



REFU - Power Quality REFUSOL – Solar Inverter

Operating Instructions DOK-RESOL-BA07-EN-WR0100K_NN-P.doc



Title REFU Renewable Energy For Us
 REFUSOL – Solar Inverter
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Class of Documentation Operating Instructions

Intent of Documentation the This document describes the **REFUSOL 100K**.
 It provides information on

- how to set up the device for operation
- fault messages, with notes on causes and their remedies

This description is valid as of April 11 2008

Revision history

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Legal validity The information given in this document serves only to describe the product, and is not to be understood as warranted characteristics in any legal sense. The content of the documentation and product delivery options are subject to change.

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1 Safety Notes for REFUSOL®

1.1 Introduction

To prevent personal injury and/or damages, read the following notes before first putting the system into operation. The safety notes must be observed at all times.

Before first operation of this unit, we strongly recommend you carefully read through all supplied documents. This also applies to the safety instructions and all other user instructions before performing any work on this unit. Should you have no user information regarding the unit, refer to REFU Elektronik GmbH. Ask for the documents to be sent immediately to those responsible for safe operation of the unit.

When selling, letting, or otherwise passing on the device to third parties, always enclose these safety notes!



WARNING

Any misuse of this equipment, failure to observe these safety notes or unqualified interference with the safety equipment or unit could result in damage, bodily injury, electric shock, or even death.

1.2 Explanations

These safety notes use the following ANSI notation to describe the various levels of danger:

Warning symbol with signal word	Danger level according to ANSI The danger level identifies the danger involved in failure to observe the safety notes:
 DANGER	Death or severe bodily injury will occur.
 WARNING	Death or severe bodily injury could occur.
 CAUTION	Bodily injury or damage could occur.

1.3 Risks Involved in Improper Use



DANGER

High electric voltage and high working current! Risk of death or severe bodily injury by electric shock!



WARNING

High electric voltage because of incorrect connection! Risk of death or bodily injury by electric shock!



WARNING

Large leakage current!

Make sure to connect to grounding before connecting to the power supply circuit!



WARNING

Health risk for persons with cardiac pacemakers, metallic implants, or hearing aids in the immediate vicinity of electrical equipment!



CAUTION

Surfaces of the housing can be hot! Risk of injury! Risk of burns!



CAUTION

Risk of injury by improper handling! Bodily injury by crushing, shearing, cutting, or striking.

1.4 General

- REFU Elektronik GmbH does not assume any liability for damages caused by failure to observe the warnings given in these operating instructions.
- Before first operation, thoroughly read through the operation and maintenance instructions and the safety notes.
- Proper and qualified transport, storage, assembly and installation, as well as conscientious operation and maintenance are preconditions for faultless and safe operation of this unit.
- Assign trained and qualified personnel to work with electrical systems.
Only suitably trained and qualified personnel should work on this unit. To be qualified, personnel must be sufficiently familiar with assembly, installation, and operation of the product, as well as with all warnings and precautions mentioned in these operating instructions. Furthermore, these qualified personnel must be trained, instructed, or authorized to switch on and off, and to ground electric circuits and devices according to the safety regulations, and to mark them appropriately according to the work instructions. Qualified personnel must be in possession of sufficient safety equipment, and have first aid training.
- Use only accessories and spare parts approved by the manufacturer.
- The safety laws and regulations of the country in which the unit will be used must be observed.
- The ambient conditions specified in the product documentation must be met.
- It is not permitted to put the system into operation until the system in which the products are installed has been found to conform to the national regulations and the safety regulations for its application.
- Operation is only admissible if the national EMC regulations for the respective application are observed.
- The manufacturer of the system or machine is responsible for compliance with the limits specified by national regulations.
European countries: EC Directive 2004/108/EC (EMC Directive).
- The technical data and conditions for connection and installation are given in the product documentation, and must be strictly complied with.

1.5 Protection Against Touching Electrical Parts



Note: This section only concerns units and unit components that are under voltages greater than 50 Volts.

It is dangerous to touch parts that are under voltages greater than 50 Volts, since this could result in electric shock. When electrical equipment is in operation, it cannot be avoided that certain parts of this equipment will be under dangerous voltage.

High voltage! Risk of death or severe bodily injury by electric shock!



WARNING

- ⇒ REFUSOL® may only be installed by qualified specialists. Furthermore, the installer must be licensed by responsible power suppliers.
- ⇒ This unit may only be operated, maintained, and/or repaired by personnel trained or qualified for working on or with electrical equipment.
- ⇒ Observe the general construction and safety regulations for working with heavy-current installations.
- ⇒ Before switching on, it must be checked that the power plug is firmly (locked) in place.
- ⇒ The PV generator may only be connected when it is completely de-energized.
- ⇒ The operator must observe all of the above regulations at all times.

Photovoltaic systems have certain special characteristics that present additional dangers!



WARNING

- ⇒ A live power source is connected. The REFUSOL® could therefore be under high voltage from the PV generator, depending on operating status.
- ⇒ Live strings can be under lethal DC voltages.
- ⇒ When disconnecting systems, these high voltages can lead to electric arcs if there is a fault or if fuses are used improperly.
- ⇒ An TN-C/TN-S network system (isolated star point) is required for connecting the central inverter.

1.6 Protection against Magnetic or Electromagnetic Fields during Operation and Assembly

Magnetic and electromagnetic fields exist in the immediate vicinity of power-carrying conductors and can be a serious danger to people with cardiac pacemakers, metallic implants, or hearing aids.

Health risk for persons with cardiac pacemakers, metallic implants, or hearing aids in the immediate vicinity of electrical equipment!



WARNING

- ⇒ People with cardiac pacemakers and metallic implants are forbidden to access the following areas:
 - Areas in which electrical equipment and parts are assembled, operated, or set up.
- ⇒ If a cardiac pacemaker patient must access these areas, a physician must be consulted beforehand. The interference immunity of present or future implanted cardiac pacemakers differs greatly, so that no general rules can be given.
- ⇒ People with metal implants or metal fragments, or persons wearing hearing aids must consult their physicians before accessing such areas, as a risk to their health must be assumed.

1.7 Protection against Touching Hot Parts



CAUTION

Surfaces of the housing can be hot! Risk of injury! Risk of burns!

- ⇒ Do not touch parts of the housing that are close to heat sources! Risk of burns!
- ⇒ Before accessing a unit, leave it to cool for 15 minutes after switching off.

1.8 Setting the Country Code



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 license!

If the REFUSOL[®] is operated with a wrong country code, the electric supply company may cancel the operating license.



Note: We do not assume any liability for an incorrectly set country code! The pertinent regulations of the responsible power supplier must be observed!

1.9 Protection when Handling and Assembling

In unfavorable conditions, handling and assembling certain parts and components in an improper way can cause injuries.

Risk of injury by improper handling! Bodily injury by crushing, shearing, cutting, striking or lifting!



CAUTION

- ⇒ Observe the general construction and safety regulations on handling and assembly.
 - ⇒ The weight of the REFUSOL is 860 kg!
 - ⇒ Use suitable assembly and transport equipment.
 - ⇒ Take appropriate measures to prevent jamming and crushing.
 - ⇒ Only ever use suitable tools. Use special tools if specified.
 - ⇒ Use lifting equipment and tools in the correct manner.
 - ⇒ If necessary, use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
 - ⇒ Do not stand under suspended loads.
 - ⇒ Immediately clean up any spilled liquids to avert the danger of skidding.
-

1.10 Disposal



Note: RoHS-compliant components are used wherever possible in the REFUSOL®. It is recommended to dispose of the unit through a specialized waste management facility.

2 General

Dear Customer,

You have made a good choice in purchasing a REFUSOL[®] solar inverter. In order to guarantee reliable operation, all connections must be made correctly. The information you will need for this is given in the following chapters and in the safety notes.



Figure 1: View of the REFUSOL control cabinet

2.1 Transport

The REFUSOL® consists of a control cabinet in which all components required for its operation are housed. The control cabinet has 4 transport eyelets attached to the roof. Given the considerable weight of the REFUSOL®, it is recommended to use a crane to load and unload it when transporting.

2.2 Storage

Store in a dry place protected against moisture ingress.

2.3 Conditions for Installing



Note: Failure to observe the below conditions might render the warranty invalid.

2.3.1 Environment

- The floor beneath the cabinet must be strong enough to bear the great weight. For weights, see technical data.
- Adherence to the minimum passage widths when installing in electrical operation rooms. See **DIN VDE 0100 Parts 729 and 731**.
- EMC and noise level (take necessary measures as needed).

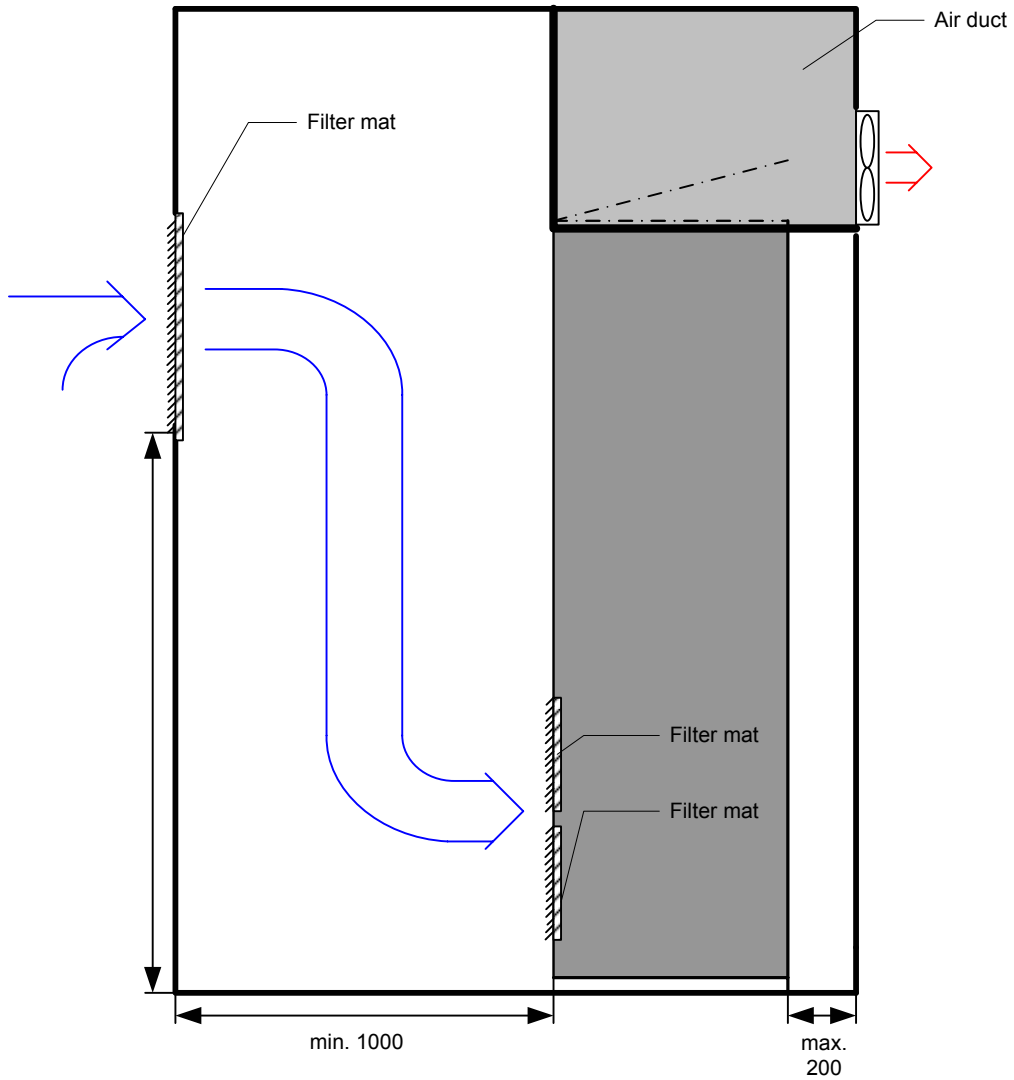
2.3.2 Ventilation / Cooling

The REFUSOL® is cooled by four fans: two in each cabinet door. To ensure sufficient cooling, the below conditions must be met:

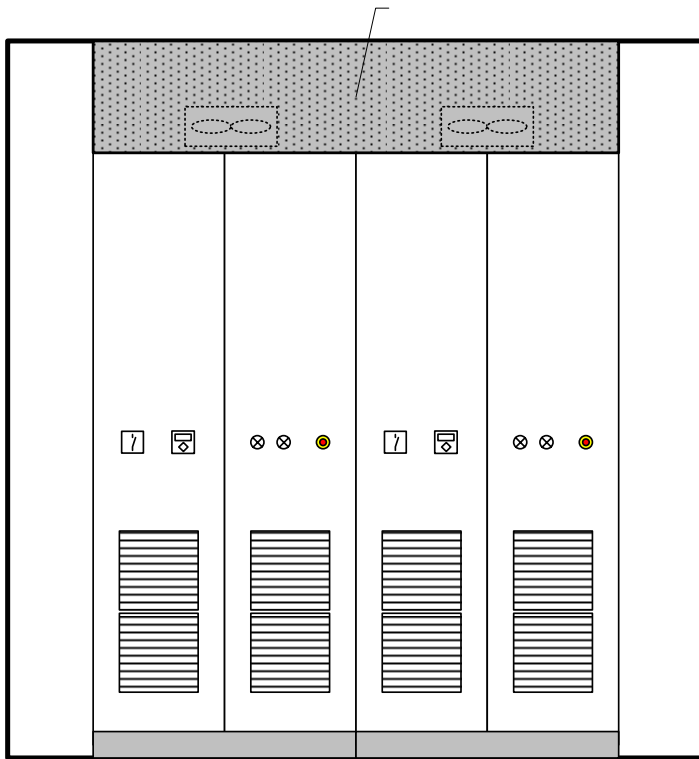
- When delivered in IP21, the cabinet roof of the REFUSOL® must be tilted before commissioning. This is essential since otherwise no sufficient cooling of the components in the control cabinet can be guaranteed.
- Adherence to permitted ambient temperatures by suitable ventilation. For cooling, the unit requires an air flow rate of 2500m³ air / hour (maximum capacity at the output).
- The supplied air must not contain any aggressive or electrically conductive gases or gases that jeopardize system function.
- The doors must be closed during operation.
- The supplied air must be dust-free! In order to protect the interior space of the REFUSOL against contamination, filter mats are installed in front of the door fans, which must be replaced more or less frequently depending on the cleanliness of the supplied air. Unless the filter mats are replaced periodically, they will clog, which might cause overtemperature shutdowns and thus interruptions in operation.
- It is recommended to draw in the air from the north (coldest air), but not at any case from the south or west.
- In accordance with the environmental classification 3K3, moisture condensation or icing must not occur. The relative humidity must range from 5% to 85%.

If the above conditions do not need to be met, please observe the below installation advice:

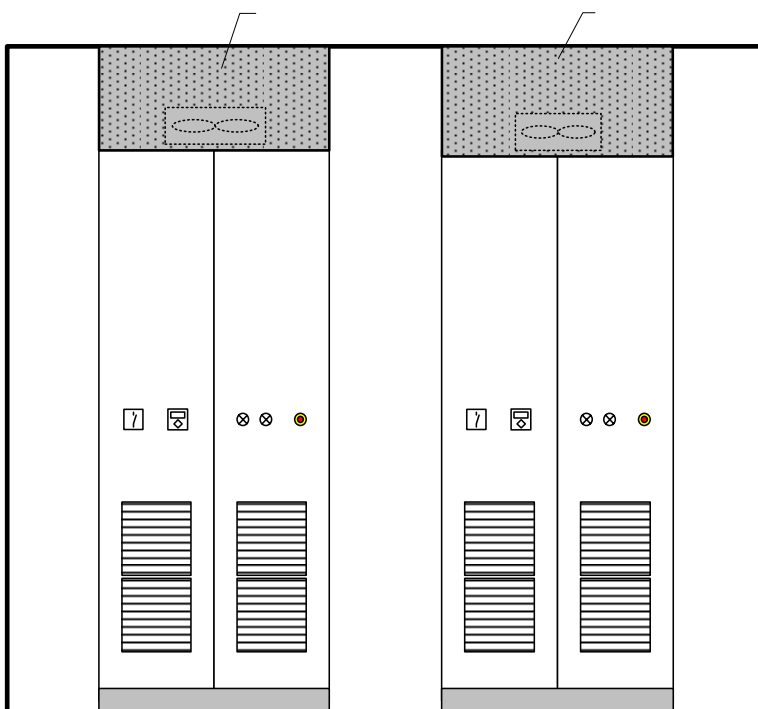
IP24 Housing



Abutting Installation



Spaced Installation



REFUSOL

2.3.3 Tilting the Control Cabinet Roof

In order to guarantee sufficient cooling of the control cabinet components, the roof of the cabinet must be tilted before the system is put into operation. To do this, proceed as follows:

2.3.4 Removing the Transport Eyelets

First remove the four transport eyelets on the control cabinet roof.

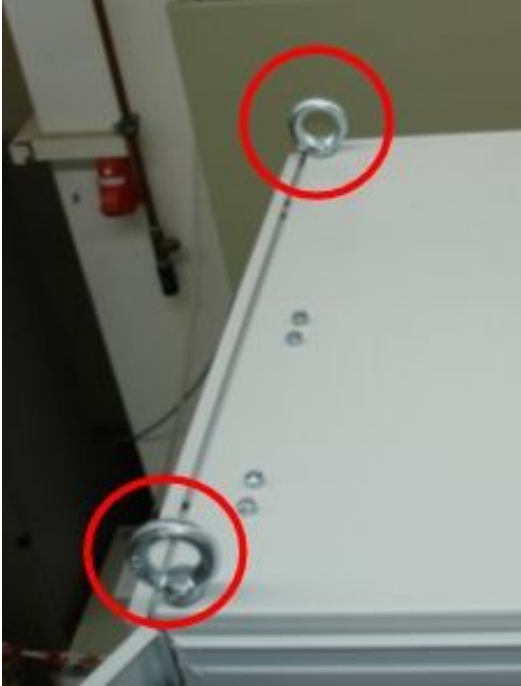


Figure 2: Transport eyelets, left

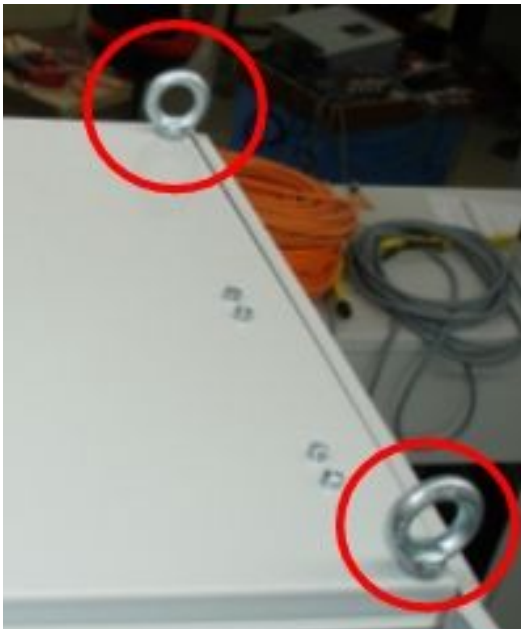


Figure 3: Transport eyelets, right

2.3.5 Loosening the Bracket Bolts

Open the control cabinet doors and loosen the fastening bolts on the roof brackets at the top of the cabinet frame.



Figure 4: Right bracket bolts, roof folded down

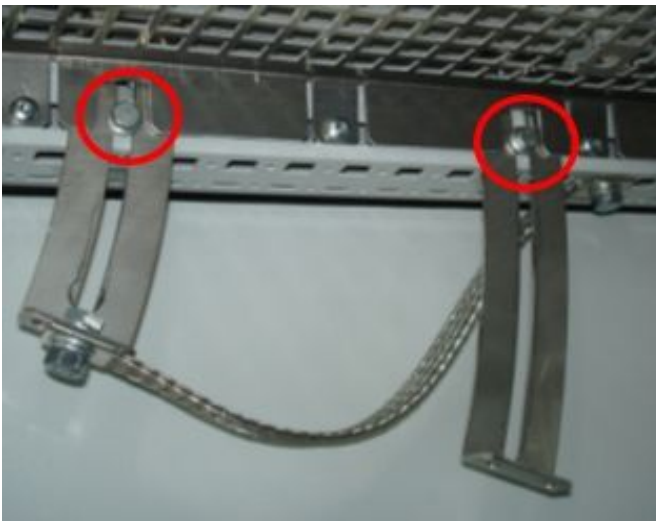


Figure 5: Left bracket bolts, roof folded down

2.3.6 Tilting the Roof

After having loosened the roof bracket fastening bolts, tilt the roof (see figure 6)!



Figure 6: Tilted roof

2.3.7 Tightening the Bracket Bolts

Now tighten the bracket bolts firmly

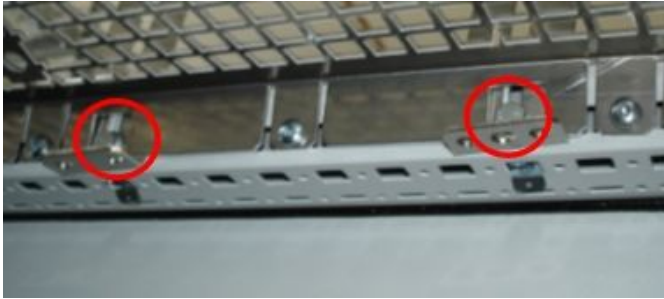


Figure 7: Right bracket bolts, roof tilted up

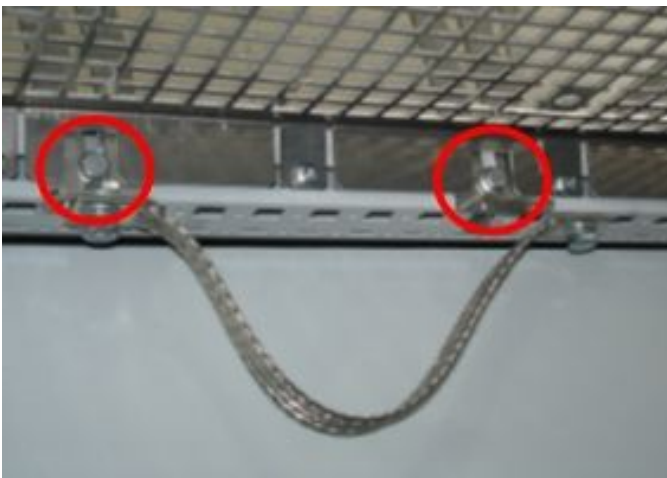


Figure 8: Left bracket bolts, roof tilted up



CAUTION

Risk of injury!

Secure the roof against falling down again!

2.4 PV Generator Requirements

2.4.1 DC Connection to the Solar Inverter

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

Max. DC voltage	850 V
Max. DC current	240 A

2.4.2 Reverse Current Due to Module Defects

Reverse currents are fault currents that only occur in PV systems comprising strings in parallel. 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 defect modules or parts of modules) so far that the intact strings connected in parallel will drive a reverse current through the defect string. In the worst case, this can destroy the string.

The reverse current can also cause secondary damage.

In order to prevent such damage to PV systems, appropriate measures should be taken. There are two different cases:

1. The PV system is designed in a way that the reverse current flowing in an event of fault, which in the worst case consists of the sum of the short-circuit currents of all intact strings, does not lead either to the destruction of the damaged string or to any secondary damage. This depends on the current-carrying capacity of the system components (connectors, lines) and the reverse current resistance of the modules. These can be seen from the manufacturer's data sheet! In this case, no further measures are necessary.
2. The PV system is designed in a way that the reverse current occurring in an event of fault exceeds the destruction limit. In this case, each string must individually be protected by a serially connected string fuse. In the event of fault, the string will then be isolated from the intact strings, thus preventing their destruction.

3 Description of the Unit

The REFUSOL[®] consists of a control cabinet in which all components required for function and safety are installed. That means the only work required for installation is to connect the mains feeder, the auxiliary power and the PV generator.

The following section describes the components of the AC inverter and DC part contained in the cabinet.

The AC part contains a 4-pin circuit breaker that trips upon thermal overcurrent or short-circuit. This circuit breaker can be manually tripped by an operator from outside the closed cabinet. Remote disconnection is possible through an external floating contact. The AC part also houses the mains-side surge protector, the EMC filter, mains disconnection contactor, and galvanic isolation in the form of a 3-phase AC isolation transformer.

The inverter consists of a modular power circuit and a control unit.

The DC part contains the precharge circuit and two motor-driven DC isolating switches for the DC positive and DC negative lines. This is triggered upon thermal overcurrent or short-circuit. Two indicator lamps in the cabinet door indicate when the PV generator is connected and the REFUSOL[®] is feeding into the mains. The DC positive and negative line are internally connected to PE over an isolation measuring unit, which triggers a fault in the case of a DC-side ground connection.

The graphic display built into the cabinet door, with an 8-key control pad, lets you display various data such as feed-in curves, giving you outstanding ease of operation and navigation.

3.1 Control Terminal Strip Functions

The following control terminal strip functions are provided for the operator's use. The control terminal strip assignment is shown in the connection diagram.

- Remote stop circuit breaker / mains disconnection
- Feedback contact for mains circuit breaker
- Operator enabling of solar generator connection
- Operator enabling of mains feed-in
- "Fault" feedback
- Fault acknowledgement

3.2 Monitoring Involving Interruption of Mains Feed-In

If any of the following faults occur, then the fault must be acknowledged as described in Chapter 6.3.1

- System voltage not OK
- Under/overvoltage
- Under/overfrequency
- Island formation
- DC voltage too high
- Cooler temperature too high
- Fault in power circuit inverter
- Ground fault in PV generator

3.3 Block Diagram

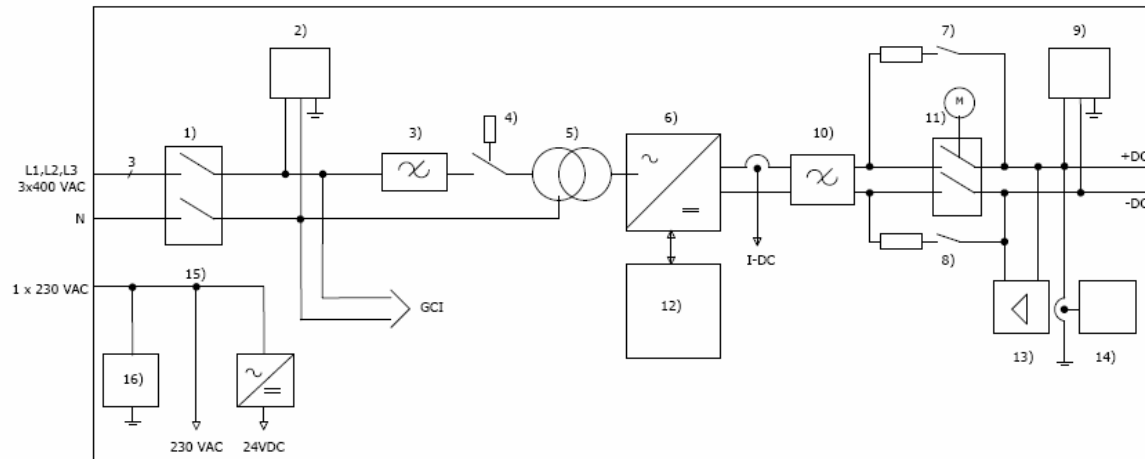


Figure 9: Block diagram of REFUSOL®

- 1) Circuit-breaker (-Q10)
- 2) Lightning protection (-F10)
- 3) EMV – mains filter (-V10)
- 4) Supply disconnection contactor (-Q11)
- 5) Three-phase transformer (-T10)
- 6) Inverter (-T20)
- 7) Contactor (-Q22)
- 8) Contactor (-Q23)
- 9) Overload protection (-F20)
- 10) EMV – DC-Filter (-V20)
- 11) Circuit-breaker with motordrive (-Q20)
- 12) Inverter controller (-T20)
- 13) DC – Voltage metering
- 14) Insulation measuring (-A21)
- 15) Auxiliary supply
- 16) Overvoltage protection (-F15)

4 Electrical Connection

4.1 Warning and Notices



DANGER

Fatal electric shock from live parts under more than 50 V!

- ⇒ REFUSOL[®] units operate at high voltages. They may only be worked on when completely de-energized!
- ⇒ They may only be worked on by qualified personnel!
- ⇒ Failure to observe this safety warning can lead to death, severe bodily injury or considerable damages.
- ⇒ The DC bus capacitors remain under dangerously high voltage even when the power has been disconnected.

They take more than 5 minutes to discharge!

Accordingly, it is only permitted to work on the unit or DC bus terminals after the appropriate waiting period, and only when it has been verified that the system is completely de-energized.

- ⇒ When working on the open unit, keep in mind that some parts are still live.
- ⇒ The operator is responsible for all units to be installed and connected in accordance with the recognized technical regulations of the country it is installed in, and other regional regulations. Cable dimensions, fuses, grounding, shutdown, isolation and overload protection must be given special attention.



CAUTION

Damage to units because of incorrect connection!

Strictly observe the type plate and the mains power rating specified in the technical data when connecting.



CAUTION

Damage to the unit due to excessive DC current!

The DC current must never exceed 240 A under any circumstances, otherwise the unit could be severely damaged.

4.2 Overview of the OPEN Control Cabinet

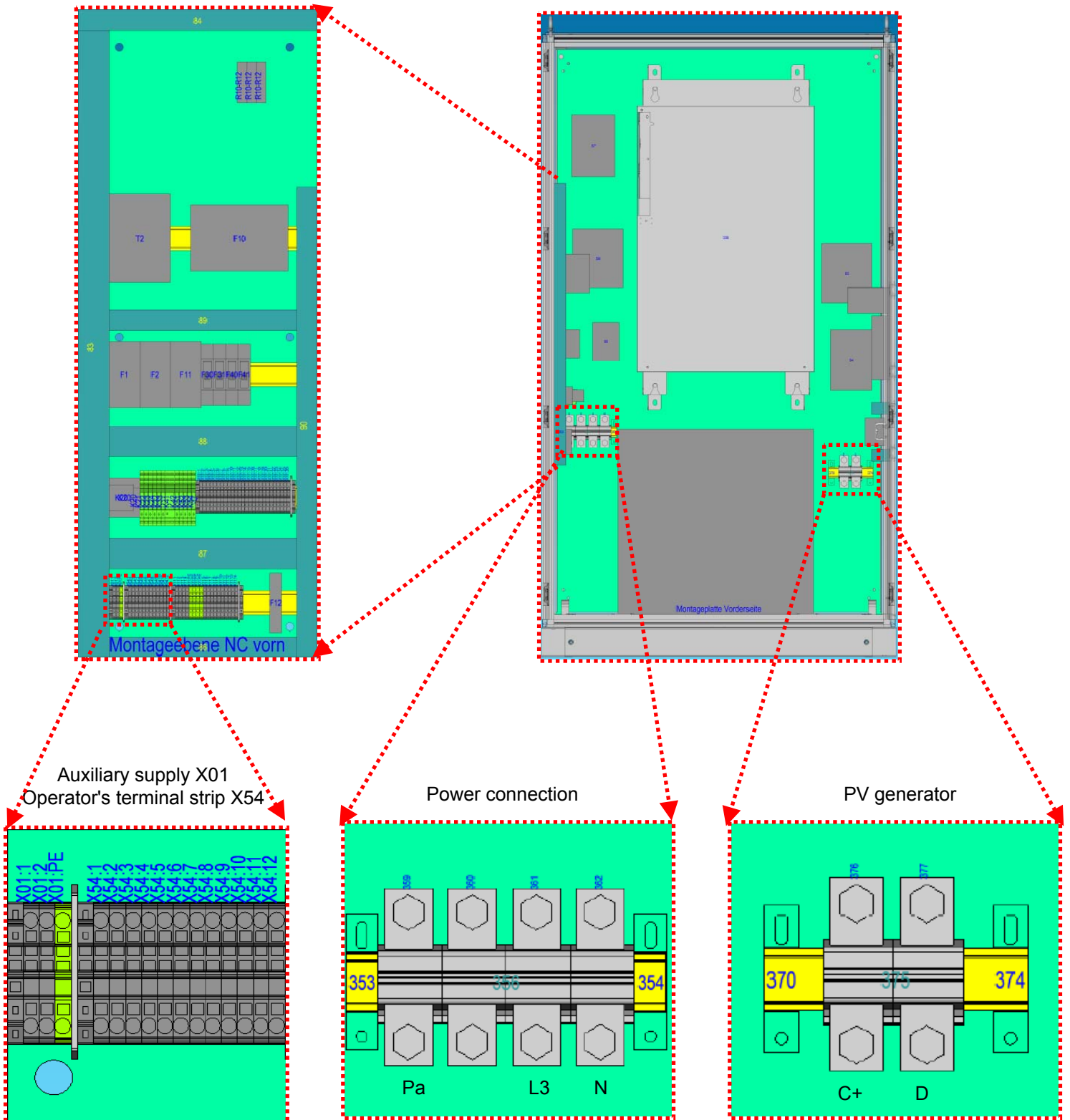


Figure 10: Overview of the REFUSOL® connections

4.3 Line Cross-Sections

Connection point	Minimum cross-section	Connectable cross section
Auxiliary supply X01 and operator's terminal strip X54	⁽²⁾ 1.5 mm ² (rigid) ⁽²⁾ 0.75 mm ² (flexible)	4 mm ² (rigid) 2.5 mm ² (flexible)
Power connection	⁽²⁾ 70 mm ²	95 mm ²
PV generator	⁽²⁾ 95 mm ²	⁽¹⁾ 2 x 150 mm ²

⁽¹⁾: The DC current must be limited by the operator to 240 A:



CAUTION

Damage to the unit due to excessive DC current!
The DC current must never exceed 240 A under any circumstances, otherwise the unit could be severely damaged.

⁽²⁾: The specified line cross-sections apply only to a specific laying system. As a result, the following must be checked in every individual case:

- Line laying system
- Desired efficiency
- Maximum voltage load; this can be taken from the technical data on the REFUSOL.
- Maximum current load; this can be taken from the technical data on the REFUSOL.

In addition, the following standards always apply:

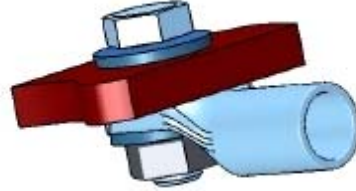
- DIN VDE 0298-4
- DIN VDE 0100; Part 430
- DIN VDE 0100; Part 410

4.4 Power connection

The mains power is attached to terminal block X01; the position of the terminal block is shown in Figure 10:. The following connection order must be strictly followed.

Connection order:

- Bolt M12 x 30
- Spring washer
- Terminal bar
- Cable eye for feed line
- Spring washer
- Nut



Caution: It is not permitted to re-use spring washers!

4.5 PE Connection

The PE connection is made on the copper rail in the bottom of the control cabinet using an M10 bolt, two spring washers and a nut, which must be connected in the order described above for the terminal block.

Connection order: See "Power connection"

4.6 Auxiliary Power Supply

This is connected to the **terminal block X01**. The auxiliary power supply 1AC 230 V, 990 W and a pre-fuse, 10Agl must be provided by the operator.

X01.1	Life conductor (L)
X01.2	Neutral conductor (N)
X01.3	PE conductor

The position of the terminal block is shown in Figure 10:.A surge arrester is integrated into the control cabinet.



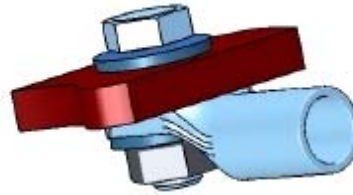
Note: It is not recommended to disconnect the auxiliary power supply at night as this also operates the motor-driven DC isolating switch and the line contactor resulting in a reduced service life.

4.7 PV generator

The PV generator is attached to terminal block X02; the position of the terminal block is shown in Figure 3. The following connection order must be strictly followed.

Connection order:

- Bolt M10 x 30
- Spring washer
- Terminal bar
- Cable eye for feed line
- Spring washer
- Nut



Caution: It is not permitted to re-use spring washers!
The DC connection lines must be designed for a maximum system voltage of 1000V!



The EMERGENCY STOP button must be pressed before opening the control cabinet doors. That opens DC circuit breakers Q20 and Q21, and isolates the PV generator from the REFUSOL.

CAUTION

4.8 DC-Grounding: Preface



Note: Some PV-module manufacturers specify for certain modules the grounding of a DC-plus or negative terminal!

REFUSOL100K feeds the obtained energy through an isolation transformer into the public network.

The internal voltage levels of the REFUSOL100K are not grounded.

The inverter voltage corresponds to the AC side of the IT network and a one-sided grounding of the DC voltage level (intermediate circuit) is allowed.

4.9 DC-Grounding

The grounding must be connected at the plus or minus pole of the PV generator connection and the PE busbar of the REFUSOL100K.

The ground connection between the PV generator connection and PE busbar have to be secured with a high performance DC-breaker (max. 3.8A)!!

The auxiliary contact of the grounding pole reports a grounding defect.

A ground leak cannot be successfully detected through the DC grounding circuit breaker. There is the possibility that during operation via power-sharing through the DC cable from the grounded pole and earth nevertheless be released.



WARNING

The insulation condition of the PV generator is tested at regular maintenance intervals!

Should the circuit breaker disconnect the REFUSOL100K will shut down automatically. The display shows the following message "ENS error".



WARNING

An insulation failure has to be rectified immediately and the circuit-breaker turned back on!

Detailed information can be found under www.refu-elektronik.de

4.10 Control and Communication

The connections for control and communication are made directly on the SR2700B control unit over the corresponding plugs.

Plan of Terminals SR2700B

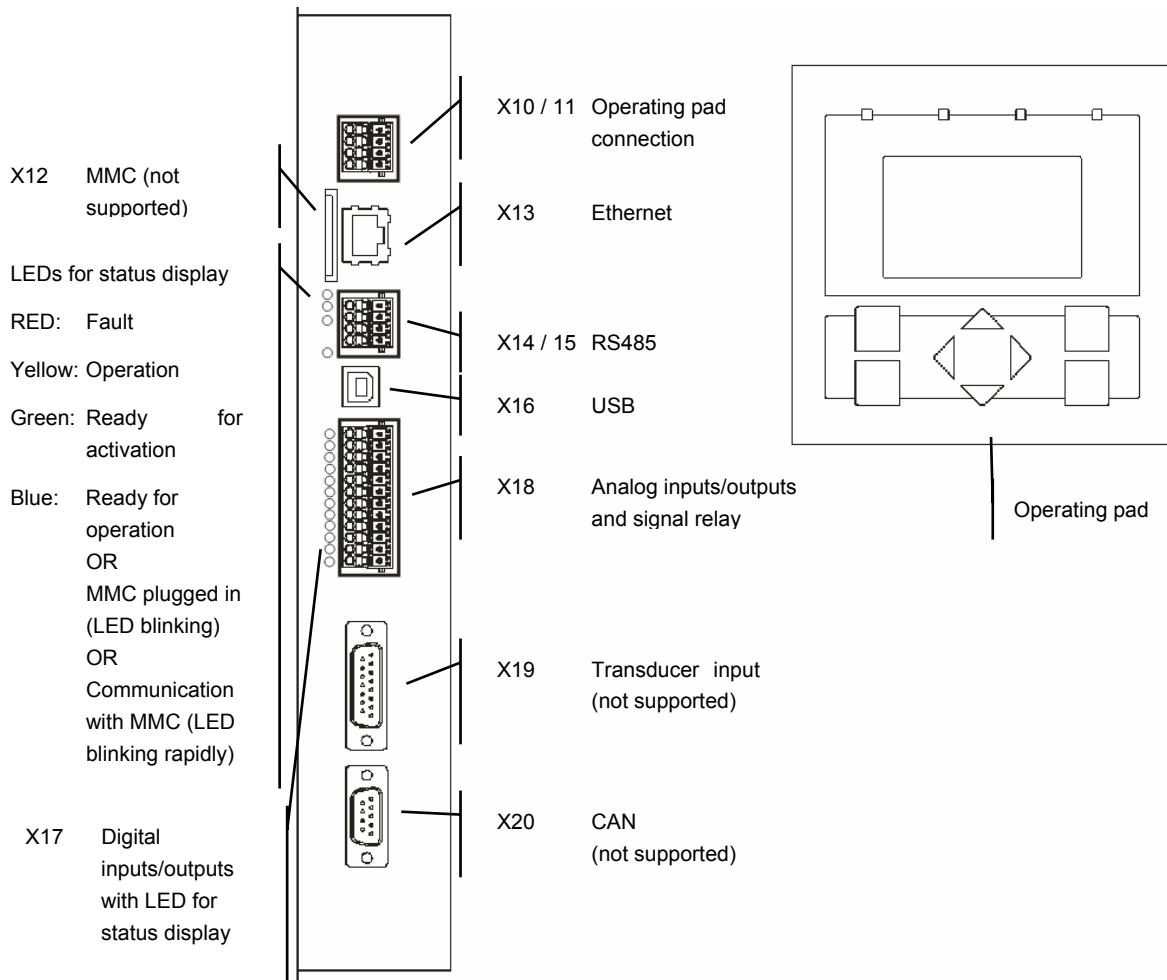


Figure 11: Overview of the SR2700B connections

Description of Data Interfaces

Operating pad connection			
Terminal		Designation	Comment
X10	X11		
	1	+5V output	Isolated!
	2	RS485+ IN	Fixed setting!
	3	RS485- IN	Baud rate: 115.2 kBaud
	4	GND	Parity: Even
1		Bus termination+	Stop bits: 1
2		RS485+ OUT	Data bits: 8
3		RS485- OUT	Protocol: USS, 4/6 words
4		Bus termination-	Address: 0

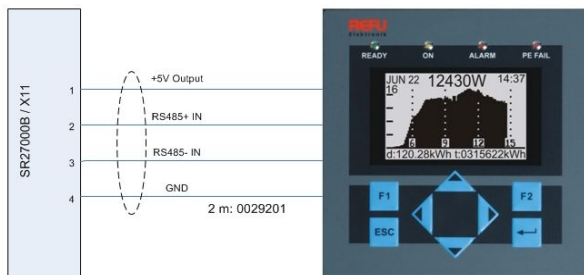


Figure 12: Operating pad connection

Ethernet, interface for REFULOCK®		
Terminal	Designation	Comment
X13	Standard connection	RJ45 plug, isolated



Note: The Ethernet interface is protected against external overvoltages. This is done directly on the adaptor of the surge protector (-F12). -F12 is installed on the left control level of the control cabinet!

Please use an Ethernet cable with S/FTP design (screened foiled twisted pair).

RS485; interface for external monitoring			
Terminal		Designation	Comment
X14	X15		
	1	-	Isolated!
	2	RS485+ IN	Fixed setting!
	3	RS485- IN	Baud rate: 115.2 kBaud
	4	IN reference	Parity: Even
1		Bus termination+	Stop bits: 1
2		RS485+ OUT	Data bits: 8
3		RS485- OUT	Protocol: USS, 4/6 words
4		Bus termination-	Address: 0

The RS485 interface supports the USS protocol (universal serial interface protocol), which can be used for transmission of data, e.g. to a data logger of a remote monitoring system.

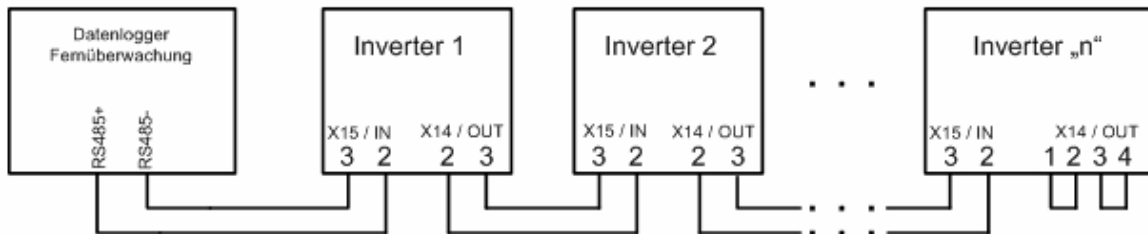



Figure 13: Connection of the standard interface

For operation of this interface ensure that the same interface configuration is set for every bus user.

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

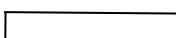



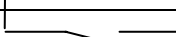
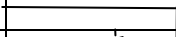
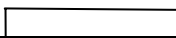

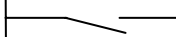



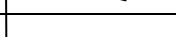
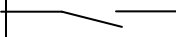
USB; connection of operating interface → Service interface!			
Terminal		Designation	Comment
X16		Standard connection USB	USB plug, isolated! Fixed setting! Baud rate: 115.2 kBaud Parity: Even Stop bits: 1 Data bits: 8 Protocol: USS, 4/6 words Plug: USB Device (B)

Digital/Analog IO				
Terminal		Designation	Function	Comment
X17	X18			
1		Digital Input 1	SZS	Digital inputs/outputs with isolation Level according to EN61131 Type 2 (SPS compatible) Digital outputs can drive max. 20 mA The line of LEDs indicate the status of the inputs/outputs
2		Digital Input 2	Malfunction	
3		Digital Input 3	Transformer temperature OK	
4		Digital Input 4	Enable solar generator	
5		Digital input 5	Enable power supply	
6		Digital input 6	Malfunction reset	
7		Digital input 7	Lightning protection OK	
8		Digital input 8	Insulation switching off	
9		Digital output 9	Malfunction message	
10		Digital output 10	Q10 off	
11		Digital output 11	K20 on	
12		Digital output 12	Ventilator E11,12 on	
	1	P24V output	-	Load capacity max. 100 mA
	2	Relay NO contact	Start insulation switching	Load capacity: AC/DC: 24V (+10%) / 1.5A Floating
	3	Relay contact root		
	4	Relay NC contact		
	5	Ground P24V	Free	
	6	Difference analog input 1	Free	Voltage input -10...+10 V, Resolution A/D converter ±11 bit
	7			
	8	Difference analog input 2	Free	Voltage input -10...+10 V, Resolution A/D converter ±11 bit
	9			
	10	Analog output 1	Free	0...+10 V Resolution D/A converter 10 bit
	11	Analog output 2	Free	Only a differential input may be used as evaluating input that evaluates the signal between X18.10/.11 and X18.12.
	12	Analog output reference	-	

CAN bus; currently not functional!		
Terminal	Designation	Comment
X20	CAN bus	CAN-OPEN protocol

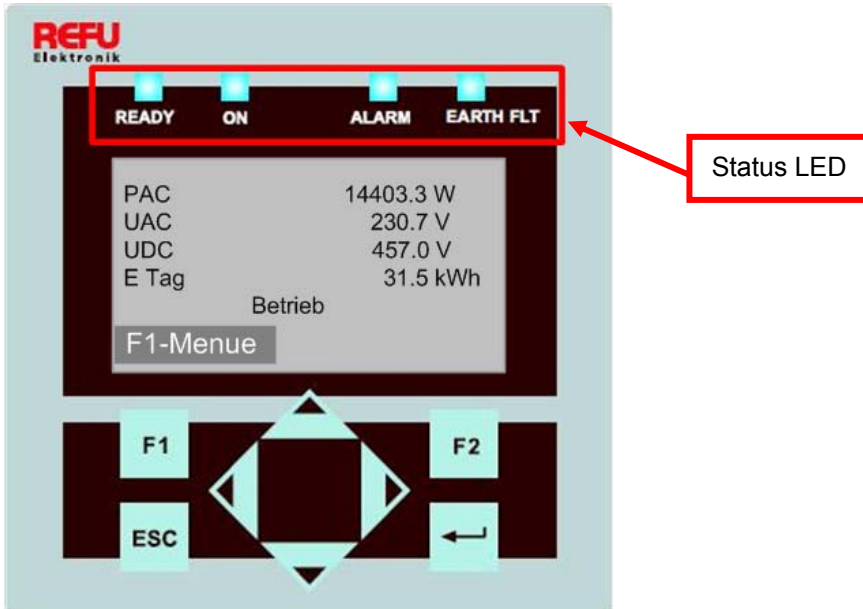
4.11 Operator's Terminal Strip X54

The following control terminal bar functions are available to the operator:

External signal	Default setting	X54	REFUSOL function description	Internal signal
		1	+24 V DC supply	
		2		
		3	Mains disconnection with Q10	24 VDC / 3 A
		4	0 V DC supply	
Max. 240 VAC / 1 A		5	+24 V DC supply	
		6		
		7	Main switch Q10 On	
		8	+24 V DC supply	
		9	Enable solar generator	<50 mA
		10	Enable mains feed-in	<50 mA
		11	Acknowledge inverter fault	<50 mA
Relay coil		12	Inverter fault message (24 VDC/100 mA)	

4.12 Operating pad

The integrated 128x64 pixel graphic display on the front displays the course of interesting data such as feed power. The required parameters can be selected and entered via the 8-key operating pad. The operating pad lights up when the first key is pressed and turns dark again after 5 minutes.



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.

4.13 Internal Data Logger

The REFUSOL[®] 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

5 Putting into Operation

5.1 Preconditions

In order to commission the REFUSOL properly and safely, the below requirements must be met.

Before connecting the power supply and PV generator, the following must be verified:

- All connections were made according to the connection diagram.
- The ground wire for the mains feed-in and auxiliary power supply must be connected.
- The mains feed-in has a clockwise rotating field.
- The correct polarity at the PV generator connection is verified.
- An insulation test of the PV generator has verified there is no ground fault.
- Check that all connection lines are firmly locked into place.
- All necessary protective covers are in place.

5.2 Switching On

- Make sure that mains voltage is present at the unit. This can be achieved by installing the external mains fuse or switching on the circuit breaker.
- Then switch the DC isolating switch on the REFUSOL to ON.

Provided that the solar modules are exposed to sufficient sunlight and that there are no errors or failures, the device undergoes the following sequence of operations which you can follow on the display of the operating pad:

- Self-test:
 - ⇒ All status LEDs are lit for approx. 6 seconds
- The initialization cycle starts:
 - ⇒ Ready status LED flashes
 - Display:
 - ⇒ PAC Feed power in watts (W)
 - ⇒ UAC Line voltage in volts (V)
 - ⇒ UDC Solar cell voltage in volts (V)
 - ⇒ State Initializing



Figure 14: Initializing display

- Initializing has been completed

- ⇒ “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



Figure 15: Device activation display

- Power-up starts if the solar cell voltage is >350 volts
 - ⇒ “READY” status LED is lit, “ON” status LED flashes
- Display:
 - ⇒ On
 - ⇒ UDC Solar cell voltage in volts (V)
 - ⇒ Activating
 - ⇒ This process can take up to one hour if the device is commissioned; during normal operation, it takes up to 3 minutes.
- Feed mode:
 - ⇒ “On” status LED emits steady light, “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)
 - ⇒ E TAG Yield of the day in kWh
- Check time:
 - If the electronic system has been disconnected from the supply voltage for a longer period (approx. 2-3 weeks), incorrect time setting is possible. For this reason, it is necessary to check and, if required, to reset the time as follows, before switching on:
 - Press F1 key to open menu.
 - Use ▼ arrow key to select “set time” menu item.
 - Use ▲▼ arrow keys for successive setting of day, month, year, hour, minute, and second.
 - Press ↵ key to confirm.

5.3 Navigation via the Operating Pad

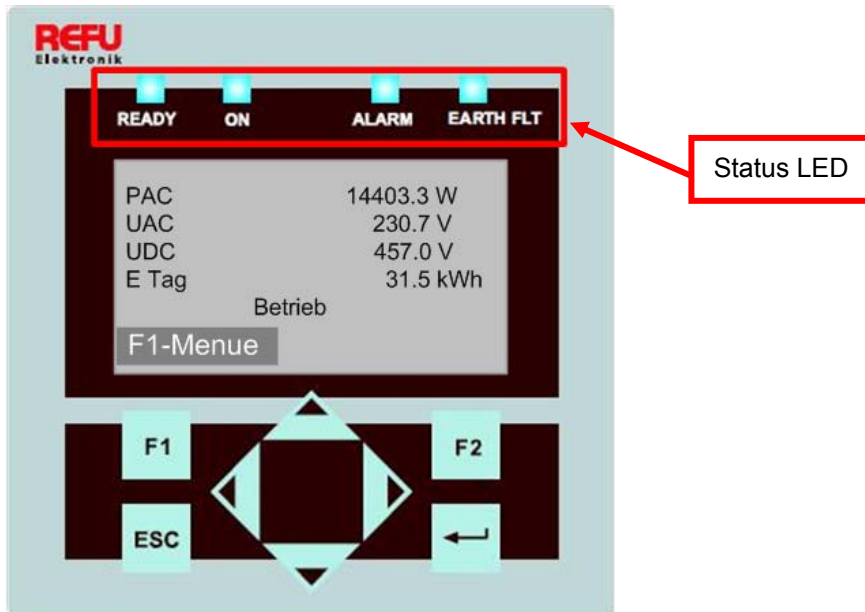


Figure 16: Navigation display

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

Basic screen display

PAC	14493 W
UAC	230.9 V
UDC	458 V
y day	31.5 kWh
Operation	
F1-Menue	

Figure 17: Operating mode display

PAC = Present feed power

UAC = Line voltage

UDC = Solar cell voltage in volts (V)

E TAG = Yield of the day in kWh

Graphic display

Press the ◀ arrow key once to display the course of the feed power of the day.

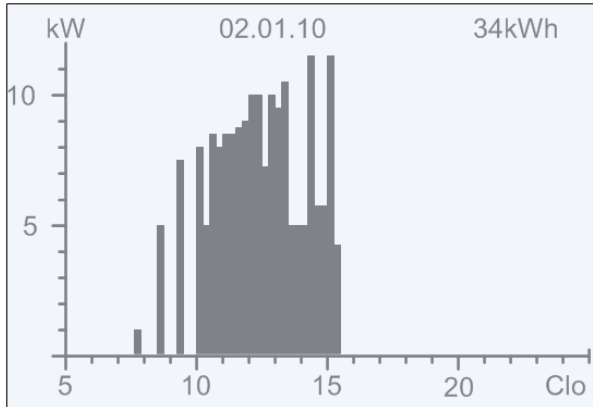


Figure 18: Feed power display "Today"

Press the ▼ arrow key to display the course of the feed power of the previous days.

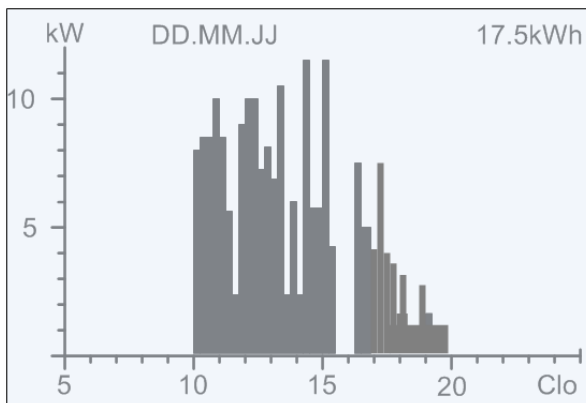


Figure 19: Feed power display "Yesterday"

Press the ESC key to return to the basic screen.

Yield data display

Press the ► arrow key once to display the absolute yield data and the operating hours accrued so far.

```
Yield absolute
Day:          36.2 kWh
Month:       864.2 kWh
Year:        956.6 kWh
Total:       956.6 kWh
Oper. hr:    313.1 h
F1-Menue
```

Figure 20: Yield data display

Standardized yield data display

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

```
Yield normalized
Day:          36.2 kWh
Month:       864.2 kWh
Year:        956.6 kWh
Total:       956.6 kWh
Oper. hr:    313.1 h
F1-Menue      F2-Edit
```

Figure 21: Standardized yield data display

Press the ESC key to return to the basic screen.

Input for standardized data

To obtain the standardized yield data, press the F2 key and enter the connected PV generator power 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.

```
P1155.00
System size
      4.0
      kWp
F1-Menue
```

Figure 22: Standardized data input display

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

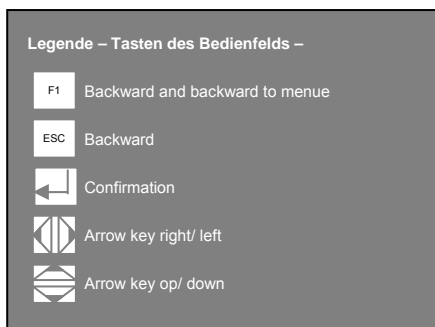
Press the F1 key to display the menu.

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

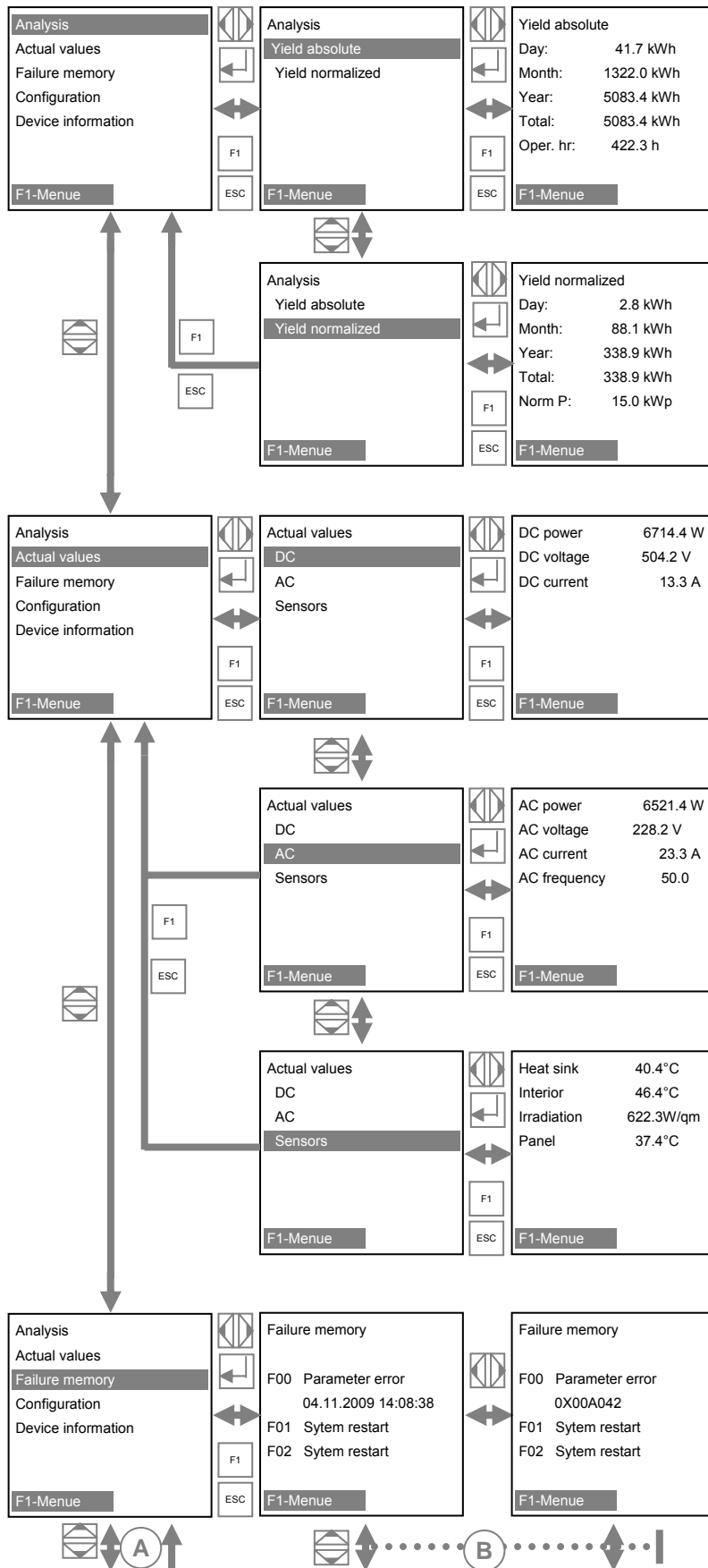
5.4 Menu Structure

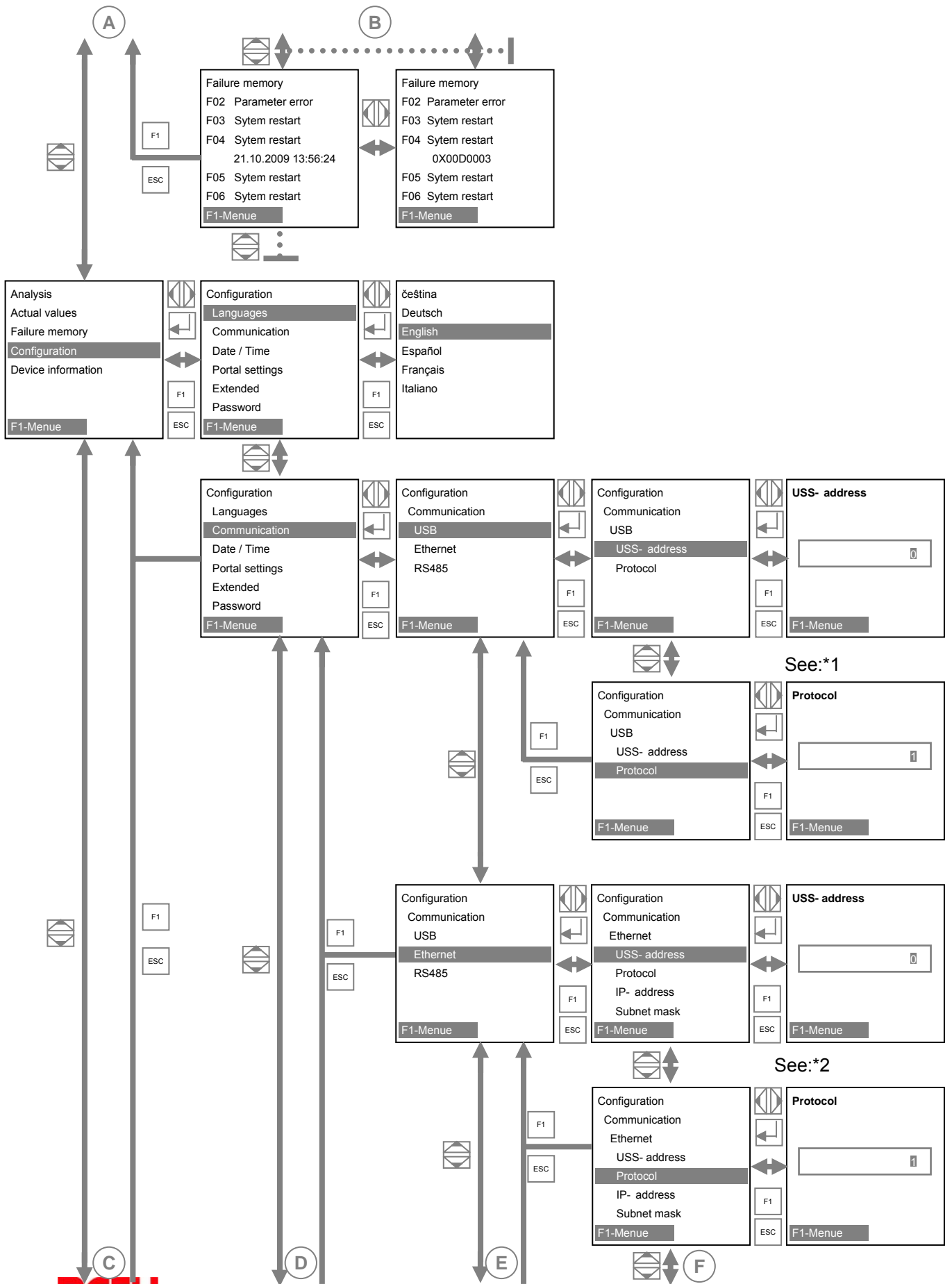
The menu structure serves as a support to change to the individual information displays and setting displays.

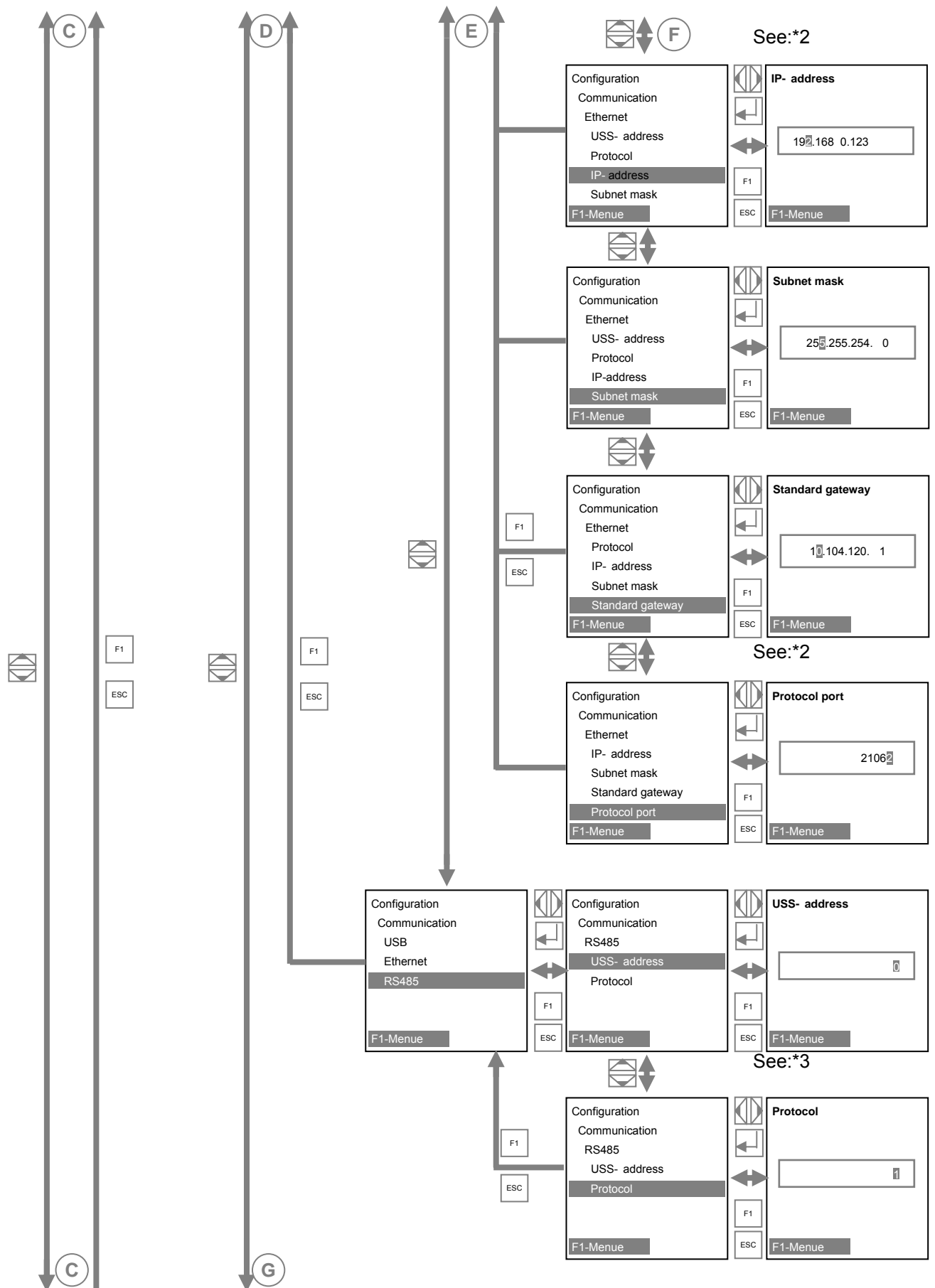
Legend:

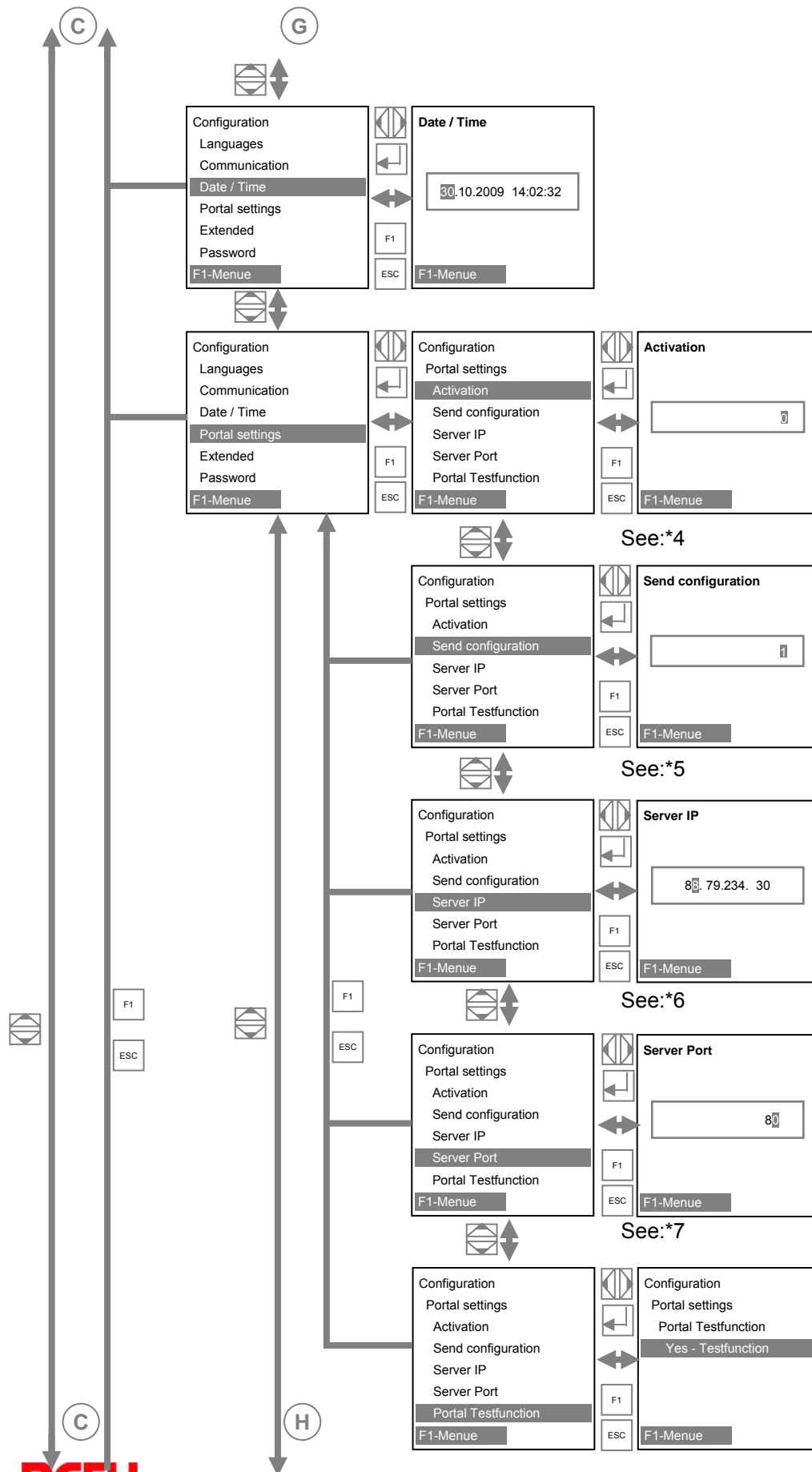


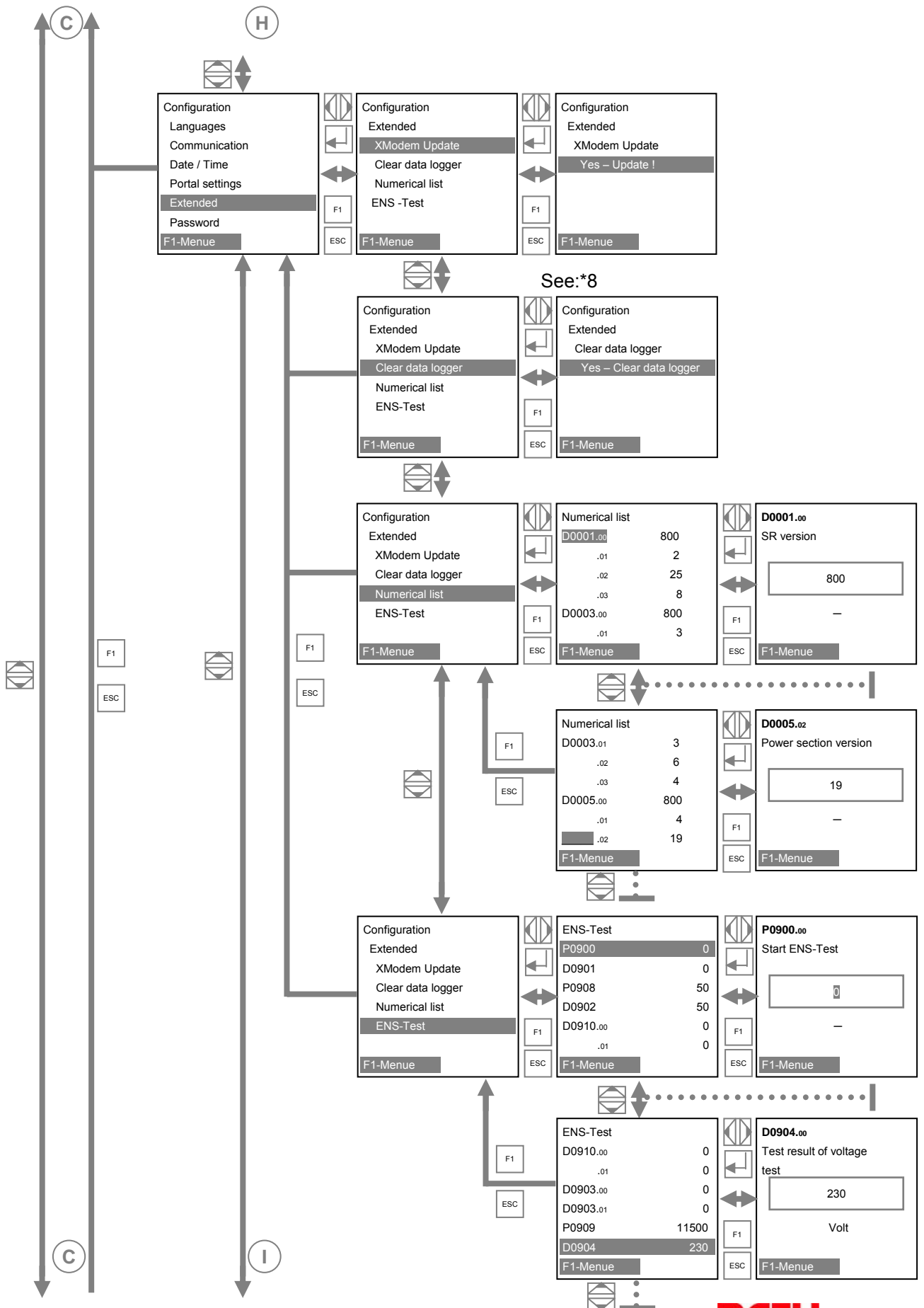
Display functionality

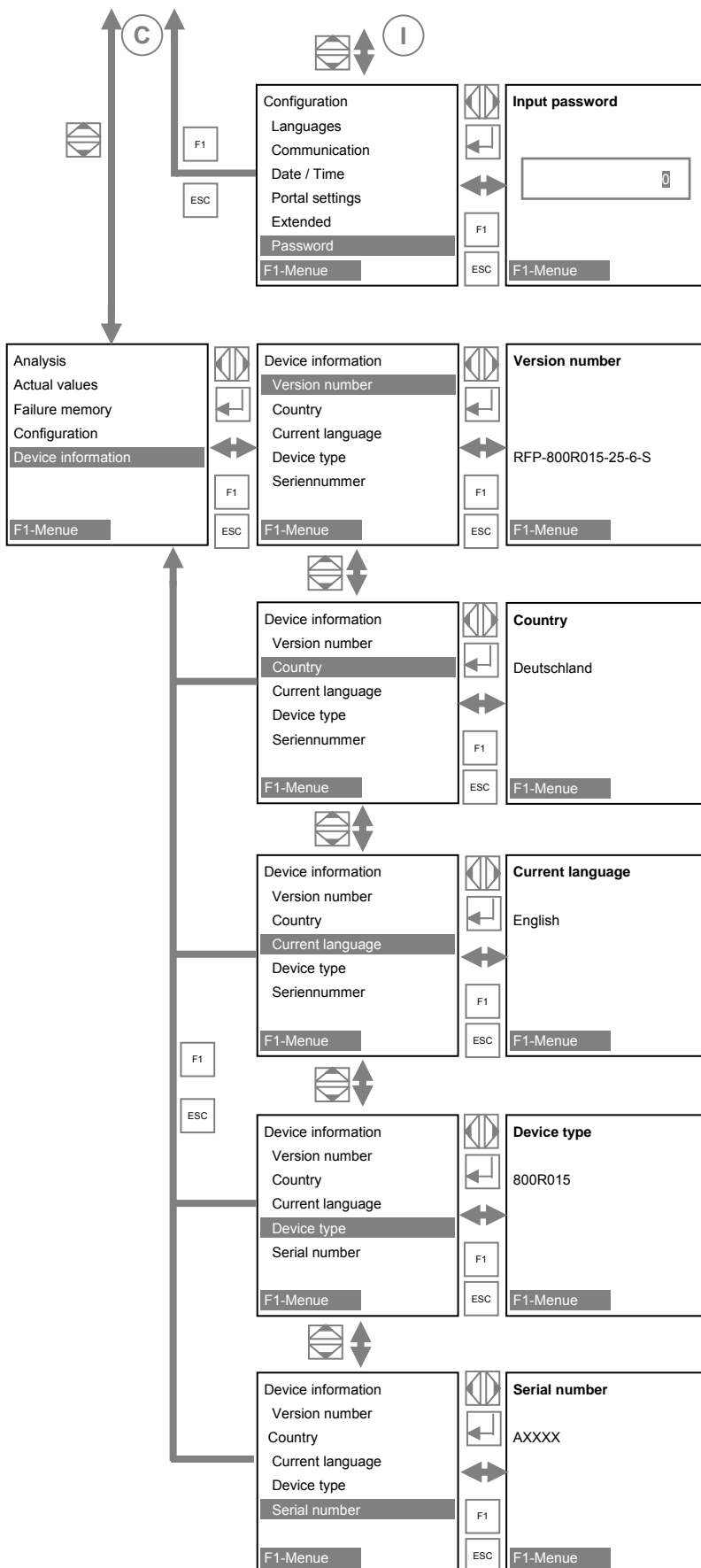












Detailed explanations

***1. Communication via USB**

USS address:

Input 1 – 31

This address is required for communicating with REFUSOL[®] via USB.

Note:

If you change this parameter (address) and wish to save it, you must restart REFUSOL[®]! The new address will only be active thereafter.

Protocol:

Input 1

USS and RPC protocol

***2. 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.

***3. Communication via RS485**

USS address:

Input 1 – 31

This address is required for communicating with REFUSOL[®] via RS485.

Note

If you change this parameter (address) and wish to save it, you must restart REFUSOL[®]! The new address will only be active thereafter.

Protocol polling via Ethernet:

Input 1, 2 and 3

1: USS and RTP protocol

2: Solar data systems (old SolarLog[®] firmware)

3: MeteoControl[®]

***4. Portal monitoring**

Activation:

Input 0 or 1

Parameter Off / On

***5. Sending Config**

Input 0 or 1

0 = no Config data in the waiting queue

1 = Config is sent.

***6. Server IP**

Display of the IP address

***7. Server port**

Display of the port number of the web server.

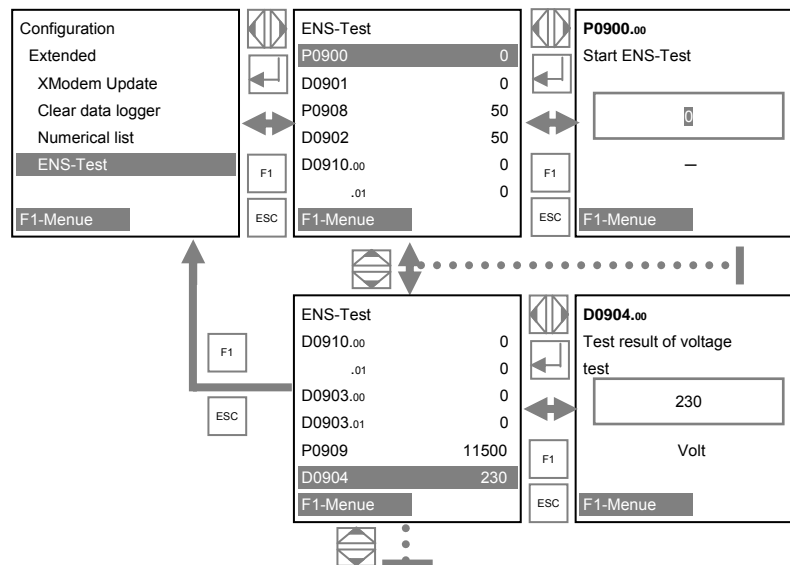
***8. Portal test function**

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.

ENS Test

Note: If the ENS test is carried out while the device is disconnected from power supply, there will be no result. First restart the device.

Carrying out the ENS Test:

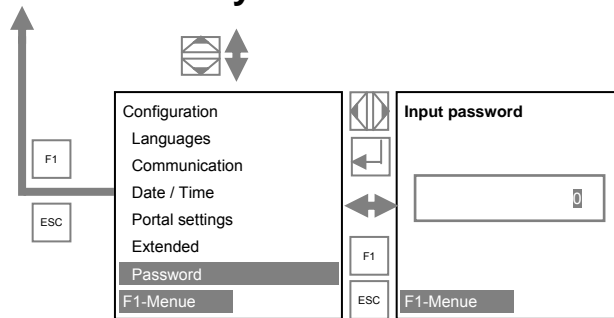
- Set P0900 to "1" → starts the ENS test
- P0901 shows the progress of the ENS test
- P0908 informs about the frequency ramp (in mHz/s)
- P0902 shows the development of the simulated frequency
- P0910.00 shows the time measured until the lower frequency limit is reached

- P0910.01 shows the time measured until the upper frequency limit is reached
- P0903.00 shows the frequency value having caused turnoff at the lower limit
- P0903.01 shows the frequency value having caused turnoff at the upper limit
- P0909 informs about the voltage ramp (in mV/s)
- P0904 shows the development of the simulated voltage
- P0910.02 shows the time measured until the lower voltage limit is reached
- P0910.03 shows the time measured until the upper voltage limit is reached
- P0905.00 shows the voltage value having caused turnoff at the lower limit
- P0905.01 shows the voltage value having caused turnoff at the upper limit

ENS test status list:

- | | |
|-----------|---|
| 0 | Initializing / ready for start |
| 1 ... 3 | Frequency test at the lower frequency limit |
| 4 ... 6 | Frequency test at the upper frequency limit |
| 7 ... 9 | Voltage test at the lower voltage limit |
| 10 ... 12 | Voltage test at the upper voltage limit |
| 13 | ENS Test completed |

5.5 Password Entry



Please enter in the following order
7 (5.) 2 (4.) 5 (3.) 5 (2.) 5 (1.)

The customer password is: 72555

6 Troubleshooting

All work on the REFUSOL[®] may only be performed when it is completely de-energized, i.e.

- The REFUSOL[®] must be definitely and safely isolated from the PV generator. To achieve this, press the EMERGENCY STOP button; this will open DC circuit breakers Q20 and Q21 and isolate the PV generator from the REFUSOL[®].
- The system voltage and the auxiliary power supply must be definitely and safely disconnected.
- It must be secured against reconnection and verified that it is completely de-energized.
- This work may only be performed by qualified personnel who are familiar with the operation of the system.

6.1 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.

6.2 Warnings

When certain errors occur, the inverter goes temporarily offline.

As opposed to the case with faults, the warning is automatically acknowledged by the inverter and a new attempt is made to start up if the error no longer exists.

Warnings are signaled by a blinking red LED, and are stored in the fault memory, where they will remain even in the event of a power failure. See the Faults section.

6.3 Faults

Permanently programmed and parameterizable limit values are continuously monitored during ongoing operation. In order to be protected, the REFUSOL[®] power section is isolated from voltage supply if a limit value is exceeded or if a failure occurs. However, the DC-i and AC voltages may still be available. The corresponding fault message appears in the display. The fault is indicated on the front of the unit (operating pad) by the red "Alarm" LED.

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 over 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. All older faults are then shifted one memory location along. When this happens, any fault already at memory location S100 will be lost.

6.4 Fault Acknowledgement

After a shutdown due to a fault, the unit 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. Once the cause of the fault has been eliminated, the fault can be acknowledged as follows.

The signals:

- Enable PV generator connection
- Enable mains feed-in connection

must be taken from the operator's terminal strip. Then, the fault acknowledgement must also be done over the operator's terminal strip.

NOTE: to acknowledge a fault, the signal status must change from 0 to 1.

Once the signals:

- Enable PV generator connection
- Enable mains feed-in connection

are reapplied, the REFUSOL[®] recommences automatic mains feed-in.

6.5 List of Fault Messages

Error code	Error message	Description	Action
000000	Error management	Although there is no error, the device is in the "fault" state	Please restart the system.
030002	Parameter error 1	Invalid parameter file; a valid parameter file could not be found	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
030005	Parameter error 2	No parameter file; a parameter file could not be found.	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
030006	Parameter error 3	Old parameter file; the existing parameter file is outdated.	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
040001	Internal communication	WS is disconnected	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
040010	System error 1	TaskCrashError; a time overflow has occurred in an internal program module	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
050000	System error 2	Error during initialization; Initialization of the device was unsuccessful	1. Please restart the system. 2. If this error occurs repeatedly, please notify the Service.
060001	Wrong time	The time is not set	Please set time. Control panel menu: Configuration ==> Date / Time
070000	Update login	No free resources for update	Please restart the system and re-update.
070001	Update is running	Another update already ongoing	Please wait until completion of the update. Then restart the system, if necessary.
080001	Wrong time	Wrong time for data logger	Please set time. Control panel menu: Configuration ==> Date / Time
080004	Data logger is full	No free memory Space for data logger	Clear the data logger. Control panel menu: Configuration ==> Extended ==> Clear the data logger and increment the recording interval P0451, if necessary.
090001	System restart	The system was restarted	Note only
0A000D	Line overvoltage	Line overvoltage is detected (ENS, control section)	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.
0A000E	Line undervoltage	Line undervoltage is detected (ENS, control section)	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.

0A000F	Overvoltage Phase	Line overvoltage is detected on outside conductor (ENS, control section)	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.
0A0010	Undervoltage Phase	Line undervoltage is detected on outside conductor (ENS, control section)	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.
0A0011	Frequency FLL	A power error is detected (FLL)	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the system frequency and line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.
0A0012	Frequency	A system frequency error is detected	Possibly caused by switching actions on the net. 1. Wait until the situation has eased or remeasure the system frequency and line voltage. 2. Contact the network operator if the line voltage fails to be within normal ranges. 3. Contact the Service if the line voltage is within normal ranges.
0A0013	PV isolation AFISR	An isolation error was detected during the automatic system isolation test	Please check and/or repair the system isolation.
0A200D	Overtemperature 6	Temperature in device too high (control section)	Let the device cool down. Please acknowledge the error.
0B0001	System 1	Error object	1. Please acknowledge the error. 2. If this error occurs repeatedly, please notify the Service.
0B0002	System 2	Error memory is full	Please contact the Service.
0B0003	System 3	Acknowledge function	Please contact the Service.
0D0001	System error	Faulty WR firmware	Please contact the Service.
0D0002	Power section bootloader	A defective bootloader was detected in the power section	Please contact the Service.
0D0003	System restart	The system was restarted	Note only
100001	Ethernet connection 1	Failed to establish Ethernet connection	Check Ethernet connection.
100002	Ethernet connection 2	Ethernet connection disconnected	Check Ethernet connection.
100003	Ethernet connection 3	No 100-Mbits/sec Ethernet connection	Establish Ethernet connection with 100 Mbit/s.

7 Options

7.1 Radiation Sensor

A radiation sensor can be optionally connected for recording the solar radiation incidence and the module temperature. We recommend Typ Si-13TC-T-K. REFU – order - no. 0029667.

The sensor comes with a 3 meter UV-resistant connection wire (5 x 0.14 mm²). Any extensions on this must be made using 5 x 0.25 mm² shielded wire.

Si-12TC-T pin assignment		REFUSOL X18 pin assignment
RD	Supply voltage (12–24 VDC)	Pin 1
BK	GND	Pin 5
OG	Measurement signal for incident light (0–10 V)	Pin 6
BN	Measurement signal for temperature (0–10 V)	Pin 8
GY	Shielding	Pin 9 / 7



Note: The shield of the sensor line must be applied to PIN 5 and PIN 9/7!

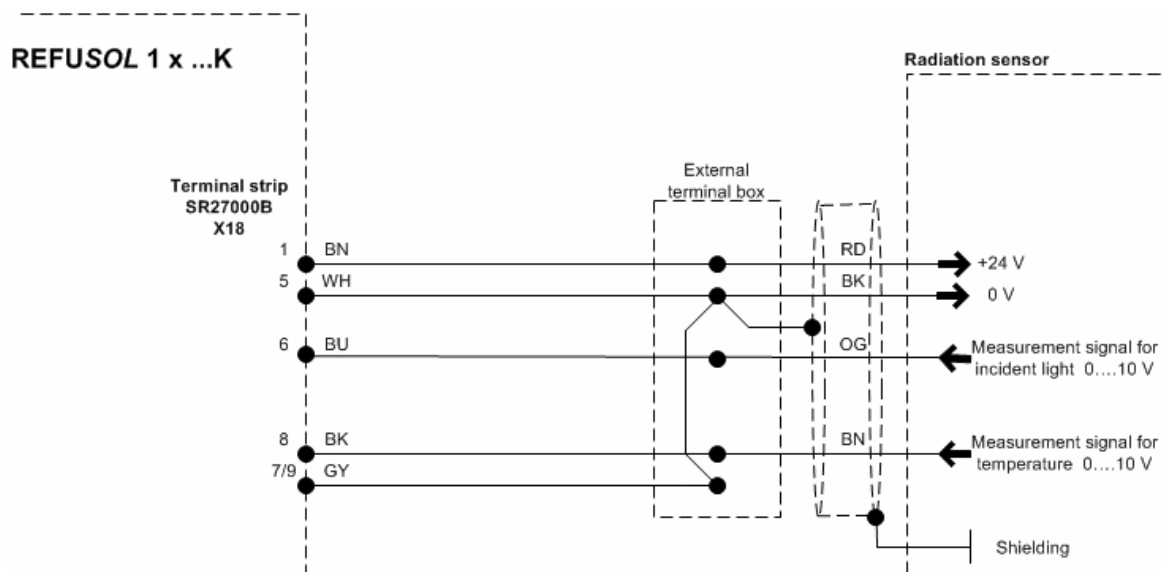


Figure 23: Connection of the solar radiation sensor

The data of the Si-13TC-T-K can be called up with the following parameters:

- D 1191.00 => incidence
 - 0-10 V => 0-1300 W/m²
- D 1193.00 => temperature
 - 0-10 V => -26.1° C – 90° C

These data may be recorded in the data logger as well.



Note: If the temperature input is not used, a bridge must be wired between PIN4 and PIN5! Alternatively, the bridge can also be wired at the intermediate terminal (cable extension).

7.2 Remote Monitoring

The user has the below options for remote monitoring:

- REFULOG[®]: REFULOG[®] is a portal developed by REFU for monitoring and recording solar system data. More information and details can be found in the DOK-ReSol-BA00-DE-REFULOG-NN-P operating instructions; please contact REFU Elektronik GmbH.
- Web Log: Data logger by MeteoControl. Connection via RS485.
- SolarLog: Data logger by Solare Datensysteme. Connection via RS485.

For MeteoControl and Solarlog[®], 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.

7.3 Instrument settings for monitoring with SolarLog[®] or MeteoControl[®]

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 ...).

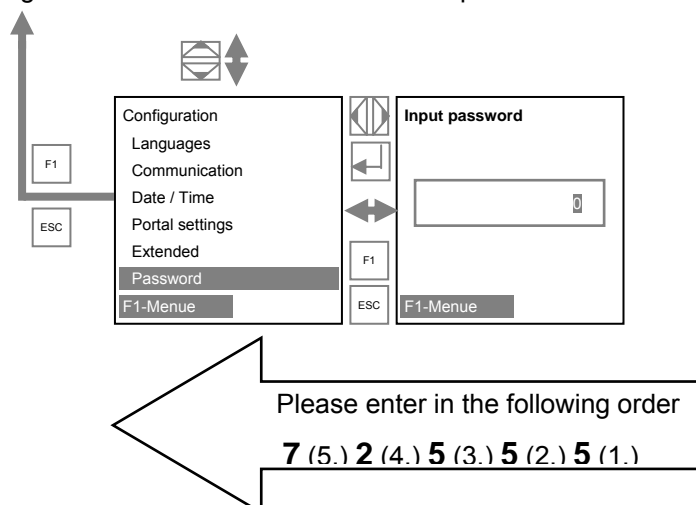
The RS485 interface (RS485 IN / OUT) is standard on all REFUSOL[®] units.

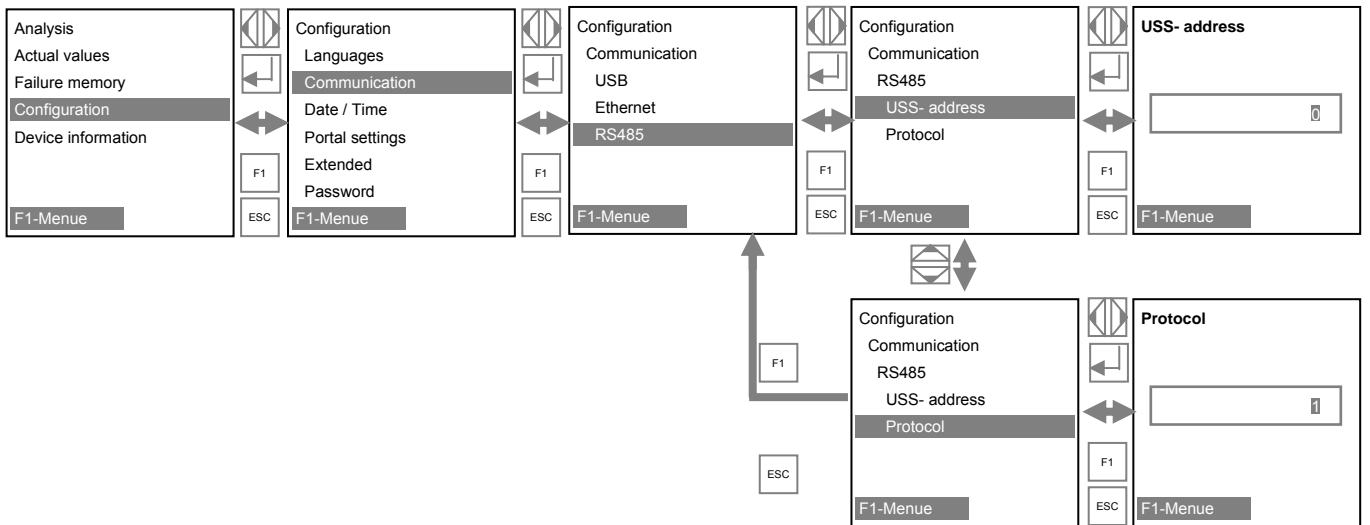
For communication via SolarLog[®] or Meteocontrol[®] each REFUSOL[®] must be given a communications address. It is recommended to predefine the addresses continuously starting with 1 (then 2, 3, etc. to max. 31).



Note: The maximum number of REFUSOL[®] systems that can be operated at one bus is 31.

These settings visible on the REFUSOL[®] control panel are to be carried out as follows:





Protocol: for SolarLog[®] enter „2“ ,
 or for MeteoControl[®] enter „3“ .



Note: After successful entry turn the REFUSOL[®] unit off and after 1 minute turn back on!

7.4 List of Parameters

Parameter number	Parameter name	Description
P404.02	Timeout configuration	<ul style="list-style-type: none"> Control unit If the value is set to 1, then the interface responds when communication drops out. If the value is set to 0, then lapses in communication are ignored.
P404.03	Timeout configuration	<ul style="list-style-type: none"> RS485 If the value is set to 1, then the interface responds when communication drops out. If the value is set to 0, then lapses in communication are ignored.
P404.04	Timeout configuration	<ul style="list-style-type: none"> USB If the value is set to 1, then the interface responds when communication drops out. If the value is set to 0, then lapses in communication are ignored.
P405.02	Configuration of the control word behavior	<ul style="list-style-type: none"> Control unit If the value is set to 0, then the interface will be completely ignored. If the value is set to 1, then the interface can control directly. If the value is set to 2, then the interface can only control if the same signal is logically applied to the terminal strip. If the value is set to 3, then the interface switches to "continuously on". That means that the REFUSOL is switched on immediately on start. It makes sense to deactivate the timeout for this particular interface.
P405.03	Configuration of the control word behavior	<ul style="list-style-type: none"> RS485 If the value is set to 0, then the interface will be completely ignored. If the value is set to 1, then the interface can control directly. If the value is set to 2, then the interface can only control if the same signal is logically applied to the terminal strip. If the value is set to 3, then the interface switches to "continuously on". That means that the REFUSOL is switched on immediately on start. It makes sense to deactivate the timeout for this particular interface.
P405.04	Configuration of the control word behavior	<ul style="list-style-type: none"> USB If the value is set to 0, then the interface will be completely ignored. If the value is set to 1, then the interface can control directly. If the value is set to 2, then the interface can only control if the same signal is logically applied to the terminal strip. If the value is set to 3, then the interface switches to "continuously on". That means that the REFUSOL is switched on immediately on start. It makes sense to deactivate the timeout for this particular interface.
P405.05	Configuration of the control word behavior	<ul style="list-style-type: none"> Ethernet If the value is set to 0, then the interface will be completely ignored. If the value is set to 1, then the interface can control directly. If the value is set to 2, then the interface can only control if the same signal is logically applied to the terminal strip. If the value is set to 3, then the interface switches to "continuously on". That means that the REFUSOL is switched on immediately on start. It makes sense to deactivate the timeout for this particular interface.
P406.	Interface address	<ul style="list-style-type: none"> Defines the address of the USS protocol. If several devices are connected to one interface (e.g. RS485), this device responds only if the address is correct.

Parameter number	Parameter name	Description
P406.02 P406.03 P406.04 P406.05		<ul style="list-style-type: none"> Control panel RS485 USB Ethernet
P407.00 P407.02 P407.03 P407.04 P407.05	Protocol	<ul style="list-style-type: none"> This parameter defines the protocol at the particular interface. 0 = RPC without real time, 1 = RPC+USS in real time, 2 = solar data systems, 3 = MeteoControl Control panel RS485 USB Ethernet
P410.00	IP address	<ul style="list-style-type: none"> Index 0
P410.01	IP address	<ul style="list-style-type: none"> Index 1
P410.02	IP address	<ul style="list-style-type: none"> Index 2
P410.03	IP address	<ul style="list-style-type: none"> Index 3
P411.00	Subnet mask	<ul style="list-style-type: none"> Index 0
P411.01	Subnet mask	<ul style="list-style-type: none"> Index 1
P411.02	Subnet mask	<ul style="list-style-type: none"> Index 2
P411.03	Subnet mask	<ul style="list-style-type: none"> Index 3
P412.00	Port number	<ul style="list-style-type: none"> Port number
P413.00	Timeout IP communication	<ul style="list-style-type: none"> IP communication timeout in ms
P414.00	IP standard gateway	<ul style="list-style-type: none"> Defines the standard gateway. If the REFUSOL is only used in a local network, the standard gateway does not need to be specified. If the device is to be addressed over a router, then the Internet address of the router must be entered here.
P414.01	IP standard gateway	<ul style="list-style-type: none"> Defines the standard gateway. If the REFUSOL is only used in a local network, the standard gateway does not need to be specified. If the device is to be addressed over a router, then the Internet address of the router must be entered here.
P414.02	IP standard gateway	<ul style="list-style-type: none"> Defines the standard gateway. If the REFUSOL is only used in a local network, the standard gateway does not need to be specified. If the device is to be addressed over a router, then the Internet address of the router must be entered here.
P414.03	IP standard gateway	<ul style="list-style-type: none"> Defines the standard gateway. If the REFUSOL is only used in a local network, the standard gateway does not need to be specified. If the device is to be addressed over a router, then the Internet address of the router must be entered here.

7.5 Data Logger Parameters

These parameters serve as settings for the internal data logger

Parameter number	Parameter name	Description
P450.00	Data logger enabled	<ul style="list-style-type: none"> Enables or disables the data logger. 0 = disabled. 1 = enabled. Data will be recorded at regular intervals.
P451.00	Data logger interval	<ul style="list-style-type: none"> Contains the time interval (60 / 300 / 600 sec) for which the data logger stores values.
P452.00 - 39	Data logger parameter numbers	<ul style="list-style-type: none"> Contains a list of all parameter numbers to be recorded. This only works in conjunction with indices (P453.x). Nonexistent parameter numbers will be ignored.
P453.00 - 39	Data logger indices	<ul style="list-style-type: none"> Contains a list of all indices assigned to the parameter numbers to be recorded. This only works in conjunction with parameter numbers (P452.x). Nonexistent parameter numbers will be ignored.
D1104.00	Actual value of the voltage at the PV generator	<ul style="list-style-type: none"> Actual value of the voltage at the PV generator, i.e. the voltage applied to the DC input of the REFUSOL.
D1105.00	Actual value of the current from the PV generator	<ul style="list-style-type: none"> Actual value of the current from the PV generator.
D1106.00	AC power	<ul style="list-style-type: none"> Instantaneous value of the total power fed into the electrical power system.
D1107.00	DC power	<ul style="list-style-type: none"> Instantaneous value of the power consumption measured on the DC-side (solar generator).
D1150.00 D1150.01	Yield of the day (today) Yield of the day (yesterday)	<ul style="list-style-type: none"> Displays the yield / standardized yield of the day. Depending on Parameter P1155.
D1151.00	Total yield	<ul style="list-style-type: none"> Displays the total yield / standardized total yield. Depending on Parameter P1155.
D1153.00	Yield of the month	<ul style="list-style-type: none"> Displays the yield / standardized yield of the month in 0.1 kWh.
D1154.00	Yield of the year	<ul style="list-style-type: none"> Displays the yield / standardized yield of the year in 0.1 kWh.
P1155.00	System size	<ul style="list-style-type: none"> Here, the power of the PV generator can be entered. This results in the display parameters D1150 to D1154 displaying the standardized yields.
D1191.00	Incident light	<ul style="list-style-type: none"> Displays the value of the radiation sensor
D1193.00	Module temperature	<ul style="list-style-type: none"> Displays the module temperature provided by the sensor.

8 Technical data

Type	REFUSOL 100K
DC Data	
Max. PV power	115 kW
MPPT range	460...800 V
Recommended STC range (crystalline Si)	560...600 V
Max. DC voltage	850 V
Max. DC current	240 A
MPP tracking	Fast, precise MPP tracking
Internal overvoltage protection	IEC 61643-21 / EN 61643-22 - type D1
AC Data	
Rated AC power	100 kW
Max. AC power	100 kW
AC mains connection	3AC400V + N, 50–60 Hz, including transformer
Cos phi	1
Max. AC current	158A
Distortion factor (THD)	<3%
Max. efficiency	96% at transformer (higher value expected, verification by measurement)
Efficiency	95% at transformer (higher value expected, verification by measurement)
Infeed from	approx. 500 W
Internal consumption by night	approx. 50 W
Internal overvoltage protection	IEC 61643-21 / EN 61643-22 - type D1
Cooling, ambient conditions, EMC	
Cooling	Controlled fan
Ambient temperature	-10...+45°C
Site altitude	Up to 1000 m above sea level / up to 2000 m with power-derating
Noise	t. b. d.
Radio interference suppression	EN55011, Group 1, Class A
Certificate	CE (UL and CSA in preparation)
Interference immunity	EN 61000-4-2 ... EN61000-4-5
Environmental classification	3K3 according to DIN IEC 721-3-3
Anti-islanding protection	Prevents inverter feed-in in the event of mains failure
Voltage monitoring	In accordance with VDEW directive

Type	REFUSOL 100K
Mechanics	
Protection class	IP 21 according to EN 60529
Dimensions Width / Height / Depth	1200 mm / 2000 mm / 600 mm
Weight	860 kg
DC disconnection	DC contactor
AC disconnection	Main switch and main contactor

8.1 Radiation Sensor

Typ	Si-13TC-T-K
General	
Shunt resistor	0,10 Ohm (TK = 22 ppm/K)
Ambient temperature	-20 °C bis +70 °C
Supply voltage	12 – 24 VDC
Current draw	0,3 mA
Connecting cable	4 x 0,14 mm ² , 3 m (UV-stabil)
Cell dimension	50 mm x 34 mm
Dimensions Length / Width / Height	145 x 81 x 40 mm
Weight	340 g
Radiation	
Measuring range	0 bis 1300 W/m ²
Output signal	0 bis 10 V
Measuring accuracy	+/- 5 % v. Endwert
Modul temperature	
Measuring range	-20 °C bis +90 °C
Output signal	$2,268V + T [^{\circ}C] * 86,9 \text{ mV}/^{\circ}C$
Measuring accuracy	+/- 1,5 % bei 25 °C
Nonlinearity	0,5 °C
Max. deviation	2 °C
Terminal assignment	
Orange	Output signal radiation (0-10V)
Red	Supply voltage (12-24VDC)
Black	GND
Brown	Output signal temperature (0-10V)
Supply voltage	Temperature and radiation sensor

9 Contact

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

REFU Elektronik GmbH

Marktstr. 185

D-72793 Pfullingen, Germany

Phone: +49 (0)7121.4332-102

Fax: +49 (0)7121.4332-140

Refusol@refu-elektronik.de

www.refu-elektronik.de

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 – 220

Email: service@refu-elektronik.de


You should have the following data at hand:

- Exact description of the error, and possibly HEX code of the error (P0017.00)
- Data from the type plate




SOL REFU

REFU Elektronik GmbH
 Uracher Str. 91
 D-72555 Metzingen / Germany
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 phone: +49 7123.969-202




Photovoltaic Central Inverter

TYP: 810R100
REFUSOL 100K AI 03



Serial-No: 810R100-0785 Date of Delivery: 4808



DC Max. Eingangsspannung Max. Input Voltage	850V	AC Nenn-Betriebsspannung Nominal operating Voltage	3AC 400V + N 50 Hz
DC MPP Betriebsspannung MPP Operating Voltage Range	460 - 800V	AC Nenn-Ausgangsleistung Nominal output power	100kW
DC Nennbetriebsspannung STC Nominal Operating Voltage STC	560 - 600V	AC Max. Ausgangsleistung Max. output power	100kW
DC Max. Eingangsstrom gesamt Max. Input current total	240A	AC Max. Ausgangsstrom Max output current	158 A
Betriebstemperaturbereich Operating temperature range	-10...+45°C	Gehäuseschutzart Enclosure	IP21

10 Certificates

The certificates are currently in preparation, and will be made available for download from REFU Elektronik GmbH website www.refu-elektronik.de when they are ready.

11 Notes:

REFU **Elektronik**

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Art.-Nr.: 0030778