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Installation and Operating Instructions

Evershine TLC4000/TLC5000/TLC6000 Solar Inverters

zeversolar

Table of Contents

1 About this manual

General Notes

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

1.1 Validity

This manual describes the mounting, installation, commissioning and maintenance of the following Zeversolar inverters:
Evershine TLC4000, Evershine TLC5000, Evershine TLC6000.
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 equipment. 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, 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

2.1 Intended use

2.1.1. Evershine converts the direct current from a PV generator 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 earth may only be used if their coupling capacity does not exceed 1.0µF.

2.1.5. When the PV modules are exposed to light, 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

Evershine complies with the EU Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC. Evershine also complies with the requirement for safety and EMC in Australia and New Zealand market.

The inverters are labeled with the CE and RCM mark and fulfill the requirements specified in the specific standards.

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 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 generator!

- Comply with local regulations for grounding the PV generator. 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 CE 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 safety protection

We provide the following safety protection:

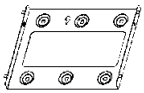
1. Over-voltage, under-voltage protection
2. Over-frequency, under-frequency protection
3. Over-temperature monitoring
4. Residual current monitoring
5. Isolation fault detection
6. Anti-islanding protection
7. DC feed-in monitoring

3 Unpacking

3.1 Scope of delivery

Object	Description	Quantity
A	Inverter	1
B	Wall bracket	1
C	Mounting accessory kit: large plain washers (2×) M5×12 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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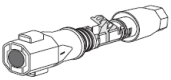
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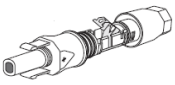
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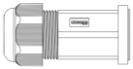

G


H

Please carefully check all of the components in the carton. If anything is missing, contact your dealer at once.

3.2 Check for transport damage

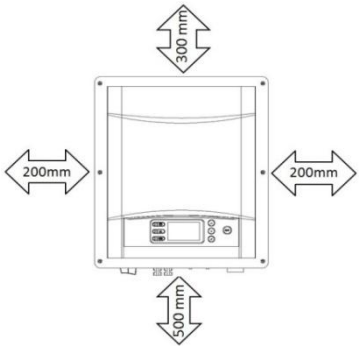
Thoroughly inspect the packaging upon delivery. If you detect any damage to the packaging which indicates the inverter may have been damaged, inform the responsible shipping company immediately. We will be glad to assist you if required.

4 Mounting

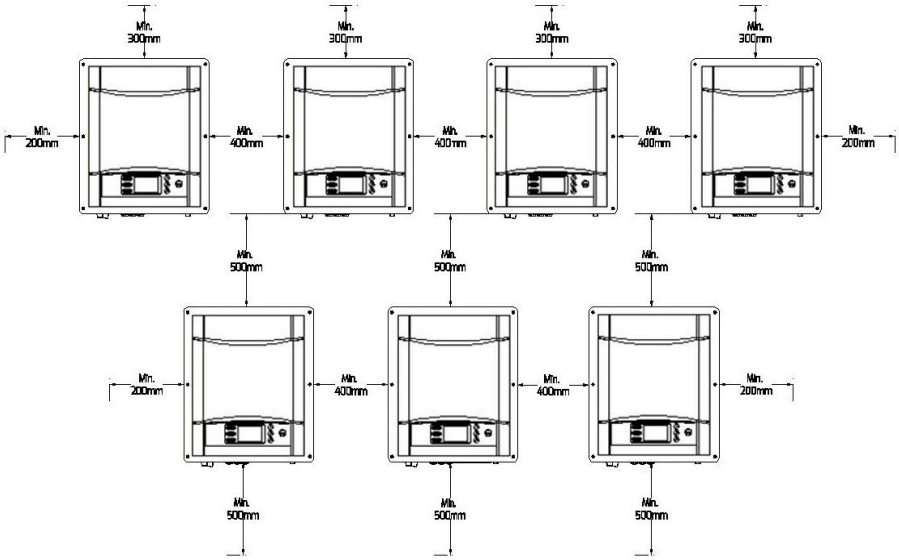
4.1 Ambient conditions

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.
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	500
sides	200



Clearances forone inverter



Clearances for multiple inverters

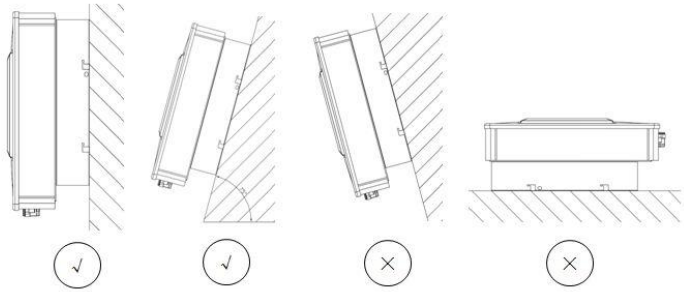
5. The ambient temperature should be below 40°C to ensure optimal operation.
6. In order to avoid power reduction caused by overheating, do not mount the inverter in a location that allows long-term exposure to direct sunlight.
7. The mounting method, location and surface must be suitable for the inverter's 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. Don't put any objects on the inverter. Do not cover the inverter.

4.2 Selecting the mounting location

Danger!

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

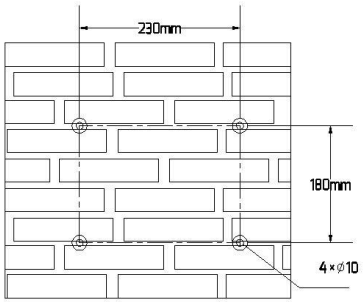
CAUTION!

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

- When mounting, take into account that the inverter weighs approx. 20kg.

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 10mm bit. The holes must be about 70mm deep, keep the drill vertical to the wall, and hold the drill steady to avoid tilted holes.

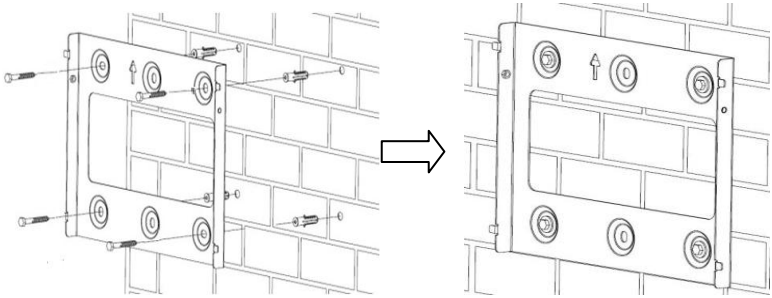


CAUTION!

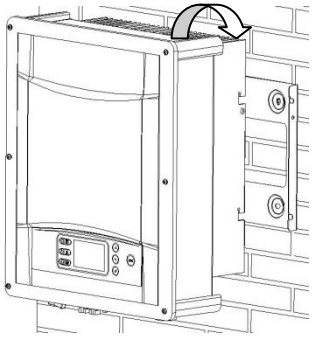
Risk of the inverter falling off and injuring the installer!

- Before inserting wall anchors, measure the depth and distance of the holes.
- If the measured values don't fulfill the mounting requirement, redrill the holes.

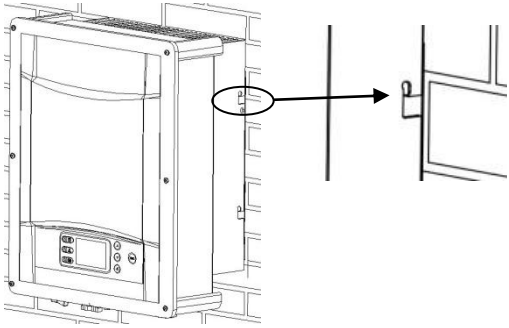
2. Fix the wall bracket to the wall with 4 wall anchors and bolts delivered with the inverter.



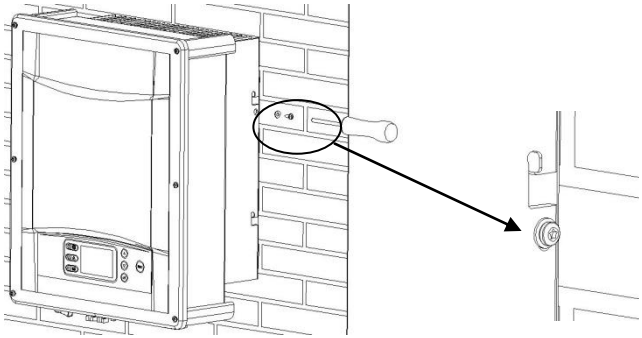
3. Holding the inverter using the handles on the sides, attach the inverter onto the wall bracket tilted slightly downwards.



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



5. Push the inverter inwards to the limit stop 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 earthing 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 local code.

CAUTION!

Risk of injury due to electric shock!

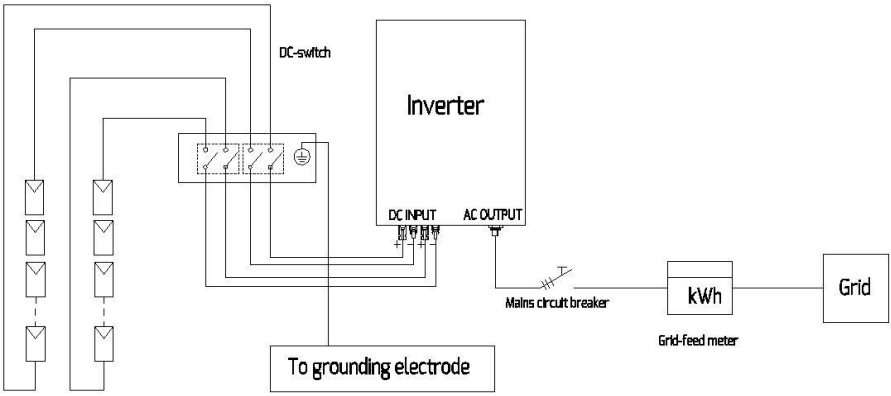
- The external protective earthing conductor is connected to the inverter's protective earthing terminal through an AC connector, make sure the connection is reliable.
- When connecting, connect the AC connector first to ensure the inverter earthing and then connect the DC inputs.
- When disconnecting, 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

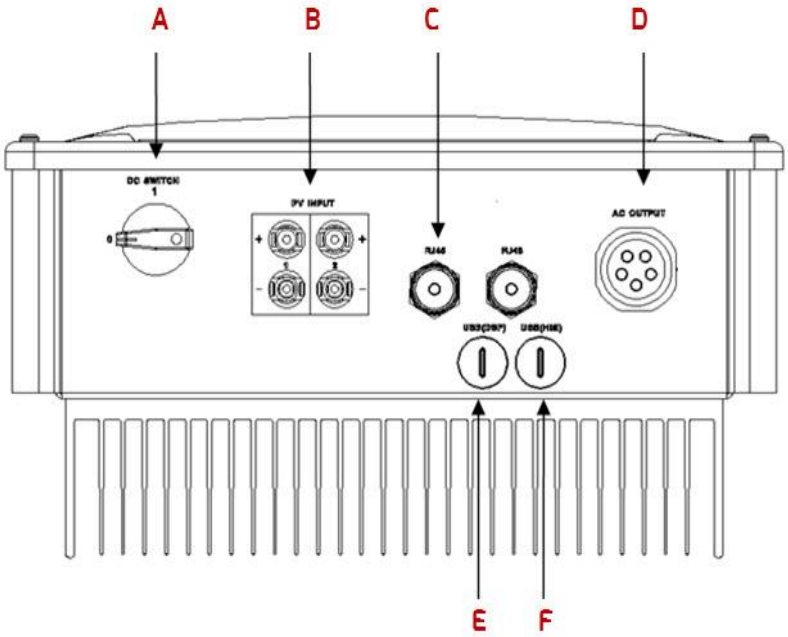
Local standards or codes may require that PV systems are fitted with an external DC-switch on the DC side. The DC-switch must be able to safely disconnect the open-circuit voltage of the PV array plus a safety reserve of 20%.

Install a DC-switch to each PV string to isolate the DC side of the inverter.

We recommendthe following electrical connection:



5.3 Overview of the connection area



Object	Description
A	DC-switch (optional): switch on or off for PV-load
B	DC input: plug-in connectors to connect the strings
C	RJ45interface: connect the monitoring device.
D	AC output: plug-in connector to connect the grid
E	USB (DSP) interface: update or burn the DSP firmware
F	USB (HMI) interface: update or burn the HMI firmware

5.4 AC connection

DANGER!

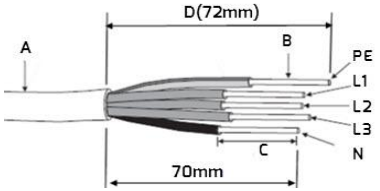
Danger to life due to high voltages in the inverter!

Before making the electrical connection, ensure that the miniature 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 5 conductors (L1, L2, L3, N, and PE).We recommend the following requirements for stranded copper wire.



Object	Description	Value
A	External diameter	12 ... 21 mm
B	Conductor cross-section area	2.5 ... 6 mm^2
C	Stripping length of the insulated conductors	Approx. 9 mm
D	Stripping length of the AC cable's outer sheath	Approx. 72 mm
The PE insulated conductor must be 2 mm longer than the L and N conductors.		

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% of rated output power.

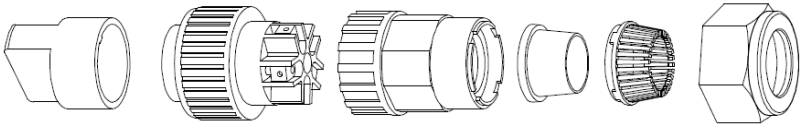
The maximum cable lengths relative to the conductor cross-section as follows:

conductor cross-section	Maximum cable length		
	TLC4000	TLC5000	TLC6000
4mm^2	65 m	53 m	43 m
6mm^2	98 m	80 m	65 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 Connection Plug and the plastic Fixture



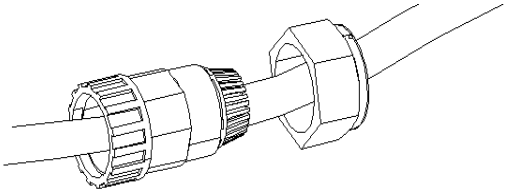
A B C D E F

	Object	Description	
Accessory	A	Plastic fixture(Auxiliary installation)	
AC Connection Plug	B	Socket element	
	C	Adapter	
	D＊	Seal ring	Thicker seal ring is suitable for cable diameter 12-18 mm
			Thinner seal ring is suitable for cable diameter 16-21mm
	E	Fastening case	
	F	Swivel nut	

＊There are two seal rings in the AC connection plug kit, please choose one according to different cable external diameter.

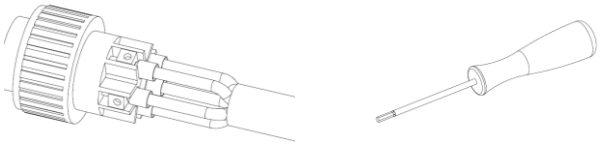
Procedure

1. Switch off the miniature circuit breaker and secure it against being inadvertently switched back on.
2. Guide the swivel nut, the fastening case with sealing ring and the adapter over the AC cable.



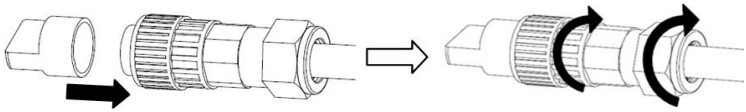
3. Strip the cable's outer sheath (72mm) and the conductors' insulation (9mm),
4. Insert bared conductors into the cord end terminals and crimp them by using a crimping tool. Please pepare suitable cord end terminals according to the conductor's diameter.

5. Insert the stripped conductors L1, L2, L3, N and PE into the corresponding terminals and tighten the screw with torque 1.0-1.2 Nm using an Allen key（AF 2.5）. The ground wire must be locked in the "PE" position.

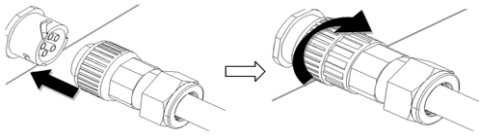


> **CAUTION!**
>
> The inverter can be destroyed due to the wrong wiring!
>
> Please ensure that the polarity of the conductors matches the signs of the screw terminals on the socket element.

6. Assemble the socket element, adapter and swivel nut together. Match the plastic fixture with the socket element and grip them, then screw the adapter and swivel nut as shown below with a torque of 3-4 Nm.



7. Insert the plug into the receptacle with the key aimed at the corresponding slot. Finally rotate the socket element clockwise until it audibly snaps into place.

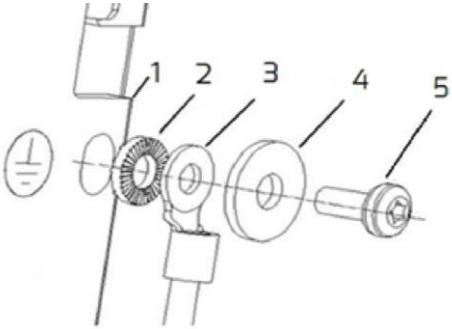


5.4.3 Second protective earthing connection

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

Procedure

1. Take out the terminal lug, insert the stripped earthing conductor into 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 into the wall bracket firmly (torque: 2Nm).



Earthing parts information:

Object	Description
1	Heat sink
2	Ground washer diameter 5mm
3	Terminal lug (M5) with protective conductor
4	Large plain washer diameter 6mm
5	M5×12 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 requirement 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 according to IEC 62109-2.

INFORMATION

If an external residual current device (RCD) needs to be used, please refer to the 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 120mA or higher.

For each connected inverter, a rated residual current of 120mA 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

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 Miniature circuit breaker

DANGER

Danger to life due to fire!

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

No consumer load should be applied between the miniature circuit breaker and the inverter. The selection of the miniature 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 miniature circuit breaker rating may be necessary due to self-heating or if exposed to heat.

The maximum output current of the inverters can be found in the following table.

Type	TLC4000	TLC5000	TLC6000
Max. output current	6.8 A	8.5 A	9.2 A
Recommended fuse type gL/gG or com- parable automatic circuit breaker rating	16A		

5.5 DC connection

DANGER

Danger to life due to high voltages in the inverter!

·Before connecting the PV generator, 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 Connection of the PV generator (DC)

·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 voltage*	Max. DC current	I_{sc} PV, absolute max. input 1/2
TLC4000	1000V	2×11A	2×16.5A
TLC5000	1000V	2×11A	2×16.5A
TLC6000	1000V	2×11A	2×16.5A

*)The maximum open-circuit voltage, which can occur at solar panel temperatures of -10°C must not exceed the maximum DC voltage of the inverter.

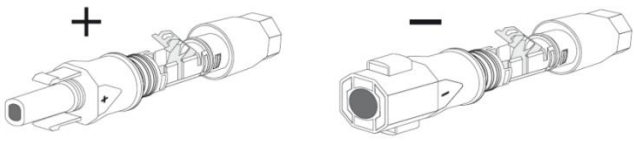
· The positive connection cables of the PV modules must be equipped with positive DC connectors.

· The negative connection cables of the PV modules must be equipped with 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 " – ".



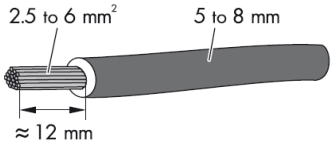
Cable requirements:

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

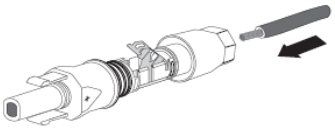
- ✧ External diameter; 5-8 mm
- ✧ Conductor cross-section; 2.5-6 mm²
- ✧ Number of conductors; at least 7
- ✧ Nominal voltage; at least 1000V

Proceed as follows to assemble each DC connector.

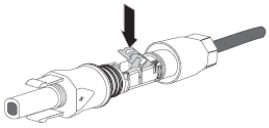
1. Strip 12 mm of the cable insulation.



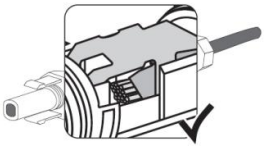
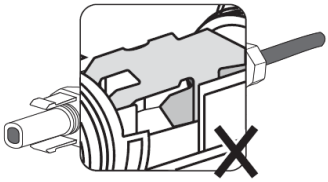
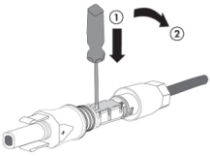
2. Route the stripped cable all the way into the DC connector. Ensure that the stripped cable and the DC connector have the same polarity.



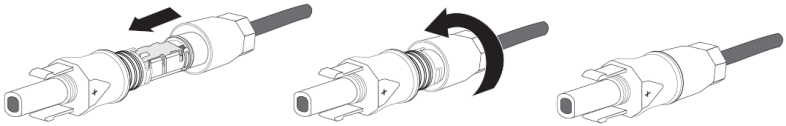
3. Press the clamping bracket down until it audibly snaps into place.



4. Ensure that the cable is correctly positioned:

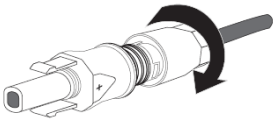
Result	Measure
If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly positioned. 	• Proceed to step 5.
If the stranded wires are not visible in the chamber, the cable is not correctly positioned. 	• Release the clamping bracket. To do so, insert a flat-blade 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).

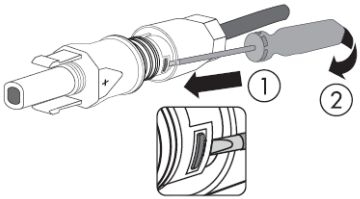


5.5.3 Disassembling the DC connectors

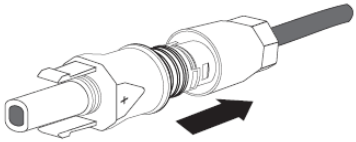
1. Unscrew the swivel nut.



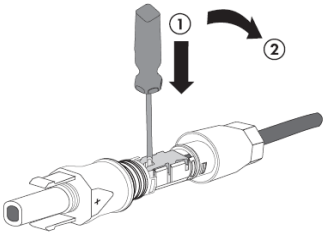
2. To release the DC connector, insert a flat-blade screwdriver (blade width: 3.5 mm) into the side catch mechanism and lever open.



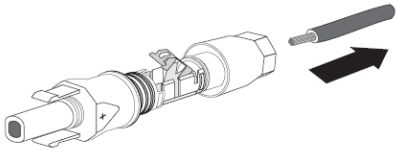
3. Carefully pull the DC connector apart.



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

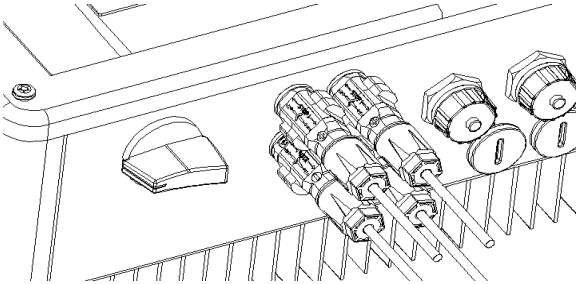
NOTICE!

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 miniature 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.

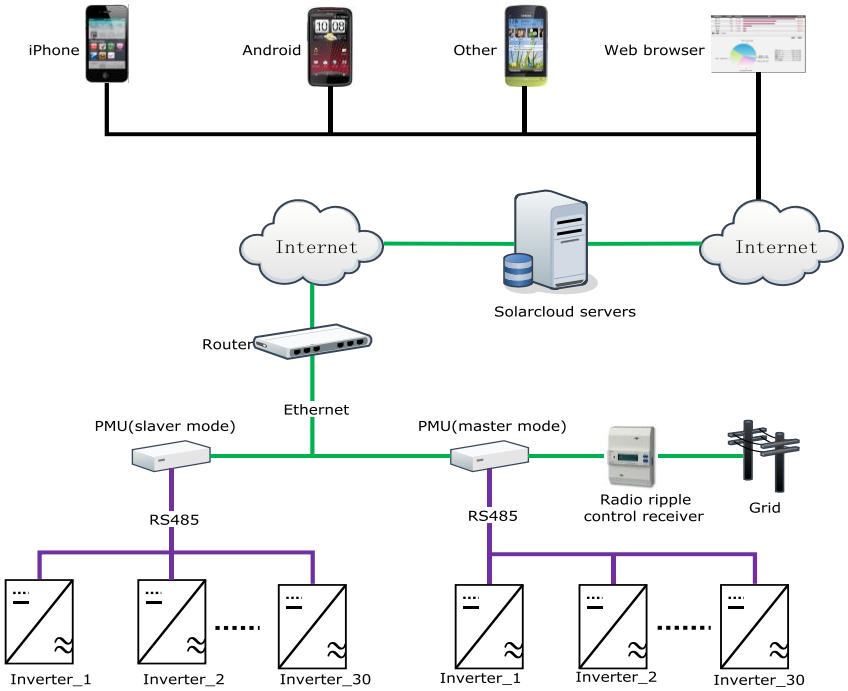
8. The inverter is only properly sealed when all the unused DC inputs are closed with sealing plugs.

6 Communication

6.1 Monitoring of system via RS485

This inverter is equipped with RJ45 interfaces for multipoint communication.

One PMU 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.

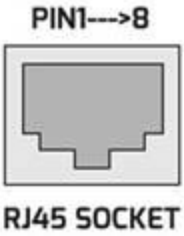


The PMU connects with the inverter via the RJ45 interface, and it connects to the router via Ethernet.

We offer a remote monitor platform "Solarcloud". You can install the "Solarcloud" 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	

NOTICE!

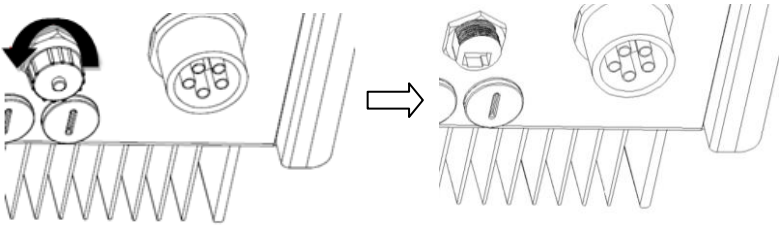
Damage to the inverter due to moisture and dust penetration!

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.

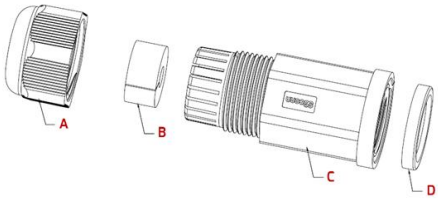
- Make sure the RJ45 plug has been tightened firmly

Connecting the RJ45 plug:

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

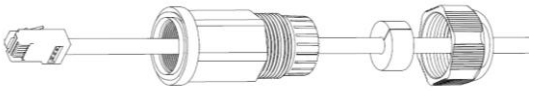


2. Take out the RJ45 plug which accompanies the inverter, and disassemble it.

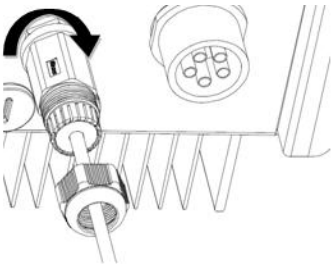


Object	Description	QTY	Color
A	Swivel nut	1	Black
B	Seal	1	Black
C	Threaded sleeve	1	Black
D	Gasket	1	Black

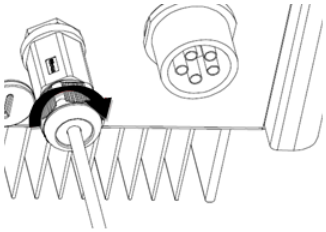
3. Guide the network cable through the components of RJ45 plug as follows.



4. 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.

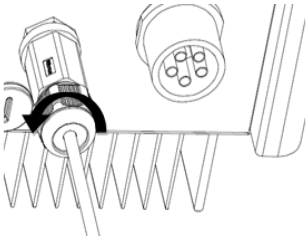


5. Screw the swivel nut to the threaded sleeve tight (torque: 1.0-1.2 Nm).

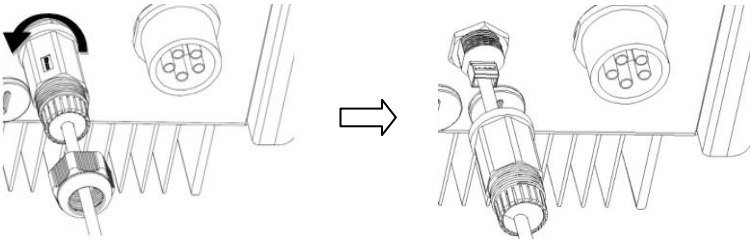


Disassemble the RJ45 plug:

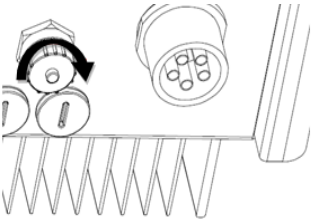
1. Unscrew the swivel nut.



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 USB

If you have to update the firmware, use a screwdriver (blade width: 9 mm) to unscrew the M20 screw plugs located at the bottom of the enclosure,

7 Commissioning

NOTICE!

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 PE connection with a multimeter: check that the inverter's exposed metal surface has an earth 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 chapter "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 generator's insulation to earth with a multimeter: make sure that insulation resistance to earth is greater than 1MOhm.

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 checks 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 mounted properly. Make sure the cap nut on the unneeded RJ45 keystone socket has been solidly tightened.

③ Make sure the AC connector has been mounted properly.

7.3 Start-up

After finishing the electrical and mechanical checks, switch on the miniature circuit breaker and DC-switch in turn. 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 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.

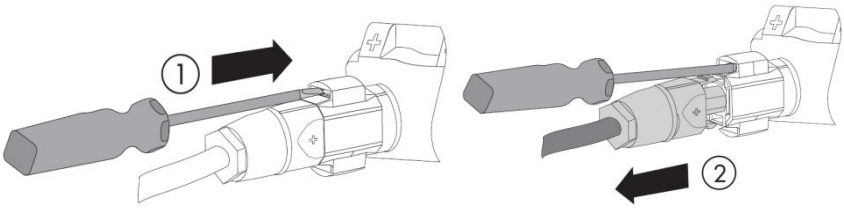
During periods of little or no sunlight, the inverter may continuously startup and shut down. This is due to insufficient power generated by the PV generator. If this fault occurs often, contact the service.

> **i** Quick troubleshooting
>
> If the inverter is in "Fault" mode, refer to chapter 11"Troubleshooting".

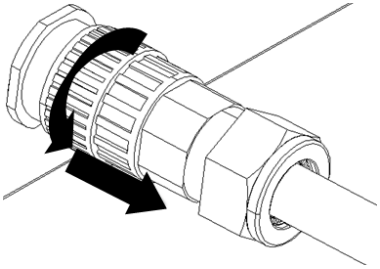
8 Disconnecting the inverter from voltage sources

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. Rotate the socket element counter-clockwise to open.



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

DANGER!

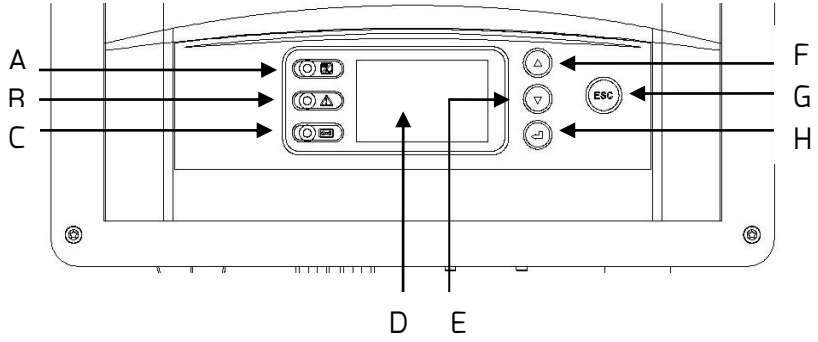
The capacitors in the inverter take 5 minutes to discharge.

- Wait 5 minutes before opening the inverter.

9 Operating

9.1 Overview of the control panel

The inverter is equipped with a control panel which includes a LCD, three LED indicators and four control buttons. You can view the data and set the parameters of the inverter using the buttons.



Object	Description
A	Normal(Green LED)
B	Fault(Red LED)
C	Communication (Bicolor LED)
D	LCD
E	▼ (Down button)
F	▲ (Up button)
G	ESC (Exit button)
H	↵ (Enter button)

9.2 LED indicators

The inverter is equipped with three LED including “green”, “red” and “bicolor” which provide information about the various operating status as follows.

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

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 at the same time.

Bicolor LED:
The bicolor LED can blink green or red. It blinks during communication with other devices such as a PMU, Solarlog, etc. The bicolor LED blinks green when the PMU is sending information to the inverter, and blinks red when the inverter is sending information to the PMU. The LED will also blink green during a firmware update.

9.3 Display messages

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

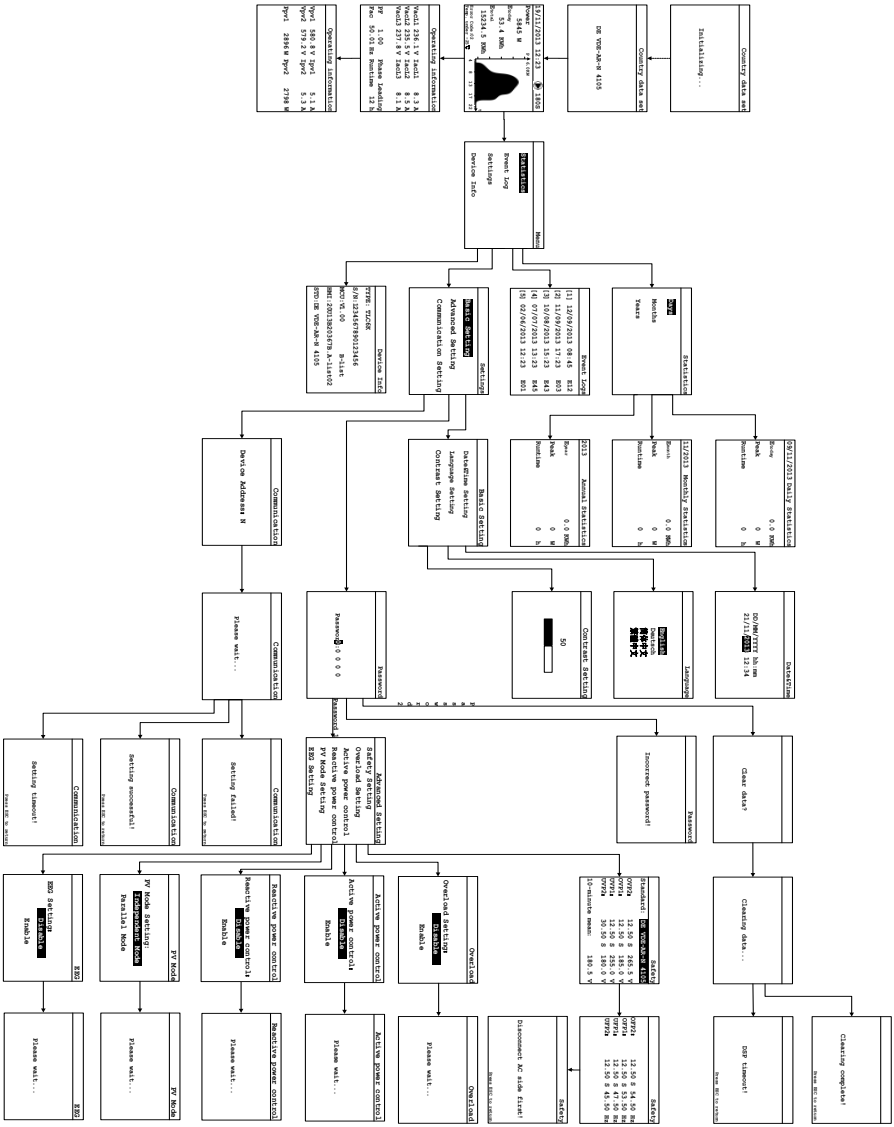
State	Error code	Description	Causes
Initialization		Waiting	Initial PV voltage is between Min. DC input voltage and start-up DC input voltage of the inverter.
		Checking	The inverter is checking feeding conditions after initial PV voltage exceeds start-up DC input voltage of the inverter.
		Reconnect	The inverter is checking feeding conditions after the last fault has been solved.
Normal		Normal	The inverter is operating normally.
Fault	9	GFCI Fault	GFCI detection circuit is abnormal.
	8	ACHCT Fault	Output current sensor is abnormal.
	46	High DC Bus	The voltage of DC Bus exceeds the permitted upper limit.
	35	Utility Loss	The utility cannot be detected, which may be caused by no utility, grid disconnected, AC cable damage, fuse broken or island.
	40	Over Temp.	The internal temperature exceeds the permitted value.
	33	Fac Fault	The grid frequency lies outside the permitted range.
	34	Vac Fault	The grid voltage lies 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.

Fault	4	DC INJ. High	Output DC feed-in exceeds the permitted upper limit.
	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.
	11	M-S version unmatched	Different firmware version between the master and slave CPU.
	38	ISO Fault	The PV generator's insulation resistance to earth is below the permitted value, or the electrical insulation inside the inverter has failed.
	1	SPI Fault	Communication between the master and slave CPU has failed.
	39	Fan Lock	The fan or internal circuit has failed.
	10	Device Fault	Unknown Error

The latest 10 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).

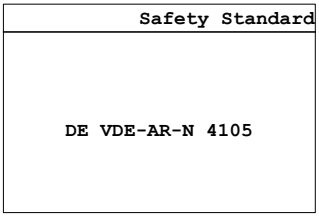
9.4.1 Overview of menu structure

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



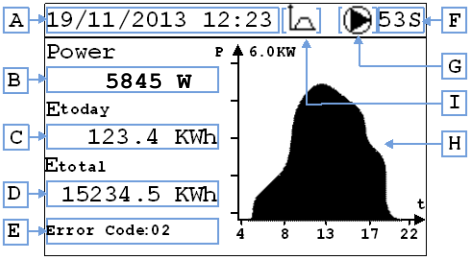
9.4.2 Initial page

When the inverter starts up, LCD will first display an initial page that shows the current safety standard information of the inverter. The page will display for about 5 seconds and then jump to the home page automatically.



9.4.3 Home page

The home page shows some of the most important running data of inverter such as the real-time output power, daily energy, an error code, and the power graph.



LCD will jump to the home page and the backlight will turn off when there is no button operation in 2 minutes.

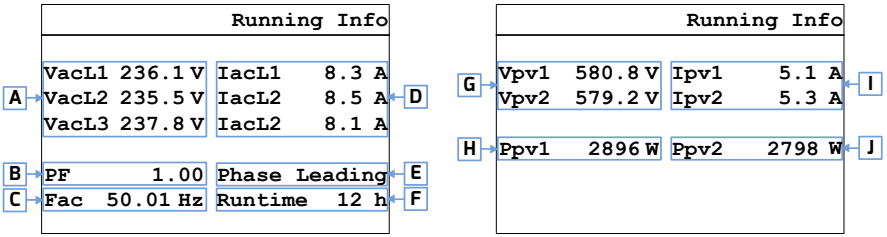
Object	Description
A	Date& Time
B	Current output power
C	Daily energy
D	Total energy
E	Error code(*), see chapter 9.3
F	Checking time
G	Operating status: waiting, operating, fault

H	Field area of output power from 4:00 to 22:00
I	Load limiting efective

(*) The inverter goes into fault mode when the temperature is lower than -25°C. LCD will show the error message "Temp.under -25°C".

9.4.4 Operation information

There are two operation information pages which show the input and output information. Switch between the home page and operation pages by means of the"▲" or "▼" button.



Object	Description
A	Grid voltage
B	Power factor
C	Grid frequency
D	Output current
E	Phase leading or lagging
F	Running time of the current day
G	DC input voltage
H	DC input power
I	DC input current
J	DC input power

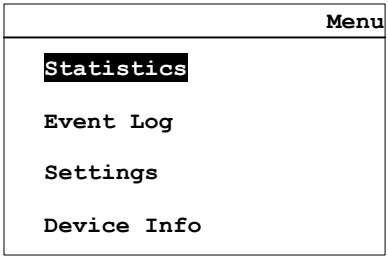
9.4.5 Main menu

Press the " ↵ " button to enter the main menu from the home page.

Press the "▼" or "▲" button to select the menu item.

Press the " ↵ " button to confirm.

Press the "ESC" button to return to the home page.



9.4.6 Statistics

Press the "▲" or "▼" button to select the "Statistics" item of main menu and press " ↵ " button to confirm.

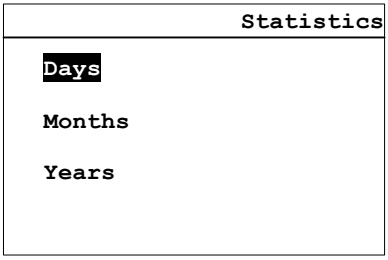
Press the "▲" or "▼" button to select: Days, Months or Years.

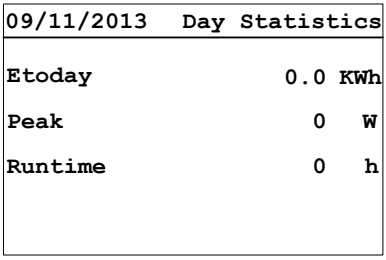
Press the " ↵ " button to confirm.

Press the "▲" button one time to display the previous history record.

Press the "▼" button one time to display the next history record.

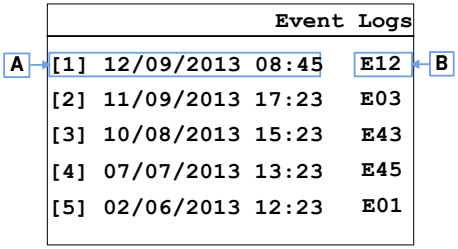
Press the "ESC" button to return to the menu.





9.4.7 Event log

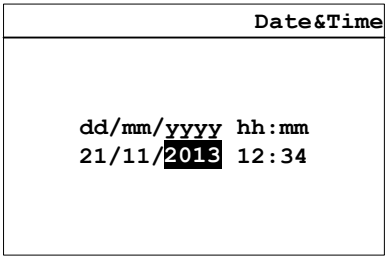
Press the "▲" or "▼" button to select the "Event Log" item of main menu and press the " ↵ " button to confirm.
Press the "▲" or "▼" button to check the fault messages.
Press the "ESC" button to return to the menu.



Object	Description
A	Date and time of the fault
B	Error code

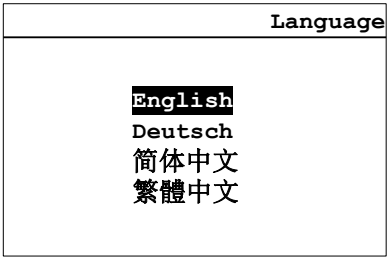
9.4.8 Date&Time setting

Press the "▼" or "▲" button to select the "Date&Time Setting" item of the “Settings” sub-menu and press the " ↵ " button to confirm.
Use the "▲"or "▼"button to set the year, month, day, hour and minute one by one.
Press the " ↵ " button to confirm.
Press the "ESC" button to return to the Basic Setting page.



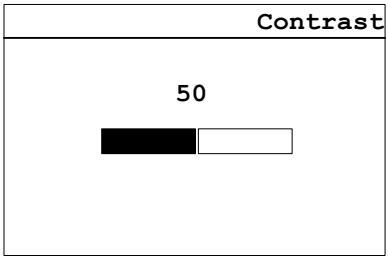
9.4.9 Language setting

Enter the sub-menu “Settings” and press the "▼" or "▲" button to select the "Language Setting" and press the " ↵ " button to confirm.
Use the "▲" or "▼" to choose the language.
Press the " ↵ " button to confirm.
Press the "ESC" button to return to the Basic Setting page.



9.4.10 Contrast setting

Enter the sub-menu “Basic Setting” and press the "▼" or "▲" button to select the "Contrast Setting" and press the " ↵ " button to confirm.
Use the "▲" or "▼" to choose the LCD contrast.
Press the " ↵ " button to save.
Press the "ESC" button to return to the Basic Setting page.

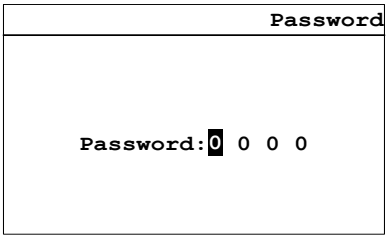


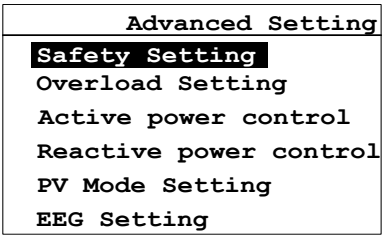
9.4.11 Safety setting

Enter the sub-menu "Advanced Setting" and press the " ↵ " button to input the password.The password is required if you want to change some one setting parameters. Please get the correct password from the service engineer. Enter the correct password and " ↵ " to enter the advanced setting page.

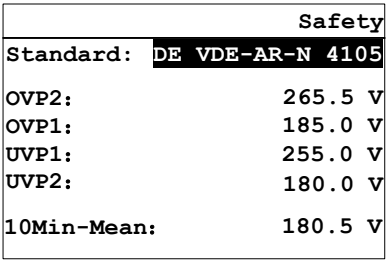
Enter the sub-menu of "settings" and select the "Advanced Setting" item and confirm. The password page is now displayed.

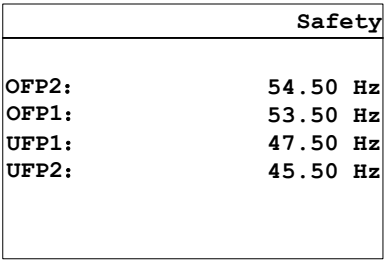
Press the "▲"or "▼"button to modify the password digit, press the " ↵ "button to change the next digit, and the advanced page is now displayed lastly.





To modify parameters, use the "▲" or "▼" button to modify the selected parameter and confirm with the " ↵ " button. Then the next parameter will be selected.
Press the "ESC" button to cancel.





There are two pages of safety parameters. After modifying the last parameter of the first page, press " ↵ "to switch to the second page.

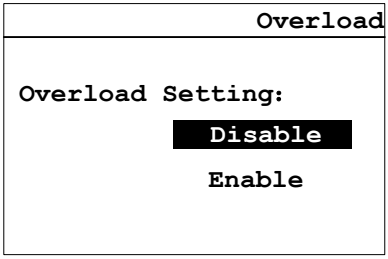
NOTICE!

The safety of the grid may be influenced due to the wrong safety setting!

- The default parameters settings comply with the local regulations.
- Don't change the values of the monitored operational limits unless the utility provider agrees with your requirement!

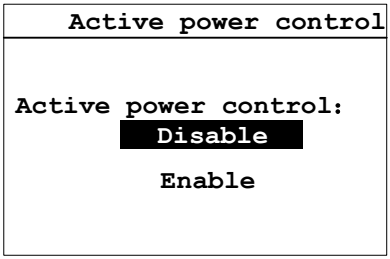
9.4.12 Overload setting

Enter the sub-menu “Advanced Setting” and press the "▼" or "▲" button to select the "Overload Setting" and press the " ↵ " button to set the state.
Use the "▲" or "▼" to choose the overload of the state.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the Advanced Setting page.



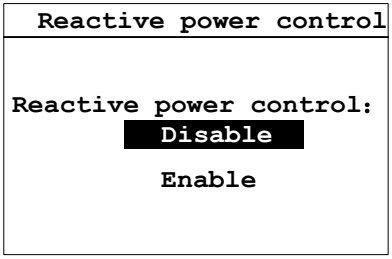
9.4.13 Active power control

Enter the sub-menu “Advanced Setting” and press the "▼" or "▲" button to select the "Active power control" and press the " ↵ " button to set the state.
Use the "▲" or "▼" to choose the active power of the state.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the Advanced Setting page.



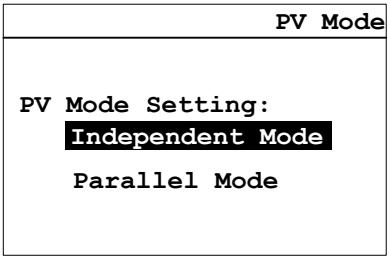
9.4.14 Reactive power control

Enter the sub-menu “Advanced Setting” and press the "▼" or "▲" button to select the "Reactive power control" and press the " ↵ " button to set the state.
Use the "▲" or "▼" to choose the reactive power of the state.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the Advanced Setting page.



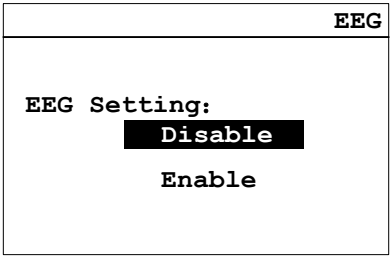
9.4.15 PV Mode Setting

Enter the sub-menu “Advanced Setting” and press the "▼" or "▲" button to select the "PV Mode Setting" and press the " ↵ " button to set the state.
Use the "▲" or "▼" to choose the PV mode of the state.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the Advanced Setting page.



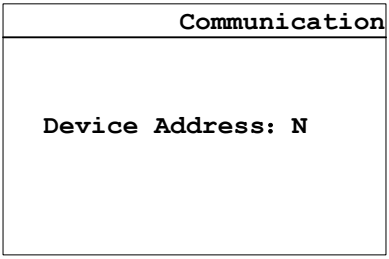
9.4.16 EEG Setting

Enter the sub-menu “Advanced Setting” and press the "▼" or "▲" button to select the "EEG Setting" and press the " ↵ " button to set the state.
Use the "▲" or "▼" to choose the EEG of the state.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the Advanced Setting page.



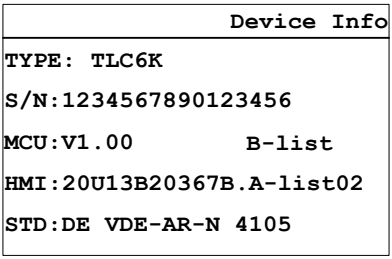
9.4.17 Communication Setting

Enter the sub-menu “Communication Setting” and press the "▼" or "▲" button to select the address and press the " ↵ " button to set the modbus communication address.
Use the "▲" or "▼" to choose the address.
Press the " ↵ " button to transfer to the inverter.
Press the "ESC" button to return to the menu.



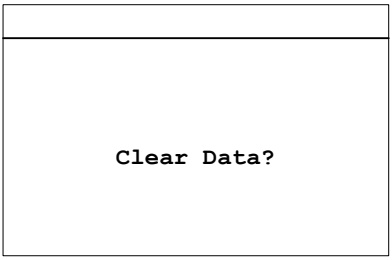
9.4.18 Device information

Press the "▼" or "▲" button to select the "Device Info" item of the main menu and press the " ↵ " button to confirm.
Press the "ESC" button to return to the menu.

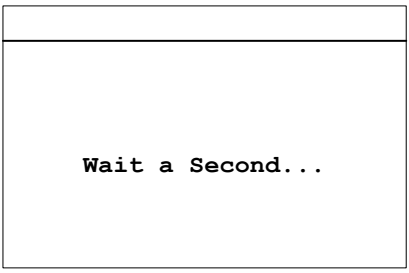


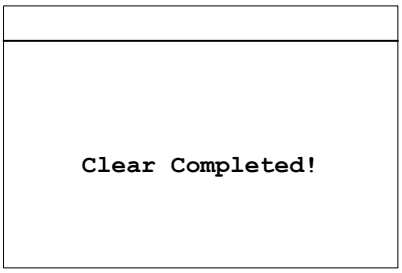
9.4.19 Clear the history data

Enter the "safety setting" page, enter the correct password, and enter the data clear page.



Press the " ↵ " button to confirm to clear the historical data. Press the “ESC” button to cancel.





10 Technical data

10.1 DC input data

Type	TLC4000	TLC5000	TLC6000
Rated DC input power (Pdc,r)	4200 W	5200 W	6300 W
Max. recommended DC input power at STC (1)	4600W	5700 W	6900W
Max. DC input voltage	1000V(2)		
Rated DC input voltage	640V		
MPP voltage range	200...900V		
Full load MPP voltage range(3)	235 ... 900 V	290 ... 900 V	350... 900V
Start-up DC input voltage	250V		
Min feed-in DC voltage	180V		
Max. DC input current(input 1/ input 2)	11A/11A		
I_{sc} PV, absolute max.(input 1/ input 2)	16.5A/16.5A		
Number of MPP trackers	2		
Strings per MPP tracker	1/1		
Turn on power	10W		
DC-switch	optional		

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

(2) when DC input Voltage is higher than 1000V, the inverter will alarm an error. When DC input Voltage is below 900V, the inverter begin to check and connect to gird.

(3) This range is for the rated output power,when overload is enable, this range will be different.

10.2 AC output data

Type		TLC4000	TLC5000	TLC6000
Power connection		Three Phase		
Rated output power		4000 W	5000 W	6000 W
Max. output active power		4400 W[4]	5500 W	6000 W
Max. output apparent power		4400 VA[4]	5500 VA	6000VA
Rated grid voltage		3/N/PE, 220/380V 3/N/PE, 230/400V 3/N/PE, 240/415V		
AC voltage range[5]		160 V to 300 V		
Operating range at AC mains frequency 50 Hz[6]		45 Hz to 55 Hz		
Operating range at AC mains frequency 60 Hz[6]		55 Hz to 65 Hz		
Rated output current at 220 V		3×6.0A	3×7.5 A	3×9.1A
Rated output current at 230 V		3×5.8 A	3×7.2 A	3×8.7 A
Rated output current at 240 V		3×5.5A	3×6.9 A	3×8.3A
Max. continuous output current		3×6.8 A	3×8.5 A	3×9.2 A
Power factor	VDE-AR-N 4105	0.85ind - 0.85cap		
	Other safety	>0.97 at 20% load, >0.99 at 100% load (adj 0.85ind - 0.85cap)		
Inrush current(peak and duration)		72A@252us	75.3A@250us	72.6A@253us
Max. output fault current (peak and duration)		56A@300us		
Max. output over current protection		300V,16A, TYPE C circuit breaker		
Harmonic distortion (THD) at $P_{ac,r}$		< 3%		
Night-time power loss		<0.6 W		
Standby power loss		<12 W		

(4) Only when overload is enable, this power can be reached..

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

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

10.3 Safety regulations

Type	TLC4000 / TLC5000 /TLC6000
Internal overvoltage protection	Integrated
DC insulation monitoring	Integrated
DC feed-in monitoring	Integrated
Grid monitoring	Integrated
Residual current monitoring	Integrated (according to EN 62109-2)
Islanding protection	Integrated (Three-phase monitoring)
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 choose the standard VDE-AR-N 4105, please refer to information below.

- If a central NS protection device is used for power generation system, then the value of the rise-in-voltage protection U > of 1.1Un presented in the integrated NS protection can be changed, but need password.

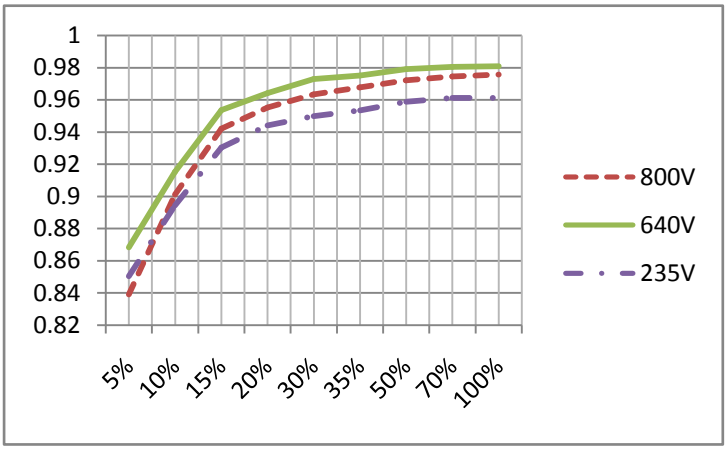
10.4 General data

Type	TLC4000	TLC5000	TLC6000
Net weight	20 Kg		
DimensionsL×W×D	498×405×222 mm		
Mounting environment	Indoor and Outdoor		
Mounting recommendation	Wall bracket		
Operating temperature range	-25...+60℃		
Max. permissible value for relative humidity (non-condensing)	100%		
Max. operating altitude above mean sea level	2000m		
Ingress protection	IP65 according to IEC60529		
Climatic category	4K4H		
Protection class	I (in accordance with IEC 62103)		
Overvoltage category	DC input: II, AC output: III		
Topology	Transformerless		
Feed-in phases	3		
Cooling concept	Convection		
Noise	<40 dB(A) @ 1m		
Display	240×160 pixels, LCD		
Communication interfaces	RS485/USB		
Standard warranty	5 years		

10.5 Efficiency

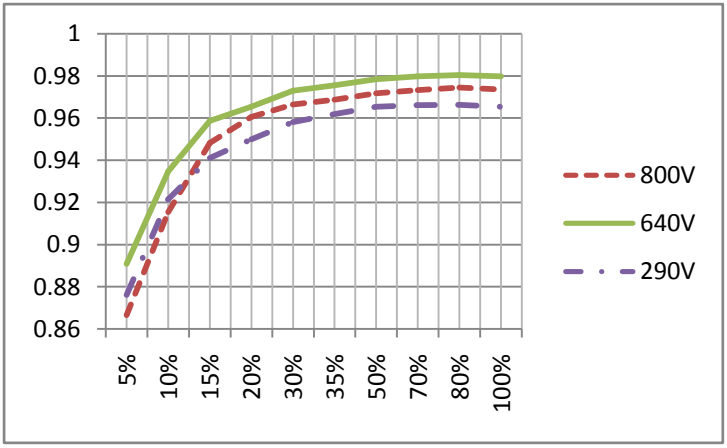
The operating efficiency is shown for the three input voltages (Vmppmax, Vdc,r and Vmppmin) graphically. In all cases the efficiency refers to the standardized power output (Pac/Pac, r). (According to EN 50524 (VDE 0126-13): 2008-10, cl. 4.5.3).
Notes: Values are based on rated grid voltage, cos (phi)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

10.5.1 Efficiency curve TLC4000



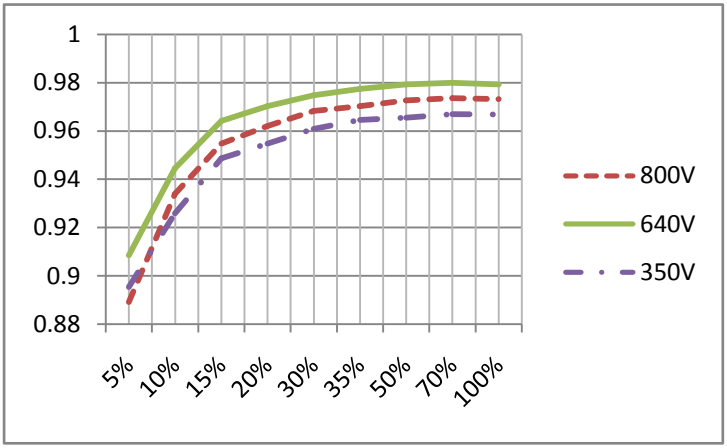
Max. efficiency, ηmax	98.09 %
European weighted efficiency, ηEU	96.99 %

10.5.2 Efficiency curve TLC5000



Max. efficiency, ηmax	98.04 %
European weighted efficiency, ηEU	97.12 %

10.5.3 Efficiency curve TLC6000



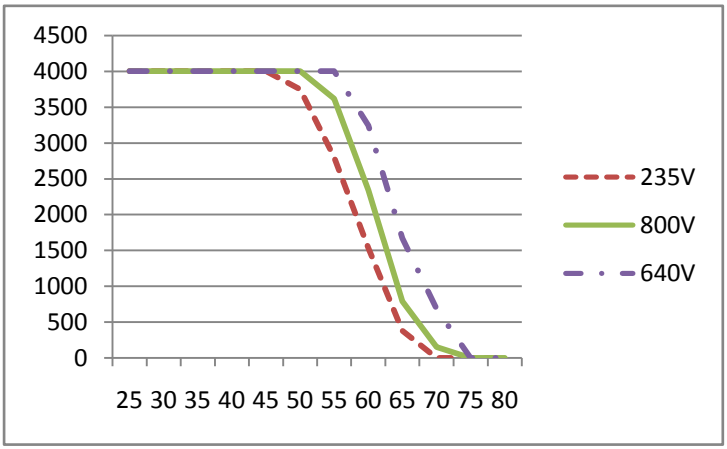
Max. efficiency, ηmax	97.99 %
European weighted efficiency, ηEU	97.34 %

10.6 Power reduction

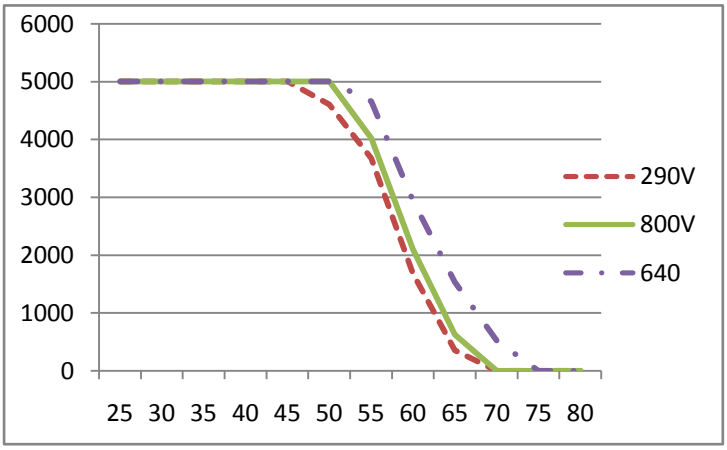
In order to ensure inverter operation under safe conditions, the device may automatically decrease power output.

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.

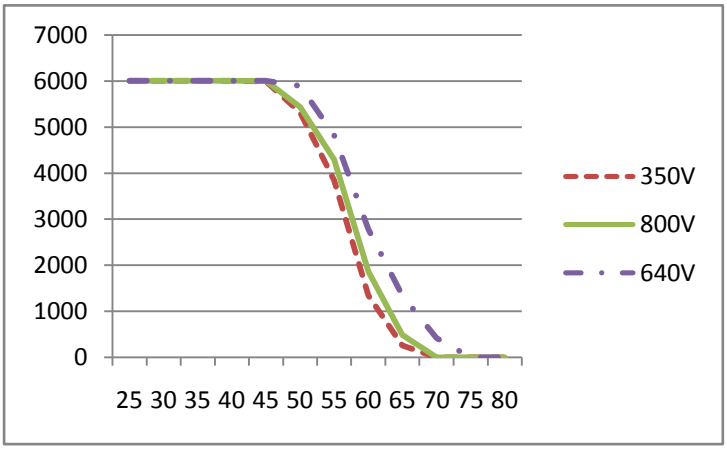
Notes: Values based on rated grid voltage and cos(phi) = 1.



Power reduction with increased ambient temperature (TLC4000)



Power reduction with increased ambient temperature (TLC5000)



Power reduction with increased ambient temperature (TLC6000)

11 Troubleshooting

When the PV system does not operate normally, we recommend the following solutions for quick troubleshooting. When system is in fault condition, fault information will be show up in LCD and monitor device, the red LED will light up. The corresponding causes are described in section 9.3 "Display messages". The corresponding corrective measures are as follows:

Object	Error code	Corrective measures
Resumable Fault	38	·Check the PV generator's insulation to earth, make sure that the insulation resistance to earth is greater than 1MOhm; Otherwise, make a visual inspection of all PV cables and modules. ·Make sure the earth connection of the inverter is reliable. If this fault occurs often, contact the service.
	36	·Make sure the earth 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.
	46	·Check the open-circuit voltages of the strings, make sure it is lower than the Max. DC input voltage of the inverter; If the input voltage lies within the permitted range, and the fault still occurs, maybe the internal circuit has broken, contact the service.
	37	·Check the open-circuit voltages of the strings, make sure it is lower than the Max. DC input voltage of the inverter. If the input voltage lies within the permitted range and the fault still occurs, contact the service.
	41, 42 43, 44	·Disconnect the inverter from the grid and the PV generator, reconnect them after 3 minutes. If this fault is still being shown, contact the service.
	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 utility provider first.

Resumable Fault	35	·Check the fuse and the triggering of the miniature circuit breaker in the distribution box. ·Check grid voltage, grid usability. ·Check 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, contact the service.
	40	·Check whether the air flow to the heat sink is obstructed. ·Check whether the ambient temperature around the inverter is too high.
Permanent Fault	1,2,3,4 ,8,9,10 ,11,39	Disconnect the inverter from the grid and the PV generator, reconnect them after 3 minutes. If this fault is still being shown, 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 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

CAUTION!

Risk 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 pressurized 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. They are also available online at www.zeversolar.com and can be downloaded and are available on paper from the usual sales channels if required.

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