540-00108-01

REV	DATE
01	2015/07/10

Zeversolar Service Line

China (incl. Hongkong, Macau)
Jiangsu Zeversolar New Energy Co., Ltd.
Tel.: +86 512 6937 0998-8866
E-mail: service.china@zeversolar.com
Add.: Building 9, No.198 Xiangyang Road, Suzhou 215011, China

Australia
Zeversolar Australia
Tel.: +61(0)1300101883
E-mail: service.apac@zeversolar.com
Add.: Suite 2.23 Level 2, 838 Collins Street, Melbourne, Docklands Vic 3008, Australia

Europe Region
Zeversolar GmbH
Tel.: +49(0) 2102 420 944
E-mail: service.eu@zeversolar.net
Add.: Luxemburger Straße 59, 50674 Köln, Germany

United Kingdom:
Tel.: +44 (0) 800 731 0899
E-mail: service.eu@zeversolar.net

Rest of the world
E-mail: service.row@zeversolar.com

Installation and Operating Instructions

Eversol TL1000-20/TL1500-20/TL2000-20/TL3000-20 Solar Inverters

zeversolar

Table of Contents

1 Notes on this Manual 4
1.1 Area of validity 4
1.2 Target group 4
1.3 Symbols used in this manual 5
2 Safety 6
2.1 Intended use 6
2.2 Safety standards 6
2.3 Important safety information 7
2.4 Symbols on the type label 8
2.5 Basic safety protection 9
3 Unpacking 10
3.1 Scope of delivery 10
3.2 Checking for transport damage 10
4 Mounting 11
4.1 Ambient conditions 11
4.2 Selecting the mounting location 13
4.3 Mounting the inverter with the wall mounting bracket 14
5 Electrical Connection 16
5.1 Safety 16
5.2 System layout of units without integrated DC switch 17
5.3 Overview of the connection area 17
5.4 AC connection 18
5.4.1 Conditions for the AC connection 18

5.4.2 Grid connection 19
5.4.3 Second protective grounding connection 22
5.4.4 Residual current protection 23
5.4.5 Overvoltage category 24
5.4.6 Circuit breaker 24
5.5 DC connection 25
5.5.1 Conditions for the DC connection 25
5.5.2 Assembling the DC connectors 27
5.5.3 Disassembling the DC connectors 29
5.5.4 Connecting the PV array 30
6 Communication 32
6.1 System monitoring via RS485 32
6.2 Updating the firmware via RS485 35
7 Operation 36
7.1 Overview of the control panel 36
7.1.1 Display 37
7.1.2 Control button 38
7.1.3 LEDs 39
7.2 Display messages 40
7.3 Language and safety regulation settings 42
7.3.1 Language setting 42
7.3.2 Safety regulation setting 42
8 Commissioning 44
8.1 Electrical tests 44
8.2 Mechanical tests 45
8.3 Start-Up 45
9 Disconnecting the Inverter from Voltage Sources 46

10 Technical Data 47
10.1 DC input data 47
10.2 AC output data 48
10.3 Safety regulations 49
10.4 General data 50
10.5 Efficiency 51
10.5.1 Efficiency curve TL1000-20 51
10.5.2 Efficiency curve TL1500-20 52
10.5.3 Efficiency curve TL2000-20 53
10.5.4 Efficiency curve TL3000-20 53
10.6 Power reduction 54
11 Troubleshooting 56
12 Maintenance 58
12.1 Cleaning the contacts of the DC switch 58
12.2 Cleaning the heat sink 58
13 Recycling and Disposal 58
14 Contact 59

1 Notes on this Manual

General Notes

The Eversol is a transformerless PV inverter with a single MPP tracker. It converts the direct current (DC) from a photovoltaic (PV) array to grid-compliant alternating current (AC) and feeds it into the utility grid.

1.1 Area of validity

This manual describes the mounting, installation, commissioning and maintenance of the following Zeversolar inverters: Eversol TL1000-20, TL1500-20, TL2000-20, TL3000-20

Observe all documentation that accompanies the inverter. Keep them in a convenient place and available at all times.

1.2 Target group

This manual is for qualified electricians only, who must perform the tasks exactly as described.

All persons installing inverters must be trained and experienced in general safety which must be observed when working on electrical equipments. Installation personnel should also be familiar with local requirements, rules and regulations.

1.3 Symbols used in this manual

The safety precautions and general information are used in this manual as follows:

DANGER!

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

WARNING!

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

CAUTION!

CAUTION indicates a hazardous situation which, if not avoided, can result in minor or moderate injury.

NOTICE!

NOTICE indicates a situation which, if not avoided, can result in property damage.

INFORMATION!

INFORMATION provides tips which are valuable for the optimal installation and operation of the inverter.

2 Safety

2.1 Intended use

2.1.1. Eversol converts the direct current from a PV array into grid-compliant alternating current.

2.1.2. Eversol is suitable for indoor and outdoor use.

2.1.3. Eversol must only be operated with PV arrays (PV modules and cabling) of protection class II, in accordance with IEC 61730, application class A.
Do not connect any sources of energy other than PV modules to the Eversol.

2.1.4. PV modules with a high capacitance to ground must only be used if their coupling capacitance does not exceed 1.0µ F.

2.1.5. When the PV modules are exposed to sunlight, a DC voltage is supplied to this equipment.

2.1.6. When designing the PV system, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Zeverplan" (http://www.zeverplan.com) will assist you.

2.2 Safety standards

Eversol inverters comply with the EU Low-Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC. They are labeled with the CE mark. For more information about certificates in other countries and regions, please visit website www.zeversolar.com.

2.3 Important safety information

DANGER!

Danger to life due to high voltages in the inverter!

- All work on the inverter must only be carried out by qualified personnel who have read and fully understood all safety information contained in this manual.
- Children must be supervised to ensure that they do not play with this device.

WARNING!

Risk of injury due to electric shock and fire caused by high leakage current!

- The inverter must be reliably grounded in order to protect property and personal safety.

CAUTION!

Risk of injury due to hot heat sink!

- The heat sink may get hot during operation. Do not touch!

CAUTION!

Possible damage to health as a result of the effects of electromagnetic radiation!

- Please maintain a distance of at least 20cm from the inverter when it is in operation

NOTICE!

Grounding the PV array!

- Comply with local regulations for grounding the PV array. We suggest the frames of PV modules must be reliably grounded.
- Do not ground any of the terminals of the strings.

2.4 Symbols on the type label

Symbol	Explanation
	Beware of high voltage and operating current. The inverter operates at high voltage and current. Work on the inverter must only be carried out by skilled and authorized electricians.
	Beware of hot surfaces. The inverter can get hot during operation. Avoid contact during operation.
	Do not dispose of this inverter with household waste. For more information on disposal, please refer to Section 13 "Recycling and disposal".
	CE mark. The inverter complies with the requirements of the applicable EC guidelines.
	Certified safety The product is TUV-tested and complies with the requirements of the German Equipment and Product Safety Act.
	RCM The product complies with the requirements of the applicable Australian low-voltage and electromagnetic compatibility standards.
	Capacitors discharge Before opening the covers, the inverter must be disconnected from the grid and PV array. Wait at least five minutes to allow the energy storage capacitors to fully discharge.
	Refer to the manual accompanying the inverter.
	Risk of danger, warning and caution Safety information important for human safety. Failure to observe the safety information in this manual may result in injury or death.

2.5 Basic safety protection

We provide the following safety protection:

1) Over-voltage, under-voltage protection

2) Over-frequency, under-frequency protection

3) Over-temperature monitoring

4) Residual current monitoring

5) Insulation monitoring

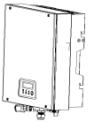
6) Anti-islanding protection

7) DC feed-in monitoring

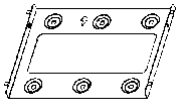
3 Unpacking

3.1 Scope of delivery

Object	Description	Quantity
A	Inverter	1 piece
B	Wall mounting bracket	1 piece
C	Mounting accessory kit: terminal lug (1 pc.), screw anchors (4 pcs.), hexagon bolts (4 pcs.), ground washer (1 pcs.), large plain washers (6 pcs.), M5×12 pan head screw (2 pcs.)	1 set
D	DC connector	2 units (for TL1000-20& TL1500-20&TL2000-20) 4 units (for TL3000-20)
E	AC plug	1 piece
F	Documentation	1 set



A



B

C

D

E

F

Carefully check all of the components in the carton. If anything is missing, contact your dealer.

3.2 Checking for transport damage

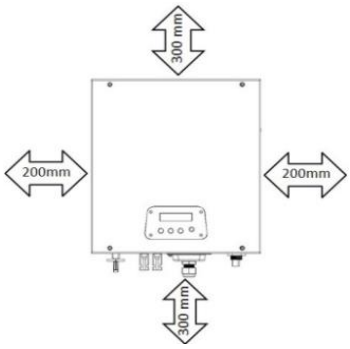
Thoroughly inspect the packaging upon delivery. If you detect any damage to the packaging which indicates the inverter may have been damaged, inform the responsible shipping company immediately. We will be glad to assist you if required.

4 Mounting

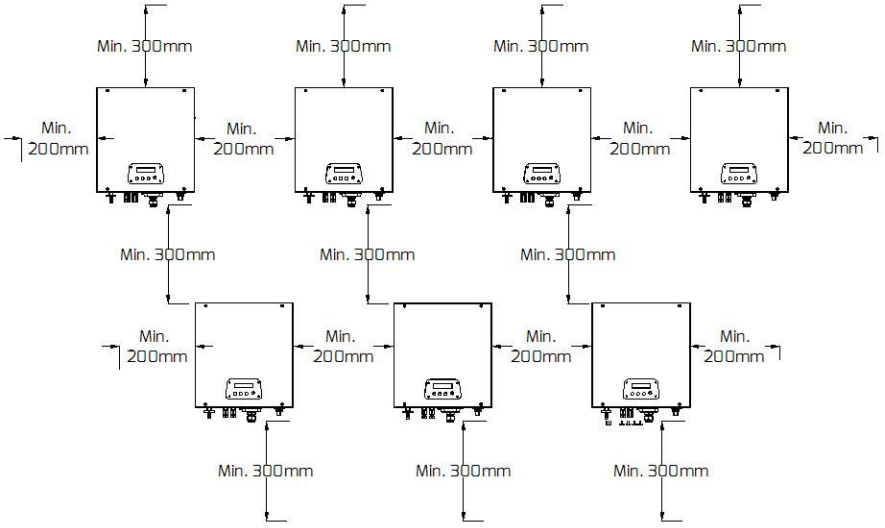
4.1 Ambient conditions

1. Be sure the inverter is installed out of the reach of children.
2. Mount the inverter in areas where it cannot be touched inadvertently.
3. Ensure good access to the inverter for installation and possible service.
4. Observe the minimum clearances to walls, other inverters, or objects as follows to ensure that heat can escape.

Direction	Min. clearance（mm）
above	300
below	300
sides	200



Clearances for one inverter



Clearances for multiple inverters

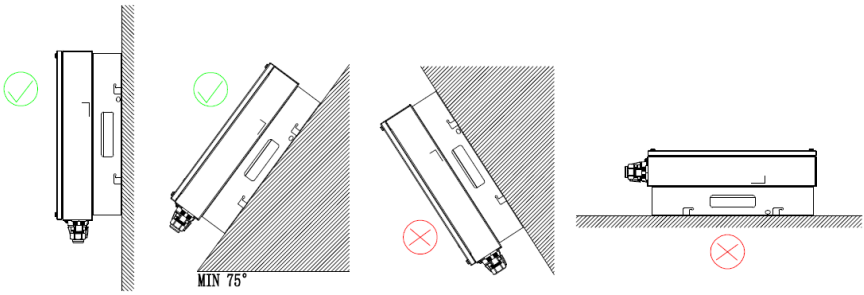
5. The ambient temperature should be below 40°C to ensure optimal operation.
6. In order to avoid power reduction caused by overheating, do not mount the inverter in a location that allows long-term exposure to direct sunlight.
7. The mounting method, location and surface must be suitable for the inverter's weight and dimensions.
8. If mounted in a residential area, we recommend mounting the inverter on a solid surface. Plasterboard and similar materials are not recommended due to audible vibrations when in use.
9. Do not put any objects on the inverter.
10. Do not cover the inverter.

4.2 Selecting the mounting location

Warning!

Danger to life due to fire or explosion!

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where flammable materials are stored.
- Do not mount the inverter in areas where there is a risk of explosion.



1. Mount the inverter vertically or tilted backward by a maximum of 15°.
2. Never mount the inverter tilted forward or sideways.
3. Never mount the inverter horizontally.
4. Mount the inverter at eye level to make it easy to operate and to read the display.
5. The electrical connection area must point downwards.

4.3 Mounting the inverter with the wall mounting bracket

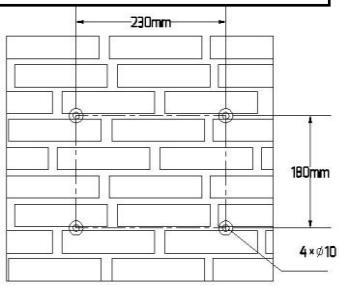
CAUTION!

Risk of injury due to the heavy weight of the inverter!

- When mounting, take into account that the inverter-weighs approx. 14 kg .

Mounting procedures:

1. Use the wall bracket as a drilling template and mark the positions of the drill holes, then drill 4 holes (φ 10) to a depth of 55 to 60mm. During operation, keep the drill vertical to the wall, and hold the drill steady to avoid tilted holes. After cleaning the dust from the holes, measure their net depth.

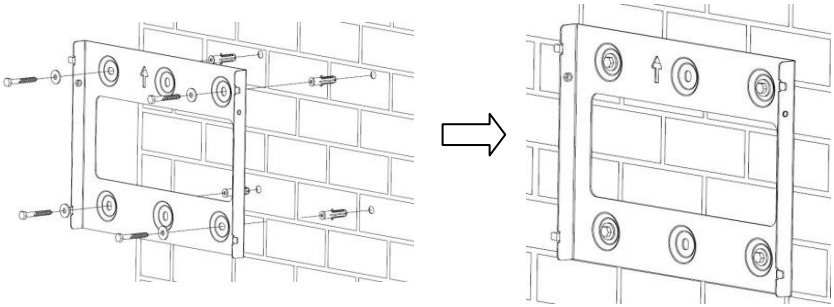


CAUTION!

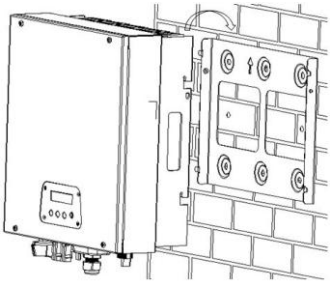
Risk of injury if the inverter falls down!

- Before inserting screw anchors, measure the depth and distance of the holes.
- If the measured values do not fulfill the mounting requirement, redrill the holes.

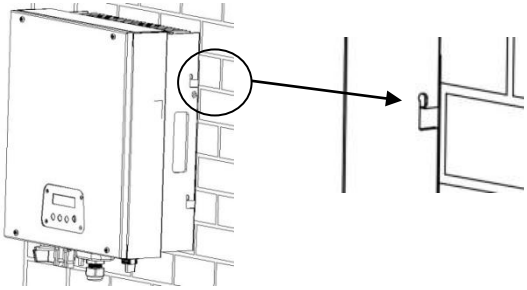
2. After drilling holes in the wall, place four screw anchors into the holes, then attach the wall mounting bracket to the wall using the self-tapping screws and washers delivered with the inverter.



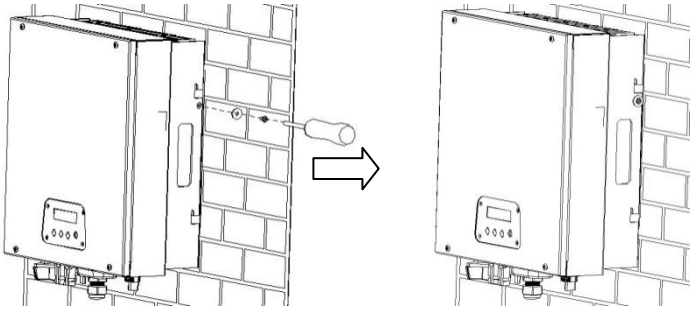
3. Hold the inverter using the handles on the sides and attach it tilted slightly downwards to the wall bracket



4. Check both sides of the inverter to ensure that it is securely in place.



5. Push in the inverter as far as possible and attach it to both sides of the wall bracket using the M5 screws and washers.



If a second protective conductor is required in your country, ground the inverter and secure it so that it cannot be lifted off the wall bracket (see section 5.4.3 " Second protective grounding connection ").

5 Electrical Connection

5.1 Safety

WARNING!

Risk of injury due to electric shock!

- The inverter must be installed only by trained and authorized electricians.
- All electrical installations must be done in accordance with the National Wiring Rules standards and all locally applicable standards and directives.

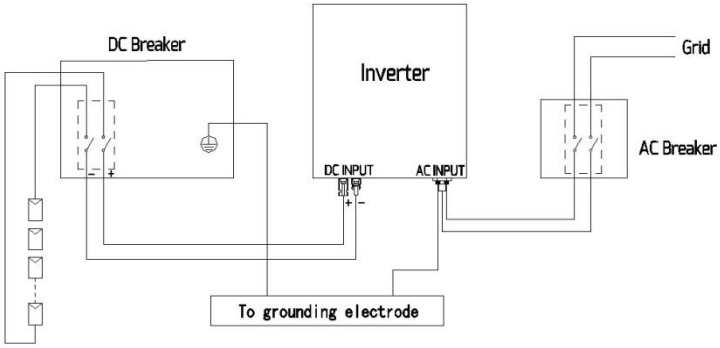
CAUTION!

Risk of injury due to electric shock!

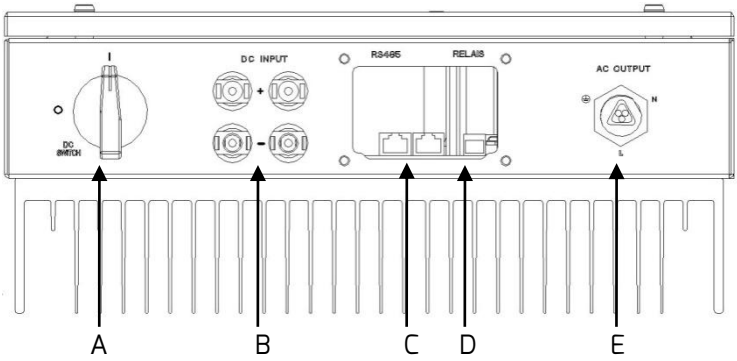
- The external protective grounding conductor is connected to the inverter's protective grounding terminal through an AC connector, make sure the connection is safe.
- When connecting, connect the AC connector first to ensure the inverter grounding and then connect the DC inputs.
- When disconnecting, disconnect the DC inputs first and then disconnect the AC connector.
- Do not, under any circumstances, connect the DC inputs when the AC connector is unplugged.

5.2 System layout of units without integrated DC switch

Local standards or codes may require that PV systems are fitted with an external DC switch on the DC side. The DC switch must be able to safely disconnect the open-circuit voltage of the PV array plus a safety reserve of 20%.
Install a DC switch to each PV string to isolate the DC side of the inverter. We recommend the following electrical connection:



5.3 Overview of the connection area



Object	Description
A	DC switch (optional): connect or disconnect the PV modules
B	DC input: plug-in connector to connect the strings
C	RJ45 interface: connect the monitoring device
D	RELAIS (optional): output fault signal
E	AC output: plug-in connector to connect the grid

5.4 AC connection

DANGER !

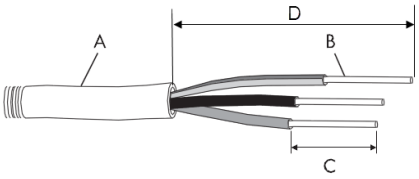
Danger to life due to high voltages in the inverter !

Before making the electrical connection, ensure that the circuit breaker is switched off and cannot be reactivated.

5.4.1 Conditions for the AC connection

Cable Requirements

The grid connection is made using 3 conductors (L, N, and PE). We recommend the following requirements for stranded copper wire.



Object	Description	Value
A	External diameter	10 mm to 14 mm
B	Conductor cross-section	2.5 mm^2 to 4 mm^2
C	Stripping length of the insulated conductors	approx. 10 mm
D	Stripping length of the outer sheath of the AC cable	approx. 30 mm

Larger cross-sections should be used for longer leads

Cable Design

The conductor cross-section should be dimensioned to avoid power loss in cables exceeding 1% at rated output power.

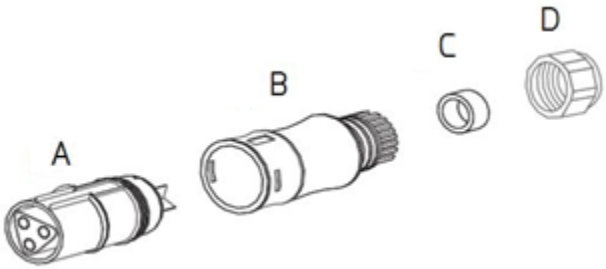
The maximum cable lengths relative to the conductor cross-section as follows:

Conductor cross-section	Maximum cable length			
	TL1000-20	TL1500-20	TL2000-20	TL3000-20
2.5 mm^2	43m	23 m	21 m	15 m
4 mm^2	69m	37 m	33 m	24 m

The required conductor cross-section depends on the inverter rating, ambient temperature, routing method, cable type, cable losses, valid installation requirements of the country of installation etc.

5.4.2 Grid connection

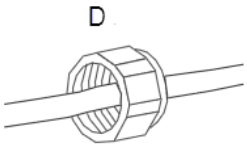
Overview of the AC Plug



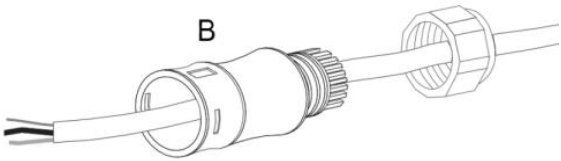
Object	Description
A	Socket element
B	Threaded sleeve
C	Sealing ring
D	Swivel nut

Procedure

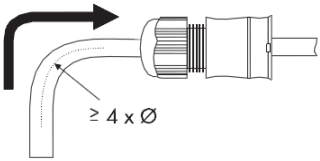
1. Switch off the circuit breaker and secure it against being inadvertently switched back on.
2. Guide the pressure screw (D) over the AC cable.



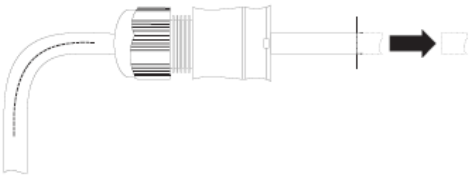
3. Guide the threaded sleeve (B) with the sealing ring over the AC cable.



4. Bend the AC cable. The bending radius must be at least four times the cable diameter.

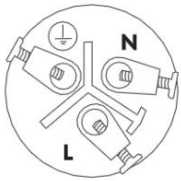


5. Shorten the cable, the PE protective conductor (green-yellow) must be longer than the insulated conductors of N and L.

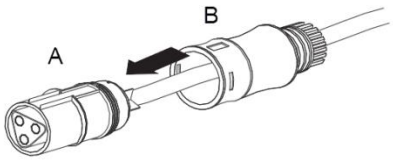


6. Shorten the line conductor L and neutral conductor N by 4 to 5 mm.

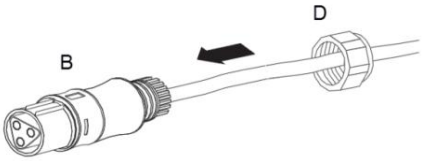
7. Connect the individual conductors to the pin connector row by row:
   - Insert the grounding conductor (green-yellow) into the screw terminal with the grounding sign and tighten the screw by using a torque of 0.8 Nm to 1Nm using the POZI-2 tool.
   - Insert the neutral conductor N (blue) into the screw terminal N on the socket element and tighten the screw.
   - Insert line conductor L (brown or black) into screw terminal L on the socket element and tighten the screw.



8. Make sure the insulated conductors are securely connected.
9. Push the threaded sleeve (B) onto the socket element (A) until it audibly snaps into place.



10. Screw the swivel nut (D) tightly onto the threaded sleeve (B) with a torque wrench (torque: 2 to 2.5 Nm). The AC plug has now been screwed together. The pressure screw serves to seal and relieve strain.



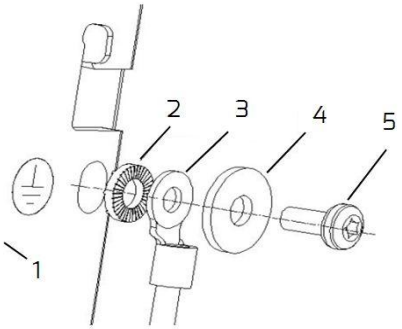
11. Finally, insert the AC plug into the AC pin connector on the inverter.

5.4.3 Second protective grounding connection

If necessary, the grounding terminal can be used to connect a second protective conductor or equipotential bonding.

Procedure

1. Remove the terminal lug, insert the stripped grounding conductor to the terminal lug and crimp the contact.
2. Align the washer, the terminal lug with protective conductor, and the ground washer on the screw. The teeth of the ground washer must be facing the heat sink.
3. Insert the screw through the hole located at the side of the heat sink, and tighten it firmly in the wall mounting bracket (torque: 2 Nm).



Information on grounding components:

No.	Description
1	Heat sink
2	Ground washerφ 5
3	Terminal lug (M5) with protective conductor
4	Large plain washerφ 6
5	M5×12 mm pan head screw

5.4.4 Residual current protection

The inverter is equipped with an all-pole sensitive residual current monitoring unit (RCMU) with an integrated differential current sensor which fulfills the requirements of DIN VDE 0100-712 (IEC60364-7-712:2002).
Therefore an external residual current device (RCD) is not required. If an external RCD needs to be installed because of local regulations, a RCD type A or type B can be installed as an additional safety measure.
The all-pole sensitive residual current monitoring unit (RCMU) detects alternating and direct differential currents. The integrated differential current sensor detects the current difference between the neutral conductor and the line conductor. If the current difference increases suddenly, the inverter disconnects from the grid. The function of the all-pole sensitive residual current monitoring unit (RCMU) has been tested in accordance with IEC 62109-2.

INFORMATION!

If an external residual current device (RCD) is required, refer to the information below!

If an external residual current device (RCD) is required in a TT or TN-S system, install a residual current device which trips at a residual current of 120 mA or higher.

For each connected inverter, a rated residual current of 120 mA has to be provided. The rated residual current of the RCD must be equal to at least the sum of the rated residual currents of the connected inverters. That means that, if, for example, two transformerless inverters are connected, the rated residual current of the RCD must be at least 240 mA.

5.4.5 Overvoltage category

The inverter can be deployed in grids of installation category III or lower, as defined under IEC 60664-1. This means that it can be permanently connected at the grid-connection point in a building. In installations involving long outdoor cable routing, additional overvoltage-reducing measures must be taken so that the overvoltage category is reduced from IV to III.

5.4.6 Circuit breaker

DANGER!

Danger to life due to fire!

You must protect each inverter with an individual circuit breaker in order that the inverter can be disconnected safely.

No load should be applied between the circuit breaker and the inverter. Use dedicated circuit breakers with load switch functionality for load switching. The selection of the circuit breaker rating depends on the wiring design (wire cross-section area), cable type, wiring method, ambient temperature, inverter current rating etc. Derating of the circuit breaker rating may be necessary due to self-heating or if exposed to heat.
The maximum output currents of the inverters can be found in the following table.

Type	TL1000-20	TL1500-20	TL2000-20	TL3000-20
Max. output current	5.5A	9 A	11 A	16 A
Recommended fuse type gL/gG or comparable circuit breaker rating	16A	16 A	16 A	20 A

5.5 DC connection

DANGER!

Danger to life due to high voltages in the inverter!

- Before connecting the PV array, ensure that the DC switch is switched off and that it cannot be reactivated.
- Do not disconnect the DC connectors under load.

5.5.1 Conditions for the DC connection

INFORMATION!

If Y adaptors are required, refer to the information below!

Y adaptors must not be visible or freely accessible in the immediate vicinity of the inverter.

- The DC circuit must not be interrupted by Y adaptors.
- In order to interrupt the DC electric circuit, disconnect the inverter from all voltage sources (see Section 8).

- PV modules of the connected strings must be of:
  - –the same type
  - –the same number of series-connected PV modules
  - –identical alignment
  - –identical tilt
- The connection cables of the PV modules must be equipped with the connectors included in the scope of delivery.
- At the DC input of the inverter, the following limits must not be exceeded:

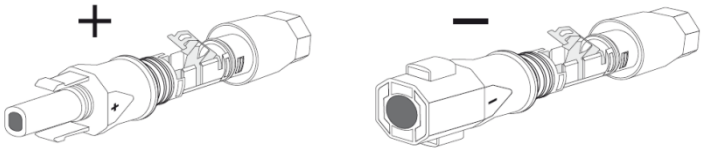
Type	Max. DC input voltage	Max. DC input current	Max. short-circuit current
TL1000-20	500 V	12 A	18 A
TL1500-20	500 V	12 A	18 A
TL2000-20	500 V	12 A	18 A
TL3000-20	500 V	18 A	27 A

- The positive connection cables of the PV modules must be equipped with the positive DC connectors.

- The negative connection cables of the PV modules must be equipped with the negative DC connectors.
- At an ambient temperature over 10℃, the open-circuit voltage of the PV strings must not exceed 90% of the maximum DC input voltage of the inverter. This prevents the voltage from exceeding the maximum DC input voltage of the inverter at lower ambient temperatures.

5.5.2 Assembling the DC connectors

Assemble the DC connectors as described below. Be sure to observe the correct polarity. The DC connectors are marked with the symbols "+" and " – ".



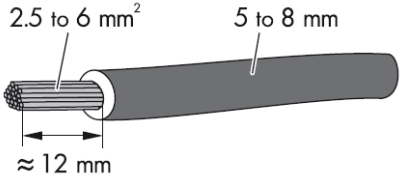
Cable requirements：

The cable must be of type PV1-F，UL-ZKLA or USE2 and comply with the following properties：

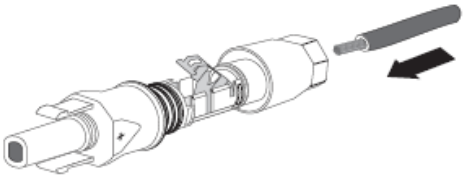
- ✧ External diameter：5 mm to 8 mm
- ✧ Conductor cross-section：2.5 mm^2 to 6 mm^2
- ✧ Number of conductors：at least 7
- ✧ Nominal voltage：at least 600V

Proceed as follows to assemble each DC connector.

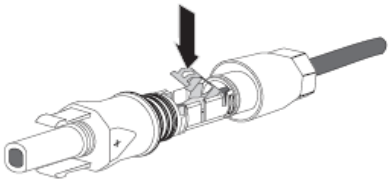
1. Strip 12 mm off the cable insulation.



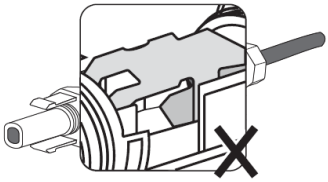
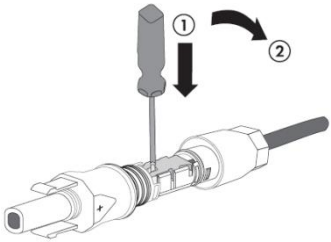
2. Route the stripped cable all the way into the DC connector. Ensure that the stripped cable and the DC connector have the same polarity.



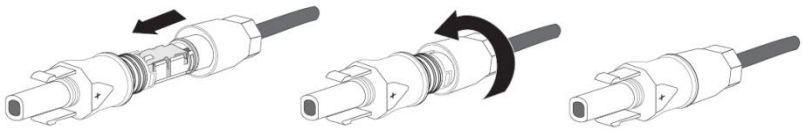
3. Press the clamping bracket down until it audibly snaps into place.



4. Ensure that the cable is correctly positioned:

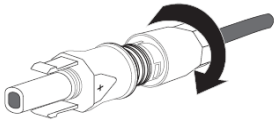
Result	Measure
If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly positioned. 	• Proceed to step 5.
If the stranded wires are not visible in the chamber, the cable is not correctly positioned. 	• Release the clamping bracket. To do so, insert a flat-blade screwdriver (blade width: 3.5 mm) into the clamping bracket and lever it open.  • Remove the cable and go back to step 2.

5. Push the swivel nut up to the thread and tighten (torque: 2 Nm).

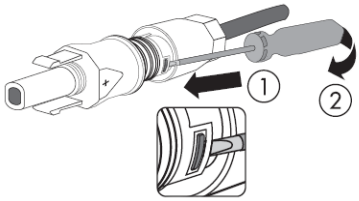


5.5.3 Disassembling the DC connectors

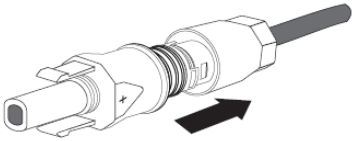
1. Unscrew the swivel nut.



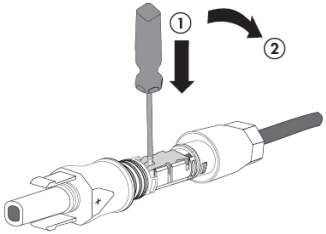
2. To release the DC connector, insert a flat-blade screwdriver (blade width: 3.5 mm) into the side catch mechanism and lever open.



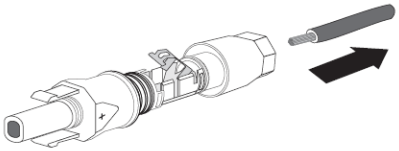
3. Carefully pull the DC connector apart.



4. Release the clamping bracket. To do so, insert a flat-blade screwdriver (blade width: 3.5 mm) into the clamping bracket and lever it open.



5. Remove the cable.



5.5.4 Connecting the PV array

NOTICE!

The inverter can be destroyed by overvoltage!

If the voltage of the strings exceeds the maximum DC input voltage of the inverter, it can be destroyed due to overvoltage. All warranty claims become void.

- Do not connect strings with an open-circuit voltage greater than the maximum DC input voltage of the inverter.
- Check the design of the PV system.

1. Ensure that the individual circuit breaker is switched off and ensure that it cannot be accidentally reconnected.

2. Ensure that the DC switch is switched off and ensure that it cannot be accidentally reconnected.

3. Ensure that there is no ground fault in the PV array.

4. Check whether the DC connector has the correct polarity.
   If the DC connector is equipped with a DC cable having the wrong polarity, the DC connector must be assembled again. The DC cable must always have the same polarity as the DC connector.

5. Ensure that the open-circuit voltage of the PV array does not exceed the maximum DC input voltage of to the inverter.

6. Connect the assembled DC connectors to the inverter until they audibly snap into place.

7. Ensure that all DC connectors are securely in place.

NOTICE!

Damage to the inverter due to moisture and dust penetration!

Seal the unused DC inputs with sealing plugs so that moisture and dust cannot penetrate the inverter.

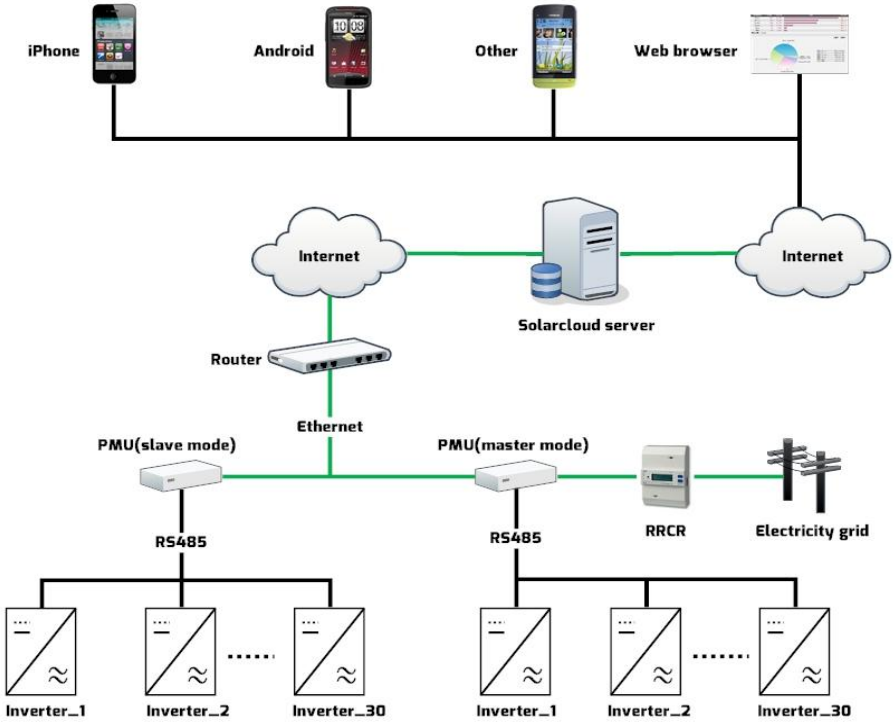
- Make sure all DC connectors are securely sealed.

8. The inverter is only properly sealed when all the unused DC inputs are closed with sealing plugs.

6 Communication

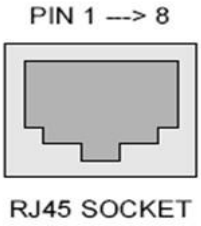
6.1 System monitoring via RS485

This inverter is equipped with RJ45 interfaces for multipoint communication.
One PMU can monitor 30 inverters at the same time via an RS485 bus. The overall length of the network cable should not exceed 1,000 m. The monitoring system layout for inverters is as follows.



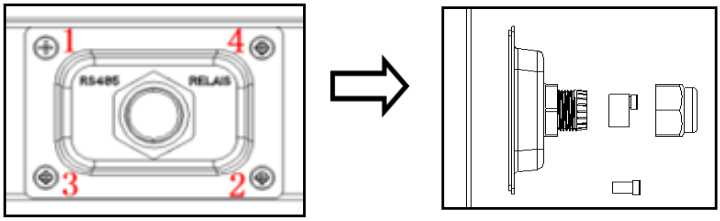
The PMU connects to the inverter via the RJ45 interface, and it connects to the router via Ethernet.
We offer a remote monitoring platform called “Solarcloud”. You can install the “Solarcloud” application on a smart phone using Android or an iOS operating systems.
You can also visit the website (http://solarcloud.zeversolar.com) for system information.

The pin assignment of the RJ45 socket on the inverter is as follows:

Pin1------- TX_RS485A	
Pin2-------TX_RS485B	
Pin3-------RX_RS485A	
Pin4-------GND	
Pin5-------GND	
Pin6-------RX_RS485B	
Pin7-------+7V	
Pin8-------+7V	

RS485 communication via network cable:

1. Remove the inverter's communication panel by loosening the four screws with the Torx T20 wrench. Unscrew the M25 cable gland and remove the filler-plug from the cable gland.



NOTICE!

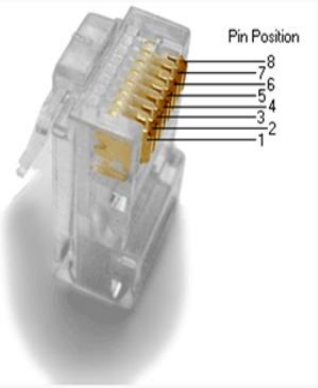
The inverter can be destroyed by wrong communication wiring!

Internal components of the inverter can be irreparably damaged due to incorrect wiring between the power wire and signal wire.

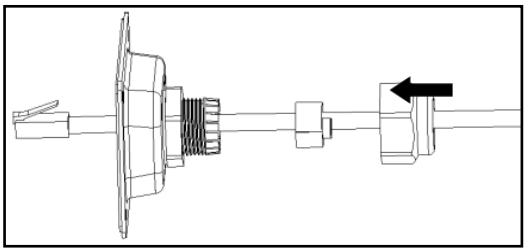
· Please check the wiring of the RJ45 connector before crimping the contact.

2. Current pin assignment for the network cable as per EIA/TIA 568 standard:

Pin	T568A Color	Pins on plug face (socket is reversed)
1	white/green stripe	
2	green solid	
3	white/orange stripe	
4	blue solid	
5	white/blue stripe	
6	orange solid	
7	white/brown stripe	
8	brown solid	



3. Guide the cable gland and communication panel over the network cable and then connect the RJ45 plug to the RJ45 keystone socket.



NOTICE!

Damage to the inverter due to moisture and dust penetration!

If the communication panel and cable gland are not mounted properly, the inverter can be destroyed due to moisture and dust penetration. All warranty claims become void.

- Make sure the inverter's communication panel has been fastened properly.
- Make sure the cable gland has been tightened firmly.

4. Connect the inverter to PMU or another communication device via the above mentioned network cable.
5. Fasten the inverter's communication panel by tightening the four screws with a torque wrench setting of 1.4 to 1.6 Nm. Press the sealing ring with the network cable into the cable gland, and then tighten the swivel nut firmly by hand. If there is only one network cable, please insert a filler-plug into the remaining hole of the sealing ring against water ingress.
6. Make sure the cable gland is mounted properly. The cable gland must be adequately locked to prevent any movement of the cable.
7. When the PMU or other communication device is connected to a PC or mobile client via Ethernet, the system data is monitored continuously.

6.2 Updating the firmware via RS485

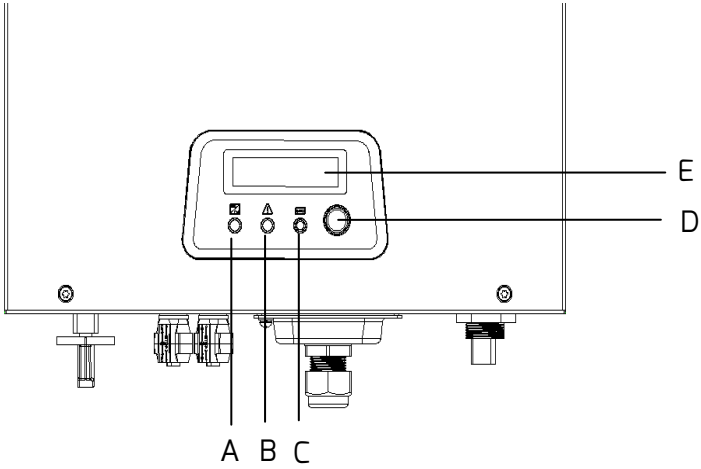
The internal controller's firmware can be updated via RS485, by qualified service personnel.

7 Operation

The information provided here covers the LED indicators, control button and display messages, and the language and safety regulation settings.

7.1 Overview of the control panel

The inverter is equipped with a character display, three LED indicators and a control button.



Object	Description
A	Normal (Green LED)
B	Fault (Red LED)
C	Communication (Yellow LED)
D	Control button
E	Display

7.1.1 Display

The display messages consist of 16 characters×2 lines. The bottom line always shows the current output (Pac = xxxx.xW). The top line shows the current state by default, it will switch to different state information by pressing the control button, as follows.

Line 1	State information	
	E-today	Daily energy
	E-total	Energy generated since the inverter has been installed
	Vpv	DC input voltage
	Ipv	DC input current
	Iac	Present output current
	Frequency	Grid frequency
	Model	Type name
	Version	Firmware version
	Set Language	Selected language
	Vac	Output voltage
	Serial No.	Serial number
Line 2	Pac = xxxx.xW	Current output

7.1.2 Control button

The inverter has a control button which is necessary to switch between the various displays for measured values and data, enter next entry and lock the expected information.

The display menus wrap around, which means that when you arrive at the last entry, the first entry is displayed when you press the button again.

You can freeze the display as follows:
Press the button for 3s when it shows the information you desire, and do not release the button until you see "LOCK". The display will show the selected information until you press the button again or the operating state of the inverter changes.

To save power, the backlight of the display turns off automatically after 20s. Press the button again to activate it.

7.1.3 LEDs

The inverter is equipped with three LED indicators “green”, “red” and “yellow” which provide information about the various operating states.

Green LED:
The green LED is lit when the inverter is operating normally.

Yellow LED:
The yellow LED flashes during communication with other devices e.g. PMU, Solarlog etc. Also, the yellow LED flashes during firmware update.

Red LED:
The red LED is lit when the inverter has stopped feeding power into the grid due to a fault. The corresponding error code will be shown on the display.

7.2 Display messages

Along with the various operating states, various messages may be shown on the display, as follows.

State	Error code	Description	Causes
Initializat-ion		Waiting	Initial PV voltage is between minimum DC input voltage and the start-up DC input voltage of the inverter.
		Checking	The inverter is checking the feed-in conditions after the start-up PV voltage exceeds the initial DC input voltage of the inverter.
		Reconnect	The inverter is checking feed-in conditions after the last fault has been solved.
Normal		Normal	The inverter is operating normally.
Fault	9	GFCI Fault	Ground-fault detection circuit is abnormal
	8	AC HCT Fault	Output current is abnormal
	6	High DC Bus	The voltage of DC busbar exceeds the permitted upper limit.
	35	No Utility Grid Available	The utility cannot be detected, which may be caused by no utility, grid disconnected, AC cables damaged, fuse broken or stand-alone grid.
	40	Over Temp.	The internal temperature exceeds the permitted value.
	33	Fac Fault	The grid frequency is outside the permitted range.
	34	Vac Fault	The grid voltage is outside the permitted range.
	37	PV Overvoltage	The voltage of the strings exceeds the permitted upper limit.
	36	Ground Fault	The residual current exceeds the permitted upper limit.
	4	DC INJ. High	Output DC feed-in exceeds the permitted upper limit.

Fault	3	Rly-Check Fault	Output relay has failed.
	2	EEPROM R/W Fault	Reading or writing of EEPROM fails
	44	DC Inj. differs for M-S	A different value of DC feed-in has been detected by the master and slave MCU.
	43	Ground I differs for M-S	A different value of residual current has been detected by the master and slave MCU.
	42	Fac differs for M-S	A different value of grid frequency has been detected by the master and slave MCU.
	41	Vac differs for M-S	A different value of grid voltage has been detected by the master and slave MCU.
	45	Fac,Vac differs for M-S	A different value of grid frequency and voltage has been detected by the master and slave MCU.
	38	ISO Fault	The PV array's insulation resistance to ground is below the permitted value, or the electrical insulation inside the inverter has failed.
	1	SCI Fault	Communication between the master and slave CPU has failed.
	10	Device Fault	Unknown Error

The last 5 dated failure reports on the NS protection can be read. An interruption in the supply voltage of ≤ 3s does not result in any loss of failure reports (according to VDE-AR-N 4105).

7.3 Language and safety regulation settings

Before setting, switch on the DC switch, and ensure that the circuit breaker is switched off and cannot be reactivated, while the inverter should be reliably grounded.

7.3.1 Language setting

The inverter provides two languages: English and German.
Press the button for approx. 5s at the entry of "Set Language" to enter the language menu and select the language. The display will switch to current state information automatically and the language setting will be saved at the same time unless you press the button again within approximately 10s.

7.3.2 Safety regulation setting

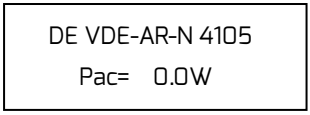
There is a safety regulation setting function in the inverter. You can choose different safety regulations according to the local requirements. If you are in Germany or Australia, you don't need to set the safety regulation because the default is correctly set for this countries. Set the safety regulation as described below:
Step 1:
Connect the inverter with the PV modules and switch on the DC switch; the LC displays the following:

Error Code: 35
Pac= 0.0W

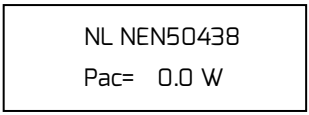
Step 2:
Press the control key (see section 9.1) approx. once per second until the LCD display shows:

TL××××
Pac= 0.0W

Then press the control key for 10 seconds. The LCD will show the safety regulation as illustrated below:
DE VDE-AR-N 4105 stands for the German safety regulation (VDE4105)



Step 3:
Before the LCD backlight goes out from step 2, press the control key again once a second to scroll through the different safety regulations showing on the screen will constantly change.
For example, if you choose the safety regulation for the Netherlands, press the control key until the LCD display shows "NL NEN50438" as below:



Wait about 10 seconds. When the LCD backlight has turned off, the safety regulation setting is complete.

Comment:
1 If the LCD display shows "DEFAULT", keep on pressing the key until the LCD display shows the desired safety regulation.
2 To set up other safety regulations refer to the example for the Netherlands

8 Commissioning

INFORMATION!

Risk of injury due to incorrect installation!

We strongly recommend carrying out preliminary checks before commissioning to avoid possible damage to the device caused by faulty installation.

8.1 Electrical tests

Carry out the main electrical tests as follows:

① Check the PE connection with a multimeter: make sure that the inverter's exposed metal surface has a ground connection.

WARNING!

Danger to life due to the presence of DC voltage!

- Only touch the insulation of the PV array cables.
- Do not touch parts of the sub-structure and frame of the PV array.
- Wear personal protective equipment such as insulating gloves.

② Check the DC voltage values: check that the DC voltage of the strings does not exceed the permitted limits. Refer to the Section "Intended use" about designing the PV system (see section 2.1.6) for the maximum allowed DC voltage.

③ Check the polarity of the DC voltage: make sure the DC voltage has the correct polarity.

④ Check the PV array's insulation to ground with a multimeter: make sure that the insulation resistance to ground is greater than 1 MOhm.

WARNING!

Danger to life due to the presence of AC voltage!

- Only touch the insulation of the AC cables.
- Wear personal protective equipment such as insulating gloves.

⑤ Check the grid voltage: check that the grid voltage at the point of connection of the inverter complies with the permitted value.

8.2 Mechanical tests

Carry out the main mechanical tests to ensure the inverter is waterproof:

① Use sealing caps for tight sealing of unused DC input connectors.

② Make sure the cable gland has been mounted properly and adequately locked. Make sure the inverter's communication panel has been fastened properly.

③ Make sure the AC connector has been mounted properly.

8.3 Start-Up

After the electrical and mechanical tests, switch on the circuit breaker. The inverter starts automatically.

Usually, there are three states during operation:
Waiting: When the initial voltage of the strings is greater than the minimum DC input voltage
but lower than the start-up DC input voltage, the inverter is waiting for sufficient DC input voltage and cannot feed power into the grid.

Checking: When the initial voltage of the strings exceeds the start-up DC input voltage, the inverter will check feeding conditions at once. If there is anything wrong during checking, the inverter will switch to the "Fault" mode.

Normal: After checking, the inverter will switch to "Normal" state and feed power into the grid.
During periods of little or no sunlight, the inverter may continuously start up and shut down. This is due to insufficient power generated by the PV array. If this fault occurs often, please call service.

Quick Troubleshooting!

If the inverter is in "Fault" mode, refer to Section 11 "Troubleshooting".

9 Disconnecting the Inverter from Voltage Sources

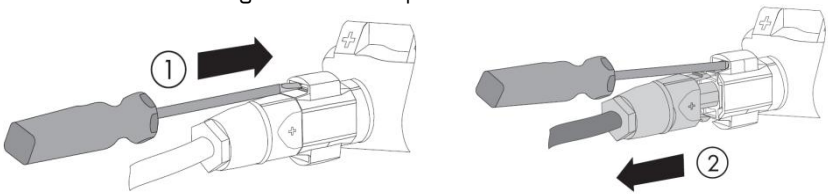
Before performing any work on the inverter, disconnect it from all voltage sources as described in this section. Always adhere strictly to the given sequence.

1. Disconnect the circuit breaker and secure against reconnection.

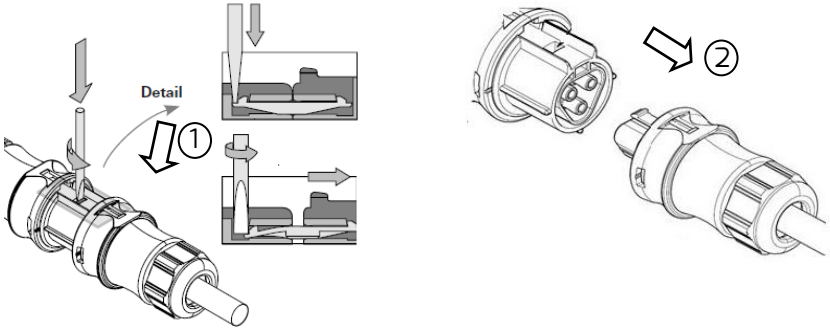
2. Disconnect the DC switch and secure against reconnection.

3. Use a current probe to ensure that no current is present in the DC cables.

4. Release and disconnect all DC connectors. To do so, insert a flat-blade screwdriver or an angled screwdriver (blade width: 3.5 mm) into one of the side slits and pull the DC connectors straight out. Do not pull on the cable.



5. Release and disconnect the AC connector. To do so, insert a flat-blade screwdriver (blade width: 3.5 mm) onto the spring clamp and pull the AC coupling plug out of the AC connection receptacle on the inverter. Do not pull on the AC cable.



6. Wait until all LEDs and the display have gone out.

DANGER!

Danger to life due to high voltages!

The capacitors in the inverter take 5 minutes to discharge.

- Wait 5 minutes before opening the inverter.

10 Technical Data

10.1 DC input data

Type	TL1000-20	TL1500-20	TL2000-20	TL3000-20
Rated DC input power (Pdc,r)	1300W	1800W	2200W	3300W
Max. recommended DC input power at STC (1)	1500Wp	2000Wp	2400Wp	3500Wp
Max. DC input voltage	500 V			
Rated DC input voltage	360 V			
MPP voltage range	90 V to 450 V			
Full load MPP voltage range	95 to 450V	150 to 450V	200 to 450 V	200 to 450V
Initial DC input voltage	95V	125 V		
Min. feed-in DC voltage	85 V			
Max. DC input current	12 A			18 A
Isc PV, absolute Max.	18 A			27 A
Number of MPP trackers	1			
Strings per MPP input	1			2
Switch-on power (W)	10 W			
DC switch	Optional			

(1) For fixed systems with semi-optimal conditions.

10.2 AC output data

Type		TL1000-20	TL1500-20	TL2000-20	TL3000-20
Power connection		Single-phase			
Rated output power		1000W	1500W	2000W	3000W
Max. output active power		1100W	1650W	2000W	3000W
Max. output apparent power		1100VA	1650VA	2140VA	3190VA
Rated grid voltage, frequency		220V/230V/240V, 50Hz/60Hz			
AC voltage range(2)		180 V to 280 V			
Operating range at AC grid frequency 50 Hz(3)		45 Hz to 55 Hz			
Operating range at AC grid frequency 60 Hz(3)		55 Hz to 65 Hz			
Rated output current at 220V		4.6A	6.8 A	9.1 A	13.6 A
Rated output current at 230V		4.5A	6.5 A	8.7 A	13 A
Rated output current at 240V		4.2A	6.25 A	8.3 A	12.5 A
Max. continuous output current		5.5A	9 A	11 A	16 A
Power factor	VDE-AR-N 4105	//		0.95 (lagging) to 0.95 (leading)	
	Other safety standard	>0.97 at 20% load, >0.99 at 100% load			
Harmonic distortion (THD) at Pac,r		< 3%	< 2%		
Night-time power loss		< 1 W			
Standby power loss		< 6 W			

(2) The AC voltage range depends on the local safety standards.

(3) The AC frequency range depends on the local safety standards.

10.3 Safety regulations

Type	TL1000-20	TL1500-20	TL2000-20	TL3000-20
Internal overvoltage protection	Integrated			
DC insulation monitoring	Integrated			
DC feed-in monitoring	Integrated			
Grid monitoring	Integrated			
Residual current monitoring device	Integrated (according to EN 62109-2)			
Islanding protection	Integrated			
EMC immunity	EN61000-6-1, EN61000-6-2			
EMC emission	EN61000-6-3, EN61000-6-4			
Utility interference	EN61000-3-2, EN61000-3-3			

INFORMATION!

If you use the standard VDE-AR-N 4105, please refer to the information below!

- If a central NS protection device is used, then the value of the voltage protection U>1.1Un in the integrated NS protection can be changed with a password.
- The displacement factor cos(phi) value is not necessary to be adjustable if the power generation system ΣSAmax≤3.68KVA and was set to 1 as default in the embedded inverter software. However, if the power generation system is such that 3.68KVA <ΣSAmax≤13.8KVA, the standard cos(phi) characteristic curve defined in VDE-AR-N 4105 shall be applied through the PMU.

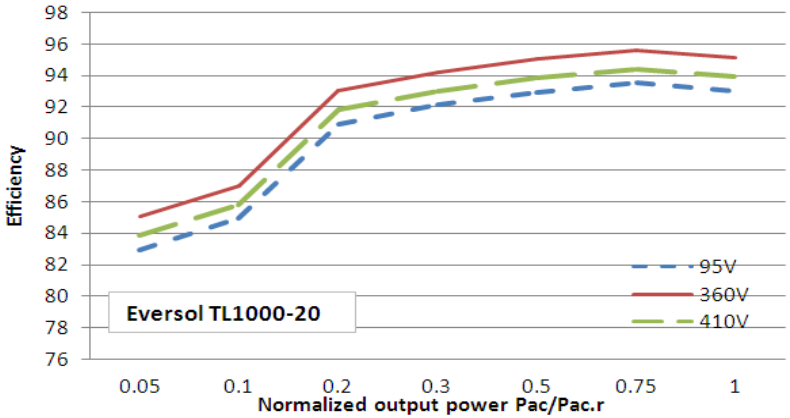
10.4 General data

Type	TL1000-20	TL1500-20	TL2000-20	TL3000-20
Net weight	11.5 kg			14 kg
Dimension L×W×D	415×352×128 mm			415×352×145 mm
Mounting environment	Indoor and outdoor			
Mounting recommendation	Wall mounting bracket			
Operating temperature range	-25°C to +60°C			
Max. permissible value for relative humidity (non-condensing)	100%			
Max. operating altitude above mean sea level	2000 m			
Ingress protection	IP65 as per IEC 60529			
Climate category	4K4H			
Overvoltage category	DC input: II, AC output: III			
Topology	Transformerless			
Cooling concept	Convection			
Noise	< 20 dB(A) @ 1m			
Display	16×2 characters			
Data communication interfaces	RS485			
Standard warranty	5 years			

10.5 Efficiency

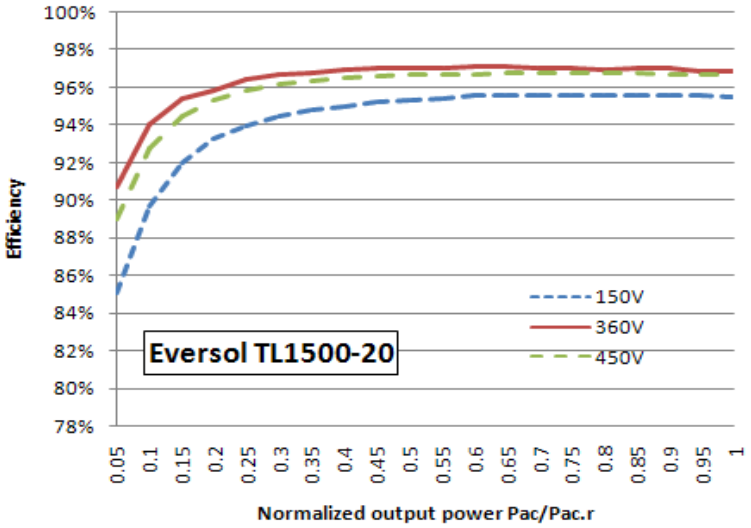
The operating efficiency is shown for the three input voltages (Vmppmax, Vdc,r and Vmppmin) graphically. In all cases the efficiency refers to the standardized power output (Pac/Pac,r). (according to EN 50524 (VDE 0126-13): 2008-10, cl. 4.5.3).
Notes: Values are based on rated grid voltage, cos(phi) = 1 and an ambient temperature of 25°C.

10.5.1 Efficiency curve TL1000-20



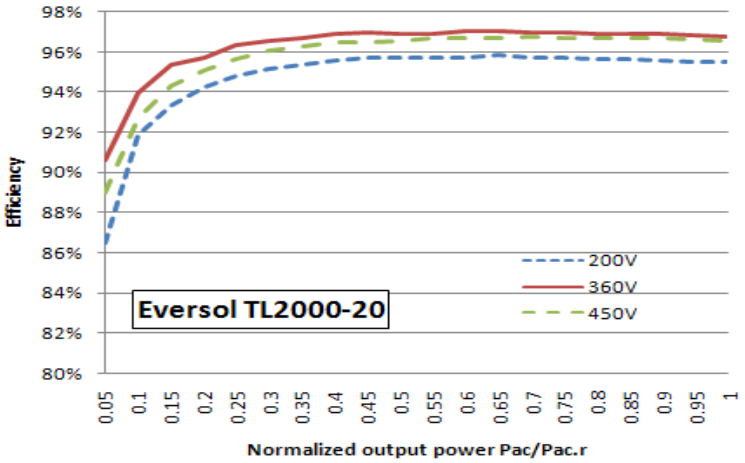
Max. efficiency, ηmax	95.6%
European weighted efficiency, ηEU	95.0%

10.5.2 Efficiency curve TL1500-20



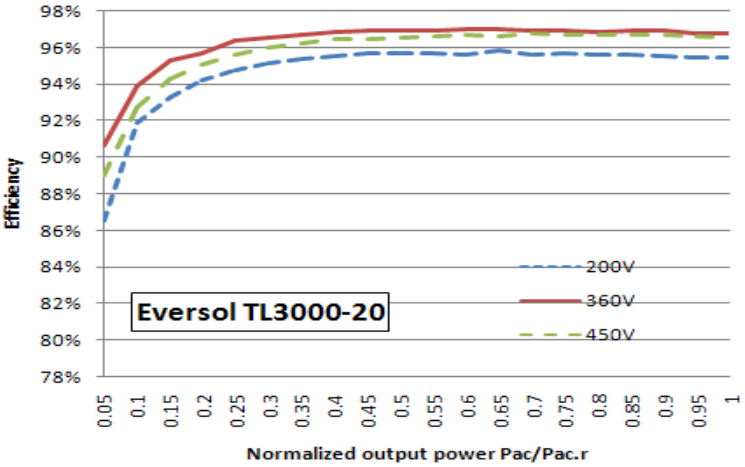
Max. efficiency, ηmax	97.0%
European weighted efficiency, ηEU	96.0%

10.5.3 Efficiency curve TL2000-20



Max. efficiency, ηmax	97.0%
European weighted efficiency, ηEU	96.0%

10.5.4 Efficiency curve TL3000-20



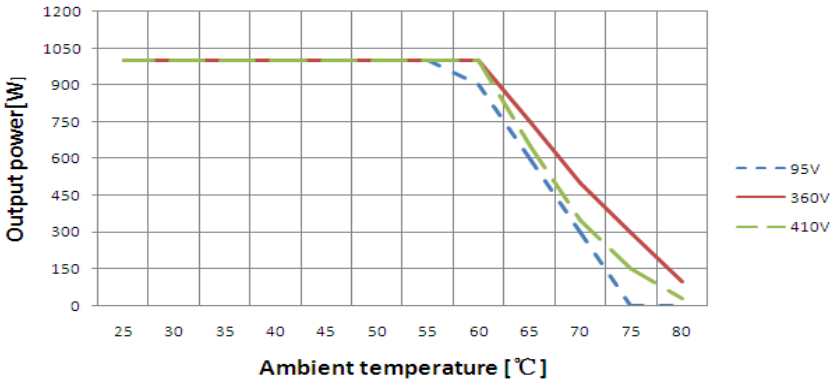
Max. efficiency, ηmax	97.2%
European weighted efficiency, ηEU	96.2%

10.6 Power reduction

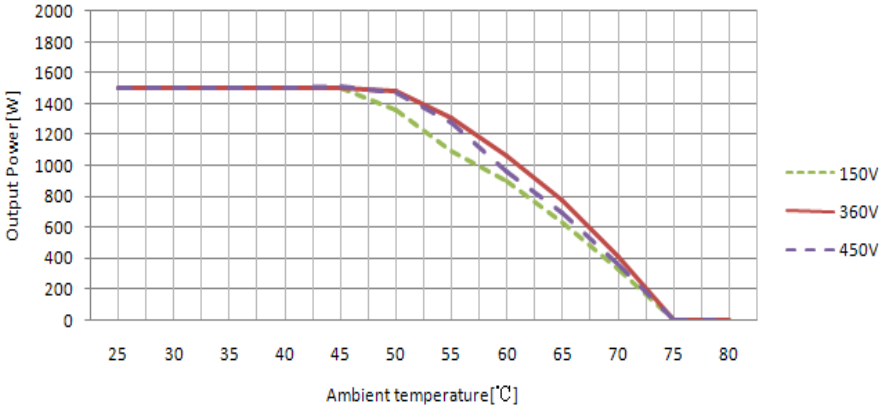
In order to ensure inverter operation under safe conditions ,the device may automatically decrease power output.

Power reduction depends on many operating parameters including ambient temperature and input voltage, grid voltage, grid frequency and power available from the PV modules. This device can decrease power output during certain periods of the day according to these parameters.

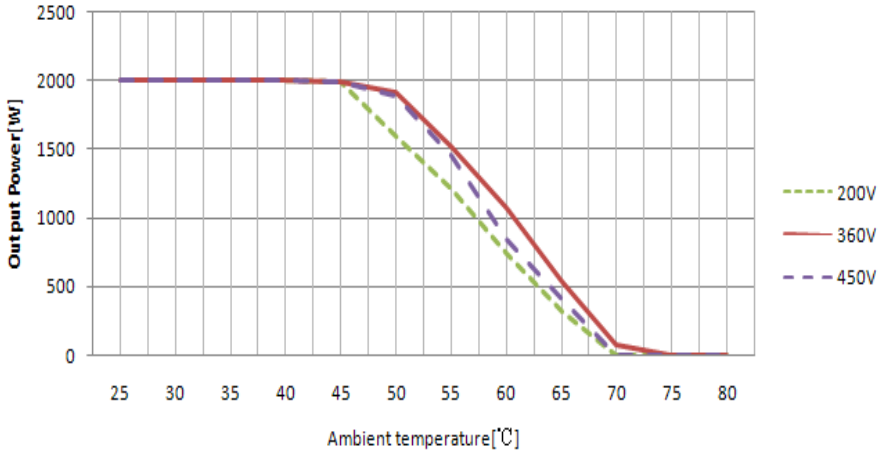
Notes: Values are based on rated grid voltage and cos (phi) = 1.



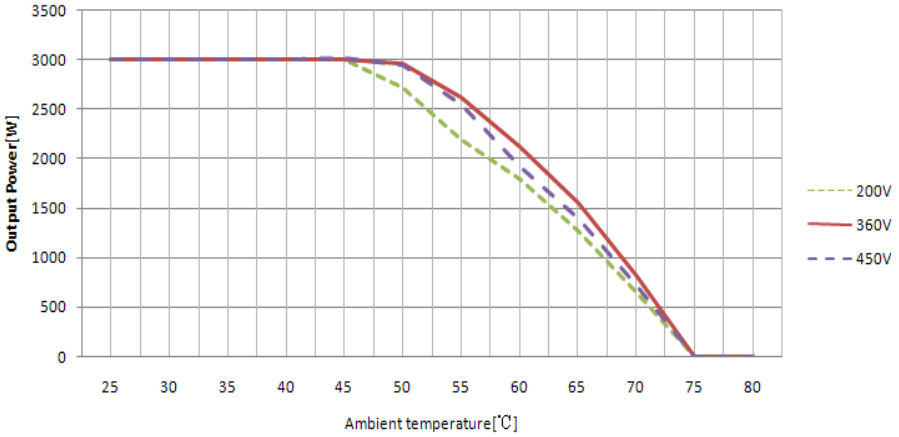
Power reduction with increased ambient temperature (TL1000-20)



Power reduction with increased ambient temperature (TL1500-20)



Power reduction with increased ambient temperature (TL2000-20)



Power reduction with increased ambient temperature (TL3000-20)

11 Troubleshooting

When the PV system does not operate normally, we recommend the following solutions for quick troubleshooting. If an error occurs, the red LED will light up. The corresponding causes are described in Section 9.2 "Display Messages". The corresponding corrective measures are as follows：

Object	Error code	Corrective measures
Presumable Fault	38	·Check the PV array's insulation to ground and make sure that the insulation resistance to ground is greater than 1 MOhm. Otherwise, make a visual inspection of all PV cables and modules. · Make sure the grounding connection of the inverter is reliable. If this fault occurs often, contact the service.
	36	· Make sure the grounding connection of the inverter is reliable. ·Make a visual inspection of all PV cables and modules. If this fault is still shown, contact the service.
	6	· Check the open-circuit voltages of the strings and make sure it is below the maximum DC input voltage of the inverter. If the input voltage is within the permitted range and the fault still occurs, it might be that the internal circuit has broken. Contact the service.
	37	· Check the open-circuit voltages of the strings and make sure it is below the maximum DC input voltage of the inverter. If the input voltage lies within the permitted range and the fault still occurs, please call service.
	41, 42 43, 44 45	· Disconnect the inverter from the grid and the PV array and reconnect after 3 minutes. If this fault is still being shown, contact the service.

Presumable Fault	33	· Check the grid frequency and observe how often major fluctuations occur. If this fault is caused by frequent fluctuations, try to modify the operating parameters after informing the grid operator first.
	35	· Check the fuse and the triggering of the circuit breaker in the distribution box. · Check the grid voltage, grid usability. · Check the AC cable, grid connection on the inverter. If this fault is still being shown, contact the service.
	34	·Check the grid voltage and grid connection on the inverter. · Check the grid voltage at the point of connection of the inverter. If the grid voltage is outside the permissible range due to local grid conditions, try to modify the values of the monitored operational limits after informing the electric utility company first. If the grid voltage lies within the permitted range and this fault still occurs, please call service.
	40	·Check whether the airflow to the heat sink is obstructed. ·Check whether the ambient temperature around the inverter is too high.
Permanent Fault	1, 2, 3, 4, 8, 9	Disconnect the inverter from the utility grid and the PV array and reconnect it after 3 minutes. If this fault is still being displayed, contact the service.

12 Maintenance

Normally, the inverter needs no maintenance or calibration. Regularly inspect the inverter and the cables for visible damage. Disconnect the inverter from all power sources before cleaning. Clean the enclosure and display with a soft cloth. Ensure the heat sink at the rear of the inverter is not covered.

12.1 Cleaning the contacts of the DC switch

Clean the contacts of the DC switch annually. Perform cleaning by cycling the switch to" | "and"○"positions 5 times. The DC switch is located at the lower left of the enclosure.

12.2 Cleaning the heat sink

CAUTION!

Risk of injury due to hot heat sink!

- The heat sink may exceed 70℃ during operation. Do not touch the heat sink during operation.
- Wait approx. 30 minutes before cleaning until the heat sink has cooled down.

Clean the heat sink with compressed air or a soft brush. Do not use aggressive chemicals, cleaning solvents or strong detergents.

For proper function and long service life, ensure free air circulation around the heat sink.

13 Recycling and Disposal

Both the inverter and its transport packaging are predominantly made from recyclable raw materials.

Do not dispose of the defective inverter and its accessories with household waste. Ensure that the defective inverter, its accessories and transport packaging are disposed of properly.

14 Contact

If you have any technical problems concerning our products, please contact Zeversolar service. We require the following information in order to provide you with the necessary assistance:

- Inverter device type
- Inverter serial number
- Type and number of connected PV modules
- Error code
- Mounting location

Zeversolar Factory Warranty

The current warranty conditions come enclosed with your device. These are also available online at www. zeversolar.com and can be downloaded and are available on paper from the usual sales channels if required.

Jiangsu Zeversolar New Energy Co., Ltd.
Tel.: +86 512 6937 0998
Fax: +86 512 6937 3159
Web: www.zeversolar.com
Factory add.: No.588 Gangxing Road, Yangzhong Jiangsu, China
Headquarters add.: Building 9, No.198 Xiangyang Road, Suzhou 215011, China