Installation and User Manual

for the SOLO 500 Photovoltaic Inverter

Manual 50604
(Revision C1)

Contents

1 Introduction

This high-quality ELECTROINVENT photovoltaic inverter is intended for feeding photovoltaic energy into the public grid with a very high efficiency. Through the liquid cooling of the inverter heat is taken out efficiently from the operating room.

1.1 Disclaimer

ELECTROINVENT delivers optimized tested equipment such as inverters and string boxes for Photovoltaic Power Plants. The correct integration and interconnection of the equipment must be made according to the manuals and datasheets of ELECTROINVENT and is the responsibility of the System Integrator. ELECTROINVENT does not accept liability for system design, dimensioning of system related parts, installation or the performance of the system.

The content of this manual is regularly reviewed for compliance with the hardware and software operation and any corrections are included in later editions. Every effort is made to ensure the details in this manual are accurate. Warranty claims will not be accepted in case of violation of the installation instructions and we do not accept liability in case of accidents caused by inappropriate handling or work performed by unauthorized personnel which results in personal injury or damage to devices, or any other subsequent damages.

1.2 IMPORTANT SAFETY INSTRUCTIONS

READ AND SAVE THESE INSTRUCTIONS!

This manual contains important safety and operating instructions for SOLO 500 photovoltaic inverter. Keep it with or near the inverter at all times.

Photovoltaic installations operate with lethal voltages and the work described here should only be performed by authorized personnel familiar with the installation, mounting, commissioning, and the operation of PV installations. This manual must be fully read and understood before installing or commissioning is performed. The SOLO product must only be used for its intended purpose and unauthorized personnel are not allowed to open the SOLO product. The faultless and safe operation of the product assumes appropriate transport, correct storage, installation and mounting as well as correct operation and maintenance. The relevant regional and country-specific regulations and instructions must be obeyed as well as requirements described in this document including placement and installation instructions (e.g. connection profiles, torque settings, etc.)

Symbols and warning signs used:

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE refers to address practices not related to personal injury. Failure to observe could lead to property damage.

1.3 Scope of Delivery

Table 1.1 Scope of delivery

Quantity	Article
1 pc	SOLO 500 PV Inverter, cooling system filled with liquid 1 bar pressure
1 pc	Cabinet key
1 pc	Heat exchanger filled with liquid 0 bar pressure with wall mountings and connection box
1 pc	Hand pump for filling liquid in the cooling system
2 x 10 m	Hose (outer diameter 37 mm) with pipe union (shorter hoses on request)
12 m	Power supply cable for the fan of the heat exchanger
10 pcs	Quick fastener buckle 37 mm for hose mounting
2 m	Hose (outer diameter 10 mm) for liquid drain outlet (see *Figure 4.5-7*)
3 liters	Coolant (45% ethylene-glycol) in the hand pump

1.4 Type Label

The type label with the product identification is located at the top right corner on the inner side of the right cabinet door.

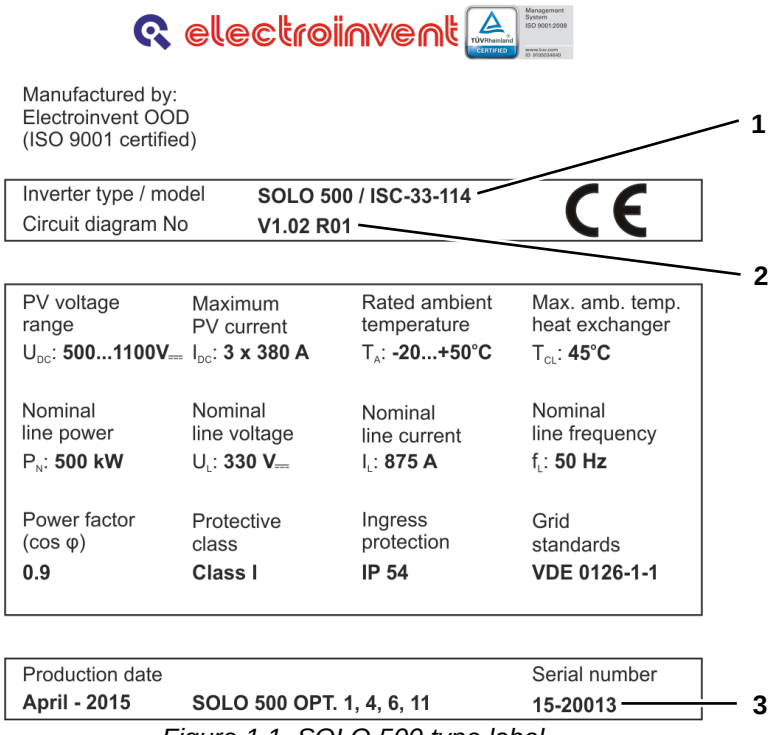


Figure 1.1 SOLO 500 type label

1 - Product identification
2 - Valid electrical circuit diagram
3 - Serial number of the inverter

2 Warnings and Notes

WARNING

The local installation standards must be obeyed.

WARNING

The device must only be installed, operated and maintained by qualified personnel.

WARNING

The device carries lethal grid and PV generator voltages. Consider a capacitor discharge time of **10 minutes**! And beware that an automatic restart can follow a grid or photovoltaic voltage failure.

WARNING

Consider all safety instructions displayed on the inverter and in the installation and user manual!

WARNING

If any information is unclear, please refer to ELECTROINVENT.

NOTICE

Loss of warranty.

The cabinet must not be damaged and no holes are allowed to be drilled in the cabinet. Any transport damage must be reported to ELECTROINVENT.

3 Transporting the Inverter

In order to avoid transport damage, the following points must be strictly obeyed:

1. The SOLO inverter must always be stored and transported in a vertical position.
2. The SOLO inverter cabinet can be transported by crane using pallet forks or by a forklift.

3.1 Transport by Crane

WARNING

If the inverter falls during lifting, persons in the vicinity could be crushed resulting in death or serious injury. Make sure that no persons are in the danger area around the lifted inverter. Observe the relevant regulations for crane operation.

The cabinet is lifted only by pallet forks.

Figure 3.1 Pallet forks

3.2 Transport by Forklift

WARNING

If the inverter tilts over during the transport, people in the vicinity could be crushed resulting in death or serious injury. Ensure that no people are in the danger area around the lifted inverter.

Note: The front and back covers of the socket must be removed for the transport (see *Figure 3.2* and *Figure 3.3*).

Figure 3.2 Forklift transportation using side openings

Figure 3.3 Forklift transportation using front openings

4 Installation of the Inverter

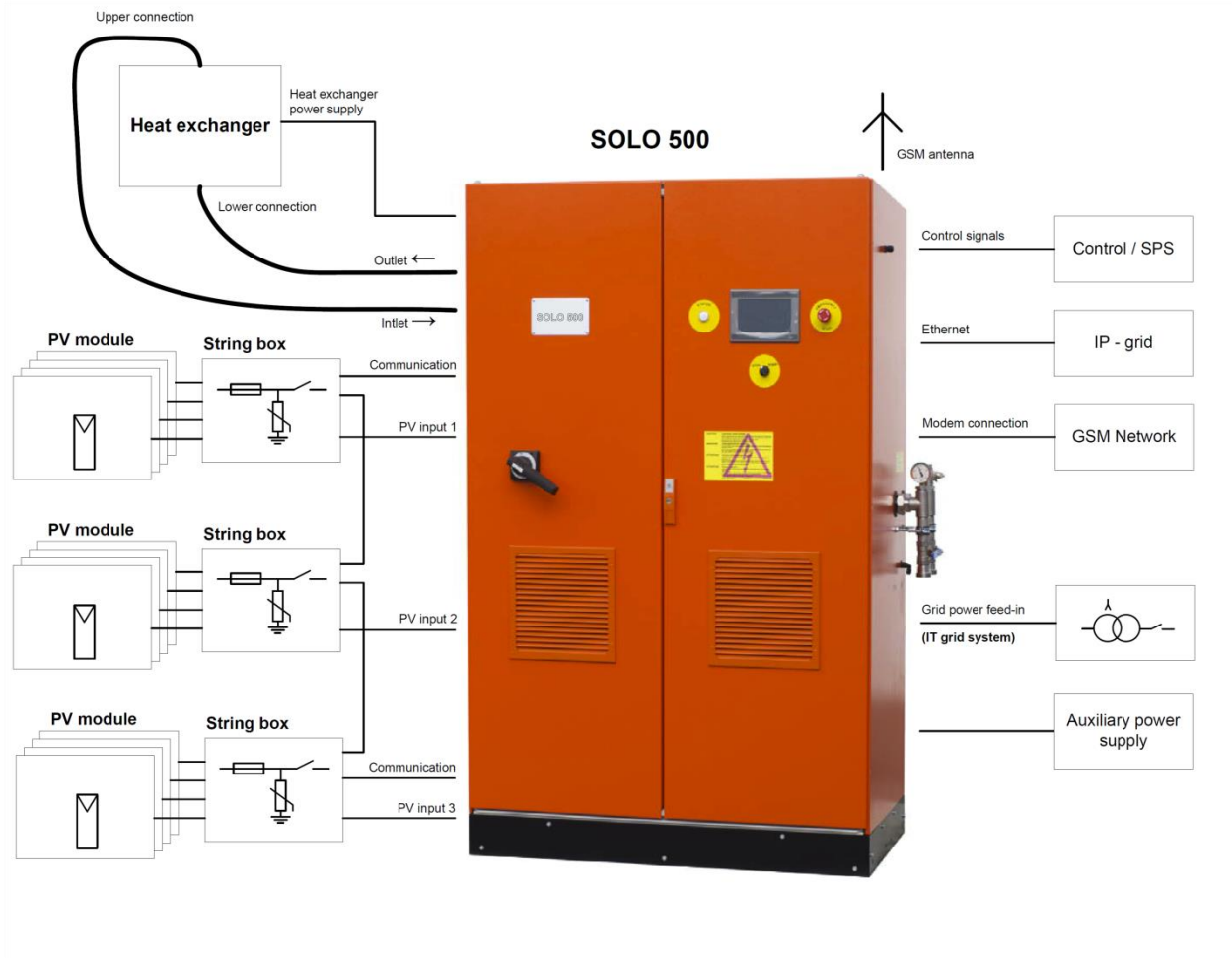


Figure 4.1 Example view of a photovoltaic installation with SOLO inverter, SOLO string boxes and grid transformer

4.1 Location Selection

- The inverter cabinet is intended for indoor operation.
- The inverter should be positioned as close as possible to the transformer (< 5 m).
- The place must meet the requirements for installation of electrical operation devices and must be ventilated. The heat output of the components that are not directly liquid cooled is up to 3000 W at maximum power.
- To avoid additional heating, a location without direct sun irradiation should be chosen.
- The cabinet must be easily accessible for operation and maintenance.
- The operating elements (main switch, emergency stop button, start/stop switch) are mounted outside the cabinet and should be protected from unauthorized manipulation.
- Assure a dust-free environment to prevent filter clogging and malfunction of the inverter cooling system. In rooms with high pollution the air filters have to be checked in shorter intervals.
- Make sure that the minimum required clearances to surrounding objects are respected (emergency exit route, maintenance works, air cooling, etc.) – see *Figure 4.2.*

4.2 Mechanical Installation

The requirements are listed in *Table4.1* the inverter must be installed on a firm, horizontal surface with the sufficient load-carrying capacity. The inverter can be mounted on a foundation or on a grounded metal frame. No liquid (water, snow, oil, coolant, etc.) should ever enter into the cabinet, not even during installation.

Table 4.1 Mechanical requirements

Item	Requirement
Minimum size of the foundation SOLO 500 (W x D)	1200 x 800 mm
Maximum inclination of the foundation	+/- 5 mm
Load-carrying capacity of the foundation	> 1500 kg / m^2
Minimum clearance: • from the cabinet rear side • from the cabinet left side • from the cabinet right side • from the cabinet front side • above the cabinet roof	 300 mm 100 mm 500 mm 1000 mm 300 mm
Entrance opening (W x H)	1400 x 2100 mm

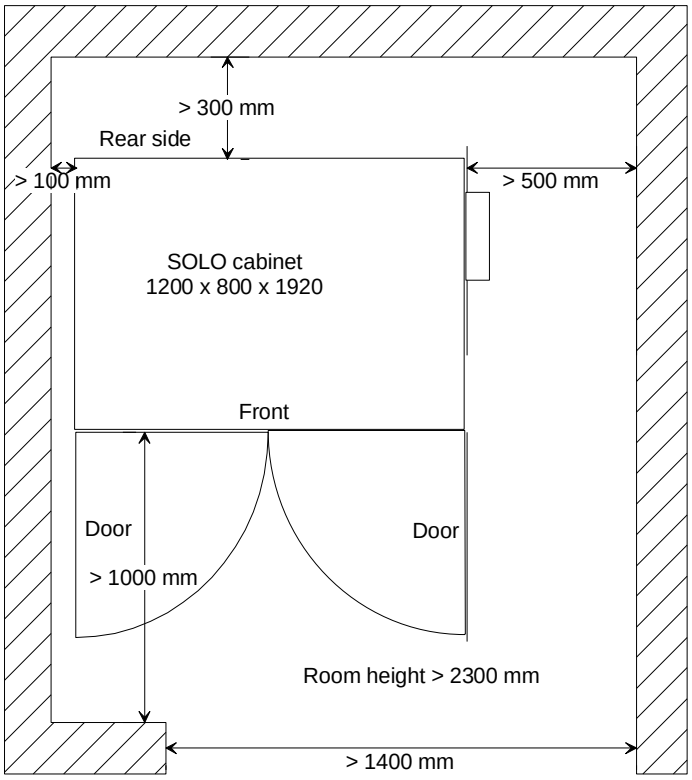


Figure 4.2 Minimum clearances

Note: Alternative placement of the SOLO inverter only after consultation with ELECTROINVENT.

4.3 Foundation

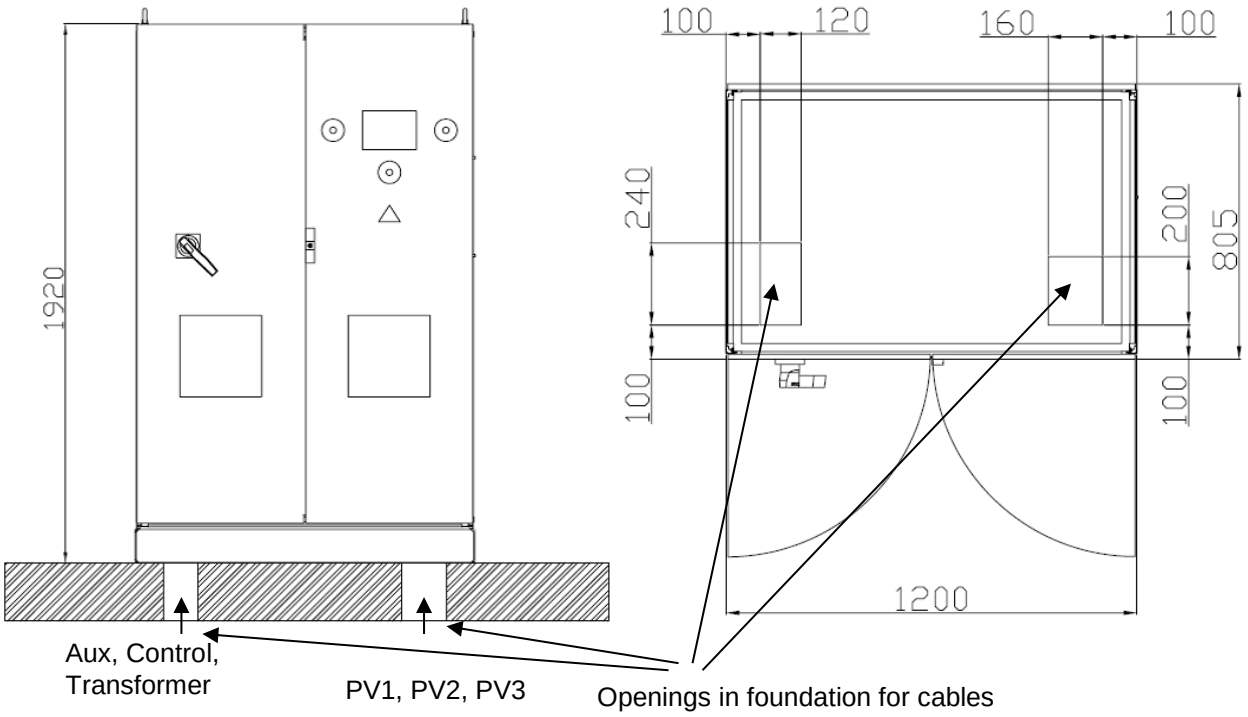


Figure 4.3 Foundation

4.4 Installing the Heat Exchanger

WARNING

The heat exchanger must be mounted using fixing steel bolts or screws type M10.

The heat exchanger [*Figure 4.4-2*] should be mounted outdoors on a solid wall, in a place with no direct sun irradiation. The elevation of the top level of the heat exchanger must be less than 9 m above the bottom level of the inverter.

The alignment should be executed as shown in *Figure 4.4*, with the bleeding valve [*Figure 4.4-1*] at the highest point of the cooling system.

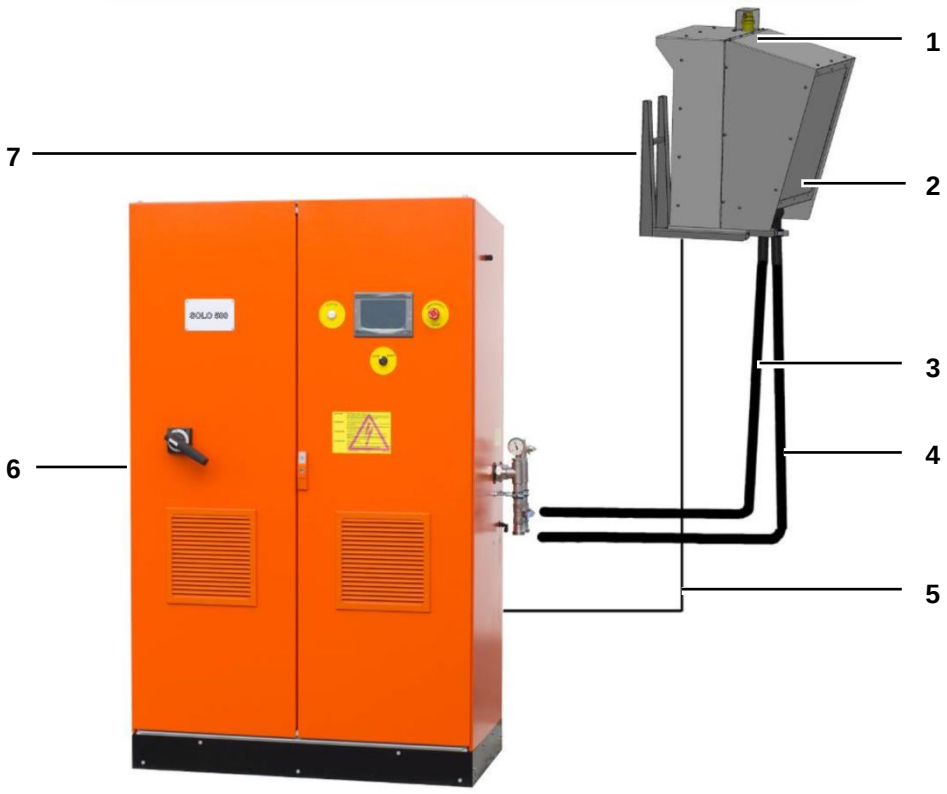


Figure 4.4 Connection of the cooling system

1 - Bleeding valve
2 - Heat exchanger with fan
3 - Coolant hose to the inverter inlet
4 - Coolant hose to the inverter outlet
5 - Fan power supply cable
6 - SOLO inverter cabinet
7 - Wall mountings of the heat exchanger

4.5 Connecting the Heat Exchanger to the Inverter

NOTICE

At delivery, all tubes in the cabinet and the hoses of the heat exchanger are filled with coolant and the entrapped air is bled (purged).

The inlet and outlet hoses **must not** be interchanged!

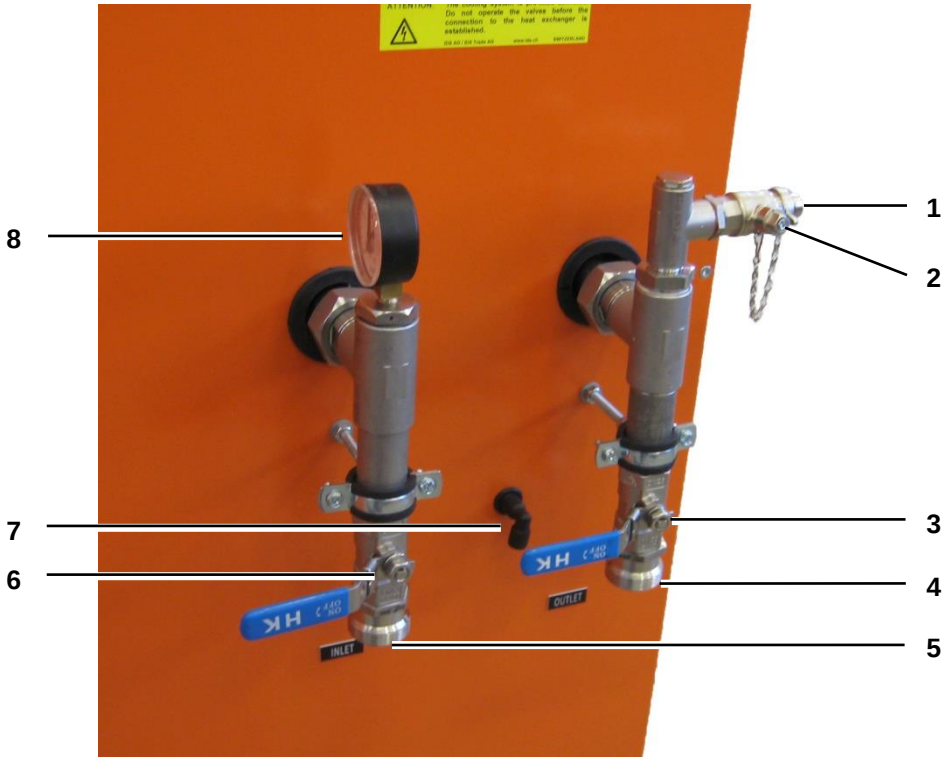


Figure 4.5 Cooling system elements and pipe connections on the inverter

1 - Filling connection
2 - Filling valve
3 - Outlet valve
4 - Hose connection inverter outlet
5 - Hose connection inverter inlet
6 - Inlet valve
7 - Liquid drain outlet (for maintenance)
8 - Manometer

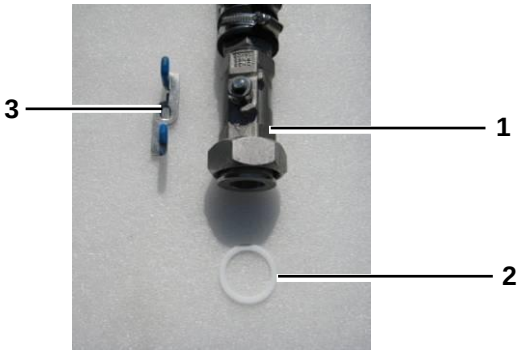


Figure 4.6 Hose connection (inlet/outlet)

1 - Union connection
2 - Gasket
3 - Valve handle

Figure 4.7 Filling valve (see Figure 4.5-2)

Figure 4.8 Valve with locking screw (see Figure 4.5-3,-6)

Please follow the sequence below to connect the heat exchanger to the inverter:

1. Connect the hose [*Figure 4.4-3*] from the upper connection of the heat exchanger (the right hose of the front view of the heat exchanger) to the inverter inlet [*Figure 4.5-5*] using the gasket [*Figure 4.6-2*].
2. Connect the hose [*Figure 4.4-4*] from the lower connection of the heat exchanger (the left hose of the front view of the heat exchanger) to the inverter outlet [*Figure 4.5-4*] using the gasket [*Figure 4.6-2*].
3. Mount the handles [*Figure 4.6-3*] on the hose valves [*Figure 4.6*].
4. Remove the locking screws from handles of inverter inlet and outlet [*Figure 4.8*].
5. Open the four valves - on the inverter inlet and outlet connections [*Figure 4.5-3, -6*] and on the inlet and outlet hoses [*Figure 4.6*] (counter-clockwise).
6. Connect the power supply cable [*Figure 4.4-5*] of the fan to the inverter [*Table 4.7*].

Table 4.2 Heat exchanger installation requirements

Item	Requirement
Maximum hose length (inverter – heat exchanger)	10 m
Maximum elevation above inverter level (inverter bottom level to heat exchanger top level)	9 m
Pressure (air pressure) in the 8 liters expansion vessel (at 20 °C and when no pressure in the liquid)	1.25 bar
Nominal pressure in the cooling system at 20 °C	2.0 bar
Minimum pressure in the cooling system (negative pressure fault) at 20 °C	1.1 bar
Integrated safety valve	3.5 bar
Antifreeze	Ethylene-glycol
Coolant concentration (for freezing point: -25 °C)	45% antifreeze, 55% water
Coolant (antifreeze-water mixture) volume (inverter with original heat exchanger and 2 x 10 m hoses)	Approx. 20 L

4.6 Electrical Installation

WARNING

The installation of the inverter must only be performed by authorized personnel. The absence of voltages (grid and PV lines) must be ensured during installation. After opening all power connections (grid and PV) wait for **10 minutes** to ensure internal power capacitors have discharged.

4.6.1 Overview of the Electrical Connections

The locations of the electrical connections in the inverter are shown in *Figure 4.9*.

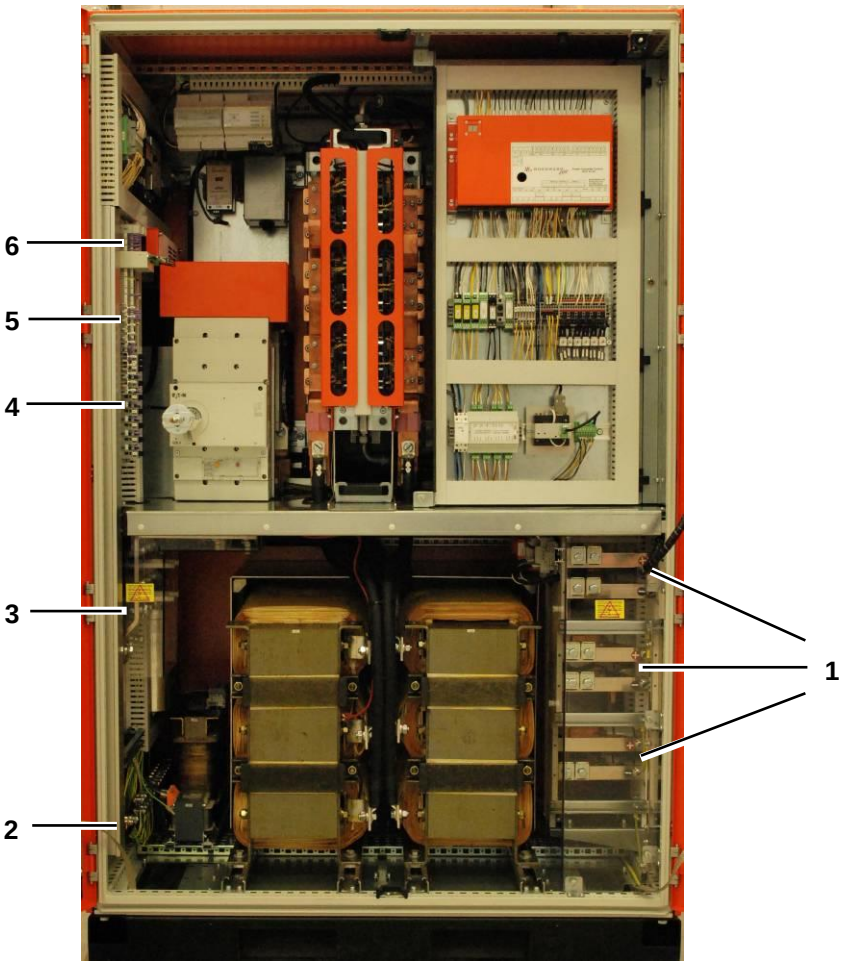


Figure 4.9 Locations of the electrical connections in the inverter

1 PV input power terminals

2 PE – copper rail for all internal and external PE connections

3 Power connections to the grid transformer

4 String box supplies, controls and feedbacks

5 Auxiliary power supply, heat exchanger fan supply, transformer monitoring, external grid monitoring, external start/stop, external E-stop

6 Fiber optic communication interface, terminal for Ethernet, extensions for additional string boxes

4.6.2 Schematic Example of SOLO System

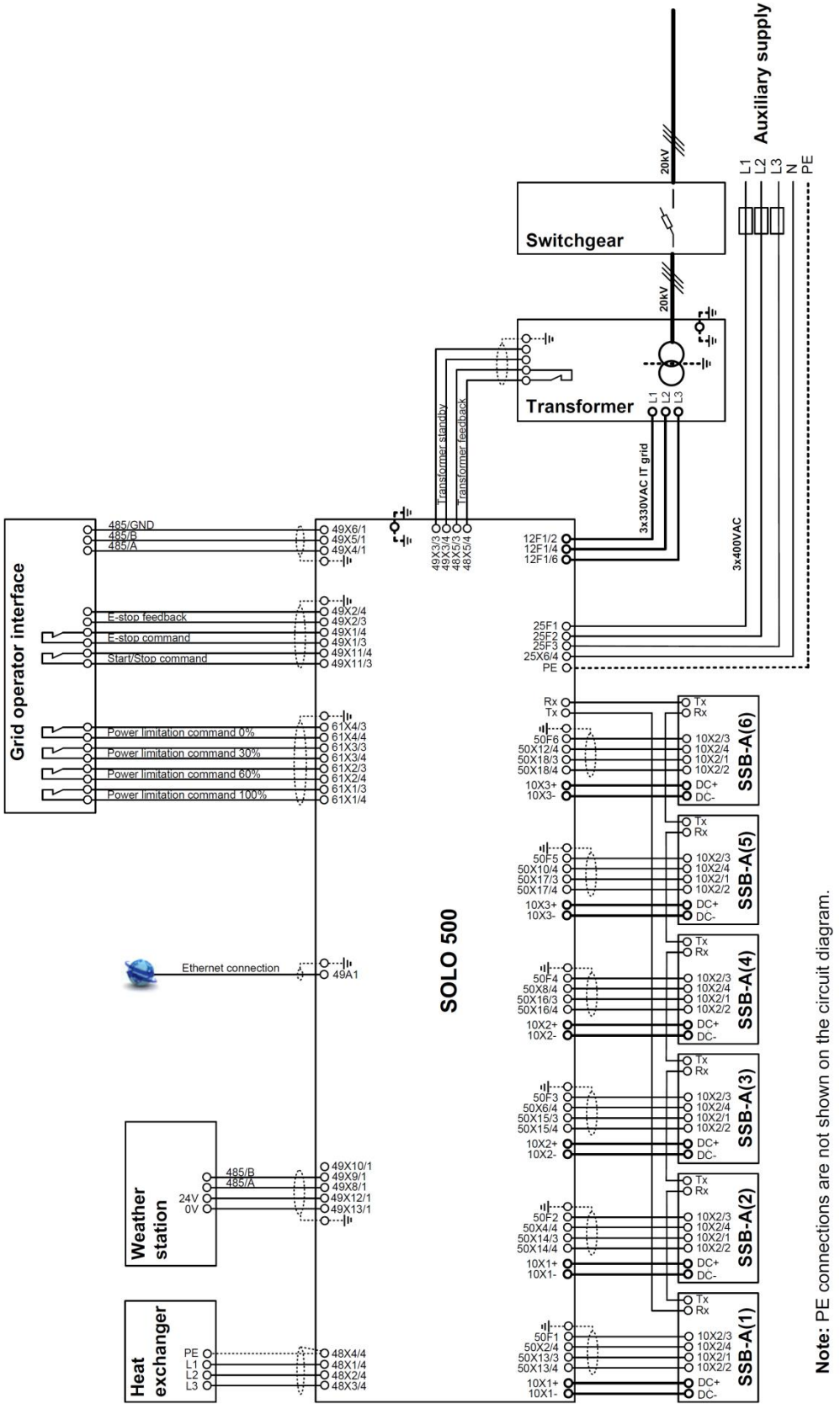


Figure 4.10-1 Schematic example of SOLO system with SBB-A

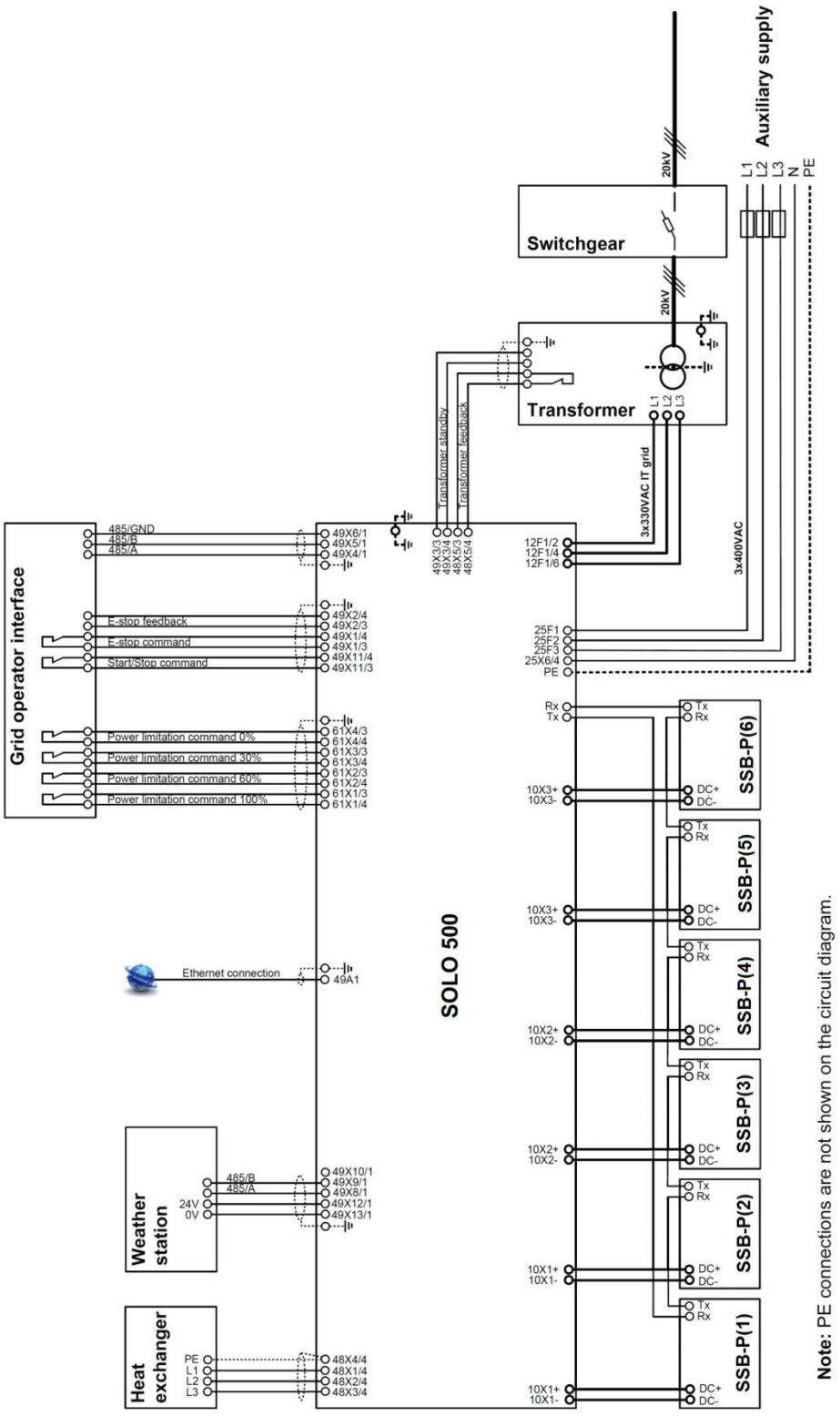


Figure 4.10-2 Schematic example of SOLO system with SBB-P

The SOLO inverter can be connected to several external devices. Most of them are shown on *Figure 4.10-1* and *Figure 4.10-2*:

- ELECTROINVENT active string boxes with contactors SSB-A and manual switchable string boxes SSB-P. See the *Installation and user manual* accompanying your string box.
- Transformer with feedback signal
- Emergency stop circuit
- Grid operator interface – Inverter control (start/stop, power limitation)
- GSM or line modem for monitoring
- Ethernet for monitoring
- ICC – Integrated Central Control unit
- Weather station

4.6.3 Power Connections (PV input and AC output terminals)

WARNING

Potentially lethal voltage!

Even if the main switch is turned off the AC and PV power terminals and the auxiliary supply could have lethal voltage! After complete separation from the grid and from the PV generator, wait **10 minutes** before opening the door and removing the protection cover.

Failure to observe this warning could result in death or serious injury.

NOTICE

Respect the correct PV polarity. Wrong polarity of the PV inputs can cause a short circuit of the PV panels. Never connect the different inverter PV inputs in parallel.

The total number of string boxes which can be connected to the inverter is limited to 6 (two string boxes per PV input). For more than 6 string boxes, please contact ELECTROINVENT.

Note: When planning and installing the photovoltaic plant, a uniform distribution of the installed power onto the three PV inputs of the inverter must be ensured. See the maximum PV input current in the datasheet.

The power connections have to be done according to *Table 4.3* and *Table 4.4*.

Table 4.3 PV input power connections (see Figure 4.11)

Terminal	Function	Specifications
10X3-	PV input 3 (negative pole)	Each PV input copper bar has two conductor clamps for two cables. Fastening torque: 12…15 Nm Cu-cross section: 70…150 mm^2 **Note:** Follow the National Electrical Code
10X3+	PV input 3 (positive pole)	
10X2-	PV input 2 (negative pole)	
10X2+	PV input 2 (positive pole)	
10X1-	PV input 1 (negative pole)	
10X1+	PV input 1 (positive pole)	

Note: For convenience, please connect the cables in the sequence shown in *Table 4.3* (starting from PV input 3), but remember that PV input 1 **must always** be connected to a PV-field. The feedback from PV input 1 controls the stand-by mode of the inverter.

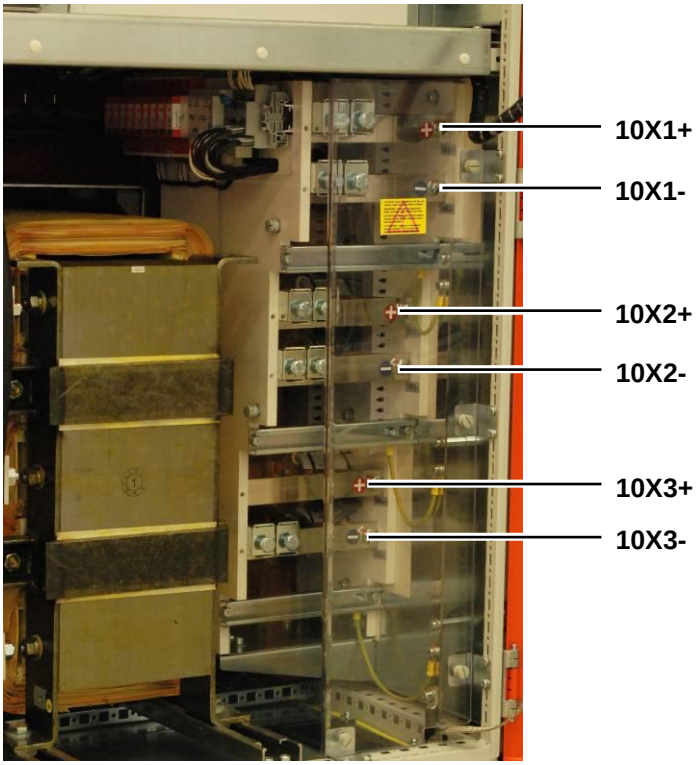


Figure 4.11 PV input power terminals (see also Figure 4.9-1)

Table 4.4 Phase connections to the grid transformer (see Figure 4.12)

Connection	Terminal	Specifications
L1	12F1 – terminal 2	Each phase terminal copper bar has two screws for two cables. Connection type: M12 Cable lug width: max. 38 mm Fastening torque: 43 Nm Copper cross section: 2 x 120 … 240 mm^2 **Note:** Follow the National Electrical Code
L2	12F1 – terminal 4	
L3	12F1 – terminal 6	

Figure 4.12 Phase terminals (see also Figure 4.9-3)

Table 4.5 Protection earth connection to the grid transformer (see Figure 4.13)

Connection	Terminal	Specifications	
Protection earth (PE)	PE – copper rail	Connection type: Fastening torque: Copper cross section:	M10 25 Nm 240 mm^2

Figure 4.13 PE – copper rail (see also Figure 4.9-2)

4.6.4 Transformer Specification

NOTICE

The SOLO inverter must **not** be connected directly to the grid. An external transformer is required.

Transformer specification:

- Rated power: 500 kVA
- Rated voltage at inverter side: 330 V (or 300 V when the relevant option is used)
- Type of system: 3-wire IT (ungrounded). In case low voltage side of the transformer is in star configuration, the neutral should be neither grounded nor connected.
- A grounded screen is mandatory between primary and secondary windings.
- Several inverters can be connected to a common transformer, but a separate secondary winding set is needed for each inverter (floating, IT grid).

4.6.5 Auxiliary Power Connection

NOTICE

The connection points of user contact spring-cage terminals (*Chapters 4.6.5 to 4.6.16*) are opened with a standard screwdriver.

After the conductor has been inserted into the terminal compartment, the screwdriver is removed and the conductor automatically makes contact.

The auxiliary power supply 400 V, 50 / 60 Hz can be implemented as internal (default) or as external power supply. When the internal auxiliary supply connection is used then the supply of the inverter control is connected internally through the main switch to the power connections L1, L2, L3 (see *Table 4.4).*

Note: The inverter is delivered with wire bridges 25X1/4 – 25F1, 25X2/4 – 25F2, 25X3/4 – 25F3, 25X4/4 – 25X6/4 connected (internal auxiliary power supply by default, see *Figure 4.14*).

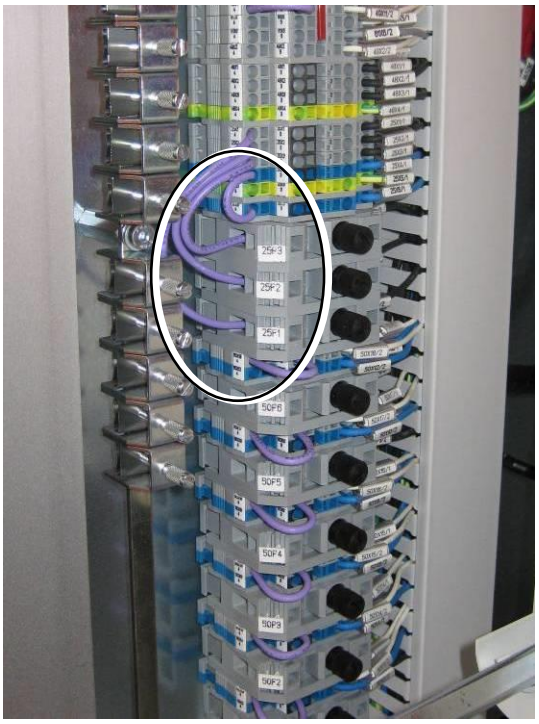


Figure 4.14 Wire bridges for internal auxiliary power supply (see also Figure 4.9-5)

External power supply 400 V grid is recommended where a low tariff grid power supply is available (see *Table 4.6*).

Note: For external auxiliary supply, remove the bridges for internal supply 25X1/4 – 25F1, 25X2/4 – 25F2, 25X3/4 – 25F3, 25X4/4 – 25X6/4 *(see Figure 4.14)*, and execute the following connections:

Table 4.6 External auxiliary power supply

Terminal	Function	Connection type	Cu-cross section	External supply configuration
				connect to:
PE	PE	Spring-cage	1.5...2.5 mm^2	PE
25F1	Input L1	Spring-cage	1.5...2.5 mm^2	External grid L1
25F2	Input L2	Spring-cage	1.5...2.5 mm^2	External grid L2
25F3	Input L3	Spring-cage	1.5...2.5 mm^2	External grid L3
25X6/4	Input N	Spring-cage	1.5...2.5 mm^2	External grid N

Note: Never supply the inverter from a source controlled by "Transformer standby output signal" (see *Table 4.8*) because it will not be able to recover after signal activation.

4.6.6 Installation of the Heat Exchanger Fan

Table 4.7 Heat exchanger fan connection (Figure 4.15)

Terminal	Function	Specifications
48X1/4	Fan power supply – Output L1	400 V_{AC} / max. 0.6 A
48X2/4	Fan power supply – Output L2	400 V_{AC} / max. 0.6 A
48X3/4	Fan power supply – Output L3	400 V_{AC} / max. 0.6 A
48X4/4	PE	PE

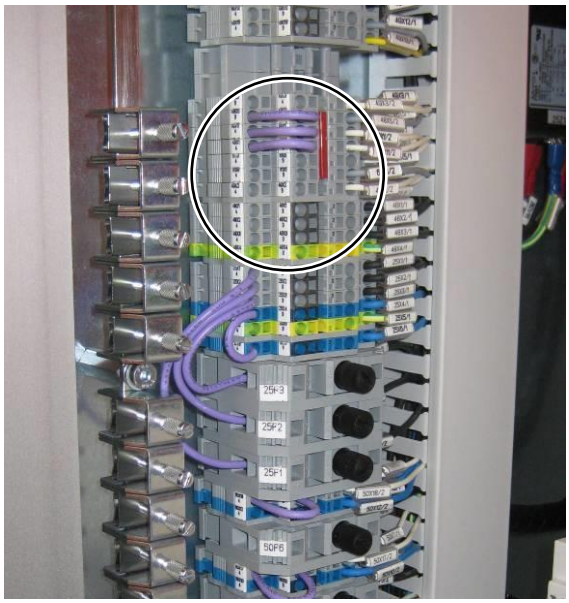


Figure 4.15 Heat exchanger fan supply, transformer monitoring, external grid monitoring, external start/stop, external E-stop (see also Figure 4.9-5)

4.6.7 Installation of the Transformer Monitoring

Table 4.8 Signal connections of the grid transformer monitoring (see Figure 4.15)

Terminal	Function	Specification
48X5/3 48X5/4	Transformer ready signal (e.g. from an automatic safety device in the transformer cabinet)	Digital input – a wire bridge required if not used Contact closed: ready Contact open : error
49X3/3 49X3/4	Transformer standby signal	Digital output: Contact closed: in operation Contact open: standby

Note: Transformer standby is used if an electrically controllable switch gear is connected between the transformer and the grid

4.6.8 Installation of the External Grid Monitoring

Table 4.9 Signal connections for external grid monitoring (see Figure 4.15)

Terminal	Function	Specification
61X6/3 61X6/4	Feedback – input to main control module of inverter in case of grid fault	Digital input – a wire bridge required if not used Contact closed: no error Contact open : error
61X5/3 61X5/4	Main contactor control – hardware deactivation of the inverter's main contactor in case of grid fault	Digital input – a wire bridge required if not used Contact closed: in operation Contact open: E-stop

4.6.9 External Start/Stop Command

External start/stop command has the same function as the two-position switch start/stop [*Figure 5.2-2*].

Table 4.10 External start/stop (see Figure 4.15)

Terminal	Function	Specification
49X11/3 49X11/4	External start/stop input	Digital input – a wire bridge required if not used Contact closed: "Start" position Contact open: "Stop" position

4.6.10 External Emergency Stop

WARNING

In case there is an external emergency stop circuit it must be interposed to the emergency stop circuit of the inverter through the corresponding terminals: The bridge 49X1/3 - 49X1/4 has to be removed and replaced by the connection to the client's potential free contact for emergency shut-down. The activation of the emergency stop leads to deactivation of the inverter's power connections, the control continues to operate.

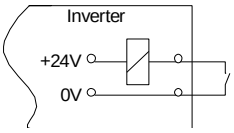
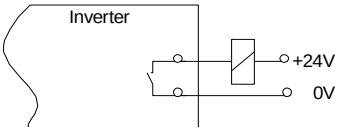
Failure to observe this warning could result in death or serious injury.

Table 4.11 Inverter control (see Figure 4.15)

Terminal	Function	Specification
49X1/3 49X1/4	Emergency stop (E-stop)	Digital input – a wire bridge required if not used Contact closed: E-stop inactive Contact open: E-stop active
49X2/3 49X2/4	Signalization: Emergency stop (E-stop)	Digital output Contact closed: E-stop inactive Contact open: E-stop active

4.6.11 Digital Interface Specification

Table 4.12 Digital interface specification

Terminal	Function	Terminal specification	Connect to
Digital input	Reads logic level Active Contact open Inactive Contact closed	24 V relay  Cu-cross section: 0.5..2.5 mm^2 Cable gland: Ø 4.5-10mm	Potential free contact • min. 24 V_{DC} • min. 20 mA
Digital output	Drive logic level Active Contact open Inactive Contact closed	Potential free contact  Insulation voltage: 2.5 kV_{AC}, 1 min Cu-cross section: 0.5..2.5 mm^2 Cable gland: Ø 4.5-10mm	24 V relay • min 10mA • max 1 A

4.6.12 String Boxes Connections (optional)

ELECTROINVENT offers active string boxes with contactors (ISB-A and SSB-A) and manual switchable passive string boxes (SSB-P).

4.6.12.1 Supplies, Controls and Feedbacks for Active String Boxes (ISB-A and SSB-A)

The contactor type string boxes (ISB-A and SSB-A) are supplied and controlled by the SOLO inverter. They must be connected according to *Table 4.13* and *Table 4.14*.

Stand-by mode: The wake-up signal for stand-by mode of the inverter is related to PV input 1. Therefore this PV input must always be connected to a PV-field in order to make sure the SOLO will start while standby-mode is active.

For contactor string box installation make sure, that one string box (called "overnight string box") is controlled separately (see *Table 4.14*).

Table 4.13 String box supplies and controls (see Figure 4.16)

Terminal	Function	Specification
50F1/1 50X2/4	String Box 1 (overnight string box) Contactor control	Inactive: 0 V (contact open) Active: 250 $V_{AC/DC}$ max. 1 A
50F2/1 50X4/4	String Box 2 Contactor control	
50F3/1 50X6/4	String Box 3 Contactor control	
50F4/1 50X8/4	String Box 4 Contactor control	
50F5/1 50X10/4	String Box 5 Contactor control	
50F6/1 50X12/4	String Box 6 Contactor control	

Note: String box 1 (overnight string box) has an additional function in standby mode of the inverter during the night. The PV output power cables from this box have to be connected to PV input 1.

Note: For more than 6 string boxes, please contact ELECTROINVENT.

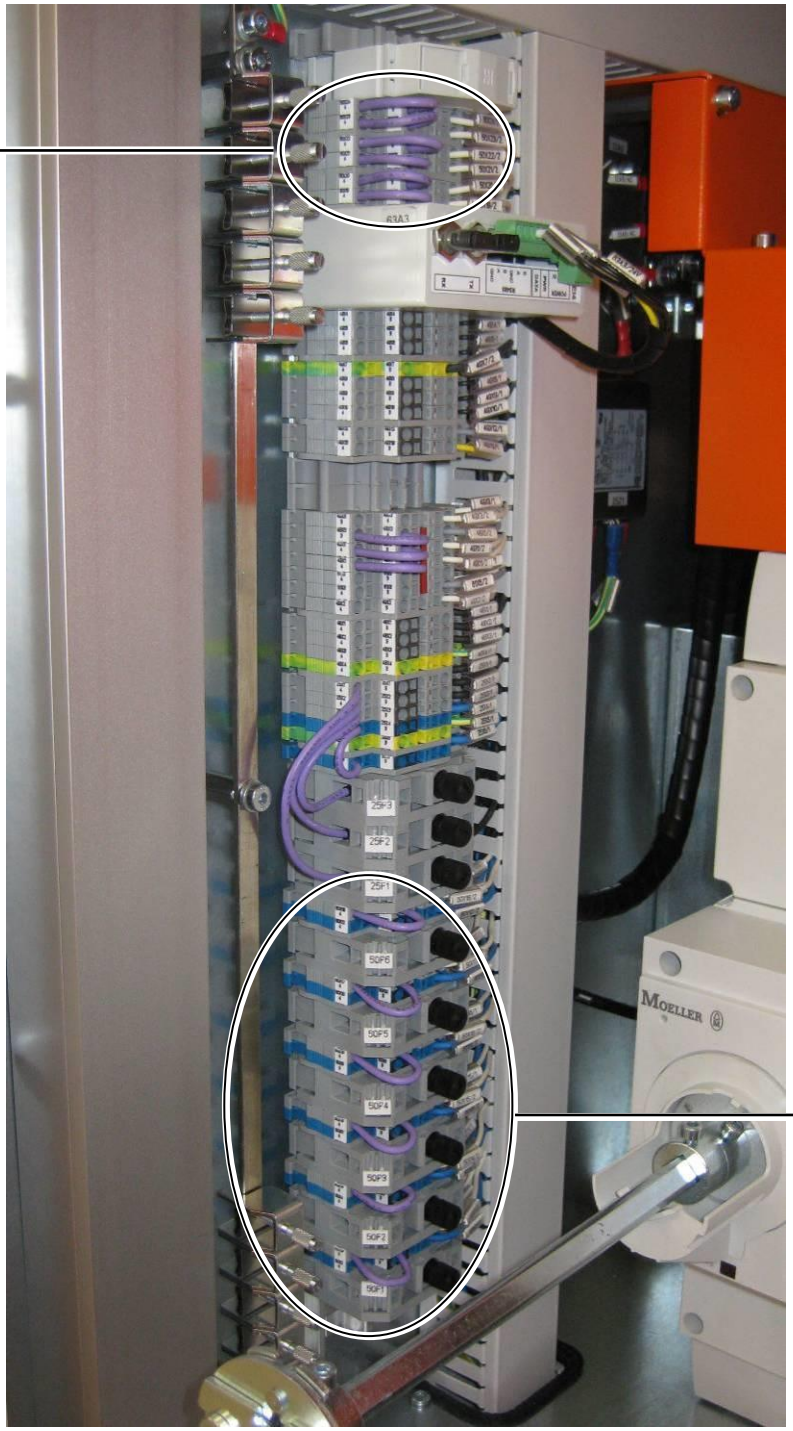


Figure 4.16 String boxes control

1 - String box supplies, controls and feedbacks (see also Figure 4.9-4)
2 - Extensions 1 to 6 (for additional string boxes) (see also Figure 4.9-6)

Table 4.14 String box feedbacks (see Figure 4.16)

Terminal	Function	Specification
50X13/3 50X13/4	String Box 1 Warning (overnight string box)	Feedback for contactor and surge protection status. Digital inputs: Contact closed: Warning inactive Contact open: Warning active Extensions 1 to 6 can be used for feedbacks from string boxes or from external protection devices (e.g. tracker fuses). At delivery each input is short connected by a wire bridge. The bridge must be removed before connecting the feedback cable. Not used feedback terminals have to be short connected by wire bridges.
50X14/3 50X14/4	String Box 2 Warning	
50X15/3 50X15/4	String Box 3 Warning	
50X16/3 50X16/4	String Box 4 Warning	
50X17/3 50X17/4	String Box 5 Warning	
50X18/3 50X18/4	String Box 6 Warning	
50X19/3 50X19/4	Extension 1	
50X20/3 50X20/4	Extension 2	
50X21/3 50X21/4	Extension 3	
50X22/3 50X22/4	Extension 4	
50X23/3 50X23/4	Extension 5	
50X24/3 50X24/4	Extension 6	

4.6.12.2 Monitoring Connections for Smart String Boxes (SSB-A and SSB-B)

The Smart String Box (SSB) measures the current of each string and sends data to the inverter via communication interface – fiber optic (default) or RS485 (optional).

Table 4.15 SSB serial glass fiber optic interface (see Figure 4.17-2)

Terminal	Function	Specification
TX	Glass fiber optic Transmit data	Cable type: Outdoor, UV light resistant, armored Fiber type: Multimode 62,5/125 or 50/125 Cable end port ST type Recommended: A-VQ(BN)H 1x4, Corning Cable Systems
RX	Glass fiber optic Receive data	

Note: SSB RS485 interface is available on request.

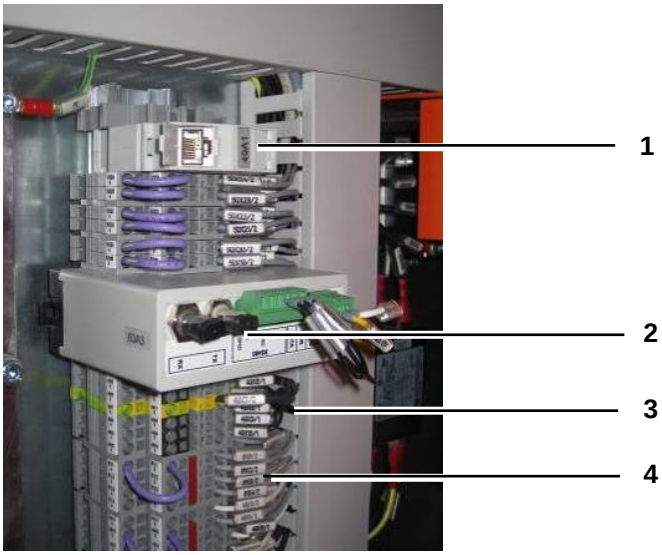


Figure 4.17 Terminals for user interface (see also Figure 4.9-6)

1 - Ethernet terminal
2 - TX and RX fiber optic interface
3 - RS485 communication terminals, weather station power supply
4 - Power limitation terminals

Note: For details see the *Installation and user manual for the String Box*.

4.6.13 Power Limitation (optional)

Certain grid operators demand a power limitation. The interface is prepared in a way that the signal lines can be easily connected.

Table 4.16 Power limitation (see Figure 4.17-4)

Terminal	Function	Specification
61X1/3 61X1/4	Input power limitation to 100%	Digital inputs – connect a wire bridge on 61X1/3-61X1/4 if not used Contact closed: active Contact open: inactive
61X2/3 61X2/4	Input power limitation to 60%	
61X3/3 61X3/4	Input power limitation to 30%	
61X4/3 61X4/4	Input power limitation to 0%	

Note: The limitation refers to the nominal power of the PV installation.

4.6.14 Serial User Interface RS485 (optional)

Table 4.17 Serial user interface RS485 (see Figure 4.17-3)

Terminal	Function	Specification	
49X4/1	485A RS485 interface	Cable type:	Outdoor, UV light resistant
49X5/1	485B RS485 interface	Recommended:	UNITRONIC® Li2YCYv(TP) 2x2x0,5 or 3x2x0,5 (1 spare pair), Lapp Kabel
49X6/1	GND RS485 interface		

4.6.15 Interface to Integrated Central Control (ICC) / Weather Station (optional)

Table 4.18 Serial interface RS485 to ICC / Weather station (see Figure 4.17-3)

Terminal	Function	Specification	
49X8/1	485A RS485 interface	Cable type:	Outdoor, UV light resistant
49X9/1	485B RS485 interface	Recommended:	UNITRONIC® Li2YCYv(TP) 2x2x0,5 or 3x2x0,5 (1 spare pair), Lapp Kabel
49X10/1	GND RS485 interface		

Note: If an ICC unit is used, the weather station communication is done via ICC. If no ICC unit is used, terminals 49X8/1 and 49X9/1 can be used for connection to the weather station.

4.6.16 Power Supply for Weather Station

Table 4.19 Weather station supply (see Figure 4.17-3)

Terminal	Function	Specifications
49X12/1	24 V_{DC} weather station supply	24 V_{DC}
49X13/1		0 V

4.6.17 Installation of the GSM Modem (optional)

Table 4.20 Connection remote monitoring/modem (see Figure 4.18 and Figure 4.19)

Function	Specification
GSM modem	Antenna with a 2 m cable (lead through the side wall)

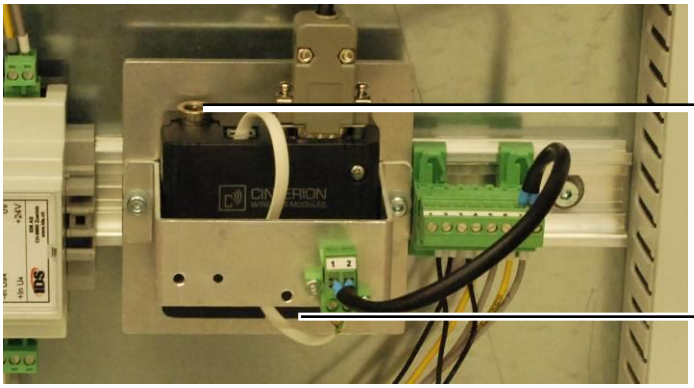


Figure 4.18 GSM modem (*see also Figure 5.3-3*)

1 - Antenna connection
2 - Position of the SIM card

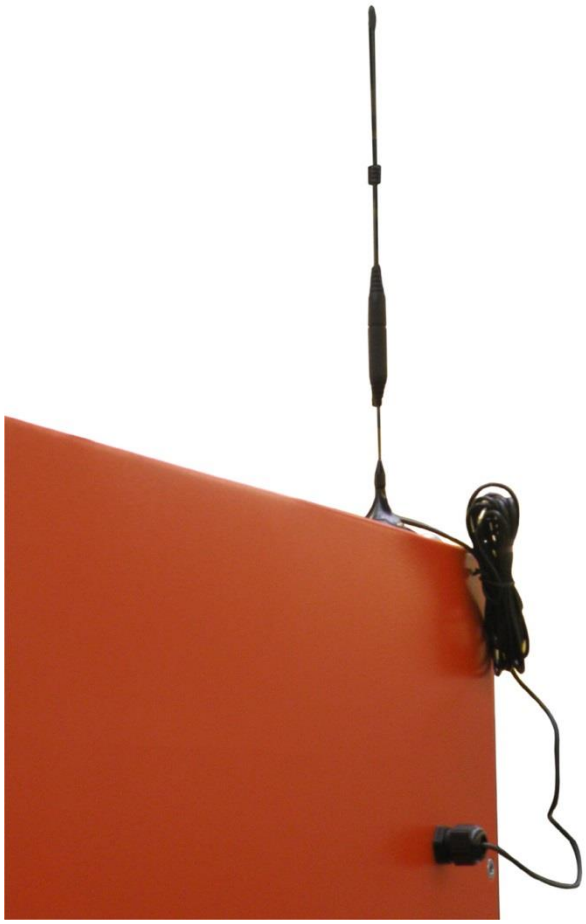


Figure 4.19 GSM antenna positioned on top of the inverter

In case the GSM modem has been supplied as a loan for the commissioning, it must be sent back in complete set (the module consists of a modem with SIM card, interface converter, plug, DIN-rail mounting and antenna) as soon as a functional Ethernet connection to the SOLO inverter has been established. The return address can be found on the last page of this user manual.

The antenna is delivered with a magnetic socket and can be positioned on another location on or close to the inverter. For a good connectivity, make sure that the antenna is **not** in a metal room (container).

4.6.18 Ethernet Connection

Table 4.21 Connection remote monitoring/Ethernet (see Figure 4.17-1)

Terminal	Function	Specifications
49A1	Ethernet connection	Ethernet cable with RJ45 connector

5 Commissioning

5.1 Refilling and Bleeding the Cooling Circuit

To be performed only, if the cooling system pressure differs from 2 bar by more than 0.5 bar (at 20°C coolant temperature)!

A properly functioning cooling system is essential for a trouble-free operation of the inverter. That is the reason, why the cooling system has to be filled up and bled properly.

WARNING

Avoid contact between the coolant and skin or clothes!

Use gloves and safety goggles!

Failure to observe this warning could result in serious injury.

WARNING

The inverter must **not** be in operation during the refilling!

Use only original ELECTROINVENT coolant!

For bleeding and refilling of the cooling circuit proceed according to the following sequence:

1. Fill the filling pump vessel [*Figure 5.1*] with fresh coolant and close the pump.
2. Connect the coolant filling hand pump to the filling connection [*Figure 4.5-1*] by using the supplied small diameter tube (small diameter – minimum air volume).
3. Make sure, the backflow valve of the filling pump is closed.
4. Open the filling valve [*Figure 4.5-2*].
5. Open the backflow valve of the filling pump for a short time, in order to fill the tube completely with coolant from the side of the inverter (no air should be pumped in the cooling circuit of the inverter). If the pressure of the cooling system is too low to fill the tube with coolant, the tube has to be filled with coolant before connecting it to the inverter.
6. Fill the cooling system by pumping the filling pump, while constantly monitoring the manometer [*Figure 4.5-8*]. The cooling system has to be filled up to 2 bar, as the bleeding process decreases the system pressure. When 2 bar is reached, close the filling valve [*Figure 4.5-2*].
7. Carry out the inverter commissioning as described in *Chapter 5.2* and turn the inverter on as described in *Chapter 5.3.1*. Then continue with the following steps.
8. While the inverter and its cooling system pump is running, open the red vent cap of the bleeding valve [*Figure 4.4-1*] by two full turns counter-clockwise from the fully closed position for proper automatic operation. Bleeding of the pump, in particular the motor area, is normally implemented automatically after a short period of operation (if the pump is only filled partly with coolant it might be necessary to bleed the pump as described in the *Installation and Operating Instructions* of the pump manufacturer).
9. Check the heat exchanger fan for correct operation. The air must be sucked from the heat exchanger through the fan. If this is not the case, the whole system must

be turned off and two of the power supply cables on the user terminals 48X1/4, 48X2/4 or 48X3/4 have to be exchanged.

10. If the pressure in the cooling system decreases through the bleeding, fill the cooling system with coolant up to nominal pressure of 2 bar.
11. Close the filling valve [*Figure 4.5-2*] tight and detach the filling pump.

Note: It is necessary to bleed the cooling system once again after a few hours normal operation of the system (take care not to bleed too much liquid, otherwise coolant must be added again in order to keep the pressure above the required minimum).

Figure 5.1 Hand pump

5.2 Inverter Commissioning

5.2.1 Control and Visualisation Elements

Figure 5.2 Control and visualization elements

1 - Emergency stop button
2 - Two-position switch (start/stop)
3 - Main switch
4 - VCU (Visual Control Unit) Touch screen panel for visualization and control
5 - Status signal lamp (see Chapter 8)

5.2.2 Important Components Overview

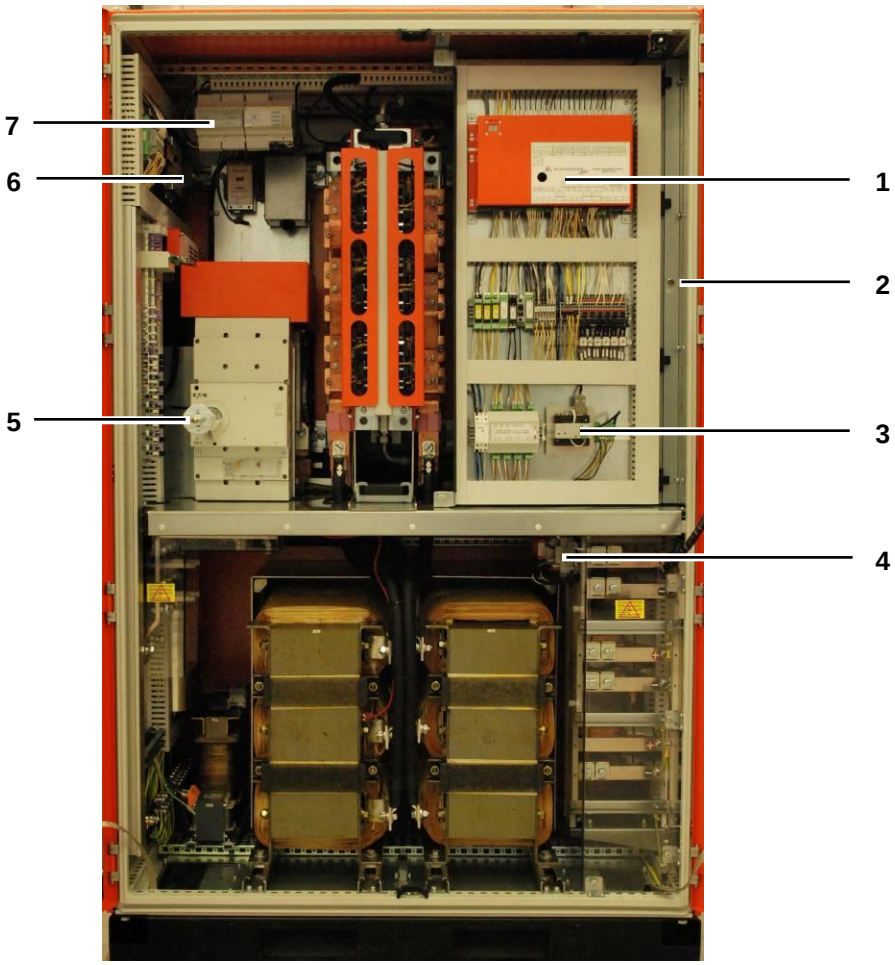


Figure 5.3 Important components

1 - Control unit with status display
2 - Operation mode switch (in normal operation mode it should be on Stand-By Active)
3 - GSM communication unit (GCU) (optional)
4 - Overvoltage protection of the PV connections
5 - Main switch
6 - Grid monitor VDE-AR-N 4105 (optional)
7 - Insulation monitor (optional)

5.2.3 Initialisation

NOTICE

The initial commissioning has to be performed with external control disconnected (power limitation, emergency stop, etc.).

Following steps must be performed:

1. Make sure the inverter's electrical connections are correctly executed and the cooling circuit has been properly installed.
2. Turn the main switch off [*Figure 5.2-3*].
3. Set the two-position switch [*Figure 5.2-2*] to "Stop" position.
4. Check the correct polarity of all PV inputs with a multimeter.
5. Release the emergency stop button [*Figure 5.2-1*] (including a possible external emergency stop circuit).
6. Turn the grid connection and the auxiliary power supply (transformer) on.
7. Turn the main switch on [*Figure 5.2-3*].
8. Wait until the touch screen panel [*Figure 5.2-4*] displays "Monitoring & Control SOLO Family". Activate the main menu by touching the display.
9. Check the grid voltage and frequency displayed in the main menu. If the voltage is 330 V (or 300 V when the relevant option is used) and the frequency 50 Hz, the grid connection is correct.
10. Make the settings in the touch screen panel according to the description in *Chapter 7* (language, date, time, Installed power and PV start voltage, Internet parameters, etc.).
11. Setup communication for remote diagnostics according for the chosen medium (modem, Ethernet). For details see *Chapter 7.6*.

Table 5.1 Operation mode switch (see Figure 5.3-3)

State	Inverter function	Application
Stand-By active	Enables the inverter to go in stand-by mode when the power on the PV inputs is too low. The inverter recovers from standby when the voltage on tracker 1 is high enough.	Used when the auxiliary supply (internal or external) is not interrupted by the transformer standby output [*Table 4.8*]. **Note:** When the inverter is in standby the touch screen display and the connections to RDS and Web portal are not available.
Converter control on	The system control is always active	Used when the auxiliary supply connection does not provide supply to recover from standby.

5.2.4 Commissioning of the Power Section

The commissioning of the inverter's power section is executed according to the following sequence:

1. Turn the PV modules on by using the string box main switches.
2. Check the correct polarity of all PV inputs with a multimeter.
3. Turn the system on by setting the two-position switch to "Start" position [*Figure 5.2-2*]. During normal operation the signal lamp [*Figure 5.2-5*] glows green and a humming from the inverter can be heard. If the light is red or if it is flashing red, see *Chapter 8* for error handling.
4. The Inverter is now ready for the setup of external control.

5.3 Operation

5.3.1 Turning the Inverter On

Turning the inverter on must be performed according to the following sequence:

1. Set the two-position switch [*Figure 5.2-2*] to "Stop" position.
2. Turn the PV modules on by using the string box main switches.
3. Turn the grid connection and the auxiliary power supply (transformer) on.
4. Turn the main switch on [*Figure 5.2-3*].
5. Wait until the touch screen panel [*Figure 5.2-4*] displays "Monitoring & Control SOLO Family".
6. If the signal lamp is flashing/glowing red, an error has occurred (see *Chapter 8*).
7. Set the two-position switch [*Figure 5.2-2*] to "Start" position. After a successful startup of the inverter the signal lamp [*Figure 5.2-5*] glows green and a humming from the inverter can be heard. If the signal lamp is glowing or blinking red, there is an error or a warning (see *Chapter 8*).

WARNING

If the signal lamp is off, this may be due to a defective light. The inverter could still be in operation and live.

Table 5.2 Status signal lamp (see Figure 5.2-5)

Signal lamp	Explanation	Comment
off	System in standby mode or switched off.	In standby mode the system is turned off when the PV voltage is low. Check whether the two-position switch has been set to "Start".
flashing green	System ready to start. The inverter is not working yet.	Wait until the inverter starts.
glowing green	System operating	Grid feed-in active
flashing green-red	A warning has occurred during operation. The inverter is still working.	See *Chapter 8.*
flashing red	A warning has occurred. The inverter has stopped feeding energy.	See *Chapter 8.*
glowing red	The system is down. An error has occurred.	See *Chapter 8.*

5.3.2 Turning the Inverter Off

NOTICE

The sequence for turning the inverter off must be observed! Through frequent turning off by using the main switch or the E-stop button during operation some components are excessively worn out. Improper operation of the inverter may lead to the warranty being void.

Observe the following sequence when turning the inverter off:

1. Set the Two-position switch [*Figure 5.2-2*] to "Stop" position.
2. Turn the main switch off [*Figure 5.2-3*].
3. Disconnect the PV modules by using the string box main switches.
4. Turn the auxiliary power supply and the grid connection (transformer) off.

6 Maintenance

WARNING

The Installation of the inverter must only be performed by authorized personnel. The absence of voltages (grid and PV lines) must be ensured before and during maintenance work. Consider capacitor discharge of **10 minutes** after switching the power connections off.

Failure to observe this warning could result in death or serious injury.

NOTICE

Warranty void if improperly maintained.

Note: A service contract with ELECTROINVENT including all preventive maintenance is recommended.

6.1 Maintenance of the SOLO Inverter

We recommend an annual maintenance of the SOLO inverter, including following inspections:

- Inspect air filters of every fan. In case of contamination they have to be replaced with new original filters.
- Check fans for abnormal noise, whistling or grinding sound during operation. In case of malfunction they should be replaced with new original ones.
- Inspect cabinet for contaminations and perform relevant clean-up.
- Inspect cabinet for loose screws and bolts (especially the ones of the electrical connections) and perform relevant tightening.

6.2 Maintenance of the Cooling Circuit

Annual maintenance:

- Check the system for leakages
- Check the hoses and pipes for cracks
- Check/remove contamination or obstacles from the heat exchanger
- Checks on fans:
  - Blades in good shape
  - No cracks in the blades
  - No abnormal roaring, whistling or grinding sound during operation
- Checks on the pump:
  - No abnormal roaring, whistling or grinding sound during operation
- Filling in the cooling system back to nominal pressure and ventilation (see *Chapter 5.1)*

For more details, please check the *Maintenance Manual*.

7 Operating the Touch Screen Panel of the Inverter and Parameterization

The inverter is equipped with a touch screen panel also called VCU (**V**isual **C**ontrol **U**nit) positioned on the front door. It serves the local operation, visualization and system configuration.

After switching on, “Monitoring & Control SOLO Family” appears as startup screen on the VCU.

Figure 7.1 “Monitoring & Control SOLO Family” startup screen

The main menu (see *Figure 7.2*) is activated by touching the screen.

10 minutes after the last activity the display switches to screensaver mode. The display can be activated again by touching it.

Note: The images shown below are for illustrative purposes only.

7.1 Main Menu

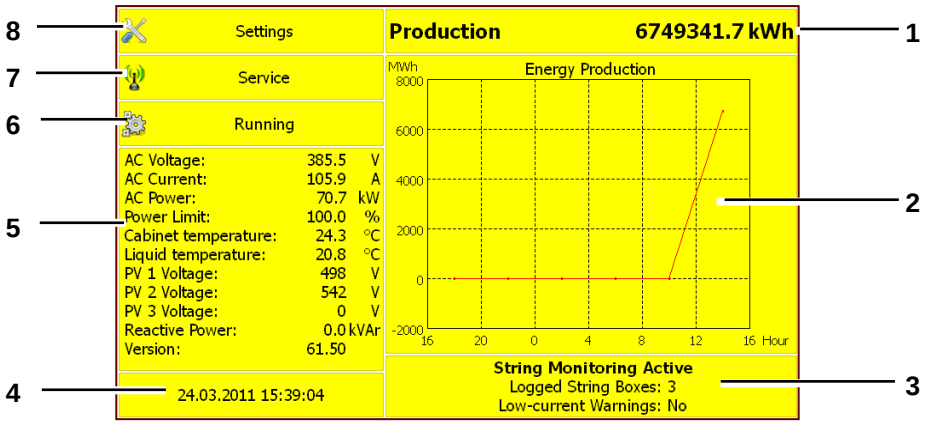


Figure 7.2 Main menu

1 - Production since operation start
2 - Electrical energy production diagram (active field)
3 - String boxes monitoring summary (active field)
4 - System date and time (active field)
5 - Operational parameters
6 - Inverter’s status (active field)
7 - Service menu (active field)
8 - Settings menu (active field)

Note: Touching active fields leads to system parameters submenus (see *Table 7.3 and Table 7.6)*

7.2 Submenus

Submenus are activated by touching the relevant field of the main menu, e.g. settings menu [*Figure 7.2-8*]:

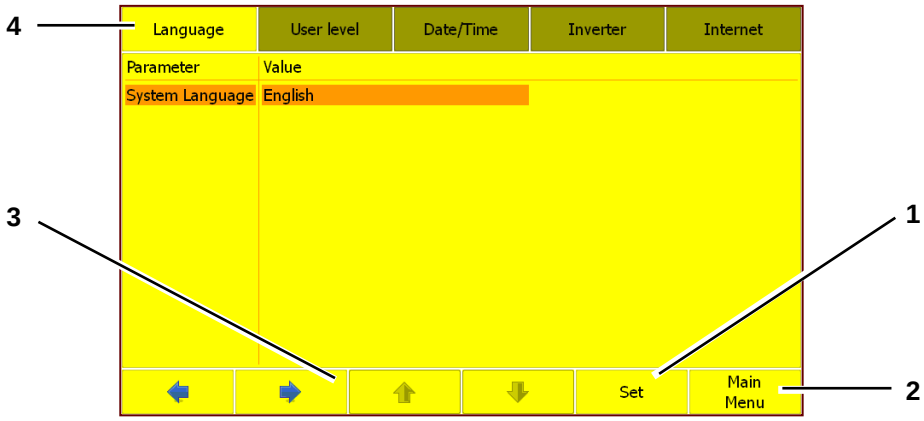


Figure 7.3 Submenu Language

1 - "Set" button
2 - "Main Menu" button
3 - Navigation bar with arrows
4 - Submenu tabs

Submenus are arranged in tab form and enable choice of options and parameters setting.

The choice between the submenus or parameters is accomplished by a navigation bar with arrows (left, right, up, down) [*Figure 7.3-3*].

For parameter changes the relevant setting menus are opened when touching the "Set" button [*Figure 7.3-1].*

The "Main Menu" button [*Figure 7.3-2*] leads back to the main menu.

7.3 Parameter Changes

Parameter values can be selected by using the navigation bar or by touching the display in the area of the desired parameter value.

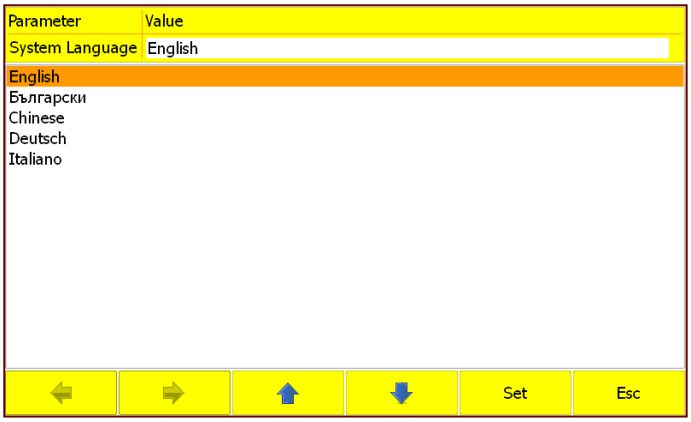


Figure 7.4 Parameter value selection

The change of the parameter value is done by touching the "Set" button.

The "Esc" button leads back to the previous submenu.

7.4 Access Rights to Functions and Parameters

For protection of the system against improper service and unauthorized access, some functions are password protected. The access levels and permissions are listed in *Table 7.1*. An example change of access level is shown below. The logout is accomplished by setting of system user parameter to "User" access level. It does not require a password.

Table 7.1 User levels (under "Settings" menu)

System user	User type	Permissions
User	System monitoring	Reading the display values / changing language (no login required)
Operator	System administrator	Setting the display parameters on the start page / Internet settings
Engineer	Installer	System installation and maintenance
Service	ELECTROINVENT service	System servicing
Designer	ELECTROINVENT development	Reserved for manufacturing purposes

Example of changing the access level to "Operator"

This sequence starts from the main menu:

1. Tap "Settings", followed by "User level" and "Set".
2. Using ↑ or ↓ select "Operator" and tap "Set".
3. Using ↑ or ↓ select "Password" and tap "Set".
4. Enter the "Operator" level password using the number key pad.
5. Tap "Set".
6. If the sequence was correctly done the following message appears:

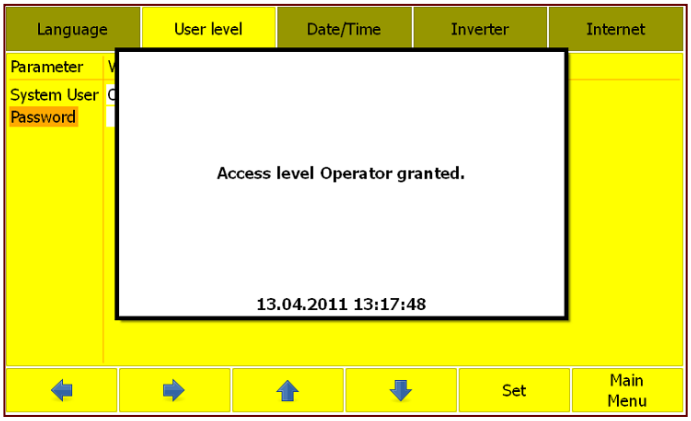


Figure 7.5 Confirmation message

7.5 Inverter Parameter List

Table 7.2 lists the operational parameters for the feedback window and the parameter display. An overview of the system parameters, their functions, meanings and locations are listed in *Table 7.3* to *Table 7.6*.

Table 7.2 Operational parameters displayed on the main menu (see Figure 7.2-5)

No.	Parameter	Description	Units
1	AC Voltage	Grid voltage RMS	V_{AC}
2	AC Current	Grid current	A_{AC}
3	AC Power	Average output power (15 min)	kW
4	Power Limit	Grid power limitation	%
5	Cabinet temperature	Temperature inside the inverter cabinet	°C
6	Liquid temperature	Coolant temperature	°C
7	PV1 Voltage	PV Voltage – input1	V_{DC}
8	PV2 Voltage	PV Voltage – input2	V_{DC}
9	PV3 Voltage	PV Voltage – input3	V_{DC}
10	Reactive power	Grid reactive power	kVAr
11	Version	SW version	-

Table 7.3 System parameters description – part 1

Main menu (active fields)	Submenu	Parameter	Function
Settings [*Figure 7.2-8*]	Language	System language	Language setting
	User level	System user	Select access level
		Password	Key in the access level password
	Date/Time	System date	System date display
		System time	System time display
	Inverter	Installed power	Installed plant power display
		PV start voltage	The minimum PV voltage (input 1) to start the inverter display
	Internet	DHCP	View status: Activated/Deactivated DHCP
		IP Address	View the configured IP address
		Subnet Mask	View the configured Subnet Mask
		Gateway	View the configured Gateway
		Current IP	View the current IP Address
Service [*Figure 7.2-7*]	Events log	N/A	View/Delete events
Status [*Figure 7.2-6*]	Events log	N/A	View/Delete events

Table 7.4 Meaning of status texts displayed on the main menu (see Figure 7.2-6*)*

Status text	Meaning
Initializing	Connecting to the inverter main control unit
Off	Inverter switched off
Ready	Temporary state before "Running"
Running	The installation is producing energy
Night Mode	Temporary state, prior to stand-by mode. PV voltage is below the minimum, waiting to switch off.
Fault	Error state

Table 7.5 Meaning of status colours displayed on the main menu (see Figure 7.2-6)

Status colour(s)	Meaning
	Glowing yellow: system is in "Initializing", "Ready" or "Running" state.
	Flashing cyan-yellow: system is in "Warning" state. The system is operating but some warnings have occurred.
	Flashing red-yellow: system is in "Fault" state. The system has stopped.

Table 7.6 System parameters description – part 2

Main menu (active fields)	Function		
Date / Time [*Figure 7.2-4*]	Shortcut to "Settings -> Date/Time" submenu		
Energy Display [*Figure 7.2-2*]	Diagram 1	Magnified image of the diagram	
	Settings	Display parameter	Selection of parameter to be displayed
		Time range	Selection of the time period to be displayed
String monitoring [*Figure 7.2-3*]	Display of string status information: • Number of logged string boxes • Low current warnings		
	String boxes	String box 1..(100) status	String box status details: • Current of each string • Average current for the box • Average current for faulty strings
	Settings	Number of string boxes	Displays the number of installed string boxes
		Low current warning at % of average string current	Setting the threshold for low current warning. When the current on a string is less than this value for 15minutes a warning is displayed.
		Activate string monitoring	Switching on/off string current monitoring function

7.6 Ethernet setup for Remote Diagnostic

The remote diagnostic and inverter data acquisition is performed via Ethernet or GSM-modem connection.

In order to provide connection to the ELECTROINVENT Remote Diagnostic System the VCU of each inverter must be connected to the Internet via an Ethernet cable with RJ45 connector and "visible" for ELECTROINVENT. For this purpose the local network at the PV plant must be configured. The local network could be based on ICC (Integrated Central Control) or on customer's specific router. When the network is not factory preconfigured the customer has to set up the network parameters of each VCU and send the access parameters to the ELECTROINVENT service center. The Internet parameters have to be taken from your network system administrator or Internet Service Provider.

Example of setting an IP address:

1. Change the access level to "Operator" as shown above.
2. From the main menu tap "Settings" and then "Internet".
3. Using ⬆ or ⬇ select "IP Address" and tap "Set".
4. Enter the IP address using ⬅ or ➡ and the number key pad and tap "Set".
5. Using ⬆ or ⬇ go to the next parameter and proceed in the same way.
6. After setting all needed parameters tap "Main Menu". The VCU will restart and the changes will take effect.

After completion of the VCU and the network settings, please call ELECTROINVENT for connection testing. For further questions on network configuration please call ELECTROINVENT Service Centre.

7.7 String Monitoring

The VCU of ELECTROINVENT SOLO inverter has the capability of string boxes monitoring, when ELECTROINVENT Smart String Boxes are used.

There is a dedicated field of the VCU main menu that shows the string box monitoring summary (see *Figure 7.2-3*) It displays the number of detected string boxes and low string current warnings.

Tapping this field leads to a window displaying the states of the string boxes. This window differs depending on the string boxes used (SSB-A or SSB-P).

7.7.1 Smart String Boxes SSB-A

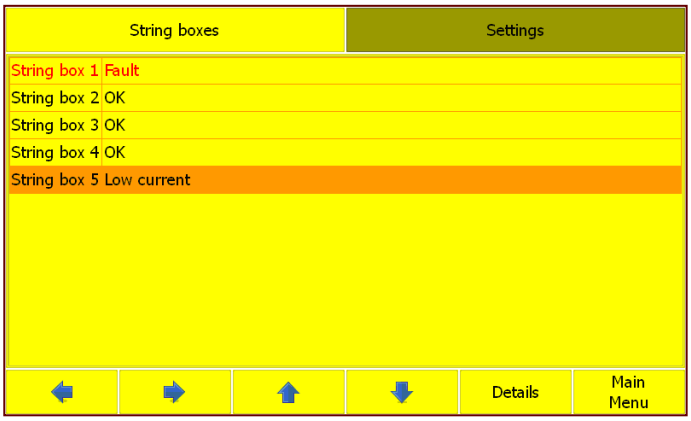


Figure 7.6 SSB-A states window

There are six available string box states explained in *Table 7.7*.

Table 7.7 SSB-A states

Status	Description
OK	All string currents are positive, no activated faults.
Low current	Some string currents are less than the defined percentage of the average string current for the string box for more than 15 minutes.
Zero current	The string current is between -1 A and 0.2 A.
Negative	String current is less than or equal -1 A.
Fault	String box fault detected.
Communication fault	Malfunction in communication between the string box and inverter.
Line fault	When the SSBs are serially connected via Fiber Optic interface [*Figure 4.10*] and Line fault on SSB3 is displayed this means that the optical interface between SSB2 and SSB3 is not working properly.

Scrolling over the string boxes and tapping "Details" opens a window which gives detailed information about the string currents of the chosen string box:

- When a string box is OK a detailed string current list is displayed.
- When a certain string box has one or more strings with low current, a warning message with string current and string box average current is displayed.
- When a string current is low for less than 15 minutes no warning is issued.

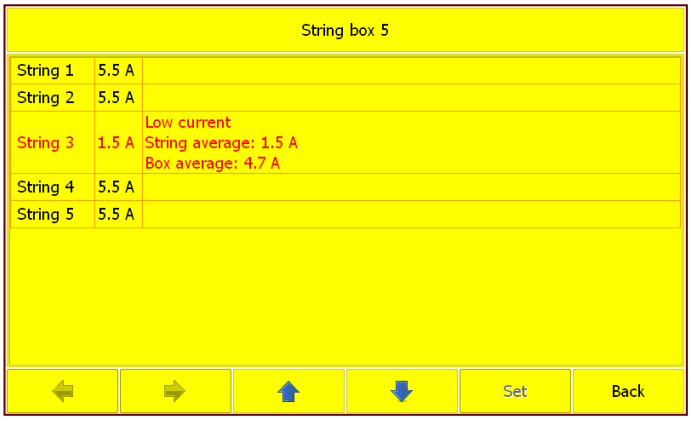


Figure 7.7 SSB-A status details

String monitoring can be switched on when the string box has string current measuring capability and otherwise is off. A low current warning is issued when the current of one or more strings is less than a preliminary defined threshold as percentage of the average string current of the box.

String monitoring switch on/off and parameter setting:

1. Change the access level to "Operator" as shown above.
2. Tap String Box Monitoring field [*Figure 7.2-3*] and then "Settings".
3. Using ▲ or ▼ go to "Activate string monitoring" parameter and tap "Set".
4. Change the value to "Yes" using ▲ or ▼ and tap "Set".
5. If you want to change the trigger limit for low current warning use ▲ or ▼ to go to "Low current warning at % of average string current" parameter and tap "Set".
6. Using the number key pad enter the desired value and tap "Set".

The value should not be too high, because faulty warnings could be generated due to string current variations resulting from shadows, clouds, etc.

7.7.2 Smart String Boxes SSB-P

The window dedicated for SSB-P states [*Figure 7.8*] shows the currently enabled string boxes along with information about the string voltage and flags for reverse current (RC) and deviation fault (DF).

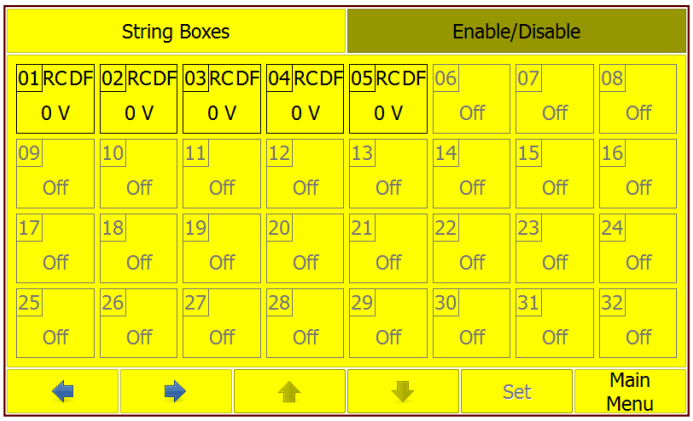


Figure 7.8 SSB-P states window

Tab “Enable/Disable” [*Figure 7.9*] is used to activate or deactivate the monitoring of a particular string box. The VCU supports up to 32 string boxes.

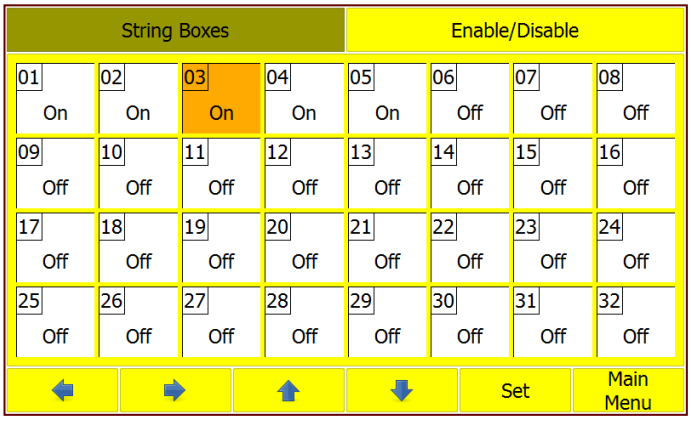


Figure 7.9 SSB-P “Enable/Disable” tab

Tapping the field of a particular box on the “String Boxes” tab [*Figure 7.8*] leads to a multi-tab window displaying detailed box data feedbacks.

The first tab “Bar” [*Figure 7.10*] displays a graphical bar diagram of the currents measured by the string box, presented as percentages of the nominal box current. Depending on its type the SSB-P supports up to 30 channels (PV strings). The channels displayed in grey are either not available in the current type of box or disabled by the user.

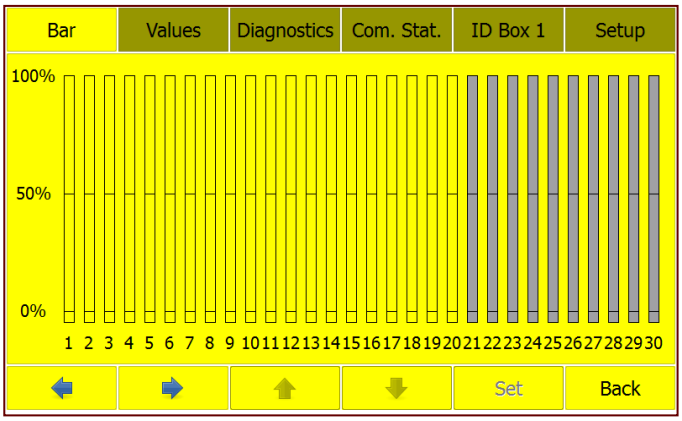


Figure 7.10 SSB-P currents bar diagram

Tab “Values” [*Figure 7.11*] provides real-time monitoring of the string currents, reverse currents (RC), deviation fault (DF) flags, PV voltage, box manual circuit breaker (BKR) fault flag, surge arrester (SA) protection fault flag, box temperature, and internal box voltage.

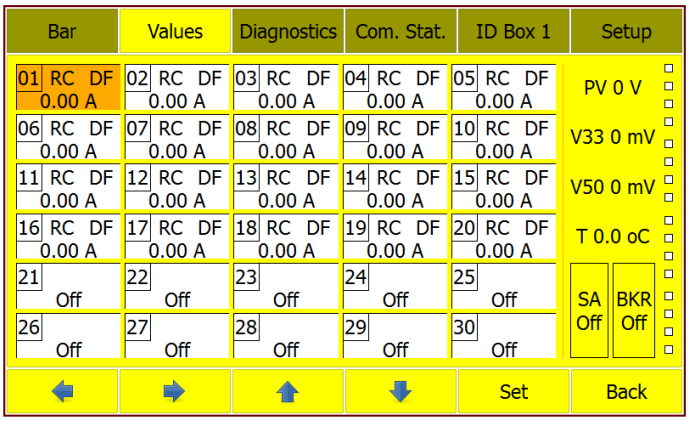


Figure 7.11 SSB-P values

To disable or enable a particular string, select its associated channel and click the “Set” button. Note that the VCU is not storing this information and after making changes to the enabled/disabled channels the user must use the “Setup” tab to apply the changes in the non-volatile box memory (see *Figure 7.13*).

Tabs “Diagnostics” and “Com. Stat.” are intended to be used by SCADA and service engineers for the purpose of communication diagnostics and statistics.

Tab “ID Box” [*Figure 7.12*] shows the main and unique box production data.
Note: MAC address field is needed for the initial box setup (described in the following paragraphs).

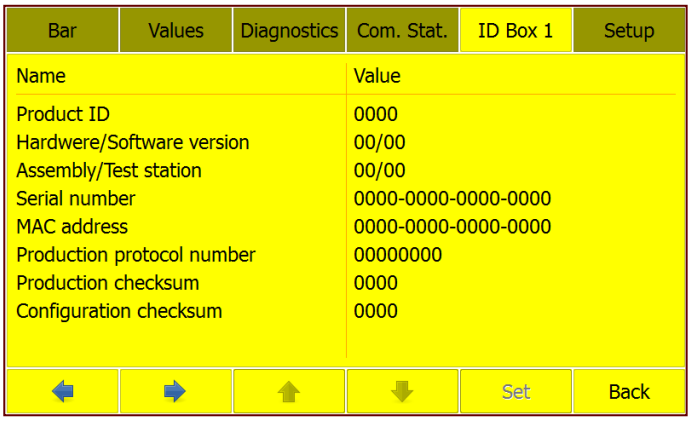


Figure 7.12 SSB-P ID

Tab “Setup” [*Figure 7.13*] is used to set particular box parameters according to the needs of the PV installation.

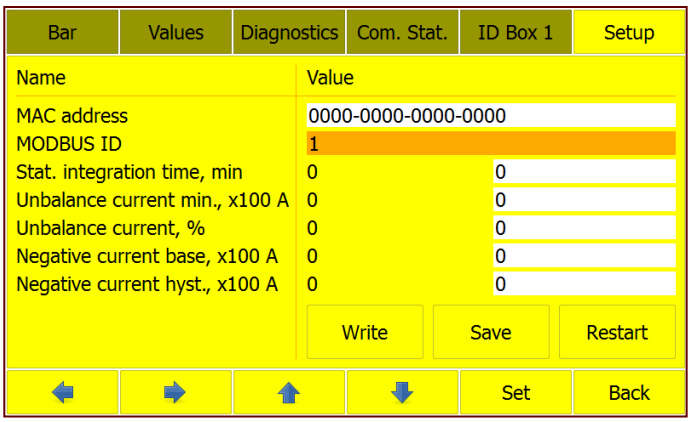


Figure 7.13 SSB-P setu

Description of the parameters is shown in *Table 7.8*.

Flowcharts for parameters setup are shown in *Figure 7.16* and *Figure 7.17.*

The “Write” button executes a write command of the current configuration in the volatile box memory.
Note: The currently selected parameter only is written.

The “Save” button executes a box save command. The configuration is saved in the non-volatile box memory.

The “Restart” button executes a restart command to the box electronics.
Note: Written but not saved changes are lost.

Table 7.8 SSB-P parameters description

Parameter	Unit	Range	Default	Description
MAC address				A unique 64-bits communication address. This number can be found on the box type label.
MODBUS ID		1 - 247	1	MODBUS protocol address
Stat. integration time	minutes	2 - 30	15	The box is capable to averaging the string currents for a specific interval. This data are accessible from the inverter MODBUS port.
Unbalance current min.	0.01A	0 - 1100	200 (2.00A)	Currents in channels below this threshold are not part of the average current used for the unbalance fault detection (see *Figure 7.14* and *Figure 7.15*).
Unbalance current	%	0 - 100	30 (0.30A)	Deviation from the average current used for the unbalance fault detection (see *Figure 7.14* and *Figure 7.15*).
Negative current base	0.01A	0 - 100	70 (0.70A)	Negative current base (see *Figure 7.14* and *Figure 7.15*).
Negative current hyst.	0.01A	0 - 100	40 (0.40A)	Negative current hysteresis (see *Figure 7.14* and *Figure 7.15*).

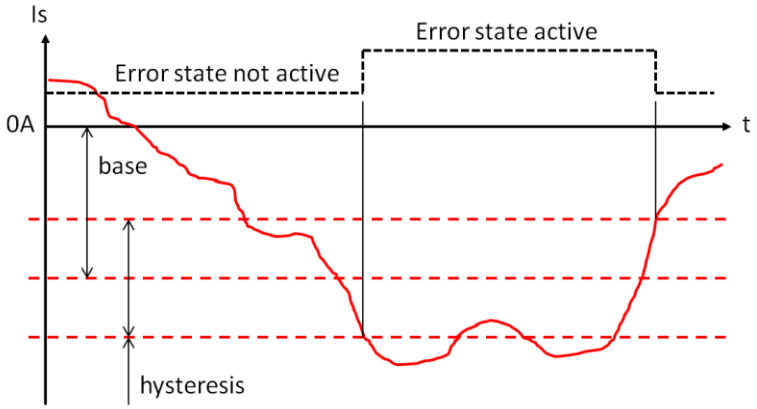


Figure 7.14 SSB-P negative string currents

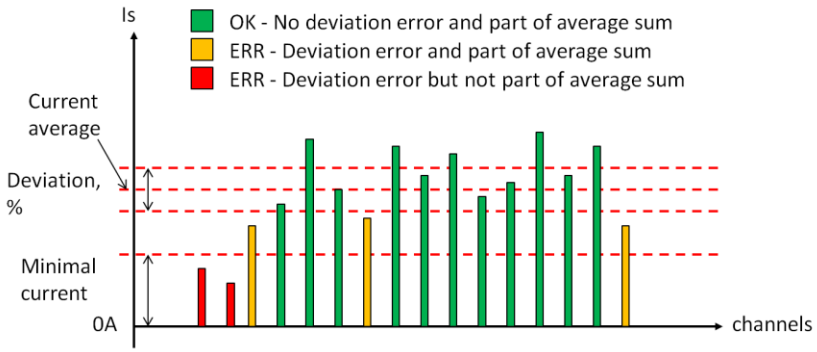


Figure 7.15 SSB-P string currents deviations

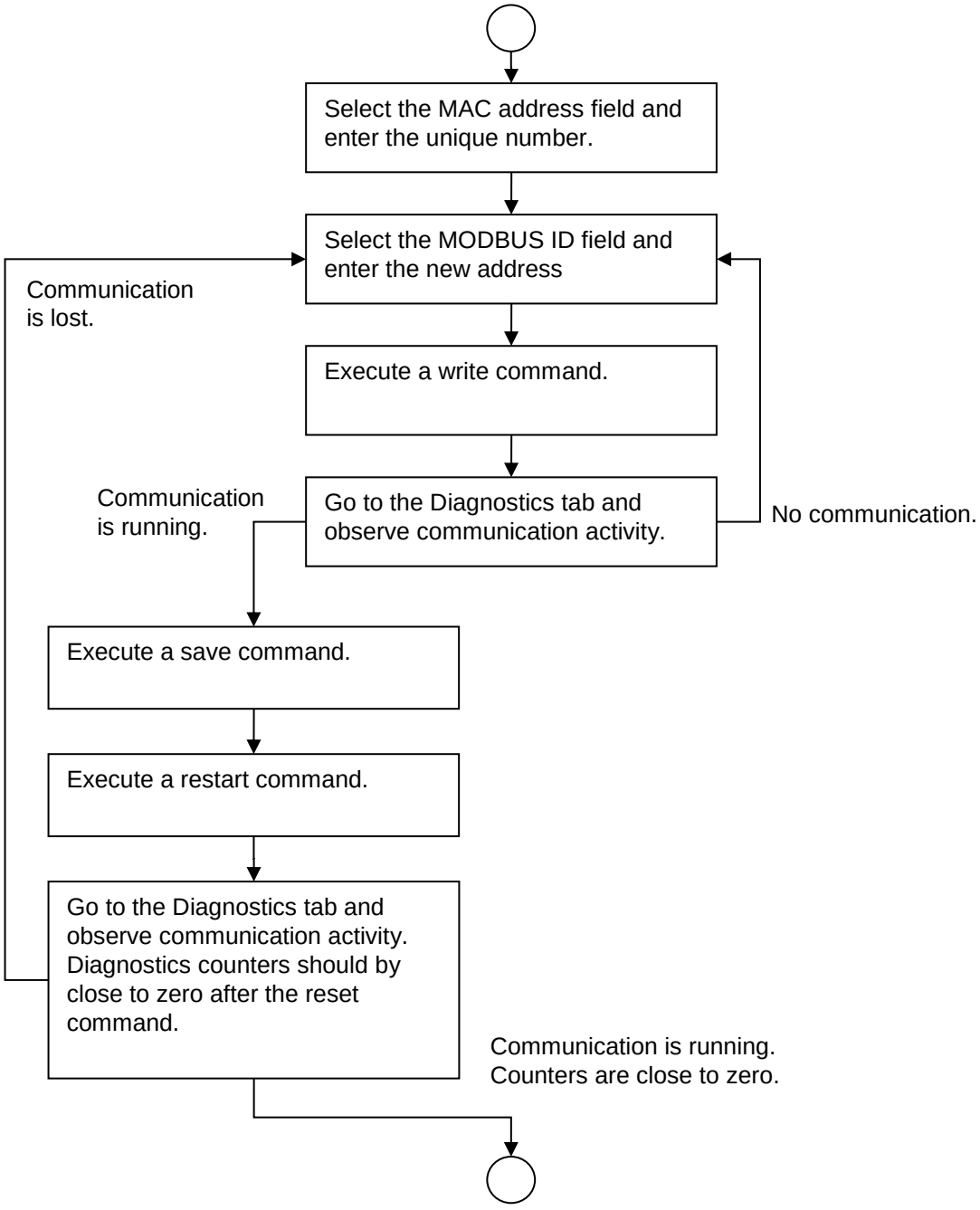


Figure 7.16 SSB-P MODBUS address setup

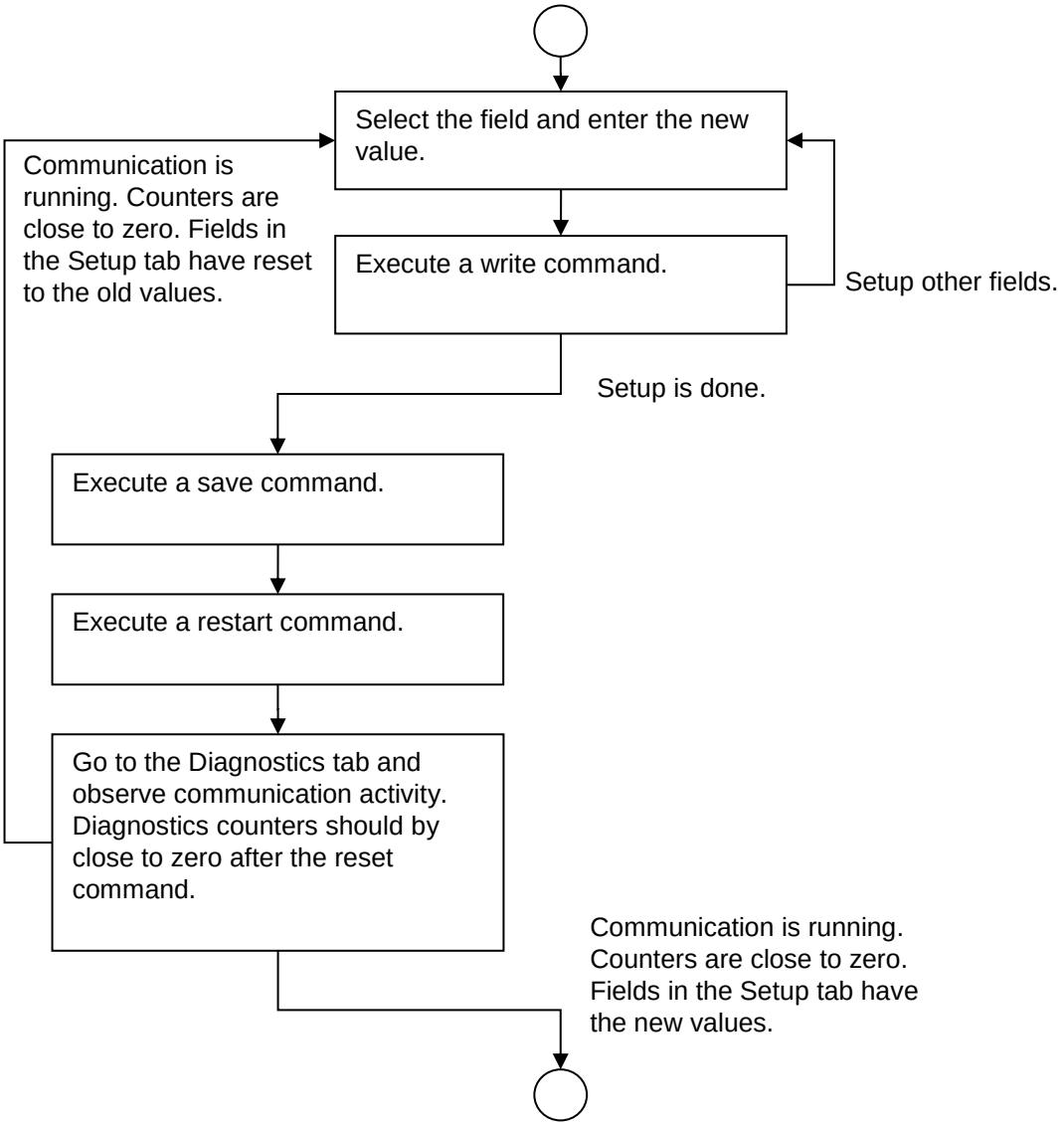


Figure 7.17 SSB-P parameters (other than MODBUS address) setup

7.8 Events Log

For the purpose of status monitoring and diagnostics an events log is available.

Tap "Service" or "Status" field of the main menu to enter the events log. It shows records of all events occurred (see *Figure 7.18*).

Scrolling through the events is done using ⬆ or ⬇.

An event can be deleted by touching "Del".

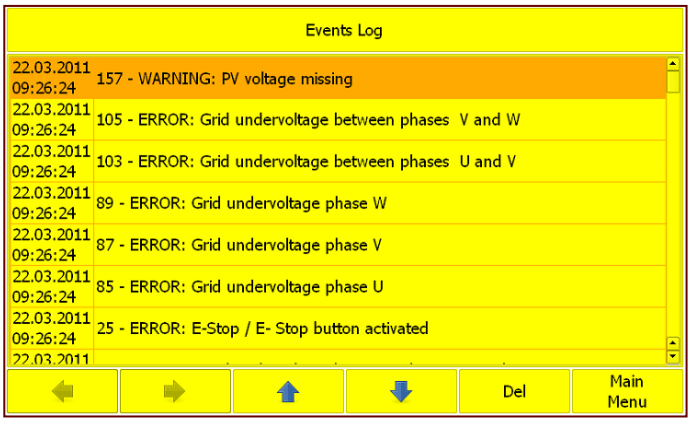


Figure 7.18 Events log

The status log has the following fields:

Time stamp	Date and time when the event occurred
ELECTROINVENT event code	Unique event code
Type of event	Warning – the inverter continues working or Fault – the inverter stops
Event description	Details about the detected malfunction

8 Diagnostics and Troubleshooting

The system control has integrated warning and error monitoring. Warnings do not lead to a stop during operation, but might limit the output power. When an error is detected the inverter is turned off. After the disappearance of the cause of the error, the inverter can restart automatically and return to the operation status and new start commands are not necessary. This automatic error acknowledgement function is limited to a maximum of 5 subsequent attempts. When an error has appeared more than 5 times and the cause of the error eliminated, the clearing of error status must be done by turning the inverter off and on by the main switch [*Figure 5.2-3*].

Table 8.1 Inverter troubleshooting

Warning lamp [*Figure 5.2-5*]	**Error pattern**	**Possible reasons**	**Troubleshooting**
Off: System in standby mode or turned off	The system cannot be turned on or the touch screen display remains dark.	• Grid voltage missing • PV voltage missing • Auxiliary supply missing	• Check if all steps according to *Chapter 4.6* have been performed • Check the PV voltage: in active standby operation the systems is turned on at $U_{PV}1 > 500$ V
Flashing green-red subsequently: inverter operation warning	Warning only. Inverter continues to operate.	• Increased cabinet temperature • Increased coolant temperature • Short-term tolerable grid disturbances	• In case of frequent occurrence check the cooling circuit according to *Table 8.2*
Flashing red: Warning, inverter is off	The system does not start in standby mode.	• Cabinet temperature too high • Coolant temperature too high • Grid disturbances	• Let the system cool down for approximately two hours • Check the cooling circuit according to *Table 8.2* • In case of frequent occurrence inform ELECTROINVENT Service
Glowing red: Error state, inverter is off	The system does not start in standby mode.	• Cooling substance flow rate too low	• Check the cooling circuit according to *Table 8.2*
		• Error in the grid connection • Error in PV connection • E-stop pressed	• Check the value of the grid voltage and frequency at the display • Check the electrical connections of the inverter
		• Internal error	• If the error stays after turning the main switch off and on, inform ELECTROINVENT Service

Table 8.2 Cooling system troubleshooting

Error report	Troubleshooting
Cooling system pressure too low	• Check the electrical connections of the pressure sensor • Check the static pressure. If the pressure is below 1.5 bar, fill with coolant up to the nominal pressure.
Flow rate of the cooling system is too low	• Check if the pump is set to level III • Check if the temperature has dropped below the required minimum • Check the electrical connections of the flow rate switch • Bleed the cooling circuit and the pump • Check the cooling circuit hoses for folds
Cooling system over temperature	• Check the cooling substance temperature (measure the temperature of the metal pipes) • Check the electrical connections of the cooling substance temperature sensor • Bleed the cooling circuit and the pump • Check if the heat exchanger fan is spinning • Check for obstacles in the way of the airflow
Cabinet over temperature	• Check if the ambient temperature is above the permissible maximum. • Check the fan filter (air intake and air outlet) **Note:** According to the dust density of the ambient air, it is possible that the filter pads are clogged after a few weeks and must be cleaned or replaced. • Check if all cabinet fans are working

9 EC – Declaration of Conformity

EC Declaration of Conformity

Manufacturer

Electroinvent LTD
43, Cherny Vrah Blvd.
1407 Sofia
Bulgaria

This declaration of conformity relates to Photovoltaic Inverters: Type / Model

SOLO – 100 / ISC - 40-2x12
SOLO – 200 / ISC - 40-3x17
SOLO – 250 / ISC - 40-3x22
SOLO – 500 / ISC - 33-114
SOLO – 500 / ISC - 30-122

The above described product is constructed and manufactured according to the good engineering practice in safety matters in compliance with the essential requirements of:

Directive 2006/95/EC of the European Parliament and of The Council of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (Low Voltage Directive, LVD 2006/95/EC)

and regarding electromagnetic compatibility in compliance with the essential applicable requirements of:

Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive, EMC 2004/108/EC)

meeting accordingly the requirements of the following harmonized European standards:

EN 62109-1:2010	Safety of power converters for use in photovoltaic power systems Part 1: General requirements (IEC 62109-1:2010)
EN 62109-2:2011	Safety of power converters for use in photovoltaic power systems Part 2: Particular requirements for inverters (IEC 62109-2:2011)
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:2005)
EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC) Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2006+A1:2010)

The CE-marking was affixed in: 2015

Issued by J. Torchanov, CEO, Electroinvent LTD

This declaration confirms the compliance with the quoted directive, but it does not constitute any warranty as to properties.
The safety information contained in the product documentation supplied must be adhered to.

Sofia, 15.05.2015

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J. Torchanov, Electroinvent LTD

EI / jt

CE Conformity SOLO

Figure 9.1 EC – Declaration of Conformity

10 Data Sheet SOLO 500

Type / Model	SOLO 500 / ISC-33-114

Grid Data

Nominal AC power (P_{AC})	500 kW	
Maximum AC power	550 kW	At ambient temperature T_{amb} < 45 °C
AC operating voltage (U_{AC})	330 V	+10 % / -15 %
AC nominal current (I_{AC})	875 A	
Grid frequency (f_{AC})	50 Hz	±10 %, Option: 60 Hz
Grid structure	IT	
Surge protection	Yes	
Harmonic distortion (%THD I_{AC})	< 3 %	
Power factor (cos φ)	–0.9 … +0.9	0.9 capacitive … 0.9 inductive Note: P-Q capability curve available on request
Max. efficiency	98.2 %	
Euro eta	97.8 %	
Auxiliary power supply (either external or generated internally)	3x400 V_{AC} 50 Hz	+10 % / -15 %; TN-S; surge protection type 2 Option: 60 Hz
Max. auxiliary power consumption	5 W / 1400 W	At standby / At full power Note: Depending on the type of the string boxes used, they may have additional consumption.

Photovoltaic Data

Nominal PV power (P_{PV})	508 kW	
Control strategy	MPPT	Maximum Power Point Tracking
Number of PV inputs Max. DC current on each PV input DC voltage range for MPPT	3 380 A 550 … 1100 V_{DC}	All PV inputs have one common MPP tracker
Max. permissible PV voltage (U_{PVmax}) Maximum PV voltage for operation start	1200 V_{DC} 1200 V_{DC}	
Voltage ripple U_{PP} (PV input)	< 3 %	
Surge protection (PV input)	Type 2	Monitored
Grounding (PV input)	Floating	Option: connection to PV(-) or PV(+) input

User Interface

External emergency stop Input	24 V_{DC} (±10 %), 20 mA, active high	Connect to dry contact: Open -> E-stop active, closed -> E-stop inactive
Emergency stop Output	24 V, max. 1 A	Dry contact: Open -> E-stop active, closed -> E-stop inactive
Transformer ready Input	24 V_{DC} (±10 %), 20 mA, active high	Connect to dry contact: Open -> not ready, closed -> ready
Transformer stand by Output	24 V, max. 1 A	Dry contact: Open -> stand by, closed -> operation
Inverter start / stop Input	24 V_{DC} (±10 %), 20 mA, active high	Connect to dry contact: Open -> stop, closed -> start
Communication interface	EIA-485, Ethernet	Others see under options
Data logger interface	ELECTROINVENT Web Portal	Others see under options

Options

Power limitation control / BDEW directives: Grid monitoring (VDE-AR-N 4105) or Low Voltage Ride Through (LVRT), Fault Ride Through (FRT) / Potential Equalization Device (PED) – connecting PV(-) or PV(+) input to ground (earth fault monitoring and earth current measurement) / AC operating voltage U_{AC} = 300 V
Communication: SCADA (Modbus RTU (EIA-485) and Modus TCP/IP), GSM or Ethernet
Data logger: SolarLog, Meteocontrol, others on request

Cabinet and Ambient Conditions

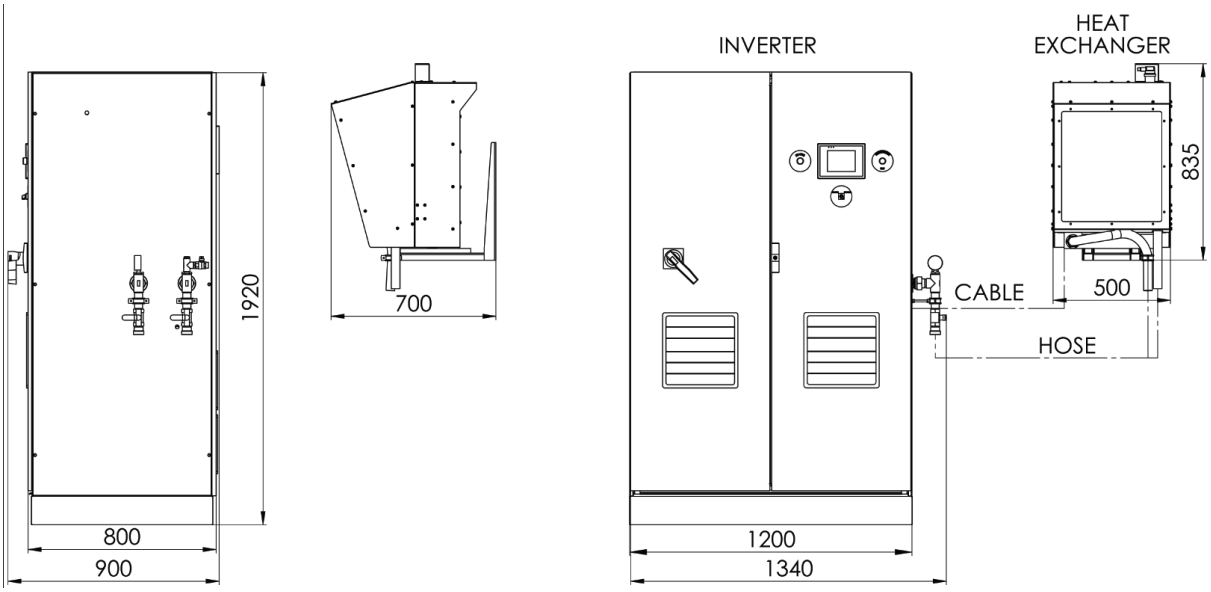
Dimensions (W x D x H)	1340 x 900 x 1920 mm	
Weight (m) approx.	1350 kg	
Ambient temperature range (T_{amb})	–20 ... +45 °C	
Humidity	15 ... 95 %	Non condensing
Enclosure type according to EN 60529	IP54	
Maximum elevation above sea level	2000 m	
Cooling	Liquid cooled	With external heat exchanger
Coolant concentration	–25 °C	water 55 %, ethylene-glycol 45 %
Static pressure of coolant (p)	2 bar (±0.5 bar)	Above ambient pressure, at 20 °C

Heat Exchanger

Dimensions (W x D x H)	500 x 700 x 835 mm	
Weight (m)	51 kg	
Air inlet temperature range (T_{hex})	–20 ... +45 °C	
Hose size (d) Hose length (l)	25 mm / 37 mm 10 m	Inside diameter / Outside diameter Inverter to heat exchanger
Max. elevation above inverter level (h)	9 m	Heat exchanger top level – inverter bottom level

Standards

CE conformity / EMC	Yes	EN 61000-6-2, EN 61000-6-4



Ordering Information

For technical or commercial information please contact the ELECTROINVENT sales office (see Contacts on last page of this user manual).

Contacts

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