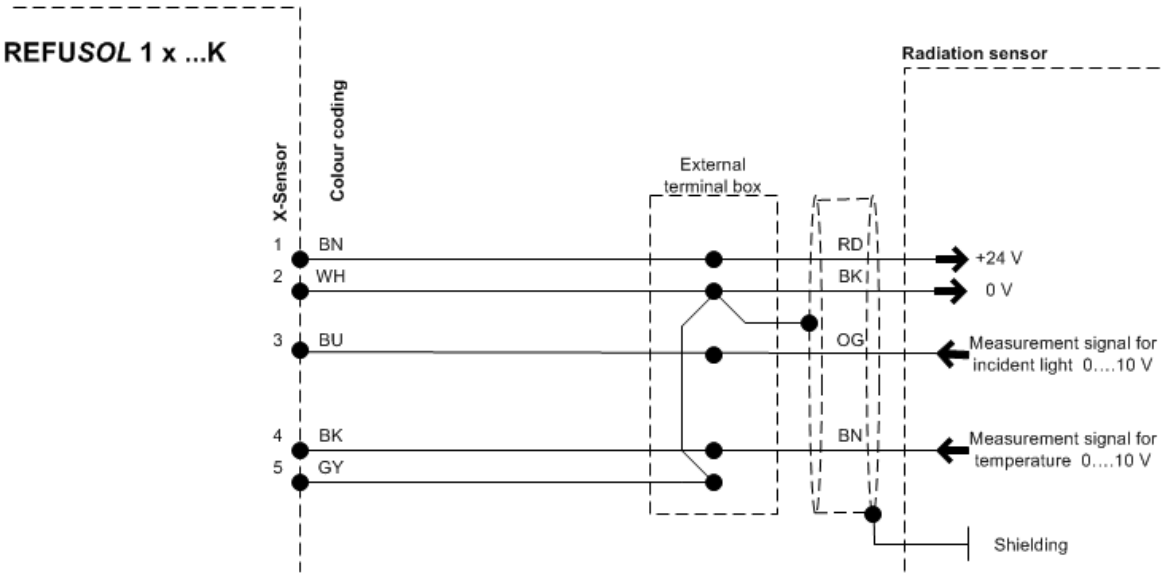


Figure No. 29 Connection of the solar radiation sensor

The actual values of the sensor can be viewed in the display below “actual values>sensor”. Furthermore, the data is recorded with the data logger and can be viewed on REFUlog.

Note: If you do not use the temperature input, wire a jumper across PIN 4 and PIN 5. Alternatively, you can also wire the jumper to the intermediate terminal point (cable extension).

8.2 External Shutdown Signal

8.2.1 Overview

Starting with firmware version 32-xx-S REFUsol string inverters can be disconnected from the external grid by a signal for example of the external power supply and system protection unit of the generating facility.

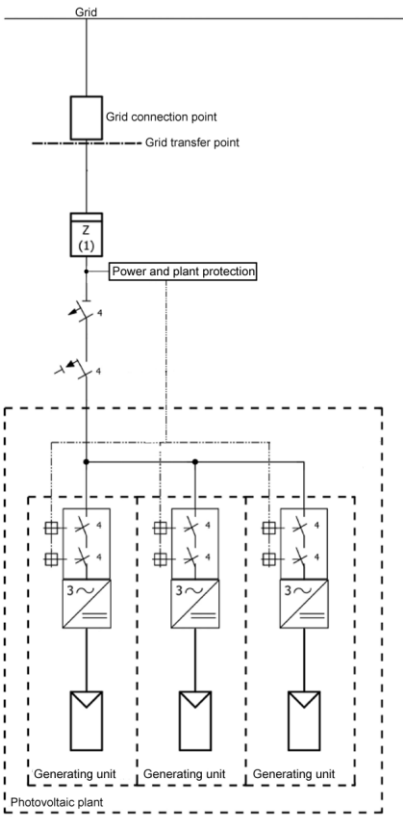


Figure No. 30 Example grid and system protection with built-in inverters dome switches

Thus in Germany, the built-in dome switch of the inverter can be used to shutdown systems with greater apparent power as 30 kVA. A central dome switch is no longer necessary.

Figure No. 31 External shutdown signal within the "daisy chain"

8.2.2 Specification

Nominal input voltage	10 V DC
Input voltage (logic 1)	7,5 – 10 V DC
Standard turn-off	50 ms
Setting switch-off	50 ms … 100 ms

If the sensor output is logic 1, the inverter remains in operation. If the Connected voltage falls below 7.5 V, a fault is triggered and the inverter will shut down.

8.2.3 Configuration via sensor input

The external shut-off signal take place via the sensor input of the inverter.

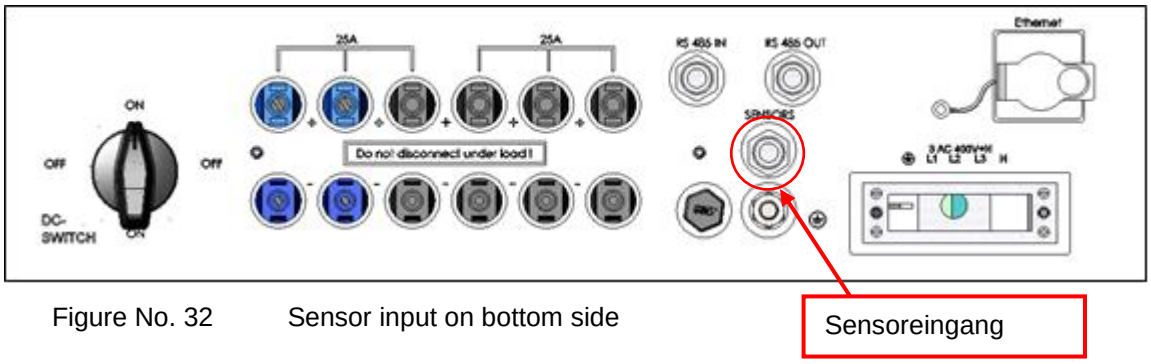


Figure No. 32 Sensor input on bottom side

The sensor plug can be ordered separately under the number 0030616 at REFUsol.

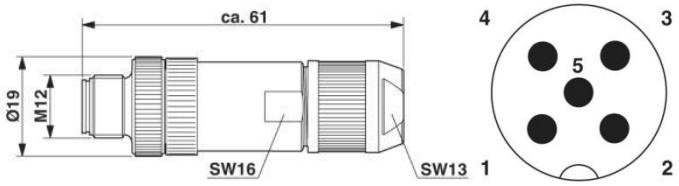


Figure No. 33 Connector M12 x 1, straight, shielded; Arrangement connector M12, 5-pin, A-coded, view pin side, Phoenix Description: SACC-M12MS-5SC SH

The possible assignments of the sensor are described:

Standard configuration

Shutdown signal		**0…10 VDC**	**GND**				
Connection sensor		**Pin1**	**Pin2**	**Pin3**	**Pin4**	**Pin5**	**Sensor selection**
Inverter	**1**	NC	GND	NC	Signal (0…10 VDC)	Shielding	3
	2						
	3						
	n						

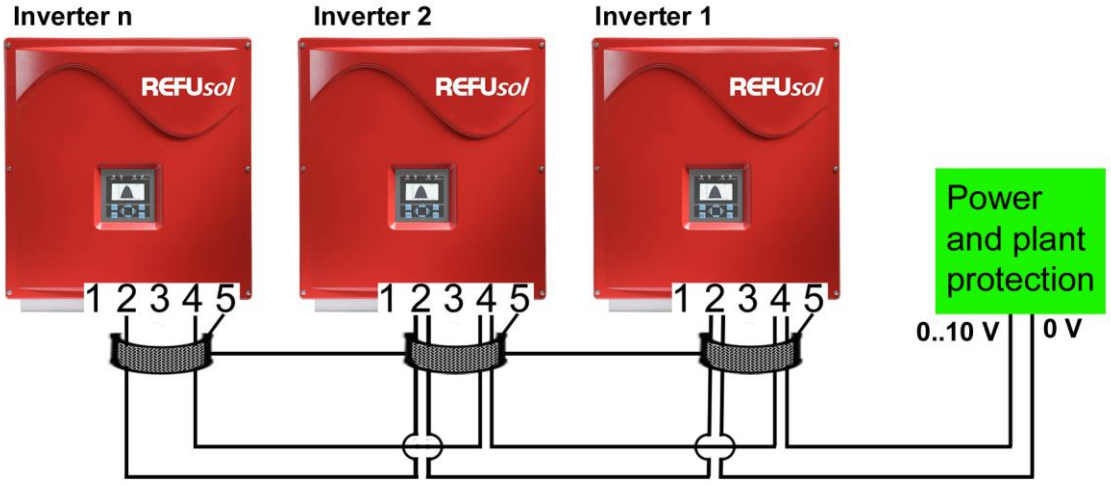


Figure No. 34 Schematic explanation of standard configuration

Standard configuration with irradiation and temperature sensor is connected

Shutdown signal		0…10 VDC	GND				
Connection Si-13TC-T-K		**Red RD**	**Black BK**	**Orange OG**	**Brown BN**	**Grey GY**	
		Supply (12-28 VDC)	GND	Measuring signal Irradiation (0-10 V)	Measuring signal Temperature (0-10 V)	Shielding	
Connection sensor		**Pin1**	**Pin2**	**Pin3**	**Pin4**	**Pin5**	**Sensor selection**
Inverter	**1**	Supply (12-28 VDC)	GND	Signal (0…10 VDC)	Measuring signal Temperature (0-10 V)	Shielding	2
	2	NC	GND	Measuring signal Irradiation (0-10 V)	Signal (0…10 VDC)	Shielding	1
	3	NC	GND	NC	Signal (0…10 VDC)	Shielding	1
	n						

Redundant monitored shutdown signal

Shutdown signal		0…10 VDC	GND				
Connection sensor		**Pin1**	**Pin2**	**Pin3**	**Pin4**	**Pin5**	**Sensor selection**
Inverter	**1**	NC	GND	Signal (0…10 VDC)	Signal (0…10 VDC)	Shielding	3
	2						
	3						
	n						

Monitoring of two different turn-off signals

Shutdown signal		Signal 1 0…10 VDC	GND		Signal 2 0…10 VDC	GND	
Connection sensor		**Pin1**	**Pin2**	**Pin3**	**Pin4**	**Pin5**	**Sensor selection**
Inverter	**1**	NC	GND	Signal 1 (0…10 VDC)	Signal 2 (0…10 VDC)	Shielding	3
	2						
	3						
	n						

Note: To ensure the function of the switch-off signal the selection of the sensor on the inverters must be done correctly.

On the display of the inverter, the sensor “configuration> External shutdown” can be entered.

Furthermore, the inverter can be cofigured by using the tool REFUset. Here, for example you can change from the energy supply companies demanded disconnection times or configure other voltage limiting ranges. Furthermore it is possible to deactivate the internal NA-protection function, if an external NA-protection relay is connected and the network provider allows it.

DANGER

Risk of electric shock.

⇒ Start the inverter only again when the problem that led to the shutdown is fixed.

8.3 Remote Monitoring System

The following options are available for remote monitoring:

- REFU*log*: REFU*log* is a portal that has been developed by REFU*sol* for the purpose of monitoring and recording solar system data. For more information and details, please refer to the REFU*log*. This is on the homepage www.refusol.com available for download.
- Web Log: Data logger by MeteoControl. Connection via RS485.
- SolarLog®: Data logger by Solare Datensysteme. Connection via RS485.

Where MeteoControl® and Solarlog® are concerned, data is imported from the inverters via an RS485 interface.

For information about the configuration, please refer to the Operating Instructions of the particular data logger.

8.4 Instrument settings for monitoring with SolarLog® or Meto-Control®

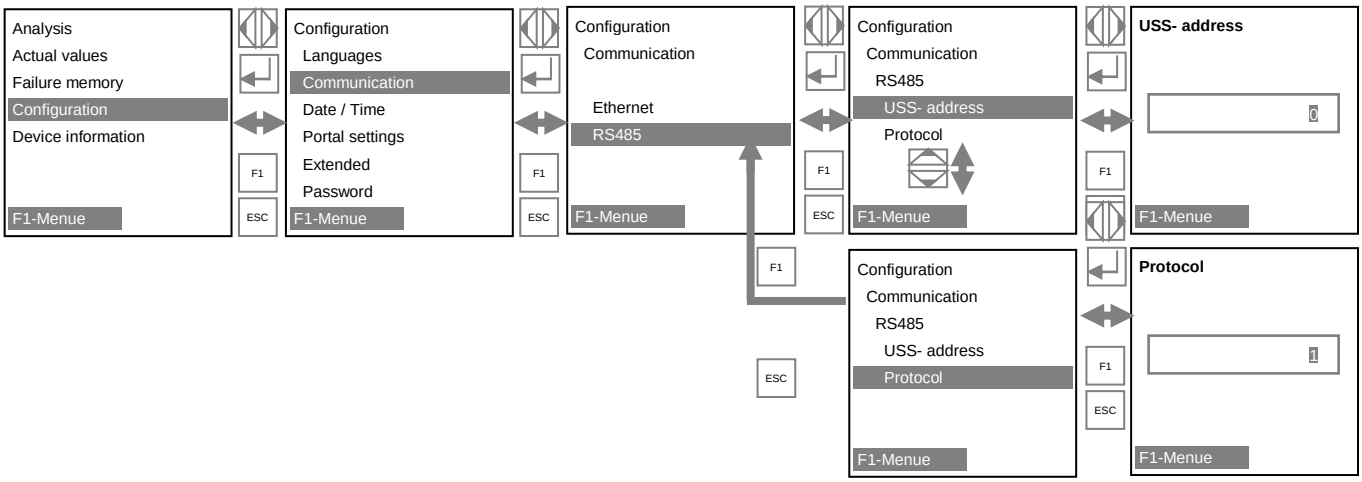
All inverters have to be equipped with the firmware version **RTF-80xR0xx-25-x-S** or higher (available at: Menu F1/unit information/version identification/RFP ...).

The RS485 interface (RS485 IN / OUT) is standard on all REFU*sol*® units.

For communication via SolarLog® or Meteocontrol® each REFU*sol*® must be given a communications address. It is recommended to predefine the addresses continuously starting with 1 (then 2, 3, etc. to max. 31).

Note: The maximum number of inverters systems that can be operated at one bus is 31.

These settings are made on the inverter panel after entering the customer's pass-word 72555 as follows:



Protocol: After the entry for the USS "1" for Solarlog® "2" for Meteocontrol® and the "3 and confirm each with ↵

Note: After successful entry turn the inverter off and after 1 minute turn back on!

8.5 Data Logger Parameters

Note: Data logger parameters can be configured using the tools REFUset.

8.6 REFU*powercap* (only 013K – 023K)

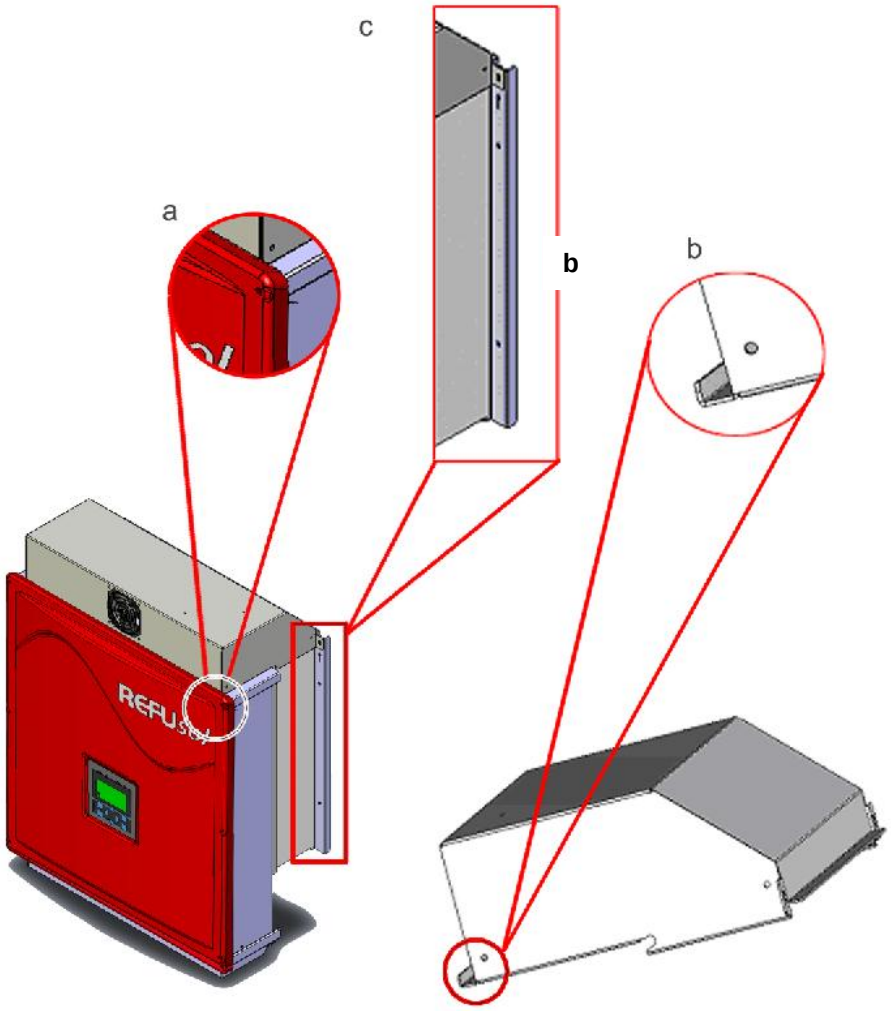


Figure No. 35 Power Cap

REFU*powercap* is an additional fan module for REFU*sol* 013K to 020K, (SCI) which is used if the available space requires that the REFU*sol* devices be mounted one on top of the other (008K to 010K on request). REFU*powercap* raises the permissible ambient temperature range by +5°C. The ventilation module mounts directly onto the inverter. The fold (b) must be hung into the upper edge of the front cover (a) and secured to the REFU*sol*® wall-mounting bracket by means of 2 M5 screws (included in scope of delivery).

The fan inside it is powered and monitored by the inverter's sensor connector (overspeed sensing). The power supply line for the Power Cap must be attached to the wall-mounting bracket by means of the enclosed 6.5-mm polyamide mounting clips and the mounting tie.

The fan motor is enclosed according to Protection Class IP54 and has a service life of approx. 10 years.

CAUTION	**Damage by affecting the convection and possible overheating.** **The inverter should in no case be mounted on top of each other without a Power Cap.**

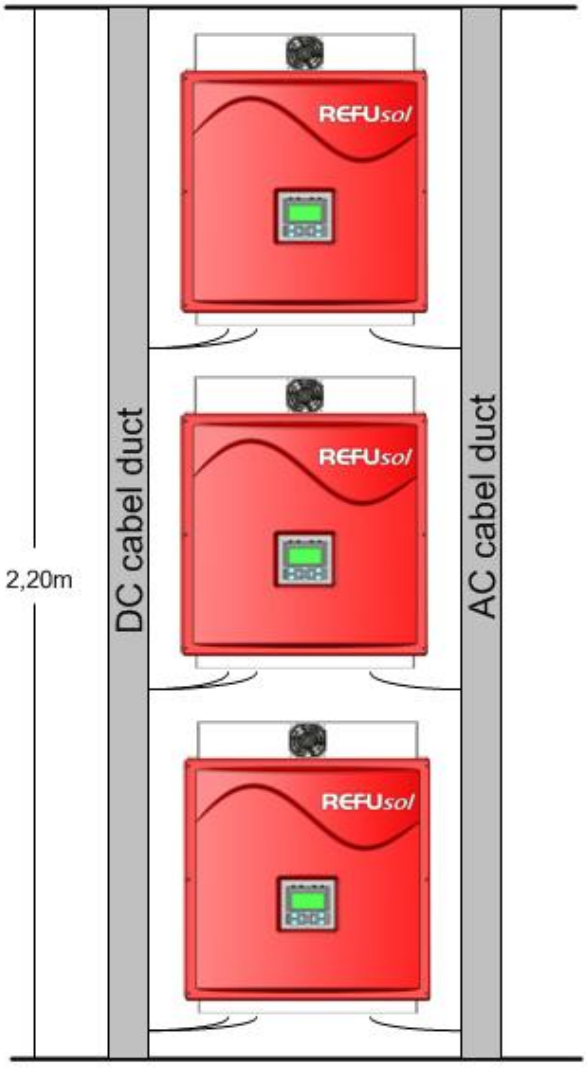


Figure No. 36 Mounting REFU*powercap*

Note: If a temperature and radiation sensor is connected, a 24-V-DC power supply unit (e.g. REFU*sol* part no.: 0030449; 230 VAC / 24 VDC, 18 W) must be provided to supply the Power Cap.
We recommend that the power supply unit be turned on during ongoing operation of the inverter only. Implement a 230-V-AC timer switch to turn the power supply unit on and off.

8.7 Connecting the AC-Adaptor Electrically to the Additional Power Cap

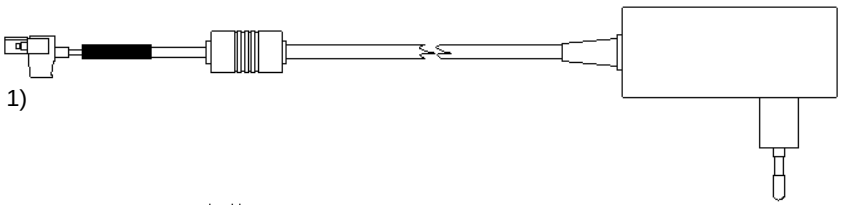


Figure No. 37 AC-adaptor

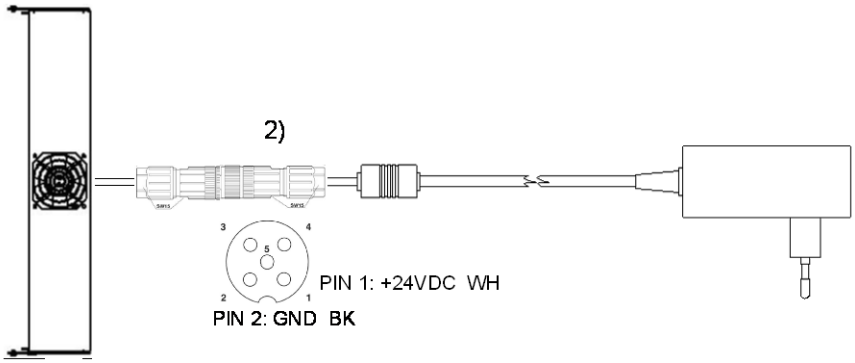


Figure No. 38 Power Cap with AC-adaptor

1) Disconnect the plug.

2) Sensor / actuator connector:
To ensure the protection class IP65, the sensor / actuator is to use socket type SACC-M12MS-5SC SH from Phoenix Contact.

Non-compliance can result in damage and void your warranty inverter!

The socket can be ordered under item number 0030626 in the REFUsol GmbH.

9 Maintenance

The cooling of the inverters is done exclusively through the natural convection. For safe operation according to the environment the cooling fins on the heat sink should be checked against dirt and if necessary clean up of dust / dirt.
The DC switch is designed for a very long life.
For maintenance it is sufficient to switch the DC switch five times in a row, without current load.

Other maintenance work is not required.

10 Technical Data

10.1 Inverters

	008K+	010K+	013K+	017K+	020K+	023K-460 VAC	020K-SCI
Art.No.	803R008	803R010	808R013	808R017	808R020	808R023	807R020
DC DATA							
Max. PV power (kW)	9.9	12	15.6	20.4	24	27.6	24
MPPT Range (V)	370-850	410-850	430-850	460-850	490-850	575-850	490-800
DC start voltage (V)	350						
max. voltage DC (V)	1000						
Max. current DC (A)	23	25	31	41,8		41	41,5
MPP trackers	1						
No. DC inputs	3 x MC4		4 x MC4	6 x MC4			
integrated DC circuit breaker	ja						
Max. total short-circuit current of PV plant (I_{SC_PV}) (A)	25	25	50				
AC DATA							
AC Nominal power (kW)	8.25	10	13	17	20	23	20
Max. apparent power (kVA)	8.25	10	13	17	20	23	20
AC grid connection / Feed-in phases	L1, L2, L3, N, PE						
Nominal Power Factor / Range	1 / 0,9i … 0,9c						
Nominal voltage AC (V)	400					460	400
Voltage range AC (V)	320-460					368-529	320-460
Nominal Frequency / Frequency Range (Hz)	50, 60 / 45…65						
Max. AC current (A)	3 x 12	3 x 16	3 x 21	3 x 29	3 x 29,2		
Max. THD (%)	2.5%	1.8%	2.5%	1.8%			
Max. Efficiency (%)	98.0%			98.2%		98.3%	98.7%
Max. european Efficiency (%)	97.3%	97.4%	97.5%	97.8%		98.1%	98.5%
Feed-in from (W)	50						20
Self consumption night (W)	< 0,5						
Max. AC fuse (A)	35	35	35	35	35	35	35
AC short circuit current (A)	12.3	16.0	19.4	26.5	29.6	29.2	29.5
AC inrush current (A)	< 5						

	008K+	010K+	013K+	017K+	020K+	023K-460 VAC	020K-SCI
PROTECTION, AMBIENT CONDITIONS							
Cooling	natural convection						
Ambient Temperature (°C)	-25 … +55						-25 … +60
Rel. Air humidity (%)	0 … 100%						
Elevation (m above sea level)	2000		4000*				
Noise (dBA)	< 45						< 35
Internal Overvoltage Protection (EN 61643-11)	Typ 3						
Equipment Class (IEC 62103)	I						
Overvoltage Category (EN 60664-1)	DC: II, AC: III						
Environment classificati-on (IEC 721-3-4)	4K4H						
Certification	latest certificates you find at http://europe.refusol.com/certifications.pdf						
SZS or grid protection	according to VDE 0126-1-1						
GENERAL DATA							
Interfaces	Ethernet, RS485, Irradiation and Temperature sensor						
Type of protection (IEC 60529)	IP65						
Dimensions W x H x D (mm)	535 x 601 x 225		535 x 601 x 277				
Weight (kg)	28.5		32.2	38.4			40
			* please note derating of DC voltage!				

***** Derating of max. DC voltage:

Site altitude above sea level	**Max. DC-voltage**
Up to 2600 m	1000 V
Up to 3000 m	950 V
Up to 3500 m	900 V
Up to 4000 m	850 V

10.2 Sensor

Type	Si-13TC-T-K
General	
Shunt resistor	0,10 Ω (TK = 22 ppm/K)
Ambient temperature	-20 °C to +70 °C
Supply voltage	12 to 24 VDC
Current draw	0,3 mA
Connecting cable	4 x 0.14 mm², 3 m (UV-resistant)
Cell dimension	50 mm x 34 mm
Dimensions Length / Width / Height	145 mm x 81 mm x 40 mm
Weight	340 g
Solar radiation	
Measuring range	0 to 1300 W/m²
Output signal	0 to 10 V
Measuring accuracy	±5% of final value
Module temperature	
Measuring range	-20 °C to +90 °C
Output signal	2.268V + T [°C]* 86.9 mV/°C
Measuring accuracy	±1.5% at 25 °C
Nonlinearity	0.5 °C
Max. deviation	2 °C
Orange	Output signal radiation (0 - 10 V)
Pin assignment	
Red	Supply voltage (12 - 24 VDC)
Black	GND
Brown	Output signal temperature (0 - 10 V)
Supply voltage	Temperature and radiation sensor or Power cap

10.3 REFU*powercap* (only 013K – 023K)

Type	REFU*sol*® Power Cap
Electrical data	
supply voltage	24 VDC
connection supply voltage	sensors connector
Internal consumption	2,4W
Cooling, ambient conditions	
free space in front of the unit	1000 mm
Type of protection	IP54 as per EN 60529
Dimensions Wide / Höhe / Depth	488 mm / 90 mm / 250 mm
Weight	1,4 kg

11 Contact

Please address any questions on the configuration of your inverter to:

REFU*sol* GmbH

Uracherstr. 91

D-72555 Metzingen, Germany

Phone: +49 (0) 7123.969-102

Fax: +49 (0) 7123.969-333

info@refusol.com

www.refusol.com

Please address any questions on failures or technical problems to:

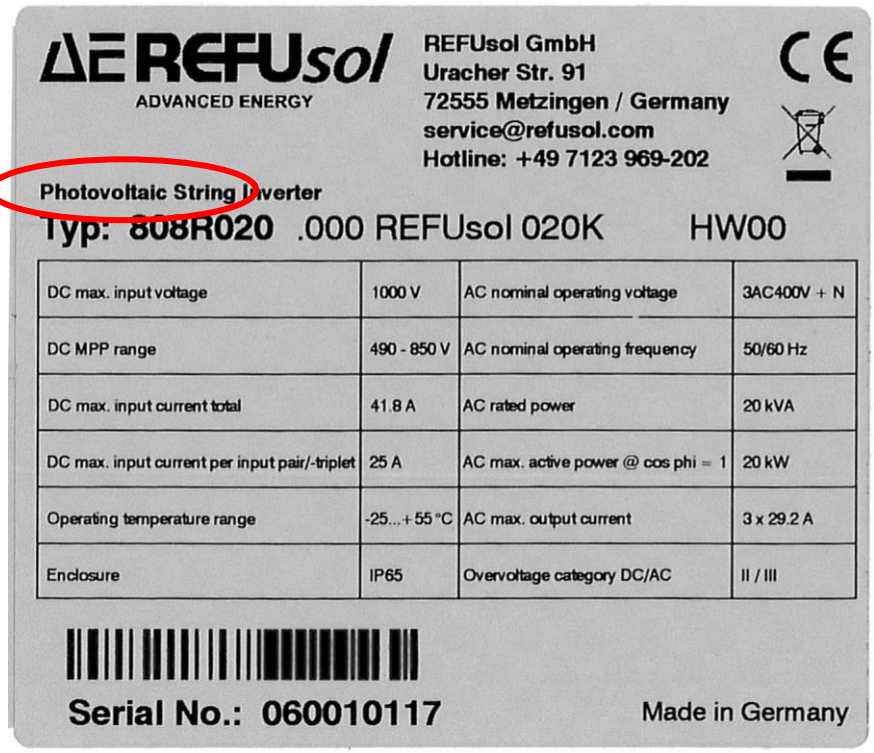
Service hotline: +49 (0)7123 / 969 – 202 ((Monday – Friday, 8 a.m. to 5 p.m)

Fax: +49 (0)7123 / 969 – 235

E-mail: service@refusol.com

You should have the following data at hand:

- Exact description of the error and if possible HEX code of the error (P0017.00).
- Data from the type plate:



12 Certificates

The following certificates

- EC Declaration of Conformity
- VDEW Declaration of Conformity
- Clearance Certificate can be downloaded from the REFU*sol* GmbH homepage www.refusol.com

REFU*sol* GmbH
Uracher Straße 91
72555 Metzingen
Germany

Phone +49 7123 969-202
Fax +49 7123 969-302 02

info@refusol.com
www.refusol.com
Part-No. 0030776