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## Installation and Operating Instructions

Evershine TL3680/TL5000-10 Solar Inverters

**zeversolar**

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# 1 Notes on this manual

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## General Notes

Evershine is a transformerless solar inverter with two MPP trackers. It converts the direct current (DC) from a photo-voltaic array to grid-compliant alternating current (AC) and feeds it into the grid.

### 1.1 Area of validity

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This manual describes the mounting, installation, commissioning and maintenance of the following Zegersolar inverters: EvershineTL3680, TL5000-10.

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

### 1.2 Target group

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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 equipment. Installation personnel should also be familiar with local requirements, rules and regulations.

### 1.3 Symbols used in this manual

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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, could result in death or serious injury.



#### CAUTION!

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



#### NOTICE!

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



#### INFORMATION!

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

## 2 Safety

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### 2.1 Intended use

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- 2.1.1. Evershine converts the direct current from a PV array into grid-compliant alternating current.
- 2.1.2. Evershine is suitable for indoor and outdoor use.
- 2.1.3. Evershine 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 Evershine.
- 2.1.4. PV modules with a high capacitance to ground may only be used if their coupling capacity does not exceed 1.0 $\mu$ 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 installation, 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

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Evershine 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](http://www.zeversolar.com).

## 2.3 Important safety information

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### DANGER!

Danger to life due to high voltage in the inverter!

- All work on the inverter may only be carried out by qualified personnel who have read and fully understood all safety information contained in this manual.
- Children should 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 become hot during operation. Do not touch!



### CAUTION!

Possible damage to health due to 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 that the frames of PV modules 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 may only be carried out by skilled and authorized electricians.
	Beware of hot surfaces. The inverter can become hot during operation. Avoid contact with it during operation.
	Do not dispose of this inverter with household waste. For more information on disposal, please see chapter 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.
	Capacitor 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 protection

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The following safety equipment is provided:

- 1) Over-voltage, under-voltage protection
- 2) Over-frequency, under-frequency protection
- 3) Over-temperature monitoring
- 4) Residual current monitoring
- 5) Isolation monitoring
- 6) Anti-islanding protection
- 7) DC feed-in monitoring

## 3 Unpacking

### 3.1 Scope of delivery

Object	Description	Quantity
A	Inverter	1
B	Wall mounting bracket	1
C	Mounting accessory kit: large plain washers (2×) M5×12 mm pan head screw (2×) wall anchors and bolts (4×) terminal lug (1×), ground washer (1×)	1
D	Positive DC connector	2
E	Negative DC connector	2
F	AC connection plug	1
G	RJ45 plug	2
H	Documentation	1



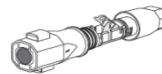
A



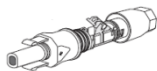
B



C



D



E



F



G



H

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

### 3.2 Check for transport damage

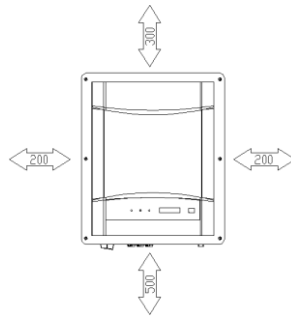
Thoroughly inspect the packaging upon delivery. If you detect any damage to the packaging which indicates the inverter may have been damaged, inform the responsible shipping company immediately. We will be glad to assist you if required.

## 4 Mounting

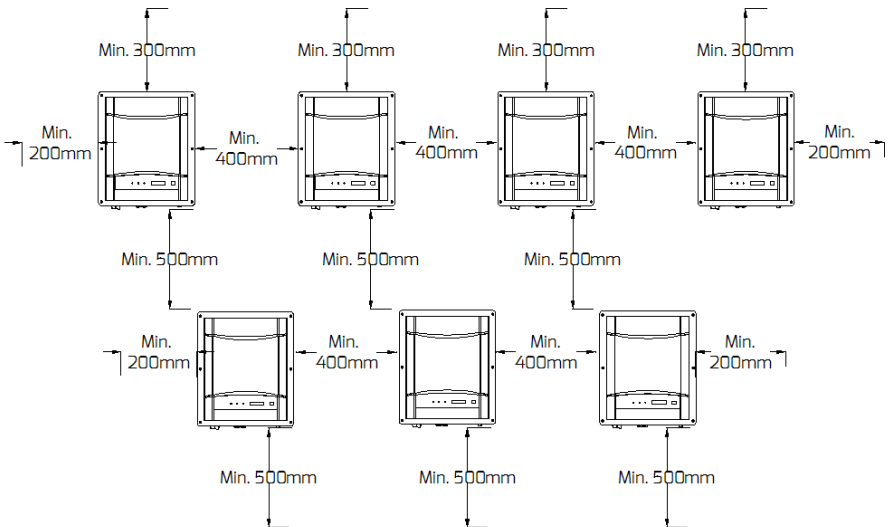
### 4.1 Ambient conditions

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 work.
4. To make sure that heat can dissipate, observe the following minimum clearance to walls, other inverters, or objects:

Direction	Min. clearance (mm)
Top	300
Bottom	500
Sides	200



Clearances for one inverter



Clearances formultiple inverters

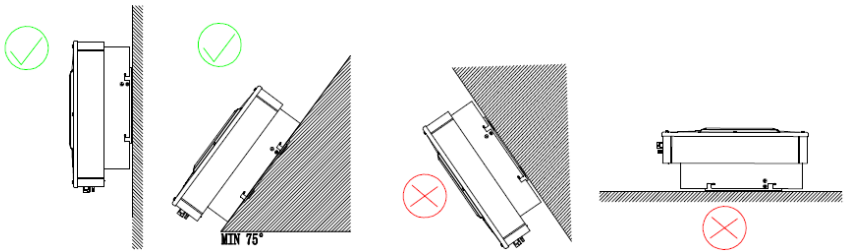
5. The ambient temperature should not exceed 40°C to ensure optimal operation.
6. In order to avoid power reduction caused by overheating, do not mount the inverter in a location that allows long-term exposure to direct sunlight.
7. The mounting method, location and surface must be suitable for the weight and dimensions of the inverter.
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. 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 bracket



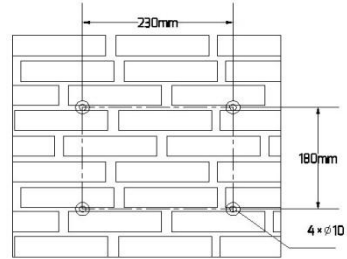
#### CAUTION!

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

·When mounting, take into account that the inverter weighs approx. 19.5kg.

Mounting procedures:

1. Use the wall bracket as a drilling template and mark the positions of the drill holes, Drill 4 holes required using a drill with 10 mm bit. The holes must be about 70 mm deep. Keep the drill vertical to the wall, and hold the drill steady to avoid tilted holes.

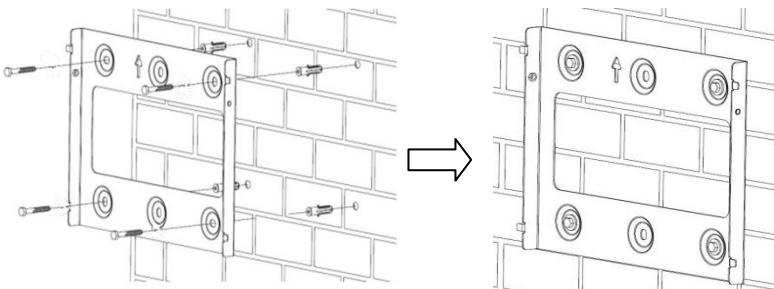


#### CAUTION!

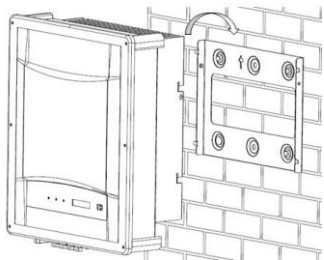
Risk of injury if the inverter falls down!

- Before inserting the wall anchors, measure the depth and distance of the holes.
- If the measured values do not meet the hole requirements, redrill the holes.

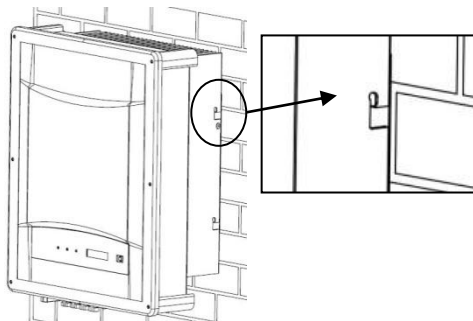
2. Fix the wall bracket to the wall with 4 wall anchors and bolts delivered with the inverter.



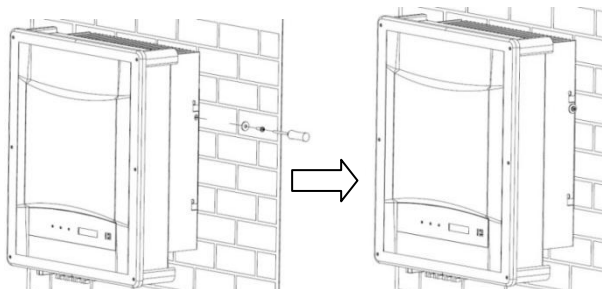
3. Holding the inverter using the handles on the sides and attach it tilted slightly downwards to the wall bracket.



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

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### 5.1 Safety

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#### WARNING!

Risk of injury due to electric shock!

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



#### CAUTION!

Risk of injury due to electric shock!

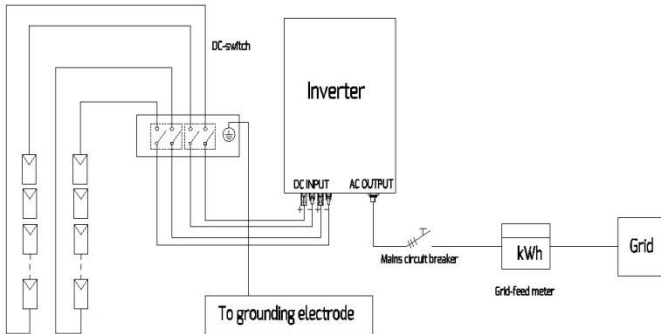
- The external grounding conductor is connected to the inverter's grounding terminal using an AC connector. Make sure the connection is reliable.
- When connecting, connect the AC connector first to ensure that the inverter is grounded and then connect the DC inputs.
- When disconnecting, disconnect the DC inputs and then disconnect the AC connector.
- Do not under any circumstances; connect the DC inputs when the AC connector is unplugged.

## 5.2 System design without integrated DC switch

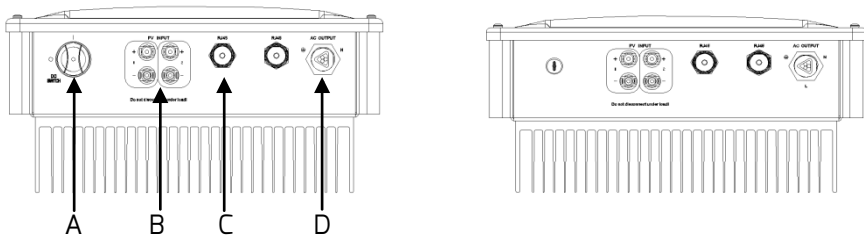
Local standards or codes may require that PV systems are fitted with an external DC switch on the DC side. The DC switch must be able to safely disconnect the open-circuit voltage of the PV array plus a safety reserve of 20%.

Install a DC switch to each PV string to insulate 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 and disconnect the PV module.
B	DC input: plug-in connector to connect the strings.
C	RJ45 interface: connect the monitoring device.
D	AC output: plug-in connector to connect the grid.

## 5.4 AC connection



### DANGER!

Danger to life due to high voltages in the inverter!

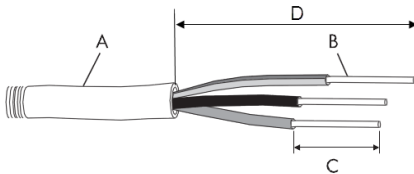
Before establishing the electrical connection, ensure that the circuit breaker is switched off and cannot be reactivated.

### 5.4.1 Conditions for the AC connection

#### Cable Requirements

The grid connection is established using three conductors (L, N, and PE).

We recommend the following specifications for stranded copper wire.



Object	Description	Value
A	External diameter	10 mm to 14 mm
B	Conductor cross-section	4 mm <sup>2</sup> to 6 mm <sup>2</sup>
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 cables.

## Cable design

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

The higher grid impedance of the AC cable makes it easier to disconnect from the grid due to excessive voltage at the feed-in point.

The maximum cable lengths depend on the conductor cross-section as follows:

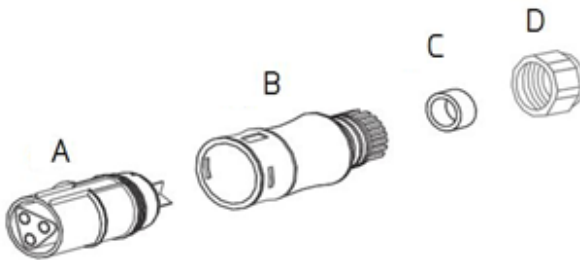
Conductor cross-section	Maximum cable length	
	TL3680	TL5000-10
4 mm <sup>2</sup>	25 m	16 m
6 mm <sup>2</sup>	40 m	24 m

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

## 5.4.2 Grid connection

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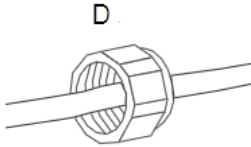
### Overview of the AC connection Plug



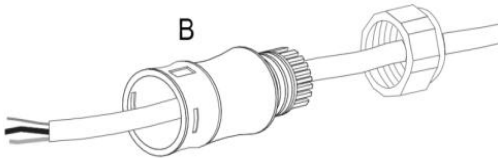
Object	Description
A	Socket element
B	Threaded sleeve
C	Sealing ring
D	Pressure screw

## Procedure

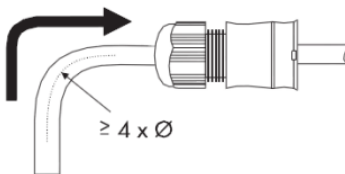
1. Switch off the circuit breaker and secure it against being inadvertently switched back on.
2. Guide the pressure screw (D) over the AC cable.



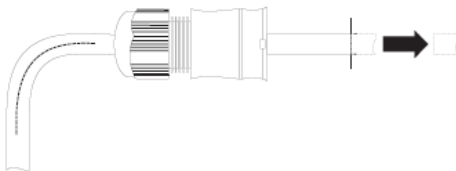
3. Guide the threaded sleeve (B) with the sealing ring over the AC cable.



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



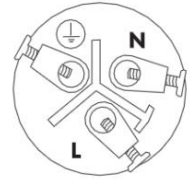
5. Shorten the cable.



6. Shorten the line conductor L and neutral conductor N by 4 to 5 mm. Recommend to crimp a cord end terminal with the chosen conductor.

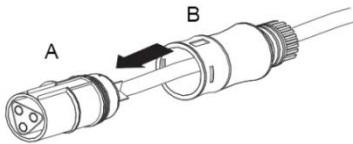
7. Connect individual conductors to the pin connector row by row:

- 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 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 the line conductor L (brown or black) into the screw terminal L on the socket element and tighten the screw.

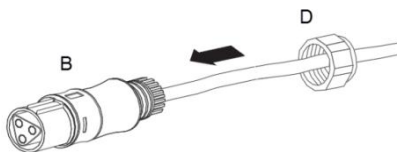


8. Make sure the insulated conductors are securely connected.

9. Push the threaded sleeve (B) onto the socket element (A) until it audibly snaps into place.



10. Screw the pressure screw (D) tightly onto the threaded sleeve (B) with a torque of at least 2-2.5 Nm. The AC plug has 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.



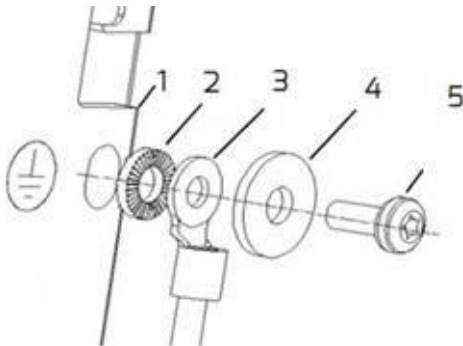
### 5.4.3 Second protective grounding connection

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

#### Procedure

1. Remove the terminal lug, insert the stripped grounding conductor into the terminal lug and crimp the contact.
2. Align the plain washer, the terminal lug with the grounding 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 at the side of the heat sink, and tighten it firmly into the wall bracket (torque: 2Nm).



Information on grounding components:

Object	Description
1	Heat sink
2	Ground washer (inner diameter 5 mm)
3	Terminal lug (M5) with protective conductor
4	Large plain washer (inner diameter 6 mm)
5	M5×12 mm pan head screw

#### 5.4.4 Residual current protection

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The inverter is equipped with an all-pole sensitive residual current monitoring unit (RCMU) with an integrated differential current sensor which meets 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 differential AC and DC 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 according to IEC 62109-2.



#### INFORMATION!

If need to use an external residual current device (RCD), please refer to information below!

Where 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, 2 transformerless inverters are connected, the rated residual current of the RCD must be at least 240 mA.




### 5.4.5 Over-voltage category

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The inverter can be used 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 outdoor installations with long cable routing, additional over-voltage protection measures must be taken in order to reduce the over-voltage category from IV to III.

### 5.4.6 Circuit breaker

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	<b>DANGER</b>
	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 switching functionality. The selection of the circuit breaker depends on the cabling concept (cross-section area), cable type, wiring method, ambient temperature, inverter current rating, etc. Derating of the circuit breaker 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	TL3680	TL5000-10
Max. output current	16A	23A
Recommended fuse type gL/gG or comparable circuit breaker rating	32A	32A

## 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 need to use Y adaptors, please 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).

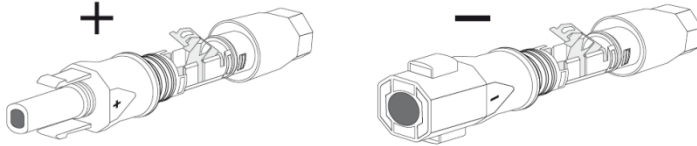
- PV modules of the connected strings must be of:
  - the same type
  - the same number of series-connected PV modules
  - identical alignment
  - identical tilt
- The connection cables of the PV modules must be equipped with the connectors included in the scope of delivery.
- At the DC input of the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

Type	Max. DC input voltage	Max. DC input current	Max. short-circuit current
TL3680	600V	2×11A	2×16.5A
TL5000-10	600V	2×11A	2×16.5A

- 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°C, 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. Make sure to observe the correct polarity. The DC connectors are marked with the symbols "+" and "-".



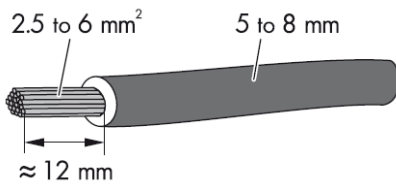
### Cable requirements:

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

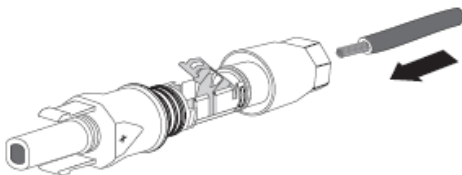
- ✧ External diameter: 5-8 mm
- ✧ Conductor cross-section: 2.5-6 mm<sup>2</sup>
- ✧ Number of conductors: at least 7
- ✧ Nominal voltage: at least 600V

Proceed as follows to assemble each DC connector.

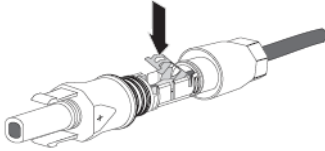
1. Strip 12 mm of the cable insulation.




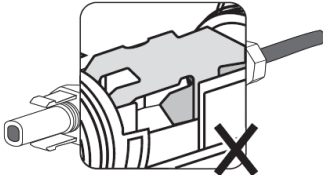
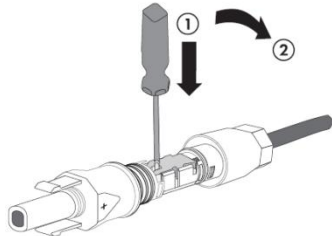
2. Route the stripped cable into the DC connector. Ensure that the stripped cable and the DC connector have the same polarity.



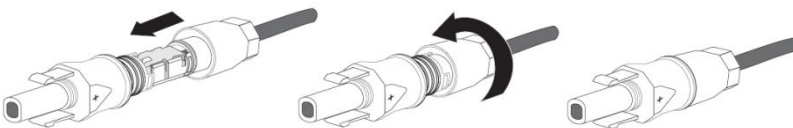
3. Press the clamping bracket down until it audibly snaps into place.



4. Ensure that the cable is correctly positioned:

Result	Measure
<p>If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly positioned.</p> 	<p>•Proceed to step 5.</p>
<p>If the stranded wires are not visible in the chamber, the cable is not correctly positioned.</p> 	<p>•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.</p>  <p>•Remove the cable and go back to step 2.</p>

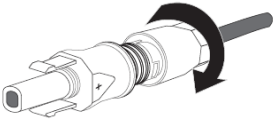
5. Push the swivel nut up to the thread and tighten (torque: 2 Nm).



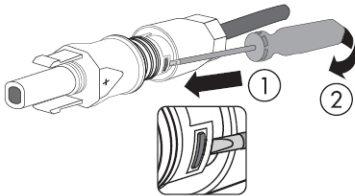
### 5.5.3 Disassembling the DC connectors

---

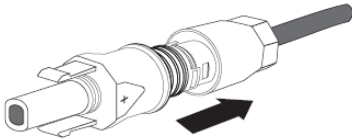
1. Unscrew the swivel nut.



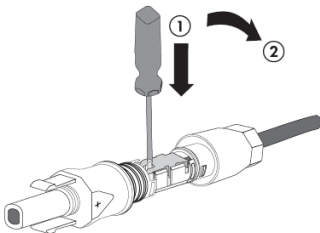
2. To release the DC connector, insert a flat-blade screwdriver (blade width: 3.5 mm) into the side catch mechanism and lever it open.



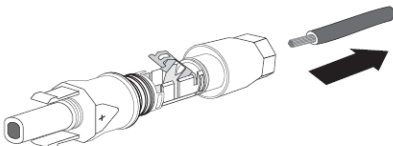
3. Carefully pull the DC connector apart.



4. Release the clamping bracket. 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!

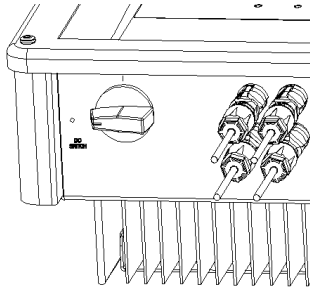
If the voltage of the strings exceeds the maximum DC input voltage of the inverter

it can be destroyed due to over-voltage. All warranty claims become void.

·Do not connect strings with an open-circuit voltage greater than the maximum DC input voltage of the inverter.

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 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.

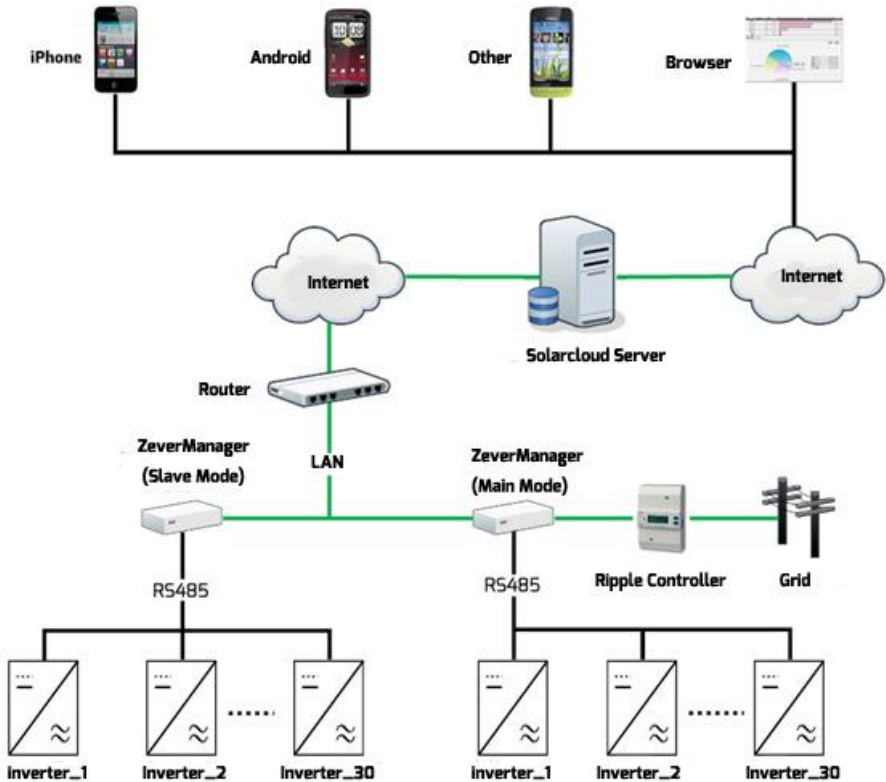
•Make sure all DC connectors are securely sealed.



## 6 Communication

### 6.1 Monitoring of system via RS485

This inverter is equipped with RJ45 interfaces for multipoint communication. One ZeverCom/ZeverManager can monitor 30 inverters at the same time via RS485 bus. The overall length of the network cable should not exceed 1000m. The monitoring system layout for inverters is as follows.

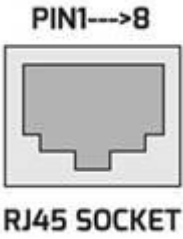


The ZeverCom/ZeverManager connects with the inverter via the RJ45 interface, and it connects to the router via Ethernet.


We offer a remote monitor platform “Solar cloud”. You can install the “Solar cloud” application on a smart phone using Android or iOS operating systems.

You can also visit the website ( <http://solarcloud.zeversolar.com> ) to browse the system information.

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

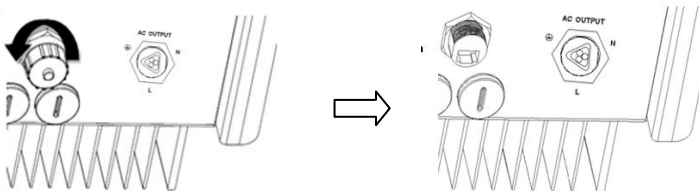
Pin1----- TX_RS485A	
Pin2----- TX_ RS485B	
Pin3----- RX_ RS485A	
Pin4----- GND	
Pin5----- GND	
Pin6----- RX_ RS485B	
Pin7----- +7V	
Pin8----- +7V	

The network cable meeting the EIA/TIA 568A or 568B standard must be UV resistant if it is to be used outdoors.

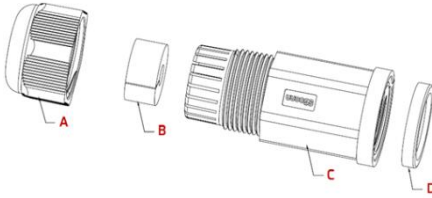
	<p><b>NOTICE!</b></p> <p>Damage to the inverter due to moisture and dust penetration!</p> <p>If the the RJ45 plug are not installed or not installed properly, the inverter can be destroyed due to moisture and dust corrode the RJ45 socket. All warranty claims become void.</p> <ul style="list-style-type: none"> <li>• Make sure the RJ45 plug has been tightened firmly.</li> </ul>
---	--

Connecting the RJ45 plug:

1. Unscrew the cap nut from the RJ45 keystone socket.

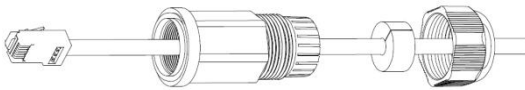


- Take out the RJ45 plug which accompanies the inverter, and disassemble it.

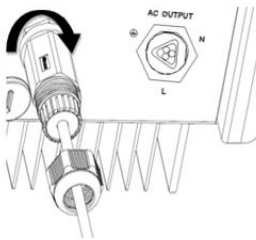


Object	Description	QTY	Color
A	Swivel nut	1	Black
B	Seal	1	Black
C	Threaded sleeve	1	Black
D	Gasket	1	Black

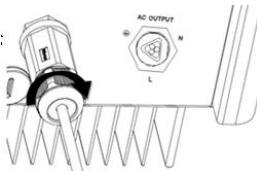
- Guide the network cable through the components of RJ45 plug as follows.



- Insert the network cable to the RJ45 keystone socket, then screw the threaded sleeve to the RJ45 socket tight (torque: 1.5 -1.7 Nm).  
Push the seal into the threaded sleeve.

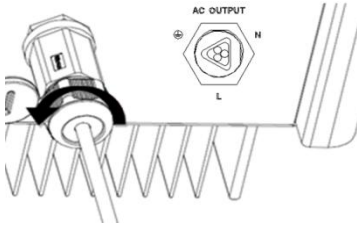


- Screw the swivel nut to the threaded sleeve tight (torque: 1.0-1.2 Nm).

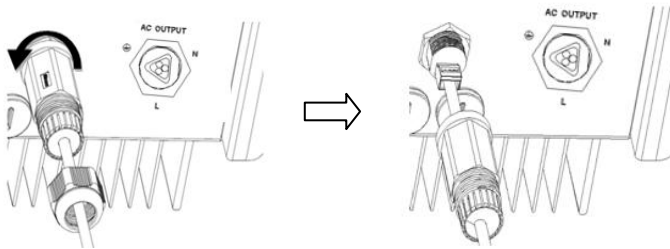


Disassemble the RJ45 plug:

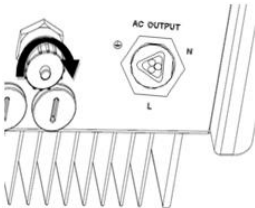
1. Unscrew the swivel nut.



2. Unscrew the threaded sleeve.



3. Remove the network cable and then screw the cap nut to the RJ45 keystone socket by hand.



If necessary, an adjustable spanner can be used on-site during installation and dismantlement.

## 6.2 Updating the firmware via RS485

---

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

## 7 Commissioning

---



### INFORMATION

Risk of injury due to the faulty installation!

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

### 7.1 Electrical checks

---

Carry out the main electrical checks as follows:

- ① Check the grounding 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 (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 insulation resistance to ground is greater than 1MΩ.



### 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.

## 7.2 Mechanical checks

---

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

- ① Use sealing caps for tight sealing of unused DC input connectors.
- ② Make sure the RJ45 plug has been fastened properly.
- ③ Make sure the AC connector has been mounted properly.

## 7.3 Start-up

---

After finishing the electrical and mechanical checks, switch on the circuit breaker and then switch on DC switch. The inverter starts up 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 feed-in conditions. If anything is wrong, the inverter will switch to “Fault” mode.

**Normal:** After checking, the inverter will switch to “Normal” mode and feed power into the grid.

During periods of little or no sunlight, the inverter may continually start up and shut down. This is due to insufficient power generated by the PV array. If this fault occurs often, please contact service.



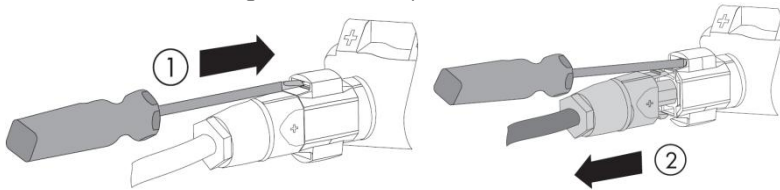
### Quick troubleshooting!

If the inverter is in “Fault” mode, refer to section 11 “Troubleshooting”.

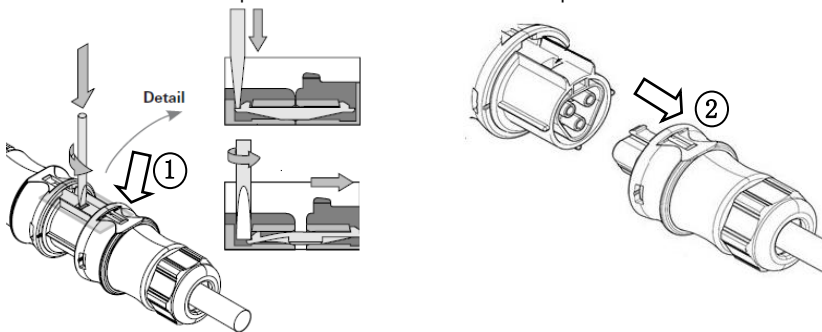
## 8 Disconnecting the inverter from voltage sources

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 miniature 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 the 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.

## 9 Operation

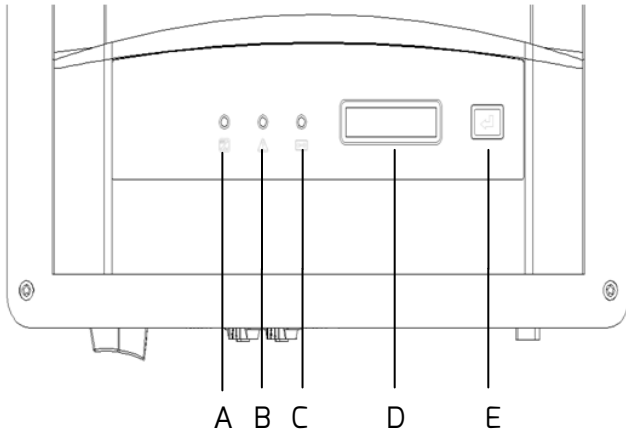
---

The information provided here covers the LEDs, the control button and the display messages.

### 9.1 Overview of the control panel

---

The inverter is equipped with a text display, three LEDs indicators and a control button.



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



## 9.1.1 Display

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

Line 1	State information ↓ E-today ↓ E-total ↓ Vpv ↓ Ipv ↓ Iac ↓ Frequency ↓ Model ↓ Version ↓ Set Language ↓ Vac ↓ Serial No.	Daily energy  Energy generated since the inverter was installed  DC input voltage  DC input current  The present output current  Grid frequency  Inverter type  The firmware version  Selected language  Output voltage  Serial number
Line 2	Pac = xxxx.xW	Current output

## 9.1.2 Control button

---

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

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 status information automatically and the language setting will be saved at the same time unless you press the button again within approximately 10s.

You can freeze the display as follows:

Press the button for 10s 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 status of the inverter changes.

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

### 9.1.3 LED indicators

---

The inverter is equipped with three LEDs (green, red and yellow) which provide information about the operating status as follows.

#### 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. ZeverCom/ZeverManager, Solarlog and in case of a 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 and fault information will be shown on the display

### 9.1.4 Setting the display language and the country data set

---

The inverter provides two display languages: English and German.

Press the button for approximately five seconds in the menu "Set Language" to enter the language menu and select a language. The display will switch to current status information automatically and the language setting will be saved at the same time unless you press the button again within approximately 10 seconds.

The inverter can be configured for various countries via the control button on the upper cover of inverter prior to commissioning. You can choose the respective safety regulation according to the local safety regulation requirement. If the installation site is in Germany or Australia, the default safety standards are "VDE-AR-N 4105" and "AS4777".

Set the safety standard as described below:

Step 1: Check whether the inverter is correctly connected to the PV module (without AC connection), the LCD display shows the characters below:

Error Code: 35 Pac= 0.0w
-----------------------------

Step 2: Press the control key (see section 9.1) every second until the LCD display shows the characters below:

TL**** Pac= 0.0w
---------------------

If you press the control key for ten seconds, the LCD display will show the safety regulation information below:

DE VDE-AR-N 4105 stands for Germany safety regulation (VDE4105)

DE VDE-AR-N 4105 Pac= 0.0w
-------------------------------

Step 3: Before the LCD backlight goes out from step 2, press the control key again every second, and the safety regulation showing on the screen will constantly change.

For example, if you select the safety regulation for the Netherlands, press the control key every second until the LCD display shows "NL NEN50438":

NL NEN50438 Pac= 0.0w
--------------------------

If you stop operation, the LCD backlight will go out after approximately ten seconds. The NL NEN50438 safety regulation setting is saved.

Note:

1. If the LCD display shows "DEFAULT", keep on pressing the key until the LCD display shows the desired safety regulation.

2. If you want to set up other safety regulations, refer to the example for the Netherlands.

## 9.2 Display messages

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

State	Error code	Description	Causes
Initialization		Waiting	Initial PV voltage is between Min. DC input voltage and start-up DC input voltage of the inverter.
		Checking	The inverter is checking feed-in conditions after the initial 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.
Flash		F/W Updating	The MCU firmware is being updated
Fault	9	GFCI Failure	Ground-fault detection circuit is abnormal
	8	AC HCT Failure	Output current is abnormal.
	6	High DC Bus	The voltage of DC bus bar exceeds the permitted upper limit.
	35	Utility Loss	The utility cannot be detected, which may be caused if no utility grid is available, the grid is disconnected, the AC cable is damaged, a fuse is broken or during island mode.
	40	Over Temperature	The internal temperature exceeds the permitted value.
	33	Fac Failure	The grid frequency is outside the permitted range.
	34	Vac Failure	The grid voltage is outside the permitted range.
	37	PV Over-voltage	The voltage of the strings exceeds the

Fault			permitted upper limit.
	36	Ground I Fault	The residual current exceeds the permitted upper limit.
	4	DC INJ High	Output DC feed-in exceeds the permitted upper limit.
	38	Isolation failure	The PV array's insulation resistance to ground is below the permitted value or the electrical insulation inside the inverter has failed
	44	DC feed-in. differs for M-S	A different value of DC feed-in has been detected by master and slave MCU.
	43	Ground I differs for M-S	A different value of residual current has been detected by master and slave MCU.
	42	Fac differs for M-S	A different value of grid frequency has been detected by master and slave MCU.
	41	Vac differs for M-S	A different value of grid voltage has been detected by 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.
	3	Relay-Check Fail	The output relay has failed.
	2	EEPROM R/W Fail	Reading or writing of EEPROM fails
	1	SCI Failure	Communication between the master and slave CPU has failed.
	10	Device Fault	Unknown error

The last five failure reports on the network and system protection device can be read. An interruption in the supply voltage of  $\leq 3$  seconds does not result in any loss of failure reports (as per VDE-AR-N 4105).

## 10 Technical data

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### 10.1 DC input data

---

Type	TL3680	TL5000-10
Rated DC input power ( $P_{dc,r}$ )	4000W	5300 W
Max. DC input voltage	600 V	
Rated DC input voltage	360V	
MPP voltage range	125–520 V	
Full load MPP voltage range	200– 520 V	225– 520 V
DC power limitation for each MPPT with independent configuration of MPPT at $P_{ac,r}$ , Max. unbalance example	2000W, Other channel: $P_{dc,r} - 2500W$	3500W, Other channel: $P_{dc,r} - 3500W$
Start-up DC input voltage	150 V	
Min feed-in DC voltage	115V	
Max. DC input current	11A	
Isc PV, absolute Max.	16.5 A	
Number of MPP trackers	2	
Strings per MPP input	1	
Turn on power (W)	10 W	
DC-switch	Optional	

## 10.2 AC output data

Type	TL3680	TL5000-10
Power connection	Single-phase	
Rated output power	3680W	4600W (Germany&Australia)/ 5000W (others)
Max. output apparent power	3680VA	4600VA (Germany&Australia)/ 5000VA (others)
Rated grid voltage, frequency	220V/230V/240V, 50Hz/60Hz	
AC voltage range <sup>(1)</sup>	180 V to 280 V	
Operating range at AC mains frequency 50 Hz <sup>(2)</sup>	45 Hz to 55 Hz	
Operating range at AC mains frequency 60 Hz <sup>(2)</sup>	55 Hz to 65 Hz	
Rated output current at 220V	16A	20.9A <sup>(3)</sup> / 22.7 A
Rated output current at 230V	16 A	20A <sup>(3)</sup> / 21.7A
Rated output current at 240V	15.3 A	19.2 A <sup>(3)</sup> / 20.8 A
Max. continuous output current	16A	23A
Power factor	VDE-AR-N 4105	0.95 (lagging) to 0.95 (leading)
	Other safety	>0.97 at 20% load, >0.99 at 100% load
Harmonic distortion (THD) at Pac,r	<3%	
Night-time power loss	<1W	
Standby power loss	<6W	

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

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

(3) At country configuration, rated output power 4600 VA.



## 10.3 Safety regulations

Type	TL3680	TL5000-10
Internal overvoltage protection	Integrated	
DC insulation monitoring	Integrated	
DC injection monitoring	Integrated	
Grid monitoring	Integrated	
Residual current monitoring unit	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, EN 61000-3-3	EN61000-3-11, EN 61000-3-12



### INFORMATION!

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

If a central network and system protection device is used for power generation systems, the value of the rise-in-voltage protection  $U >$  of 1.1 $U_n$  presented in the integrated network and system protection can be changed, but a password is required.

It is not necessary to adjust the value of the displacement power factor  $\cos(\phi)$  if the power generation system is  $\Sigma S_{Amax} \leq 3.68\text{KVA}$  and was set to 1 as default in the embedded inverter software. However, if the power generation system is  $3.68\text{KVA} < \Sigma S_{Amax} \leq 13.8\text{KVA}$ , the standard  $\cos(\phi)$  characteristic curve defined in VDE-AR-N 4105 shall be applied through the ZeverCom/ZeverManager.

## 10.4 General data

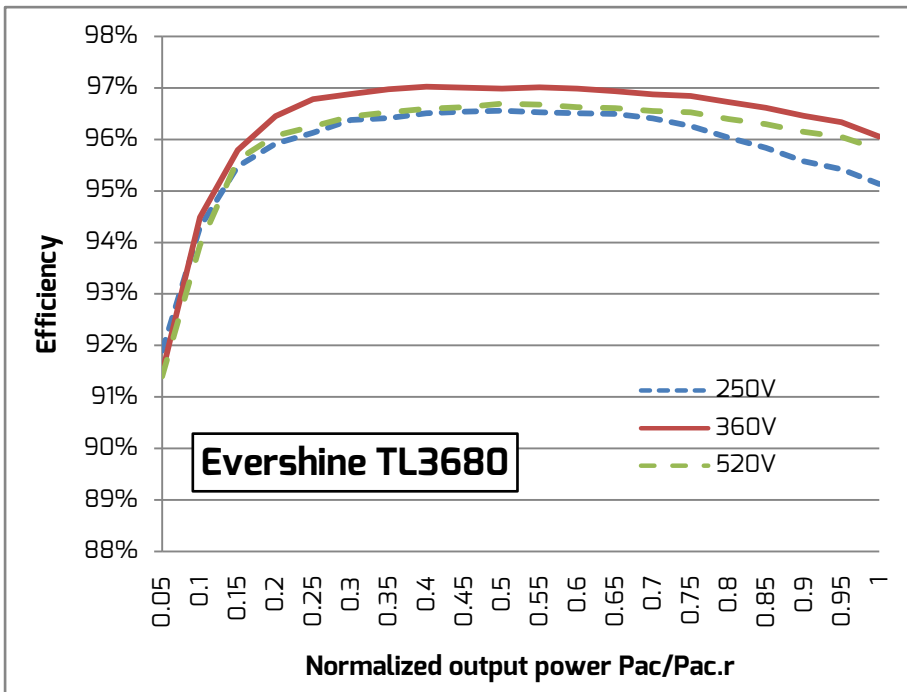
Type	TL3680	TL5000-10
Net weight (Kg)	19.5	
Dimension L×W×D (mm)	480×405×200	
Mounting environment	Indoor and outdoor	
Mounting recommendation	Wall mounting bracket	
Operating temperature range	-25°C to +60°C	
Max. permissible value for relative humidity (non-condensing)	100%	
Max. operating altitude above mean sea level	2000m	
Ingress protection	IP65 as per EN 60529	
Climatic category	4K4H	
Over voltage category	DC input: II, AC output: III	
Topology	Transformerless	
Cooling concept	Convection	
Noise	< 30 dB(A) @ 1m	
Display	16×2 Characters	
Communication interfaces	RS485	
Standard warranty	5 years / 10 years (optional)	

## 10.5 Efficiency

The operating efficiency should be specified at least for the three input voltages ( $V_{mppmax}$ ,  $V_{dc,r}$  and  $V_{mppmin}$ ) graphically. In all cases the efficiency is referred to the standardized power output ( $P_{ac}/P_{ac,r}$ ) as per EN 50524 (VDE 0126-13): 2008-10, cl. 4.5.3.

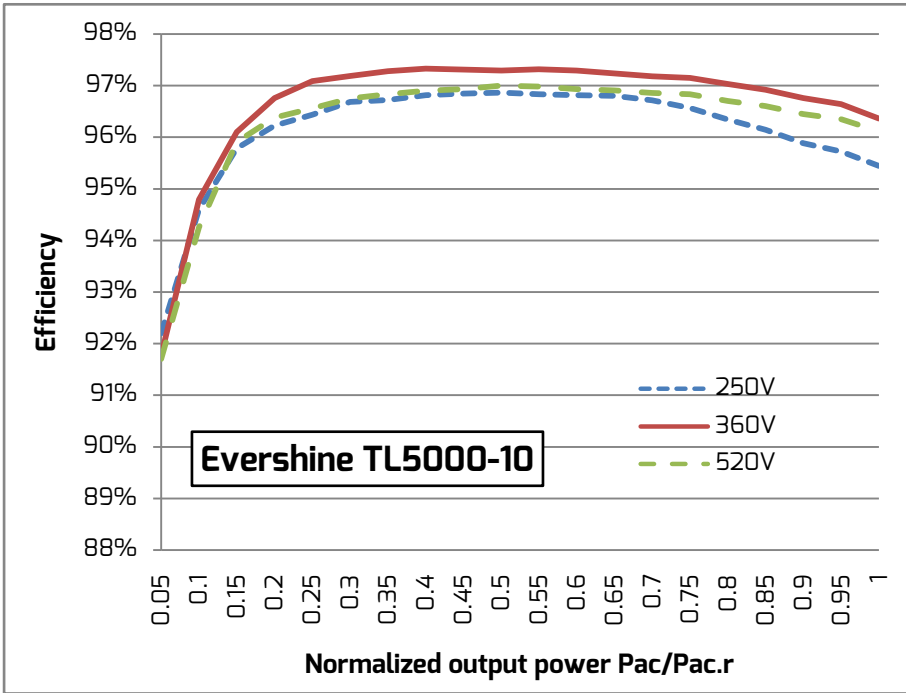
Notes: Values are based on rated grid voltage,  $\cos(\phi) = 1$  and an ambient temperature of 25 °C.

### 10.5.1 Efficiency curve TL3680



Max. efficiency, $\eta_{max}$	97.0 %
European weighted efficiency, $\eta_{EU}$	96.2 %

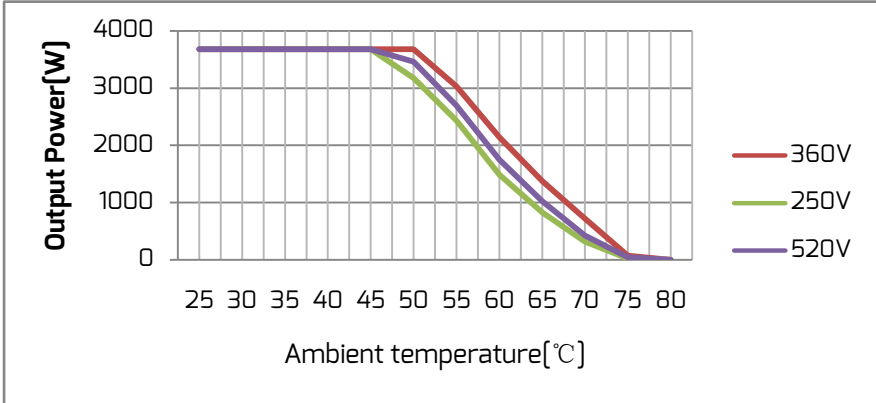
## 10.5.2 Efficiency curve TL5000-10



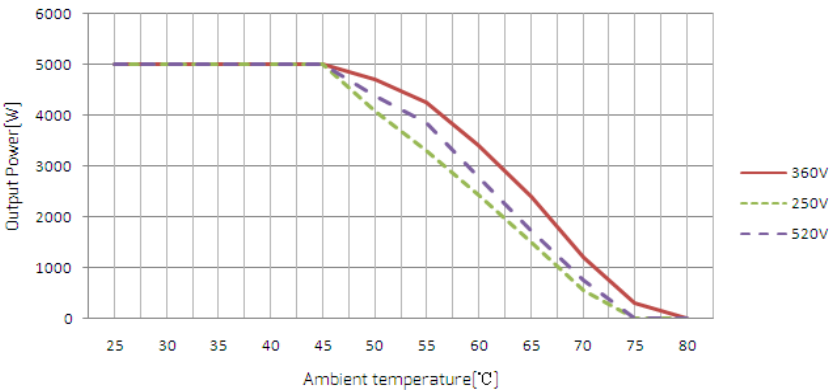
Max. efficiency, $\eta_{max}$	97.3 %
European weighted efficiency, $\eta_{EU}$	96.6 %

## 10.6 Power reduction

In order to ensure inverter operation under safe conditions in terms of the ambient temperature and input voltage, the device automatically decreases power output. Apart from the ambient temperature and the input voltage, power reduction depends on many operating parameters, such as grid voltage, grid frequency and power available from the PV modules. This device can decrease its power output during certain periods of the day according to these parameters.



Power reduction with increased ambient temperature (TL3680)



Power reduction with increased ambient temperature (TL5000-10)

## 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 is lit.

The corresponding causes are described in section 9.2 "Display messages".

The corresponding corrective measures are as follows:

Object	Error code	Corrective measures
Resumable Fault	38	<ul style="list-style-type: none"> <li>·Check the PV array's insulation to ground, make sure that the insulation resistance to ground is greater than 1MΩ; Otherwise, make a visual inspection of all PV cables and modules.</li> <li>·Make sure the ground connection of the inverter is reliable.</li> </ul> <p>If this fault is still shown, please contact service.</p>
	36	<ul style="list-style-type: none"> <li>·Make sure the ground connection of the inverter is reliable.</li> <li>·Make a visual inspection of all PV cables and modules.</li> </ul> <p>If this fault is still shown, please contact service.</p>
	6	<ul style="list-style-type: none"> <li>·Check the open-circuit voltages of the strings, make sure it is lower than the Max. DC input voltage of the inverter;</li> </ul> <p>If the input voltage lies within the permitted range, and the fault still occurs, maybe the internal circuit has broken, please contact service.</p>
	37	<ul style="list-style-type: none"> <li>·Check the open-circuit voltages of the strings, make sure it is lower than the Max. DC input voltage of the inverter.</li> </ul> <p>If the input voltage lies within the permitted range and the fault still occurs, please contact service.</p>
	41,42,43 44,45	<ul style="list-style-type: none"> <li>·Disconnect the inverter from the grid and the PV array, reconnect them after 3 minutes.</li> </ul> <p>If this fault is still being shown, please contact service.</p>

Resumable Fault	33	<ul style="list-style-type: none"> <li>• Check the grid frequency and observe how often major fluctuations occur.</li> </ul> <p>If this fault is caused by the frequent fluctuations, try to modify the operating parameters after informing the utility provider first.</p>
	35	<ul style="list-style-type: none"> <li>• Check the fuse and the triggering of the circuit breaker in the distribution box.</li> <li>• Check the grid voltage and the grid usability.</li> <li>• Check the AC cable and the grid connection on the inverter.</li> </ul> <p>If this fault is still being shown, please contact service.</p>
	40	<ul style="list-style-type: none"> <li>• Check whether the airflow to the heat sink is obstructed.</li> <li>• Check whether the ambient temperature around the inverter is too high.</li> </ul>
	34	<ul style="list-style-type: none"> <li>• Check the grid voltage and grid connection on the inverter.</li> <li>• Check the grid voltage at the point of connection of the inverter.</li> </ul> <p>If the grid voltage lies outside the permissible range due to local grid conditions, try to modify the monitored operating limits after informing the utility provider first.</p> <p>If the grid voltage lies within the permitted range and this fault still occurs, please contact service.</p>
Permanent Fault	1,2,3 4,8,9	<ul style="list-style-type: none"> <li>• Disconnect the inverter from the utility grid and the PV array and reconnect after three minutes. If this fault is still shown, contact service.</li> </ul>

If you have any problems others than those described above, contact service.

## 12 Maintenance

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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

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Clean the contacts of the DC-switch once per year. Perform cleaning by cycling the switch to "1" and "0" positions 5 times. The DC-switch is located at the lower left of the enclosure.

### 12.2 Cleaning the heat sink

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#### CAUTION!

Risk injury due to hot heat sink!

- The heat sink may exceed 70°C 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.

To guarantee proper functioning and a long service life, ensure that sufficient air circulates around the heat sink.

## 13 Recycling and disposal

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

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



## 14 Contact

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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. They are also available online at [www.zeversolar.com](http://www.zeversolar.com) and can be downloaded and are available on paper from the usual sales channels if required.

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