

Advanced Energy® AE 3TL 40 ... 46
Installation and use
Operating instructions
October 2014



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Exclusion and limitation of liability



WARNING

AE assumes no liability in the event of damage as a consequence of the failure to observe the warning instructions in these operating instructions or of improper usage.

The operating, maintenance and safety instructions are to be read carefully prior to installation and commissioning.

The installation, commissioning and safety-related check must be undertaken by a qualified electrician.

Error-free and safe operation of the device requires proper and professional transport, storage, assembly, and installation, as well as careful operation and maintenance.

Only accessories and spare parts approved by the manufacturer are permitted.

Technical modifications to the device are not permitted.

Adherence to the safety regulations and provisions of the country in which the inverter will be used are to be observed.


The environmental conditions, technical calculation data and connection conditions of the grid operator given in the product documentation must be upheld.

For European countries, the valid EU guidelines are to be observed when using the inverter.

The technical data, calculation, connection and installation conditions are to be derived from the product documentation and must be observed under all circumstances.

No liability is assumed for damages in connection with force majeure and disaster situations.

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Feedback from customers

The technical editor of Advanced Energy has carefully developed this handbook on the basis of research-based document design principles. Suggestions for improvements are always welcome. Please send your comments regarding the content, structure or format of these operating instructions to: mail.aei-power@aei.com.

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2. About these Operating Instructions

These operating instructions form part of the product.



- ⇒ Read the operating instructions carefully before installing and using the product.
- ⇒ Keep the operating instructions readily available with the device for the entire service life of the product.
- ⇒ Provide all future users of the device access to the operating instructions.
- ⇒ For more information on the device, troubleshooting, and options under: http://www.advanced-energy.de/de/1TL_3TL_Downloads.html

2.1. SYMBOLS AND MARKUP

| | |
|---------------------|----------------------------|
| ☑ | Prerequisite |
| ⇒ | One-step instruction |
| 1. | Multiple-step instruction |
| • | Bulleted list |
| Highlighting | Highlighting within a text |
| ↪ | Result |


2.2. WARNING NOTICES



2.2.1. Layout of a Warning Notice

| | |
|--|---|
|  WARNING TEXT | <p>The type and source of danger are described here.</p> <p>⇒ Measures for avoiding the danger are shown here.</p> |
| Example | |
|  DANGER | <p>Death or severe injury due to high discharge current when opening the device.</p> <p>⇒ It is essential to ensure an earthing connection has been established prior to connection to the supply current circuit.</p> |

2.2.2. Categories of warning notices

There are three categories of warning notices.

| | |
|--|---|
|  DANGER | <p>"DANGER" designates a safety notice, the disregarding of which will lead directly to death or severe injury!</p> |
|--|---|

| | |
|---|--|
|  WARNING | "WARNING" designates a safety notice, the disregarding of which can lead to death or severe injury! |
|  CAUTION | "CAUTION" designates a safety notice, the disregarding of which can lead to property damage or minor injury! |

2.3. INFORMATION



Note:

A **notice** describes information which is important for the optimum and cost-effective operation of the equipment.

3. Safety Information

3.1. DESIGNATED USE

The AE 3 TL 40 ... 46 inverter, also referred to in these operating instructions as the inverter, is a solar inverter, which transforms the direct current generated by the PV generator (photovoltaic modules) into alternating current and feeds this into the power supply network.

The AE 3 TL 40 is connected as a transformerless inverter directly to the low voltage supply network.

The connection of the AE 3 TL 46 is connected via an isolating transformer to the medium-voltage supply network.

The inverter has been constructed according to the current state of technology and in line with the rules of technical safety.

Both inverters meet the requirements of degree of protection IP65 and can be used indoors and outdoors.

An agreement of the network operator for connection and operation of the inverter for low voltage network or medium voltage network must be present.

The technical design of the network connection, the required additional electrical equipment and to the applicable connection and installation conditions should be clarified in this regard in advance.

Any other use is not considered to be a designated use. The manufacturer accepts no liability for any damage resulting from this.


3.2. QUALIFICATION OF PERSONNEL


Target group for these instructions are professionals who can assess the assigned tasks due to their professional training, knowledge and experience as well as knowledge of the relevant provisions and recognize possible dangers.


Electrical work must only be carried out by qualified electricians.

Only suitably trained and qualified personnel are allowed to work on this inverter. Personnel are regarded as being qualified if they are sufficiently familiar with the assembly, installation, and operation of the product as well as with all warnings and safety measures set out in these operating instructions.


3.3. DANGERS ARISING FROM MISUSE

| | |
|--|--|
|  DANGER | <p>Danger to life from electric shock</p> <ul style="list-style-type: none"> ⇒ Device may only be installed and serviced by qualified specialist technical personnel. ⇒ Only class A modules according to IEC 61730 must be used. ⇒ The PV generator must be free of earth potential. ⇒ The PV generator must be designed in accordance with the technical data of the inverter. ⇒ Every power supply line must be equipped with an appropriate AC-disconnecting device. ⇒ A consumer must never be switched between an inverter and line protection switch. ⇒ Access to the shutdown mechanism must always be free. ⇒ Installation and commissioning must be carried out properly. |
|--|--|

| | |
|---|--|
|  DANGER | <p>Danger to life from electric shock</p> <p>After the device has been switched off, the interior may still contain life-threatening voltage</p> <ul style="list-style-type: none"> ⇒ Do not open inverter. ⇒ Discharge time is at least 15 minutes. |
|---|--|

| | |
|--|---|
|  DANGER | <p>Danger to life from high discharge current</p> <ul style="list-style-type: none"> ⇒ It is essential to ensure an earthing connection has been established prior to connection to the supply current circuit. |
|--|---|


3.4. PROTECTION AGAINST CONTACT WITH ELECTRICAL PARTS

| | |
|--|--|
|  DANGER | <p>Danger to life, danger of injury due to high electrical voltage</p> <ul style="list-style-type: none"> ⇒ Installation of the inverter must only be carried out by trained specialist personnel. In addition, the installer must be accredited by the responsible utility company. ⇒ General assembly and safety stipulations relating to working on high current facilities must be followed. ⇒ Before switching on, a check must be made to ensure that the plugs are firmly in place (locked). ⇒ Before plugging or unplugging the DC plug, always disconnect the connection to the PV generator. ⇒ The feeder must be isolated and secured against being |
|--|--|


| | |
|--|--|
| | switched on again before working at the AC grid. |
|--|--|

3.5. PROTECTION AGAINST MAGNETIC AND ELECTROMAGNETIC FIELDS DURING OPERATION AND ASSEMBLY


Magnetic and electromagnetic fields found in the immediate vicinity of live conductors can pose a serious risk to persons with cardiac pacemakers, metallic implants and hearing aids.

| | |
|---|---|
|  WARNING | <p>Danger to health for persons with pace-makers, metallic implants, and hearing aids in direct proximity to electrical equipment</p> <ul style="list-style-type: none"> ⇒ Persons with cardiac pacemakers and metallic implants may not enter areas in which electrical devices and parts are being assembled, operated or commissioned. ⇒ Should people wearing cardiac pacemakers need to enter such areas, the decision as to whether this is permitted is to be made by a doctor beforehand. Immunity from interference of cardiac pacemakers that have already been implanted or will be in future varies greatly, meaning that there are no generally applicable rules in this respect. ⇒ Persons with metal implants or metal splinters, as well as those with hearing aids, must ask a doctor before entering such areas, as impairments to health are to be expected. |
|---|---|

3.6. PROTECTION AGAINST CONTACT WITH HOT PARTS

| | |
|---|---|
|  CAUTION | <p>Danger of burns caused by hot surfaces on housings</p> <p>At an ambient temperature of 45°C, the upper part of the housing as well as the refrigeration unit can reach a surface temperature of more than 75°C.</p> <ul style="list-style-type: none"> ⇒ Do not touch the housing surface near to heat sources. ⇒ Allow the device to cool down for 15 minutes before touching the surface of the device. |
|---|---|

3.7. PROTECTION DURING HANDLING AND ASSEMBLY

| | |
|---|---|
|  WARNING | <p>Danger of injury during improper handling caused by crushing, shearing, cutting, striking, and lifting</p> <ul style="list-style-type: none"> ⇒ The weight of the inverter amounts to 74.0 kg! ⇒ Follow the general setup and safety regulations for handling and assembly. ⇒ Use suitable assembly and transportation equipment. ⇒ Avoid trap and crush injuries by taking suitable precautions. ⇒ Only use suitable tools. Use special tools where this is prescribed. ⇒ Use lifting equipment and tools in a technically correct manner. ⇒ If necessary, use suitable protective equipment (for example, goggles, safety footwear, protective gloves). ⇒ Do not stand under hanging loads. ⇒ Remove any liquids onto the floor immediately to avoid the danger of slipping. |
|---|---|





3.8. PLEASE NOTE BEFORE STARTING UP

- In the event of installation in France, the device must be furnished with the warning sticker laid down by UTE C 15-712-1. The warning stickers are included in delivery.
- Problem-free and safe operation of the inverter is conditional upon due and specialised transportation, storage, assembly and installation as well as careful operation and maintenance.
- Only use accessories and spare parts approved by the manufacturer.
- Adherence must be ensured to the prescriptions and stipulations regarding safety of the country in which the inverter is to be used.
- The ambient conditions stated in the product documentation must be observed.
- In the planning and installation of the PV system, the technical design data, installation and safety of the PV module manufacturer must be observed.
- Starting up is prohibited until the entire system meets the national regulations and safety rules regarding use.
- Operation is only permitted with adherence to the national EMC prescriptions for the present use case.
- The manufacturer of the equipment or machine is responsible for ensuring compliance with the thresholds required by the respective national regulations.
- For European countries, the EU Directive 2004/108/EU (EMC Directive) is to be observed when using the inverter.
- The technical data, connection and installation conditions are to be taken from the product documentation and must be observed under all circumstances.
- It is not necessary to switch off the inverter overnight, as the inverter switches off completely as soon as no DC voltage is present at the input. If no switch-off is effected, the inverter switches on automatically in the morning when the PV generator

supplies sufficiently high voltage. This means that the maximum output is generated.

- During installation, operation, maintenance and repair the following standards must be observed:
 - EN 50110-1: Operation of electrical installations - Part 1: General requirements
 - EN 50110-2: Operation of electrical installations - Part 2: National annexes
 - IEC 60364-1: Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions
 - IEC 60364-7-712: Low-voltage electrical installations - Part 7-712: Requirements for special installations or locations - Photovoltaic (PV) power systems
 - IEC 61730-1: Photovoltaic (PV) module safety qualification. Part 1: Requirements for construction
 - IEC 62109-1: Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
 - IEC 82/749/CD: Grid connected PV systems - Minimum requirements for system documentation, commissioning tests and inspection
 - IEC 62305-1: Protection against lightning - Part 1: General principles
 - IEC 61439-1: Low-voltage switchgear and controlgear assemblies - Part 1: General rules
 - IEC 61643-11: Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods

3.9. ADDITIONAL SYMBOLS AND WARNING NOTICES ON THE INVERTER

| | |
|---|--|
|  | <p>This symbol advises that the user handbook must be read before the device is used.</p> |
|  | <p>Hot surface! The housing can get hot during use.</p> |
|  | <p>Discharging time of the device longer than 15 minutes.</p> |
|  | <p>Do not work on this device before it is disconnected from both power sources (grid and PV generator).</p> |

4. Description of Device

4.1. HOW IT WORKS

The AE 3TL 40/46 transforms the direct current generated by photovoltaic (PV) modules into alternating current and feeds this into the grid.

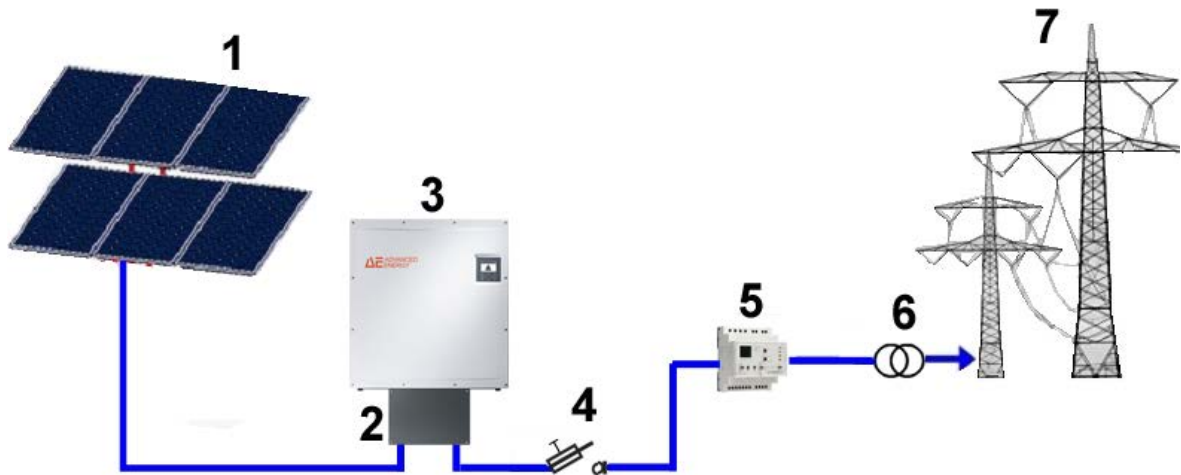


Figure 1: How it works: a grid-connected PV system with photovoltaic inverter

- | | |
|---|--|
| 1 | PV- modulec |
| 2 | ConnectionBox |
| 3 | AE 3TL photovoltaic inverter |
| 4 | Fuse switch disconnecter or circuit breaker |
| 5 | AE GridProtect |
| 6 | Isolation transformer is required for medium-voltage network |
| 7 | Low or medium-voltage AC grid |

4.2. INFRASTRUCTURE REQUIREMENTS

| Additional required equipment | AE 3 TL 40 at the low voltage network | AE 3 TL 40/46 at the medium voltage network |
|--|---------------------------------------|---|
| DC load break switch | necessary* | necessary * |
| AC-Trenneinrichtung | necessary | necessary |
| Zentraler NA-Schutz mit Kuppelschalter (VDE-AR-N 4105) | necessary | necessary |
| NS-/MS-Trenntrafo | not necessary | necessary |

*As a DC load break switch, we recommend the AE ConnectionBox

The following points are to be considered when planning the infrastructure:

- The AE 3 TL 40 can feed into the low-voltage grid and the medium-voltage grid.

- The AE 3 TL 46 can only feed into the medium-voltage grid.
- The 5-wire power supply line must be equipped with an appropriate AC disconnecting device.
- The AE 3 TL 40/46 is not equipped with internal potential isolation.
- If the AE 3 TL 40/46 is connected with the medium-voltage-grid, it must be operated with electrically isolating transformers.
- No other equipment may be connected between the transformer and inverters.

The following standards and technical regulations are also to be observed:

| | |
|----------------|---|
| IEC 60364-4-41 | Protection: Protection against electric shock |
| IEC 60364-4-43 | Protection for safety - Protection against overcurrent |
| IEC 60364-5-52 | Selection and erection of electrical equipment - wiring systems |
| BDEW | Technical Guidelines |
| VDN | Technical Guidelines |

For the AE TL 46 an isolating transformer with the following specifications is required:

| Specification of medium voltage transformers | AE 3 TL 40 | AE 3 TL 46 |
|--|-------------------------------|-------------------------------|
| Rated power | 40 kVA | 46 kVA |
| Rated voltage OS | Electric Supply Company | Electric Supply Company |
| Rated voltage US | 3 x 460 V PE + N | 3 x 460 V PE + N |
| Frequency | 50/60 Hz | 50/60 Hz |
| Short-circuit voltage u_k | Electric Supply Company | Electric Supply Company |
| Switching group | Dyn5 oder Dyn11 | Dyn5 oder Dyn11 |
| Protection | Outdoor use IP65 or protected | Outdoor use IP65 or protected |

4.3. FEATURES OF AE 3TL 40 ... 46

The AE 3TL 40 ... 46 inverter is a transformer-less, three-phase solar inverter, which has a particularly high efficiency at any operating point. Heat is dissipated only by convection. An internal monitor prevents the device from exceeding the permissible ambient temperature.

The inverter is designed such that the device does not have to be opened for assembly and connection work. All electrical connections are exclusively made with lockable connectors. The inverter provides the usual communication interfaces RS485 and Ethernet. An illuminated graphical display shows the development of the feed-in power and other operating data in a clearly arranged manner. An 8-key control panel below the display also provides excellent control and navigation convenience. Based on its design in protection class IP 65, the inverter can be installed at almost any outside location. The inverter has extensive safety and security features. For details, refer to Technical Data, p. 73.



Fig. 2: AE 3 TL 46 to 46

4.4. EXTERNAL DIMENSIONS

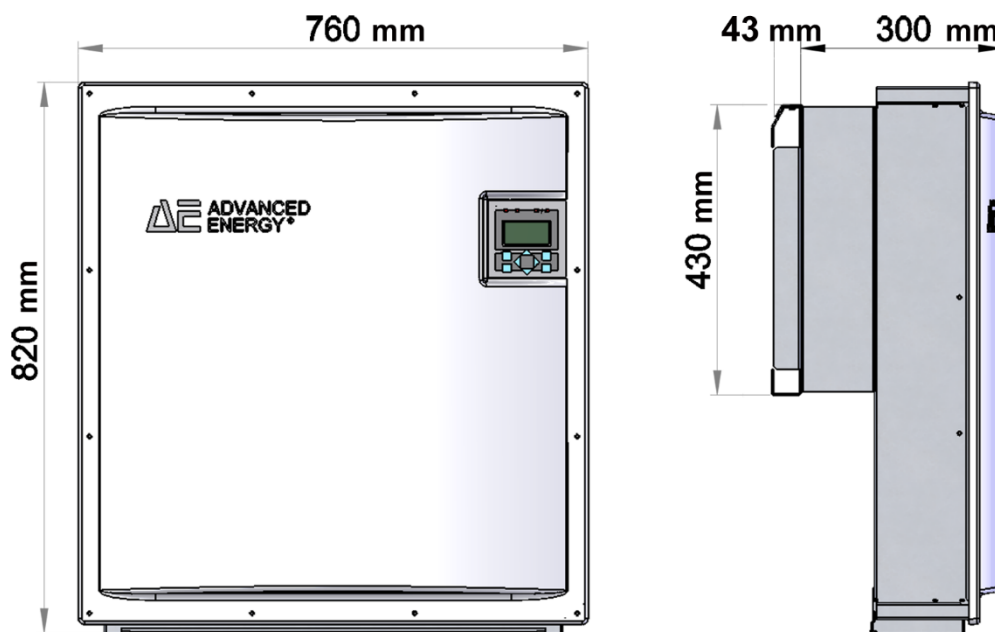


Fig. 3: External dimensions



Note

When installing a ConnectionBox mind that additional space is needed!

4.5. BLOCK DIAGRAM

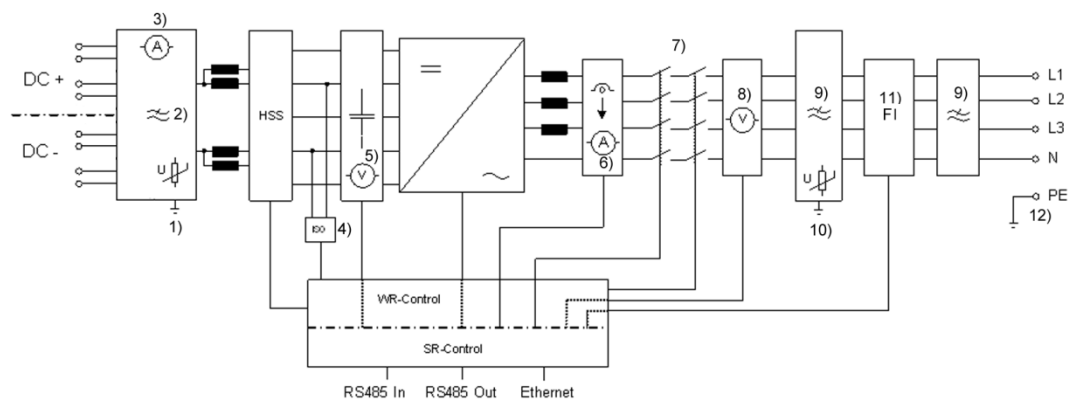


Fig. 4: Block Diagram

- 1) DC-overvoltage protection type 3 (SPD)
- 2) DC-EMC filter
- 3) DC-current measurement
- 4) ISO-monitoring
- 5) DC-voltage- measurement
- 6) AC-current- measurement
- 7) AC-protection (redundant)
- 8) AC-voltage and frequency measurement
- 9) AC-EMC filter
- 10) AC-overvoltage protection type 3 (SPD)
- 11) Fault current monitoring
- 12) Protective earth connection

4.6. DC CONNECTION

4.6.1. AE 3TL 40 connections

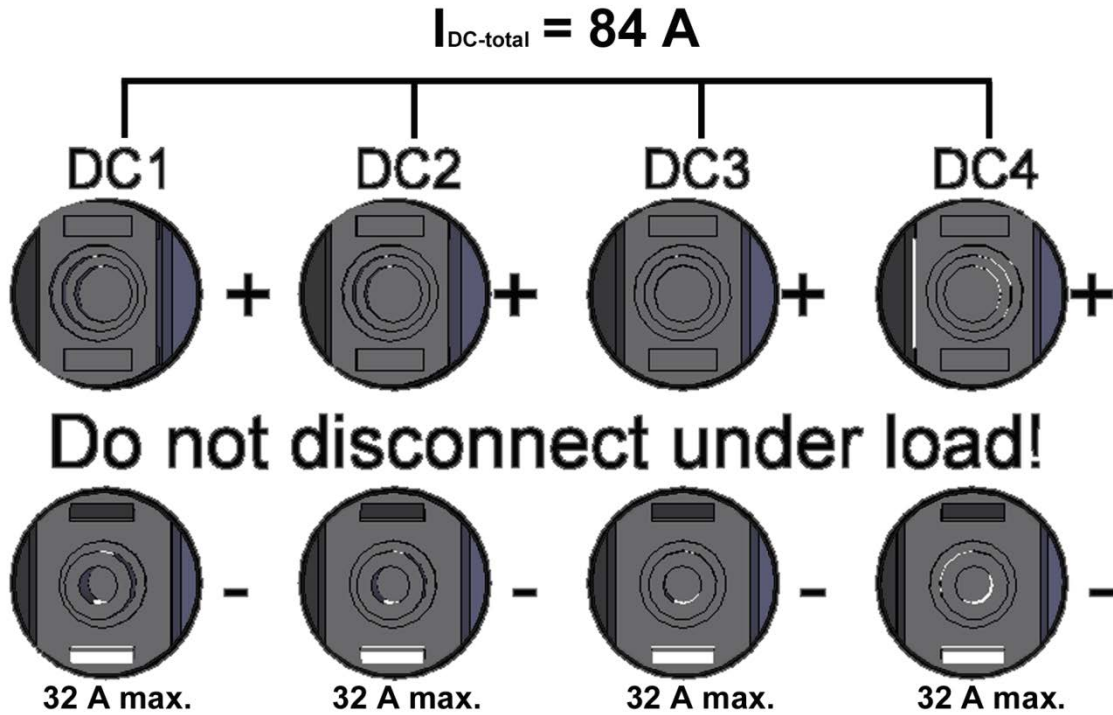


Fig. 5: AE 3TL 40 connection

4.6.2. AE 3TL 46 connections

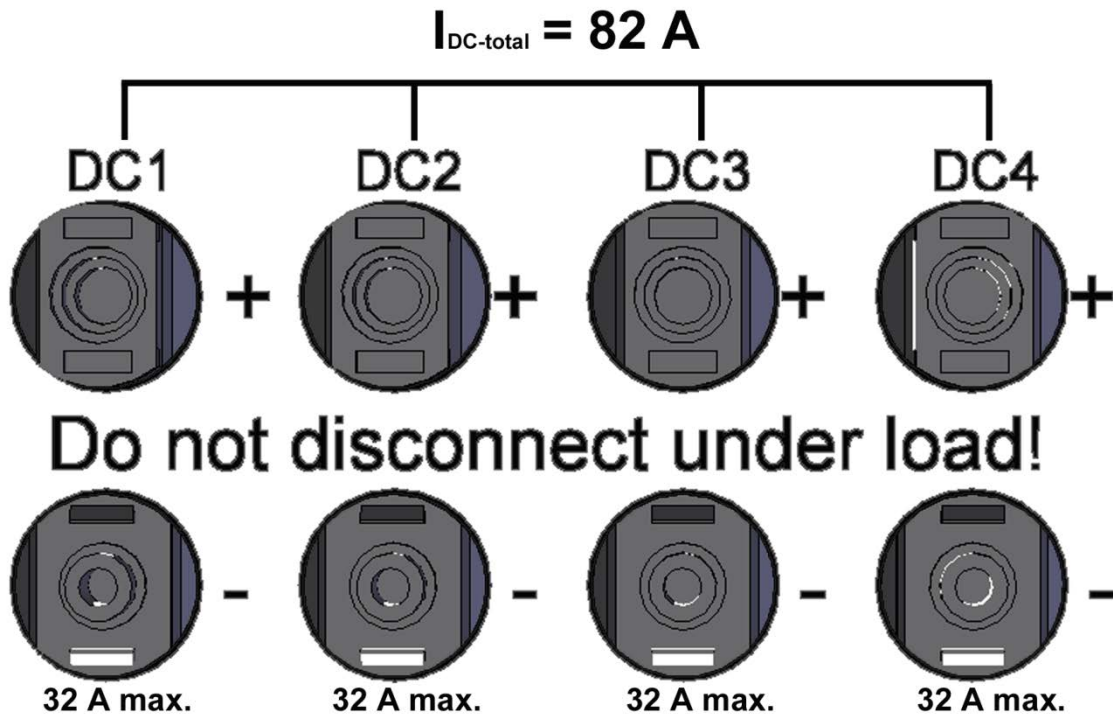


Fig. 6: AE 3TL 46 connection

4.7. OPERATION OPTIONAL CONNECTIONBOX

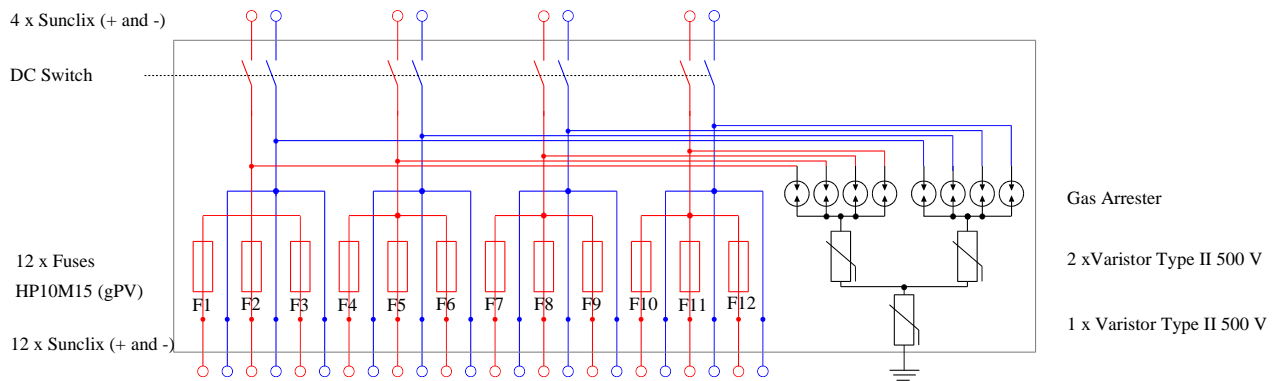


Fig. 7: Operation ConnectionBox

The optional ConnectionBox offers the following additional functions:

- DC-switch disconnectors
- Extension of the DC-Inputs from 4 to 12
- String fuses for all of the 12 DC-inputs
- Overvoltage protection (optional, 2 x Type: DG MOD PV SCI 500 952 051)
- Overvoltage protection (optional, 1 x Type: DG MOD PV SCI 500 952 041)

4.8. CONTROL PANEL

The graphical user interface which is integrated on the front of the device and comprises 128 x 64 pixels can be used to display the development of data, such as the feed-in power or yield. The parameters required are selected and entered on the 8-key control panel. The control panel is illuminated when a key is pressed and turns dark automatically.

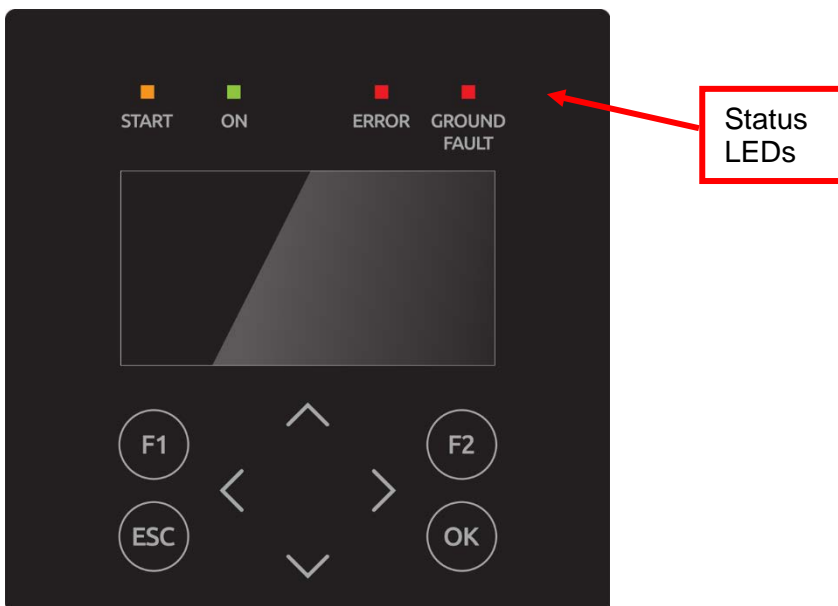


Fig. 8: Control panel


4.9. INTERNAL DATA LOGGER


The inverter features an internal data logger that allows measured values to be simultaneously recorded in the form of parameters. If the storage capacity is full, the oldest data is overwritten. With the default setting on delivery, the data logger logs 16 measuring channels, which can be displayed and analyzed by AE SiteLink.

| Recording cycle | Storage time |
|-----------------|--------------|
| 1 minute | 2.5 years |
| 2 minutes | 5 years |
| 5 minutes | 12.5 years |
| 10 minutes | 25 years |

5. Installation

5.1. ASSEMBLY SITE REQUIREMENTS

| | |
|--|---|
|  <p>DANGER</p> | <p>Danger to life due to fire or explosion.</p> <ul style="list-style-type: none">⇒ Do not install inverter in areas with risk of explosion.⇒ Do not install inverter on flammable materials. Uphold fire protection class F30.⇒ Do not install inverter in areas where easily flammable materials are stored.⇒ Under no circumstances are the cooling ribs of the heat sink to be covered. |
|--|---|

| | |
|---|--|
|  <p>WARNING</p> | <p>Danger of accident</p> <ul style="list-style-type: none">⇒ When installing and servicing, unrestricted and safe access to the devices must be ensured. |
|---|--|

The following requirements of the installation site must be upheld:

- Only vertical installation is permitted as otherwise the cooling of the device cannot be guaranteed (convection cooling).
- Do not subject the inverter to any direct sunlight.
- The installation of numerous devices on top of one another is not permitted.
- A fixed wall or a metal construction is necessary for installation. The weight of an inverter amounts to 74.0 kg. Plus, 4.5 kg for the optionally usable CombinerBox. Relevant construction regulations must be observed.
- The device is to be mounted at an appropriate distance from combustible materials.
- To allow for the heat dissipation required, keep the following minimum distances from the ceiling and wall as well as from neighbouring devices:

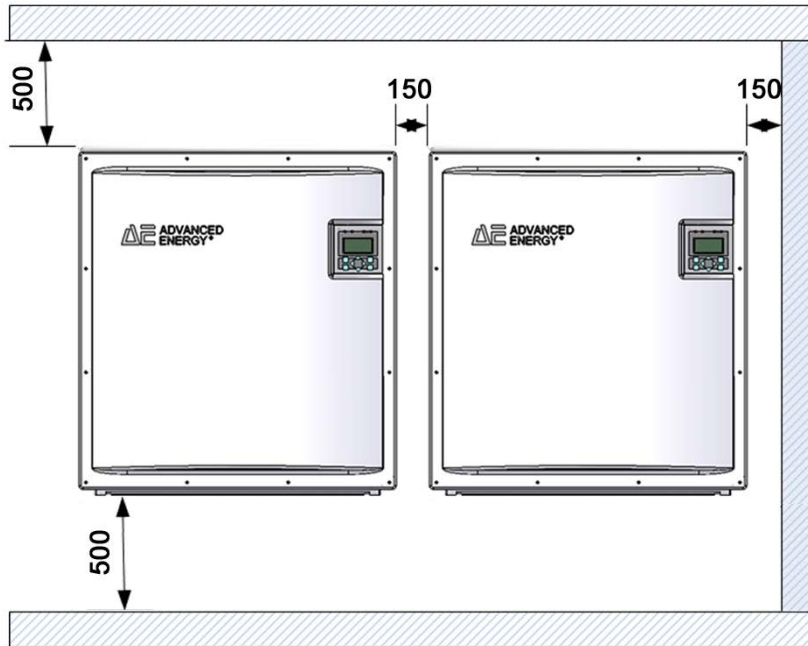


Fig. 9: Minimum distances

The device is best operated if the display is at eye level.

Owing to its protection type (IP65), the device can also be mounted in outside areas.

When using the optional ConnectionBox the altitudes have to be adjusted accordingly.

5.2. TRANSPORT

The devices must be transported under clean and dry conditions, if possible in their original packaging. The transport temperature must be between -25°C and $+70^{\circ}\text{C}$. Permissible variations in temperature may not exceed 20°C per hour.

5.3. STORAGE

The devices must be stored in clean and dry premises, if possible in their original packaging. The storage temperature must be between -25°C and $+55^{\circ}\text{C}$. Permissible variations in temperature may not exceed 20°C per hour.



Note:

The inverter contains electrolyte capacitors which can be stored for no more than 1 year and at a storage temperature of $\leq 40^{\circ}\text{C}$ while in a de-energized state. If the storage time of two years has been exceeded, please contact the AEI Power GmbH Service before connecting the inverter to your system!

5.4. CHECK DELIVERY

The scope of delivery includes a wall-mounting bracket and an accompanying bag AE 840R0XX containing:

- 2 x AE 840 MZ 00 mounting eyes for the handling of the device with the crane.
- 1 x adapter housing, AC connection 840 MZ 00
- 1 x cable gland, ST-M40x1.5 light grey (AC connection)
- 1 x counter nuts for ST-M40x1.5 light grey (AC connection)
- 6 x M5x12 ISO14583 A2 mushroom head bolts for fixing the AC-adapter housing.
- 3 x M5x12 ISO14583 A2 mushroom head bolts for fixing of the inverter at the wall mount.

The screws for attachment to the wall are not included.

5.5. UNPACKING THE DEVICE



Note:

Moisture and dirt can get in through the openings after unpacking. Therefore, only unpack the device when it is to be connected. Failure to do so voids your warranty!

The device is delivered on a pallet in a ply wood box. Note the following sequence when unpacking.

1. Remove side elements.

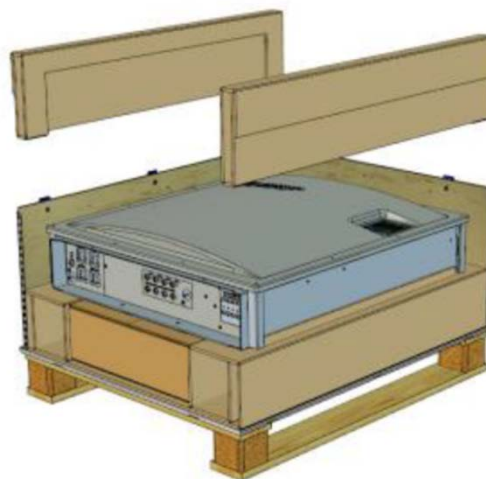


Fig. 10: Side elements

2. Have two people take out the device with the side holding grips (arrows).

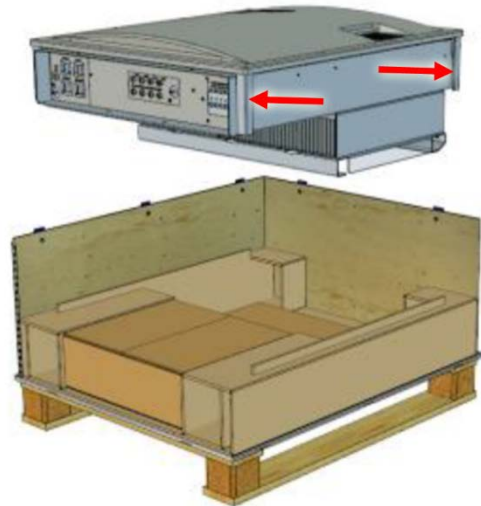


Fig. 11: Side elements

3. The optionally available AE CombinerBox is located under the inverter.

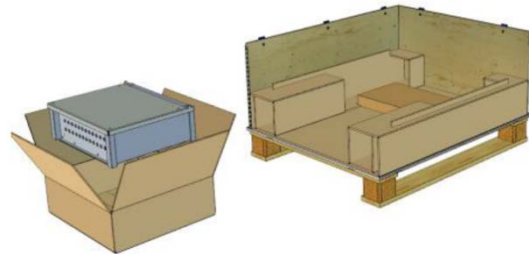



Fig. 12: CombinerBox

5.6. INSTALLATION

| | |
|---|---|
|  CAUTION | <p>Danger of injury or damage to property</p> <ul style="list-style-type: none"> ⇒ Do not use the cover to hold the device. Only use the four holding grips to move the device. ⇒ When designing the attachment of the wall-mounting plate, take the 74.0 kg weight into account. Plus, <dg_ref_source_inline> kg for the optionally usable CombinerBox. ⇒ Do not open device. Opening the device voids the warranty. |
|---|---|

The inverter is mounted using the wall-mounting plate which is included in the scope of delivery.

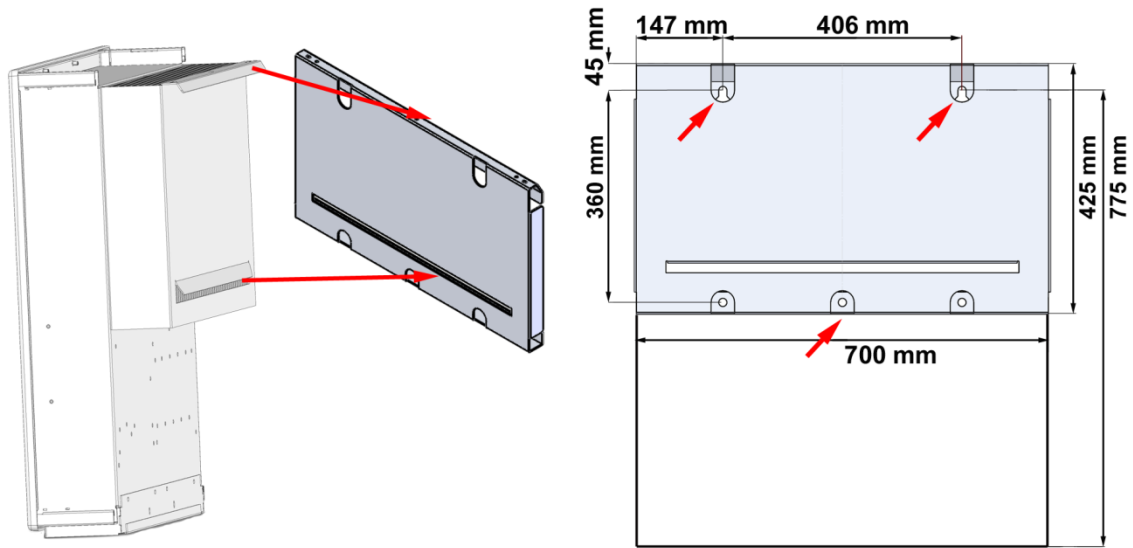


Fig. 13: Mounting the inverter

1. Use the wall bracket to mark the positions of the holes to be drilled.
2. Attach the wall-mounting plate to the wall using 3 screws in the holes marked by arrows. The screws for attachment to the wall are not included. Screws with a diameter of 6 mm must be used.
3. Attach the lower clip into the slit of the wall mounting-bracket and apply the upper clip.
4. Attach the inverter with the 3 screws included (M5x20) at the top of the wall-mounting bracket (red arrows).

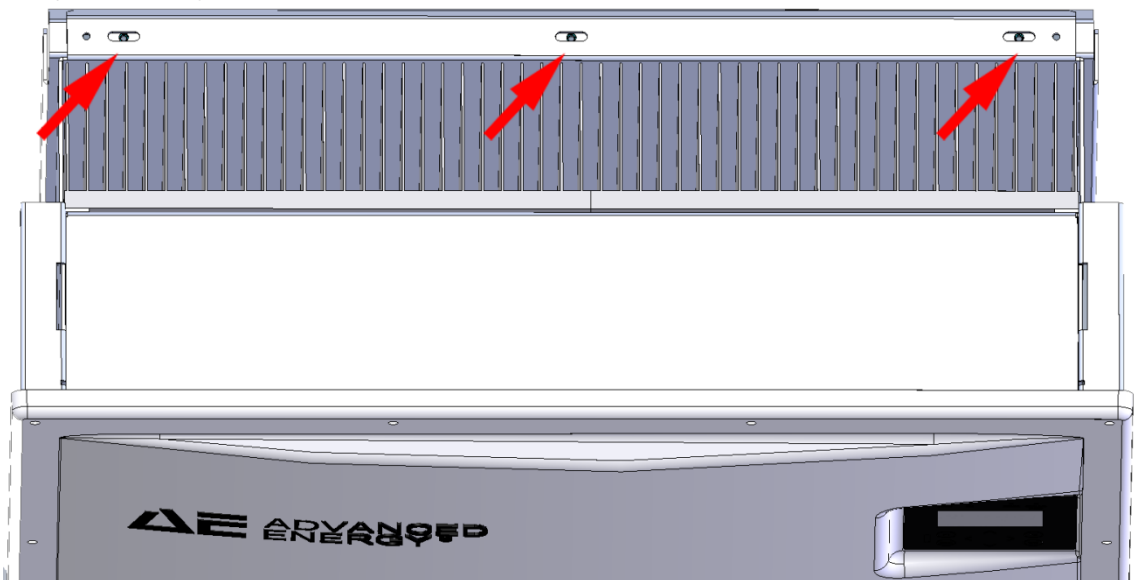


Fig. 14: Attaching with 3 screws

5. Tighten with torque key (2.5 Nm).
6. In order to avoid adhesive residue on the inverter, remove the display protection immediately after installation.

5.7. DEVICE CONNECTORS

The following figure shows the connectors of the inverter on its bottom side.

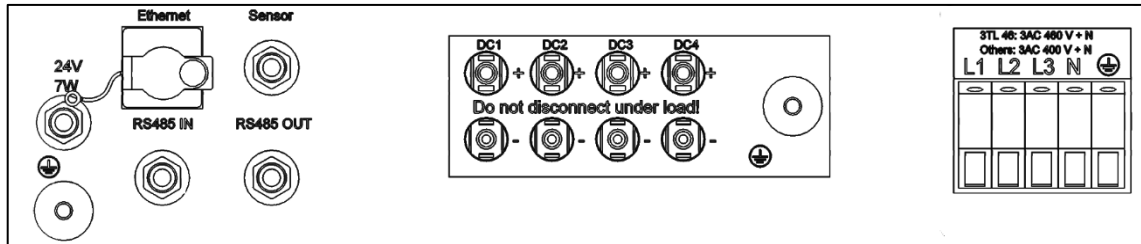



Fig. 15: Device connectors

The inverter is provided with the following connectors, as seen from left to right, top to bottom:

- 24 V/7 W power supply
- Inverter earthing connection
- Ethernet interface port
- RS485 connections (IN)
- SENSOR (connection: radiation and temperature sensor or use for shutdown signal)
- RS485 connections (OUT)
- 4 pairs of PV generator connectors
- Earthing connection for ConnectionBox
- AC-Power Connection

5.8. GROUNDING

| | |
|--|--|
|  <p>DANGER</p> | <p>Danger to life from electric shock</p> <p>The inverter must be earthed with the grounding bolt, otherwise a potential difference can build up, causing a risk of electric shock!</p> |
|--|--|

The inverter features a threaded bolt below the power supply port on the connection side for additional grounding. Grounding is intended to ensure optimum overvoltage protection. The cross section for the ground must be 16 mm² for copper and 25 mm² for aluminium. Depending on the function and use of the additional ground wire other wire sizes may be required depending on the installation instruction. In addition, ensure that the ground wire is placed as far away from and not directly in parallel to the power supply line.

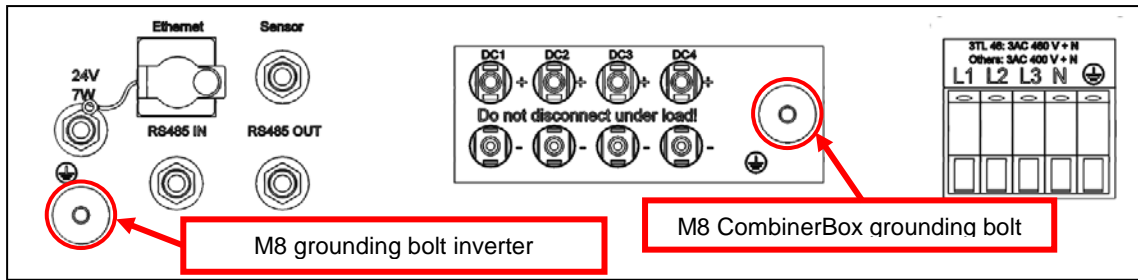


Fig. 16: Grounding bolt

5.9. RESIDUAL CURRENT PROTECTION

Since February 2009 in Germany, RCDs (residual current protective devices) have been prescribed for receptacle circuits of up to 20 A in interior rooms and of up to 32 A in outside areas which are used by electrotechnical non-professionals.


Note:



The photovoltaic power supply inverters without transformers meet the fault protection requirements according to DIN VDE 0100-712, IEC 60364-7-712:2002 and CEI 64-8/7 and can be operated with a type A residual-current circuit breaker without any functional impairment of the protection or the inverter.

The rated leakage current should be at least 100 mA per inverter.

5.10. POWER CONNECTION

| | |
|--|--|
|  DANGER | <p>Risk of electric shock and fire caused by high discharge current!</p> <p>⇒ Before connecting the device to the supply circuit, establish a ground connection by means of the labelled ground stud!</p> |
|--|--|

Note:



To ensure the IP65 protection class, only use the male and female connectors provided and connect them according to the connector manufacturer's mounting instructions. To prevent any penetration of moisture and dirt, unused inputs and outputs must be properly closed. Failure to do so could void your warranty!

The following mains systems are allowed:

- TN-C-S-Net
- TN-S-Net

The connection to the power supply must be via a 5-wire line. For safety reasons, the PE protective conductor must always be connected.

The power supply line must be equipped with an appropriate line protection. More information regarding the power connection you will find in the Technical Data, Inverter. Reducing factors must be taken into account if circuit breakers are connected in series.

Always observe the following standards:

| | |
|----------------|---|
| IEC 60364-4-41 | Protection: Protection against electric shock |
| IEC 60364-4-43 | Protection for safety - Protection against overcurrent |
| IEC 60364-5-52 | Selection and erection of electrical equipment - wiring systems |
| BDEW | Technical Guidelines |
| VDN | Technical Guidelines |

The respective national standards, technical regulations and local installation and connection requirements are complied with.

In addition, the following requirements of the local network operator must be followed:

- Check the line voltage. It must be within the technical data for that device. If the line voltage is different, contact your local network operator.

5.11. POWER SUPPLY LINE



Fig. 17: Power Connection

Select the cross-section of the power supply line such, that they can withstand the expected requirements during operation and that line losses are as low as possible. However, observe the following points:

- The plant raiser must be selected according to the case of operation (installation location and laying type) and the national regulations of the cable material.
- The power supply line is provided with a suitable strain relief device..

The following table shows the maximum wire lengths upon use of a AE 3TL 40 ... 46 depending on the cable cross section with a voltage drop $\leq 1\%$:

| Line cross section | 25 mm ² | 35 mm ² |
|--------------------|--------------------|--------------------|
| Max. line length | 50 m | 70 m |



Note:

The use of other Conductor nominal cross-sections must be clarified in advance with the service from AE.



Note:

In order to ensure IP65 protection, the AC connection housing supplied must be used.

5.11.1. Create power supply

The power supply allows the connection of 5 x 25 mm² to 5 x 35 mm² cables. The maximum external diameter of the power supply line is 28 mm. A strain relief for the AC power cable must be installed.



Fig. 18: Supplied AC connector housing with cable gland, seals, mounting screws and lock washers

1. Guide cable through AC connection housing.



Fig. 19: AC connection housing

2. Bend single conductor into position as shown.
3. Remove cable jacket just enough so that the rubber seal of the gland seals the cable securely.
4. Remove single conductor insulation.

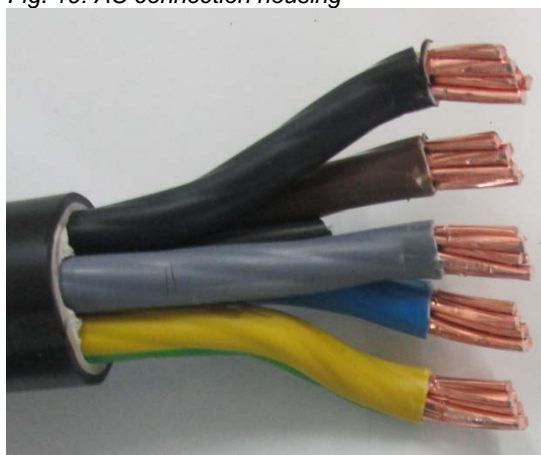


Fig. 20: Cable preparation

5. If possible first insert the PE conductor in PE screw and tighten to 4-4.5 Nm.
6. Insert the other wire into the appropriate screw terminal and tighten to 4-4.5 Nm.

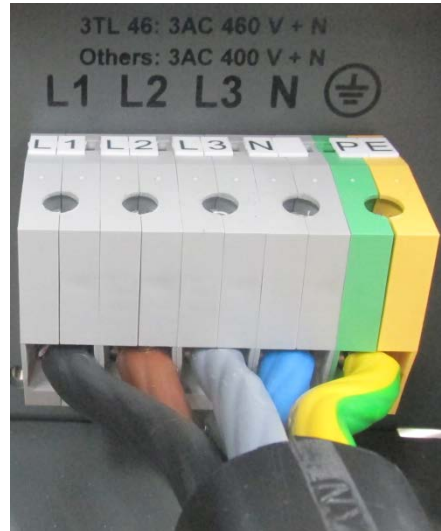


Fig. 21: Attachment of cable

7. AC interface enclosure and seal with the included 6 screws TORX M5X12 and pulleys securely fastened to the chassis.
8. Tighten with a torque wrench (2.5 Nm).
9. Tighten the high-strength cable gland (arrow) firmly and check tightness of the cable entry.

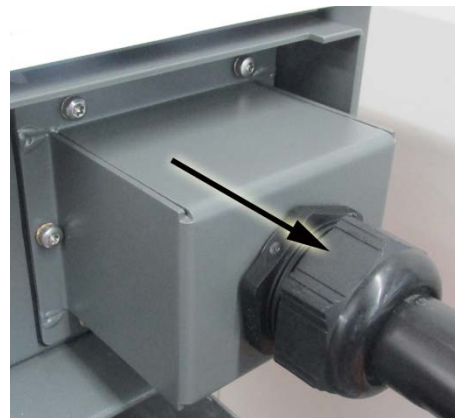


Fig. 22: Screw the AC interface enclosure

5.12. GRID LINE INDUCTANCE

For better efficiency, large line cross-sections in single cables are increasingly used for power supply lines, especially if local conditions require long supply lines.

The considerable line lengths between inverter and the transformer station result in a high cable inductance and therefore an increased line impedance. This presents high resistances for harmonics of the fundamental frequency (50 Hz) of the line voltage and causes voltage distortions in the inverters as well as error messages with regard to:


- controller voltage
- Grid frequency
- grid overvoltage
- sometimes increased operating noise of the inverters



Note:

The sum total of the ohmic and inductive voltage drop on the power supply line at nominal load should not exceed 1% of the line voltage. It must be ensured that the line inductance remains $< 30 \mu\text{H}$.

5.13.DC CONNECTION PV GENERATOR

| | |
|--|---|
|  DANGER | <p>Danger to life due to high voltages from active PV strings</p> <p>Before connecting the PV strings, connect the inverter to the power supply and additional ground connection.</p> <p>The PE conductor of the optional ConnectionBox is to connect to the grounding terminal of the inverter</p> <p>The connection of the PV strings must always be carried out de-energised.</p> |
|--|---|

- The DC connection is effected with Sunclix plugs and sockets. For further information, see "Connect PHOENIX CONTACT connector (SUNCLIX)", p. 34.
- Before connecting the PV strings an isolation measurement must be taken. Whenever it is switched on, the inverter automatically checks the insulation of the PV generator. If the isolation is defective, the inverter switches off automatically. The inverter can only be started once the PV generator isolation error has been removed.
- Be absolutely sure to verify proper polarity when connecting the PV strings. Any inappropriate connection of individual strings may damage the PV generator.
- The inverter is protected by an integrated polarity reversal protection diode.

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

| Device type | AE 3 TL 46 | AE 3 TL 46 |
|---|------------|------------|
| Max. DC voltage at each input | 1000 V | |
| Max. short-circuit current per DC input | 40 A | |
| Max. DC operating current via all DC inputs | 84 A | 82 A |



Note:

Failure to observe this can lead to damage to the inverter and therefore void the warranty.



Note:

It is recommended that you take all inputs to avoid asymmetric loading.



Note:

If all DC inputs are not occupied, then the open inputs must be closed with Sunclix protective caps. By Not observing these requirements the IP65 protection class can not be guaranteed! Both caps (+/-) can be ordered at any time from AE using part number 0034844!



Note:

Reverse currents are fault currents that only occur in PV systems comprising parallel strings. Given short circuits of individual modules or cells in a module, the open circuit voltage of the string in question can drop so far that the intact parallel strings will drive a reverse current through the defective string. This may result in significant heating and therefore to destruction of the string.

What is more, the reverse current may cause secondary damage.

Therefore, each string must be separately protected by a string fuse

connected in series with the other string fuses. In the event of a failure, this isolates the string from the intact strings so that destruction is prevented.

5.13.1. DC-Connection

Please note the following information (plug type, cross section) regarding the DC power cable:

| Designation | Type | Type no. AE | Art.-Nr. PHOENIX CONTACT | Diameter with wire insulation | Cable cross section |
|---------------------|-------------------|-------------|--------------------------|-------------------------------|-----------------------|
| Connectors | PV-CM-S 2.5-6 (-) | 0034848 | 1774687 | 5 – 8 mm | 4 – 6 mm ² |
| Connectors | PV-CF-S 2.5-6 (+) | 0034847 | 1774674 | 5 – 8 mm | 4 – 6 mm ² |
| PV-C PROTECTION CAP | | 0034844 | 1785430 | | |

If necessary, the following photovoltaic Y distributors may be used:

| Type | Type no. AE | Type no. PHOENIX CONTACT |
|----------------------------|-------------|--------------------------|
| PV-YC 6/ 1-0,12-SO3 (-/++) | 0035216 | 1787726 |
| PV-YC 6/ 1-0,12-SO3 (+/--) | 0035217 | 1787739 |

For the adjustment of MC4 to Sunclix use the following adapter cable:

| Typ | Type no. AE | Type no. PHOENIX CONTACT |
|------------------------|-------------|--------------------------|
| PV-AS-MC4/6-150-MN-SET | 0035043 | 1704982 |


Note:




In order to ensure IP65 protection, plug connectors and power supply connection cables must be matched to each other and all unused connectors shall be fitted with blanking plugs.

Only the original components by PHOENIX CONTACT can be used!
Failure to do so could void your warranty!

5.13.2. Connect PHOENIX CONTACT connector (SUNCLIX)

| | |
|--|---|
|  DANGER | <p>Danger to life due to high voltages from active PV strings</p> <ul style="list-style-type: none"> ⇒ The SUNCLIX connectors are only to be connected by electro-technically trained personnel. ⇒ Never connect or disconnect SUNCLIX connectors when under load. |
|--|---|

| | |
|---|---|
|  CAUTION | <p>Danger of injury or damage to property</p> <ul style="list-style-type: none"> ⇒ Only use the SUNCLIX connectors together with a PV1-F type 2.5-6 mm² solar cable or UL-certified solar cable (ZKLA stranded copper wire, AWG 10-14). A safe electrical connection is only guaranteed with this cable. Further cable types can be requested from PHOENIX CONTACT. ⇒ When laying the solar cable, observe the bend radii specified by the manufacturer. ⇒ Only connect the connectors to other SUNCLIX connectors. ⇒ When connecting, always observe the specifications for rated voltage and rated current. The smallest mutual value is valid. ⇒ Protect the connector against moisture and dirt. ⇒ Do not submerge the connectors under water. ⇒ Do not lay the plug directly on the roofing. ⇒ Protect unplugged connectors with a protective cap (e.g. PV-C PROTECTION CAP, 1785430). |
|---|---|

5.13.2.1. CONNECT CABLE

1. Strip the cable by 15 mm with a suitable tool. Ensure no individual strands are cut off.
2. Carefully add stripped conductors with drilled bunched conductors until impact. The bunched conductor ends must be visible in the spring.
3. Close spring. Ensure that the spring is locked in place.
4. Push insert into the barrel.
5. Tighten the cable screws with 2 Nm.
6. Bring together plug and bush. The connection latches.
7. By pulling the coupler, check the correct connection.

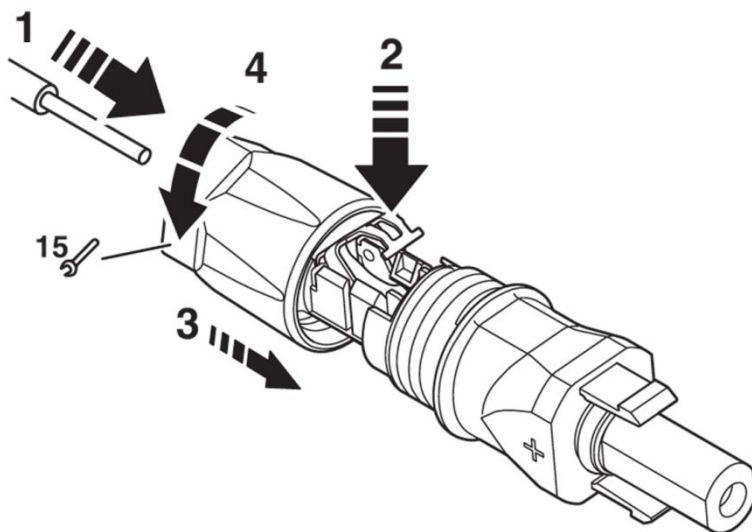


Fig. 23: Connect cable

5.13.2.2. DISCONNECT CONNECTOR

A slit screwdriver is required with 3 mm wide blade (e.g. SZF 1-0,6X3,5, 1204517).

1. Enter screwdriver as demonstrated in picture below.
2. Leave screwdriver attached and separate bush and plug from one another.

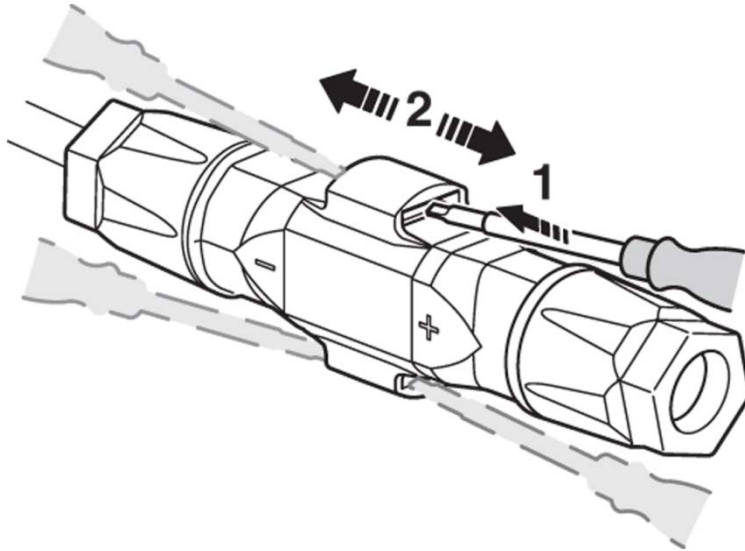


Fig. 24: Disconnect connector

5.13.2.3. REMOVE CABLE

1. Unscrew cable screwing.
2. Enter screwdriver as demonstrated in picture below.
3. Pry open connection and separate barrel and insert from one another.
4. Open spring with screwdriver. Remove cable.

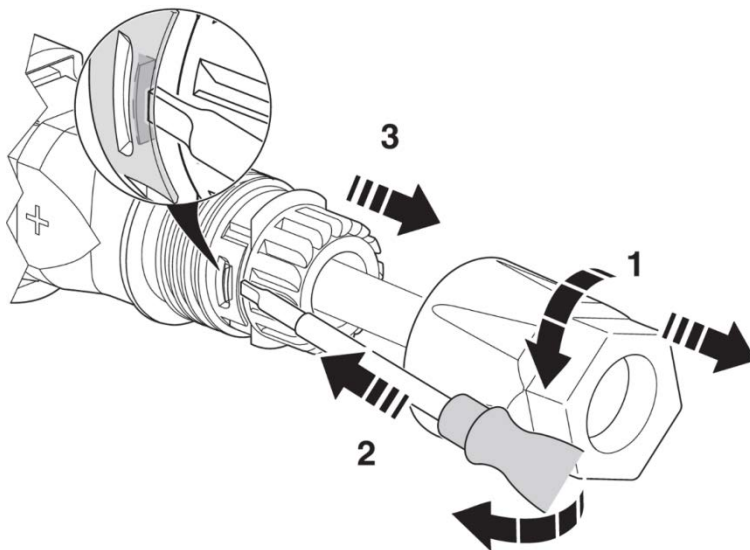



Fig. 25: Remove cable

5.13.3. Connection with AE ConnectionBox

| | |
|---|---|
|  WARNING | <p>Risk of death by electric shock</p> <p>Use of incorrect fuses in the ConnectionBox can lead to personal injury or property damage.</p> <ul style="list-style-type: none"> ⇒ Use in the ConnectionBox only full range PV fuses of operational class gPV. ⇒ Depending on the PV module type used the full range of PV fuses must be selected and used taking into account the technical design data and safety of the PV module manufacturer. ⇒ If other full-range PV fuses are used, the technical rating of the inverter must not be exceeded. |
|---|---|

With the optionally usable ConnectionBox the number of possible connections increases to 12. Furthermore, the ConnectionBox has a DC load break switch so that the inverter can also be switched off via the ConnectionBox. Every string within the ConnectionBox is fitted as standard with a 15 A +DC-fuse of type HP 10M15. The ConnectionBox is equipped with Sunclix bushes. Therefore, only original Sunclix plugs can be used (See "Connect PHOENIX CONTACT connector (SUNCLIX)", p. 34).

The ConnectionBox must first be equipped with string fuses and, if necessary, protective modules for overvoltage protection.

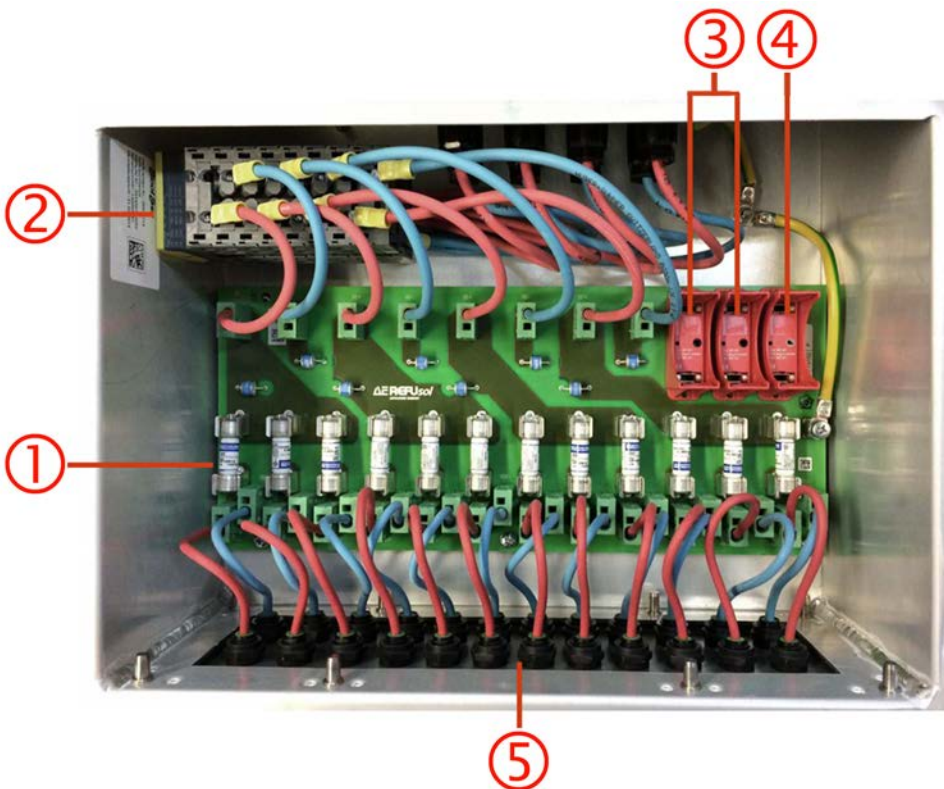


Fig. 26: ConnectionBox equipment

| | |
|---|--|
| ① | 12 x string fuses, Type: HP 10M15 (gPV) (see "Connect PHOENIX CONTACT connector (SUNCLIX)", p. 34) |
| ② | DC Circuit Breaker |

| | |
|---|--|
| ③ | 2 x overvoltage protection, Type: DEHN DG MOD PV SCI 500 952 051 (Item no. 0034643) (optional) |
| ④ | 1 x overvoltage protection, Type: DEHN DG MOD PV SCI 500 952 041 (Item no. 0034644) (optional) |
| ⑤ | 12 x plus, 12 x minus Phoenix Sunclix® connections |



Note

Ensure uniform assignment of the 4 input blocks the ConnectionBox. An input block corresponds to 3 inputs. Assignment after table below to perform.

| Number of PV-inputs | Input block corresponds to the inverter input | | | | | | | | | | | |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | 2 | | | 3 | | | 4 | | |
| 12 | X | X | X | X | X | X | X | X | X | X | X | X |
| 11 | X | X | X | X | X | X | X | X | X | X | X | |
| 10 | X | X | X | X | X | X | X | X | | X | X | |
| 9 | X | X | X | X | X | | X | X | | X | X | |
| 8 | X | X | | X | X | | X | X | | X | X | |
| 7 | X | X | | X | X | | X | X | | X | | |
| 6 | X | X | | X | X | | X | | | X | | |
| 5 | X | X | | X | | | X | | | X | | |
| 4 | X | | | X | | | X | | | X | | |
| 3 | X | | | X | | | X | | | | | |
| 2 | X | | | X | | | | | | | | |
| 1 | X | | | | | | | | | | | |

Install the ConnectionBox as follows:

1. Set the ConnectionBox switch to OFF.



Fig. 27: DC Circuit Breaker

2. Position ConnectionBox according to the following drawing over the connection area of the inverter.

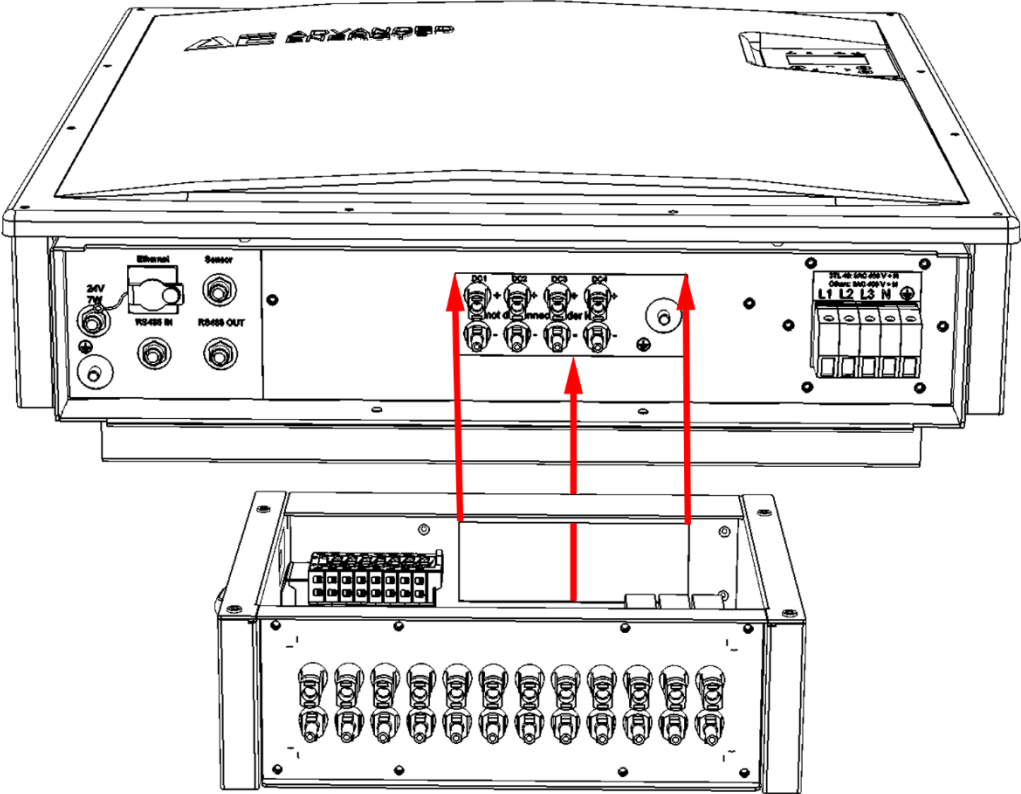


Fig. 28: Recess of the ConnectionBox

- 3. Attach ConnectionBox with 4 screws TORX M5X12.
- 4. Tighten with torque key (2.5 Nm).

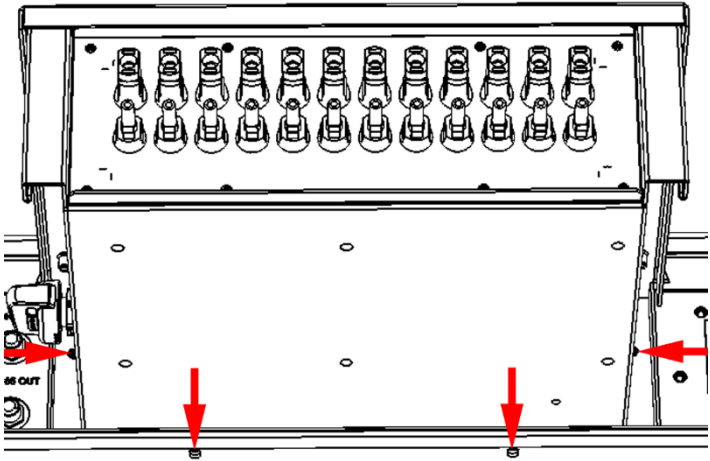


Fig. 29: Position of the attachment drill holes

5. Connect earthing cable of the ConnectionBox with grounding bolts of the inverter.
6. Tighten washer, spring ring and nut (arrow) with torque key (12 Nm).



Fig. 30: Earthing of the ConnectionBox

7. Connect minus cable (blue), left with the shortest cable beginning with DC plus connections of the inverter.
8. Connect plus cable (red), left with the shortest cable beginning with DC minus connections of the inverter.



Fig. 31: Create Sunclix connectors

9. Attach ConnectionBox cover with the two pegs under the inverter cover.



Fig. 32: Attach cover

- 10. Attach cover of the ConnectionBox with 5 TORX M5X12.
- 11. Tighten with torque key (2.5 Nm).



Fig. 33: Fasten cover

- 12. Connect ConnectionBox with PV generator with the help of Sunclix plugs (See <dg_ref_source_inline>).

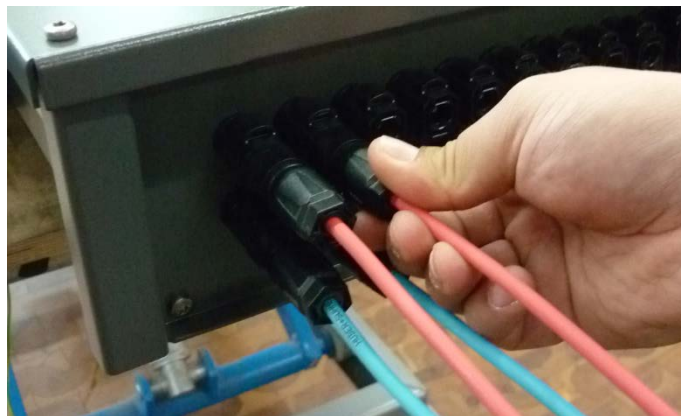


Fig. 34: Create outer Sunclix connectors

5.14. INTERFACE PORT RS485

| RS485 OUT | | RS485 IN | |
|-----------|-------------------|----------|-------------|
| Pin 1 | Bus termination + | Pin 1 | Reference + |
| Pin 2 | RS485+ OUT | Pin 2 | RS485+ IN |
| Pin 3 | RS485- OUT | Pin 3 | RS485- IN |
| Pin 4 | Bus termination - | Pin 4 | Reference - |

Bus termination (wire jumper)

The RS485 interface supports the USS protocol (Universal Serial Interface Protocol) which can be used for transmission of data, for example, to a data logger of a remote monitoring system.

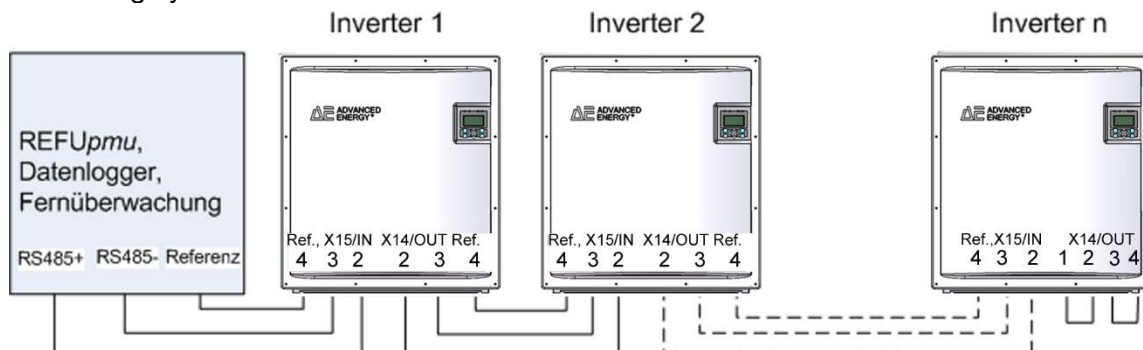


Fig. 35: Standard interface

When using this interface, please note that each device using the bus requires a unique address.

The bus termination is made by means of wire jumpers on X14 to the last bus user (inverter “n”).

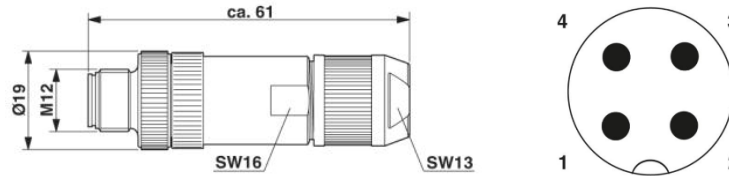


Fig. 36: Connector M12 x 1 straight, shielded; pole arrangement: male M12, 4 pins, A-coded, view of male connector side



Note:

In order to ensure IP65 protection and the required and declared conformity with the domestic EMC standard a PHOENIX CONTACT type M12MS SACC-4SC SH plug and a shielded cable must be used. The outer diameter of the connecting cable can be max. 8mm.

Failure to observe this can lead to damage to the inverter and therefore void the warranty.

The plug pair can be ordered with item number 0033270 at AE.

5.15. ETHERNET INTERFACE CONNECTION

Please use an Ethernet cable with S/FTP design (shielded foiled twisted pair) and PhoenixContact plug type Quickon VS-08-RJ45-5-Q/IP67.



Note:

In order to ensure IP65 protection, the plug type mentioned above must be used.

Failure to observe this can lead to damage to the inverter and therefore void the warranty.


The plug can be ordered from AE under item number 0028943.

6. Commissioning

Before commissioning the inverter, be sure the following steps have been completed:

- ☑ All connections and covers are securely fastened.
- ☑ Measurements and functional tests and test report in accordance with IEC 82/749 / CD.
- ☑ If applicable, further requirements and technical rules need to have been considered in this context(.

6.1. TURNING ON THE DEVICE / RESETTING

| | |
|--|--|
|  DANGER | Risk of death by electric shock ⇒ Turn on according to the 5 safety rules. |
|--|--|


1. Remove any covers and barriers to adjacent live parts.
2. Remove forehand end earthing and short-circuiting devices on active conductors.
3. Checking of the AC and DC voltages applied.
4. Remove protection against reactivation of separators.
5. Reconnect PV strings to the inverter or ConnectionBox.
6. Turn on DC voltage across switch separator.
7. Turn on AC voltage across switch separator.
 - ⇒ If at the DC input of the inverter sufficient voltage is present, the inverter starts operation.



Note:

The control panel, including its status indicators, display, and operator keys, is only active when the PV generator is supplying sufficiently high voltage.

6.2. DISCONNECTING DEVICE POWER

| | |
|--|--|
|  DANGER | Risk of death by electric shock ⇒ Disconnecting according to the 5 safety rules. |
|--|--|



1. Disconnect the AC-voltage on separator.
2. Disconnect the DC-voltage on separator.
3. Disconnect PV-Strings from inverter or ConnectionBox.
4. Secure separators against being switched back on.
5. Determine absence of voltage, observe stored energy and discharge time in the intermediate circuit.
6. Earth and short circuit on the AC supply side.

7. Cover or shield any adjacent live parts.
 - ⇒ Inverter is de-energized and out of service.

6.3. SETTING THE COUNTRY ABBREVIATION AND THE MENU LANGUAGE

When switching on for the first time an initial configuration is necessary.

The country abbreviation defines the country-specific grid monitoring parameters. The menu language is automatically set when the country abbreviation is selected. The menu language can subsequently be selected as desired at any time, independent of the country abbreviation set in the menu. The country abbreviation is not set on delivery.

| | |
|---|---|
|  CAUTION | <p>The selected country code can only be changed by Service personnel.</p> <p>After the initial setting and confirmation of the country code the country code can no longer be altered. This is also valid for replacement devices. The country code can then only be changed by authorised Service personnel.</p> |
|  CAUTION | <p>Cancellation of the operating license!</p> <p>Operating the AE inverter with the wrong country code can lead to the withdrawal of the operating permission from the energy supplier.</p> |

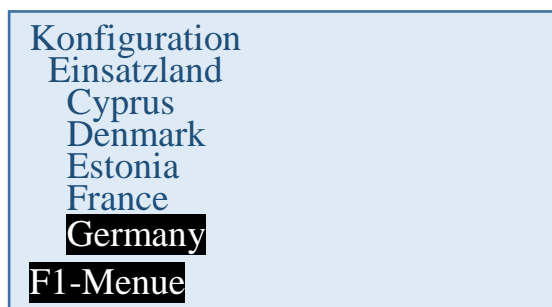


Note:

We assume no liability for the consequences of an incorrectly set country abbreviation!

Set country code/grid guideline

The following window appears on the display after initial switch on of the DC voltage and prompts you to set the country code. You can choose from among the offered countries. The term "country code" as such is not displayed in the menu. The display is illuminated after you press the first key.



1. Use the “^” and “v” keys to select the country code which is specific for your country and your location. The menu language is selected simultaneously with the country code. However, the menu language can later be changed independently of the country code.
2. Press "OK" to confirm. Then the grid feed guideline given by the energy supplier must be selected.



3. Select valid grid feed guideline with "▲" and "▼" buttons.
4. Press "OK" to confirm.

Accepting the country code

To be certain, you will be queried whether you wish to accept the country code. After accepting the country code it can only be changed within 40 hours.



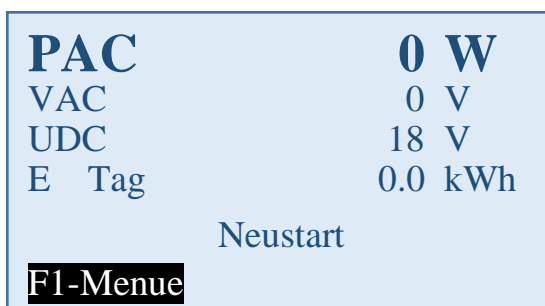
Only confirm the country code if you are absolutely sure it is correct.

If you are not sure, press "ESC" to cancel your selection. In this case the device cannot be operated.

If the country code is to be accepted, then confirm with "OK".

A restart then takes place:

⇒ "ERROR" and "GROUND FAULT" status LEDs flash red alternately.



6.4. DEVICE START

Meaning of the abbreviations on the display:

| | |
|-----|---------------------------|
| PAC | Feed power in watts (W) |
| UAC | Line voltage in volts (V) |

| | |
|-------|---------------------------------|
| UDC | Solar cell voltage in volts (V) |
| Y day | Yield of the day (kWh) |

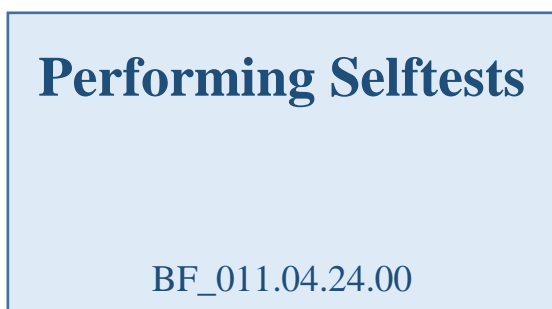
Solar modules are irradiated with sufficient sunlight.

Country code is set.

The following procedure follows:

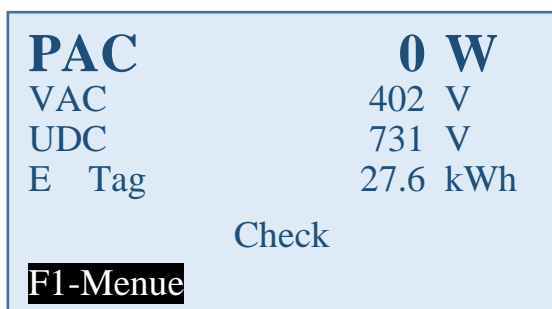
Self-test:

⇒ All status LEDs are lit for approx. 6 seconds



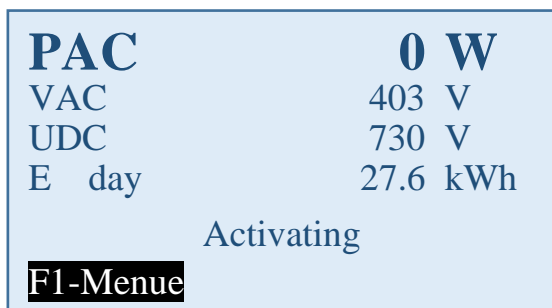
Check:

⇒ "Start" status LED lights orange.



Activation:

⇒ "Start" status LED lights orange/LED "ON" flashes green.



This process can take several minutes.

Feed in

↗ "ON" status LED lights green/normally all other status LEDs are off.



6.5. CONTROL PANEL

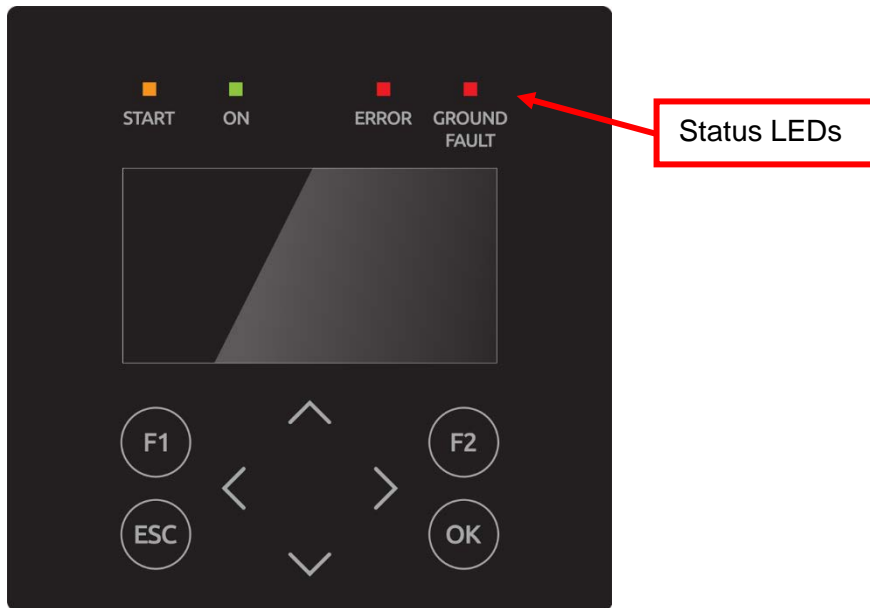


Fig. 37: Control panel with status LEDs, display and keys

| | |
|-----------------|---|
| F1 | Menu display |
| F2 | In basic display: Reboot of display "Yield normalised" on the display Input of standardized data. |
| <> | <u>Function in the menu:</u> Navigation within the menu level (previous menu, next menu). <u>Function while parameters are edited:</u> digit to the left, digit to the right (decade jump) |
| ^ v | Selection within the menu. |
| ESC | <u>Acknowledge failures</u> and exit from menu level, exit from input menu without entering data |
| OK | confirm the selected menu (next menu level) and entered data. |

6.6. BASIC SCREEN DISPLAY



Fig. 38: Operating mode display

PAC = Current feed power in watts (W)

Uac = Line voltage in volts (V)

UDC = Solar cell voltage in volts (V)

y day = yield of the day in kWh

6.7. GRAPHICAL DISPLAY

Press the **◀** arrow key once to display the development of the day's feed power.

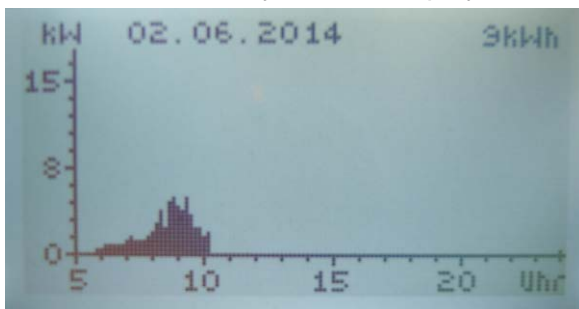


Fig. 39: "Today's" feed power display

Press the **▼** arrow key to display the development of the previous days.

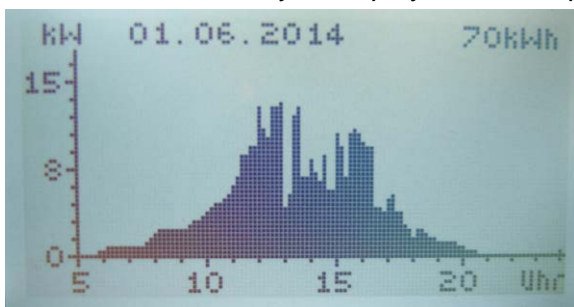


Fig. 40: "Yesterday's" feed power display

Press the **ESC** key to return to the basic screen display.

6.8. YIELD DATA DISPLAY

Press the **▶** arrow key to display the current yield data and the operating hours having currently elapsed.

| Energy absolute | |
|------------------------|------------|
| Day : | 10.1 kWh |
| Month : | 80.1 kWh |
| Year : | 738.1 kWh |
| Total : | 3986.4 kWh |
| Oper. hr : | 675.7 h |

Fig. 41: Yield absolute display

6.9. STANDARDIZED YIELD DATA DISPLAY

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

| Energy / x kWp | |
|-----------------------|-----------|
| Day : | 0.7 kWh |
| Month : | 5.3 kWh |
| Year : | 49.2 kWh |
| Total : | 265.8 kWh |
| Norm P : | 15.0 kWp |
| F2-Edit | |

Fig. 42: Yield normalised on the display

Press the **ESC** key to return to the basic screen display.

6.10. INPUT OF STANDARDIZED DATA

To change the normalization, press the **F2** key and enter the currently connected PV generator power as follows:

- ◀▶ keys: Pressing the **◀** key: Selection of the place before the point
Pressing the **▶** key: Selection of the place after the point
- ^ key: Whenever you press this key, the number at the digit selected is incremented by 1.
- ▼ key: Whenever you press this key, the number at the digit selected is decremented by 1.

| |
|-----------------|
| P1155.00 |
| Generator Power |
| 15.0 |
| kWp |
| F1-Menue |

Fig. 43: Standardized data input display

Press the "OK" key to apply the set value.

Press the **ESC** key to discard the value and display the previous "normalized yield" level.

Press the **F1** key to display the menu.

6.11.MENU STRUCTURE

The menu structure serves as a support to change to the individual information displays and setting displays. For navigation, see "Control panel", p. 48.

| Menu level 1 | Menus level 2 | Menus level 3 | Menus level 4 | Display without entry |
|---------------|--------------------|---------------|--|---|
| Analysis | Absolute yield | | | Yield absolute Day: 41.7 kWh Month: 1322.0 kWh Year: 5083.4 kWh Total: 5083.4 kWh Oper. hr: 422.3 h F1-Menuue |
| | Standardized yield | | | Yield / x kWp Day: 2.8 Month: 88.1 Year: 338.9 Total: 338.9 Norm P: 15.0 F1-Menuue |
| Actual values | DC | | | DC power 6714.4 W DC voltage 504.2 V DC current 13.3 A F1-Menuue |
| | AC | | | AC power 6521.4 W AC voltage 228.2 V AC current 23.3 A AC frequency 50.0 Hz F1-Menuue |
| | Sensors | | | Heat sink 40.4°C Interior 46.4°C Irradiation 622.3W/qm Panel 37.4°C F1-Menuue |
| Fault memory | | | Display of the fault memory, e.g. grid undervoltage. Using < > you can navigate between the display of | |

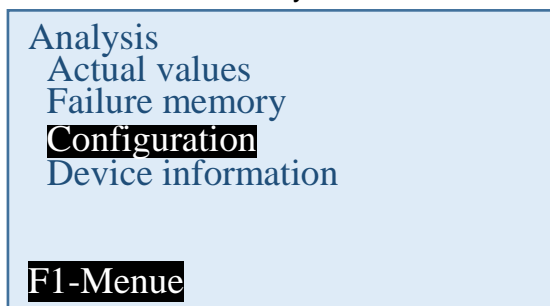
| Menu level 1 | Menus level 2 | Menus level 3 | Menus level 4 | Display without entry | |
|----------------------|---------------------|-----------------------------|---|---|----------------------------------|
| | | | the date and the fault number. | | |
| Configuration | Languages | "List of languages" | See p. 53 | | |
| | RAC limit | See p. 53 | | RAC limit | |
| | External switch off | | | Entry of sensor | |
| | Communication | Ethernet (see p. 54) | DHCP | | DHCP entry |
| | | | IP address | | Entry of IP address |
| | | | Subnet mask | | Entry of subnet mask |
| | | | Standard gate-way | | Standard gate-way entry |
| | | DNS | | DNS entry | |
| | | RS485 (see p. 55) | USS address | | Entry USS address |
| | | | Protocol | | Entry Protocol |
| | Baud rate | | | Entry Baud rate | |
| | Date/Time | | | Entry of Date/Time | |
| | Portal monitoring | Activation | | | Activation: 0 = off 1 = on |
| | | Sending Config | | 0 = no activity 1 = configuration data is being sent | |
| Portal Test function | | | With a "yes" entry the data package is sent to the webserver (portal). There is no feedback. To check, contact service. | | |
| Extended | Numerical list | | Display of all internal parameters (only for service) | | |
| Device information | Version ID | Version recognition display | | | |
| | Country of use | Country code display | | | |
| | Current language | "Current language" display | | | |
| | Device type | Device type display | | | |
| | Serial number | Serial number display | | | |
| | Ethernet | Active IP-adress display | | | |

7. Configuration

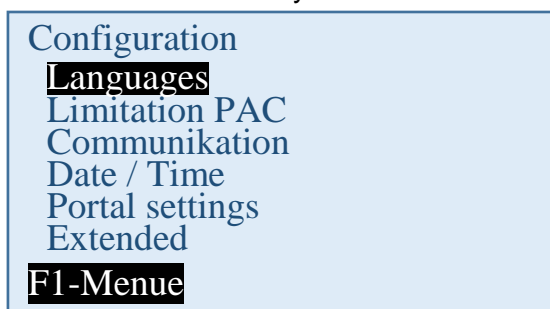
7.1. CHANGING THE MENU LANGUAGE

The language selection has no effect on the country code. Proceed as follows to change the menu language:

1. Press "**F1**" to open the menu.
2. Use the "**▼**" and "**▲**" keys to select the fourth menu item Configuration.



3. Press "OK" to confirm.
4. Use the "**▼**" and "**▲**" keys to select the first menu item Languages.



5. Press "**OK**" to confirm.
6. Use the "**▼**" and "**▲**" keys to select the desired menu language.
7. Press "OK" to confirm.
 - ↳ The menu switches to the selected language. The display is initially empty.
8. Press "ESC" to return to the menu.

7.2. REDUCTION OF THE POWER OUTPUT

Proceed as follows in order to limit the power output of the inverter:

1. Using the "**F1**" key, select the menu item Configurations and confirm with the "**OK**" key.
2. Select the sub-menu "PAC reduction" and confirm with the "**OK**" key.
3. Enter the invert power output desired and confirm with the "**OK**" key.
An input of 70, for example, means that the inverter will only deliver 70% of its possible power output.

↳ The changed value is immediately used.

7.3. AE-SETUP - ÄNDERUNG UND ANPASSUNG LÄNDERSPEZIFISCHER PARAMETER

You can set the country-specific parameters of the inverter with the REFUset tool. This covers in detail:

- Feed-in conditions voltage and frequency.
- Ramp starting time in the event of a grid error
- Average voltage monitoring
- Phase conductor voltage monitoring
- Frequency-dependent power reduction
- Actual voltage monitoring (rapid disconnection)
- Actual frequency monitoring
- Reactive power ($\cos \varphi$)
- Power-up time
- K factor (fault ride through)

AE Setup (former REFUset) can be downloaded free under www.advanced-energy.de/de/1TL_3TL_Downloads.html.

7.4. COMMUNICATION VIA ETHERNET

The settings for the Ethernet communication can take place either automatically (via DHCP) or manually.

7.4.1. Automatic setting via DHCP

1. Navigate to Configuration > Communication > Ethernet > DHCP.
2. Enter "1" in DHCP input field.
3. Press "OK" to confirm.
4. Restart inverter.

⇒ There is then an automatic integration of the inverter into the existing network. The necessary settings for IP address, subnet mask, standard gateway and DNS are automatically taken from the DHCP server, e.g. the superior router.

7.4.2. Manual setting

In order to ensure a trouble-free operation, all values must be given by the responsible network administrator and individually set in each inverter.

1. Navigate to Configuration > Communication > Ethernet > IP address.
2. Enter IPv4 address. The IPv4 address is arbitrary, but must be consistent throughout the subnet (default value: 192.168.1.99, unchangeable IP address for service purposes: 192.168.130.30).
3. Press "OK" to confirm.
4. Navigate to Configuration > Communication > Ethernet > Subnet mask.

5. Enter IPv4 mask. The IPv4 mask is arbitrary, but must be consistent throughout the subnet (default value: 255.255.255.0).
6. Press "**OK**" to confirm.
7. Navigate to Configuration > Communication > Ethernet > Standard gateway.
8. Enter the address of the router that allows connection to the internet (default value: 192.168.1.1).
9. Press "**OK**" to confirm.
10. Navigate to Configuration > Communication > Ethernet > DNS.
11. Enter arbitrary IPv4 address of the superior DNS server (default value: 0.0.0.0).
12. Press "**OK**" to confirm.
13. Restart inverter.

7.5. COMMUNICATION VIA RS485

USS address:

Input 1 – 31

This address is required for communicating with the inverter via RS485

- ⇒ After entering the address, restart the inverter. Only then is the new address activated.

Protocol polling via Ethernet:

Input 1

1: USS protocol

Baud rate: 57600 (preset), 115200 (only for short cable lengths)

Parity: straight

Handshake: no handshake

Data bits: 8

Stop bits: 1

Block check: CRC16

7.6. PORTAL MONITORING

Activation 0 or 1

0 = Portal monitoring not active

1 = Portal monitoring active

To ensure the inverter sends data to the AE SiteLink monitoring portal, the portal monitoring must be active.

7.7. SENDING CONFIG

The configuration data is required by AE-SiteLink in order to recognise the inverter. Of the sent data, the device type, Firmware version and country code are visible for the SiteLink user.

By setting the parameter to 1 the configuration data is first sent, then the parameter is automatically set back to 0.

7.8. PORTAL TEST FUNCTION

Input: "yes"

A data package is sent to the web server (portal).

There is no feedback!

Please contact the Service team to learn whether the data package was sent successfully.

8. Troubleshooting

8.1. SELF-TEST – ERROR MESSAGE

After the initialization routine, the system runs through a self-test. The individual parts of the system, such as firmware and dataset, are checked and data is read in from the power control board. If an error continues to be detected, possible remedial measures must be taken according to the type of error.

8.2. TRANSIENT FAILURE

In certain operating states the inverter goes temporarily offline.

Unlike malfunctions, “transient failures” are automatically acknowledged by the inverter which attempts to restart once the error no longer exists.

A transient failure is indicated by the red LED "ERROR" on the control panel flashing and remains stored in the fault memory even in the event of a power failure. See "List of Fault Messages", p. 57.

8.3. FAULTS

Permanently programmed and parameterizable limit values are continuously monitored during ongoing operation. In order to be protected, the inverter power section is isolated from voltage supply if a limit value is exceeded or if a failure occurs. However, the DC and AC voltages may still be available. The corresponding fault message appears in the display.

The fault is indicated on the control panel by the red "ERROR" LED emitting steady light.

Fault messages are stored in the fault memory, where they will remain even in the event of a power failure. The fault memory can be called up via the display. The last 100 faults are recorded in the fault memory. The latest fault is kept at memory location S0, the oldest at S100. A new fault is always stored to memory location S0. When this happens, any fault already at memory location S100 will be lost.

8.4. FAULT ACKNOWLEDGEMENT

After shutdown due to a fault, the device remains locked against reactivation until the fault is acknowledged. It is not possible to acknowledge the fault while the cause of the fault still exists. The fault can only be acknowledged after the cause of the fault has been eliminated.

- ⇒ To acknowledge the fault message, press the ESC key or turn the inverter off with the DC switch and wait min. 30 seconds to turn the inverter ON again.

8.5. LIST OF FAULT MESSAGES

| Error code | Error message | Description | Action |
|------------|------------------|---------------------------------------|--|
| 090006 | grid overvoltage | A grid overvoltage has been detected. | As long as the inverter is detecting a grid overvoltage: check line voltages (with a true RMS measurement device). As long as you consider the |

| Error code | Error message | Description | Action |
|------------|-------------------|---|--|
| | | | line voltages to be in order, contact Service. |
| 090007 | Grid undervoltage | Grid undervoltage detected Voltage dip | As long as the inverter is detecting a grid undervoltage: check line voltages (with a true RMS measurement device). As long as you consider the line voltages to be in order, contact Service. |
| 090008 | Overfrequency | The grid frequency has exceeded the limit value. | As long as the inverter is detecting an overfrequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service |
| 090009 | Underfrequency | The grid frequency has dropped below the limit value. | As long as the inverter is detecting underfrequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service |
| 09000A | DC link 3 | Regulation error in positive boost converter | Wait for the regulator to become stable again. If this takes more than 2-3h, please contact Service. |
| 09000B | DC link 1 | Asymmetry low: Difference between the two solar voltages is too high. | If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service. |
| 09000C | DC link 2 | Asymmetry high: Difference between the two boosted DC link voltages is too high | If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service. |
| 09000D | DC link 4 | The positively boosted DC link has dropped below the mains peak value | If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service. |
| 090010 | DC link 5 | The positively boosted DC link voltage is too high. | If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service. |
| 090011 | DC link 6 | The positive solar voltage is too high. | If problem occurs once only: wait for the regulator to become stable again. If problem occurs repeatedly: please contact Service. |

| Error code | Error message | Description | Action |
|-------------------|----------------------|--|--|
| 090017 | Communication PS | Communication malfunction between power section and control and regulation unit | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service |
| 090018 | Grid frequency PS | Power section has detected under/overfrequency | As long as the inverter is detecting a PS grid frequency: check the frequency of the phases. As long as you consider the frequencies to be in order, contact Service |
| 090019 | Grid overvoltage PS | The power section has detected a grid overvoltage. | As long as the inverter is detecting a grid overvoltage: check line voltages (with a true RMS measurement device). As long as you consider the line voltages to be in order, contact Service. |
| 09001A | Grid undervoltage PS | The power section has detected a grid undervoltage. | As long as the inverter is detecting a grid undervoltage: check line voltages (with a true RMS measurement device). As long as you consider the line voltages to be in order, contact Service. |
| 09001B | RCD fault | The power section has detected residual current. Isolation error during operation. | Check system isolation. As long as you consider the isolation impedance to be in order, contact Service. |
| 09001D | RCD warning | The power section has detected residual current during operation. | Check system isolation. If you consider the system isolation to be in order, contact Service. |
| 090020 | Initialisation C1 | Initialisation has failed. | Restart inverter. If this does not rectify the error, contact Service. |
| 090021 | Initialisation C0 | Initialisation has failed. | Restart inverter. If this does not rectify the error, contact Service. |
| 090023 | Permanent fault | A critical fault has repeatedly occurred. The device has been permanently shut down. | please contact Service. |
| 090024 | SR parameter error | Error in parameter initialisation. The device has been permanently shut down. | Please contact Service. |
| 090028 | Update Start | Update start notification. | When starting an update this notification is entered. It shows that an update is currently running and that the device is not running. |
| 090029 | Update fault | Update failed | The update has failed. Contact Service. Warning, the device is stopping. |

| Error code | Error message | Description | Action |
|------------|----------------------|---|--|
| 09002B | Update End | Update successful notification. | An update was successfully completed. The device will resume normal operation. |
| 090052 | User lock active | User lock is active | Deactivate user lock |
| 090053 | Communication SR | Internal communication problems | Fault is independently resolved after a few minutes. If not, switch device off and on again. If this does not resolve the problem, contact Service. |
| 090054 | Overvoltage 2 | The nominal grid voltage was below the limit value of the voltage average monitor for too long. | As long as the inverter is detecting the voltage error: monitor line voltages (analyse grid). As long as you consider the line voltages to be in order, contact Service. |
| 090057 | Watchdog C0 | Internal protection function is triggered. | Contact Service. |
| 090058 | Watchdog C1 | Internal protection function is triggered. | Contact Service. |
| 090059 | PS Firmware | The software of the PS is defective. | Contact Service. |
| 0A0013 | PM isolation AFISR | Control and regulation unit has detected residual current. | Check system isolation. If you consider the system isolation to be in order, contact Service. |
| 0A0102 | Overtemperature PS 1 | Cooler overtemperature (right) | Check temperature of direct surroundings and reduce this as required. |
| 0A0103 | Overtemperature PS 2 | Interior overtemperature (left) | Check temperature of direct surroundings and reduce this as required. |
| 0A0104 | Overtemperature PS 3 | Interior overtemperature (right) | Check temperature of direct surroundings and reduce this as required. |
| 0A0105 | Overtemperature PS 4 | Cooler overtemperature (left) | Check temperature of direct surroundings and reduce this as required. |
| 0A0106 | Supply voltage PS | Supply voltage at the power section is too low. | Please contact Service. |
| 0A010C | PM isolation PS | The power section has detected a grid undervoltage. | Check system isolation. If you consider the isolation resistance to be in order, contact Service. |
| 0A010E | Device fault PS | Power section hardware shutdown | Note: When did the error occur (precisely: day, kW output, time). |
| 0A0110 | Solar voltage PS 1 | Power section overvoltage shutdown in positive DC link | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, |

| Error code | Error message | Description | Action |
|------------|---------------------|--|--|
| | | | contact Service |
| 0A0111 | Solar voltage PS 2 | Power section overvoltage shutdown in negative DC link | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service |
| 0A0114 | PM isolation RCD PS | The isolation impedance of the photovoltaic module is too low | Check system isolation. If you consider the system isolation to be in order, contact Service. |
| 0A0116 | R-detect | Separator defective. | Please contact Service in order to arrange an inverter replacement. |
| 0A0117 | Isolation test unit | DC discharge is taking too long. | Please contact Service. |
| 0A0118 | Voltage offset PS | Offset adjustment values between power section and control and regulation unit divergent | Please contact Service. |
| 0A011A | Activation PS 1 | DC discharge is taking too long. | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service |
| 0A011B | Activation PS 2 | DC link voltage drop during activation | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service |
| 0A011C | Activation PS 3 | Target value for balancing is invalid. | Do nothing. The inverter will acknowledge the error automatically. If problem occurs repeatedly, contact Service |
| 0A011D | Activation PS 4 | Balancing has failed | Please contact Service. |
| 0A011E | Activation PS 5 | Uploading of DC links has failed. | Please contact Service. |
| 0A011F | PS parameter error | Faulty reading or writing process in power section memory | 1.) Switch off device with DC disconnecter. 2.) Wait until the display has turned off completely. 3.) Switch on device with DC disconnecter. If this does not rectify the error, contact Service. |
| 0A0130 | Comb. relay config | Faulty configuration of elements for the power section | Please contact Service. |
| 0A0131 | Combine relay | Switching the combine relay has failed. | Please contact Service. |
| 0A0172 | P24V aux. supply PS | P24V supply voltage at the power section is too low. | Please contact Service. |

| Error code | Error message | Description | Action |
|-------------------|----------------------|--|-------------------------|
| 0A0173 | P5V aux. supply PS | P5V supply voltage at the power section is too low. | Please contact Service. |
| 0A0174 | P15V aux. supply PS | P15V supply voltage at the power section is too low. | Please contact Service. |

9. Options

9.1. IRRADIATION AND TEMPERATURE SENSOR

An irradiation and temperature sensor can be optionally connected for recording the irradiation and the module temperature. Type Si-13TC-T-K is recommended. AE item no. 0030628. The sensor plug is included in the scope of delivery for the irradiation and temperature sensor. The sensor plug can also be separately ordered from AE under item no. 0030616.

The sensor comes with a 3 meter UV-resistant connecting line (5 x 0.14 mm²). The line can be extended with a 5 x 0.25 mm² shielded line, max. 100 m.

More information about the technical data of the sensor you will find in p. see "Sensor",p. 75.

| Pin assignment | | | | | |
|----------------|---|--|--------|-------|----|
| Si-13TC-T-K | | | Sensor | Plug | |
| Red RD | Supply voltage (12-28 VDC) | | Pin 1 | Brown | BN |
| Black BK | GND | | Pin 2 | White | WH |
| Orange OG | Measurement signal for irradiation (0–10 V) | | Pin 3 | Blue | BU |
| Brown BN | Measurement signal for temperature (0–10 V) | | Pin 4 | Black | BK |
| Grey GY | Shielding | | Pin 5 | Grey | GY |



Note:

The shield of the sensor line must be applied to PIN 2 and PIN 5! The outer diameter of the connecting cable can be max. 8mm.

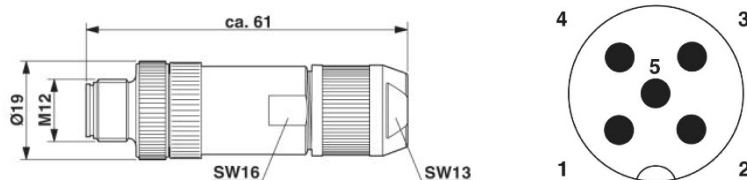
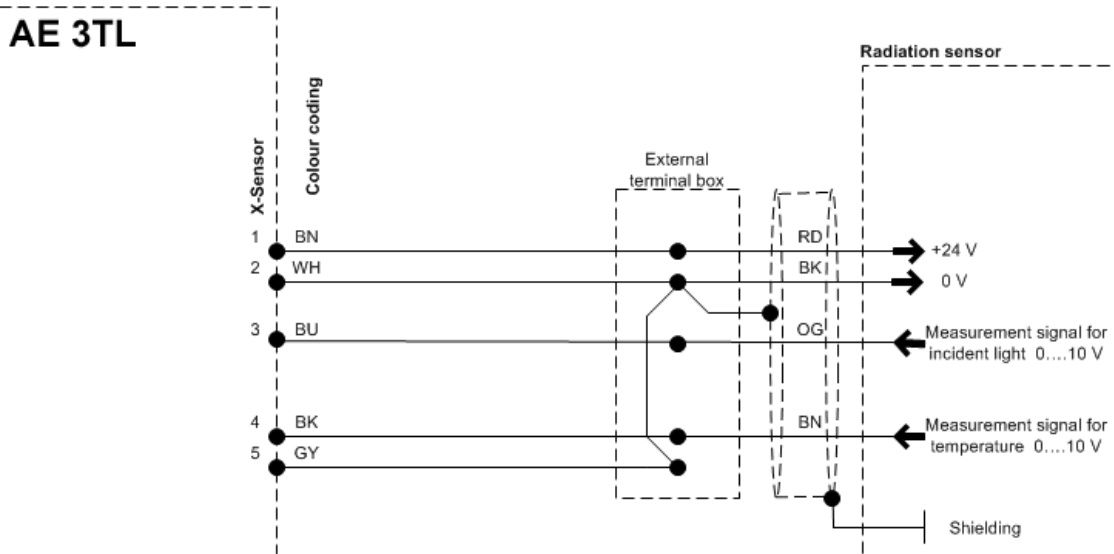


Fig. 44: Connector M12 x 1 straight, shielded;pole arrangement: male M12, 5 pins, A-coded, view of male connector side

PHOENIX CONTACT designation: SACC-M12MS-5SC SH



Note:

If you do not use the temperature input, wire a jumper across PIN 4 and PIN 5. Alternatively, you can also wire the jumper to the intermediate terminal point (cable extension).

9.2. EXTERNAL TURN OFF SIGNAL

9.2.1. Overview

AE String inverters have an internal NS protection and section switch.

Depending on local connection, installation instructions and the selected line voltage level either the internal NA-protection can be used with section switch, or an external NS protection must be used with section switch also.

It is also possible to combine the internal to the external NA protection.

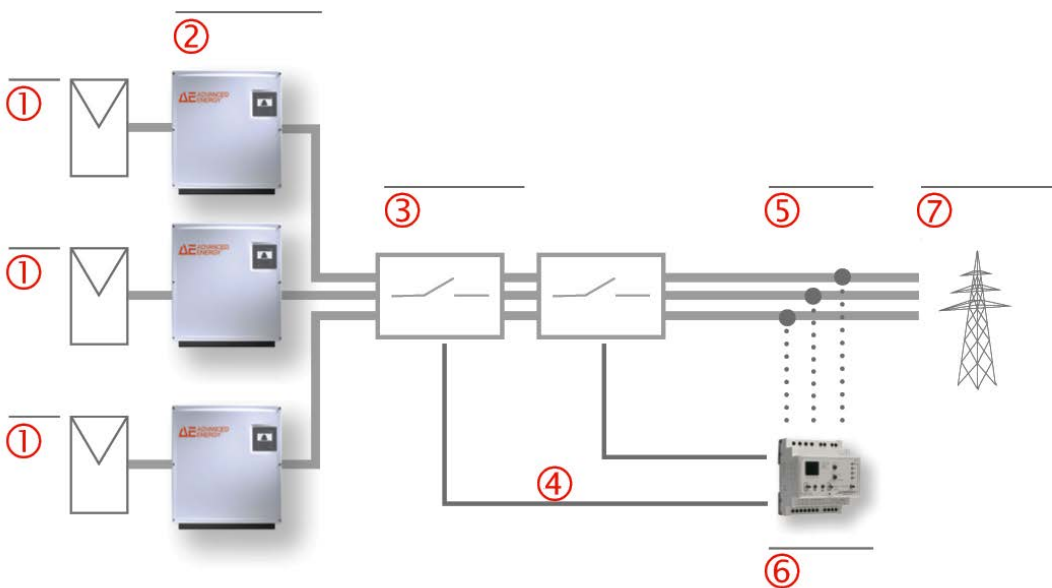


Fig. 46: Central grid and plant protection with external section switches

| | |
|---|----------------------------|
| ① | Photovoltaic modules |
| ② | AE 3TL 40/46 kW |
| ③ | Section switch |
| ④ | Control line |
| ⑤ | AC |
| ⑥ | AE GridProtect |
| ⑦ | Low or medium voltage grid |

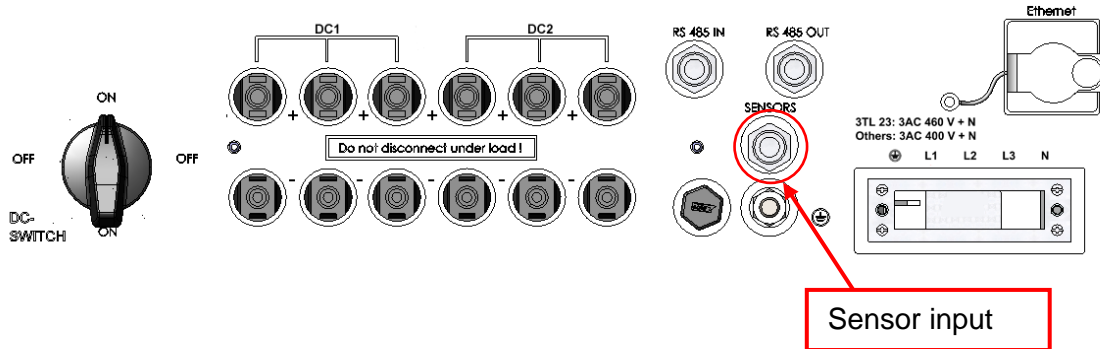
9.2.2. Specification

| | |
|-----------------------------------|------------------|
| Rated input voltage | 10 V DC |
| Input voltage (operation) | 7.5... 10 V DC |
| Input voltage (stop) | 0... 7.5 V DC |
| Standard inverter switch off time | 50 ms |
| Switch off time setting area | 50 ms ... 100 ms |

If there is a logical 1 at the sensor output, then the inverter stays in operation. If the connected voltage drops below 7.5 V, then a fault is triggered and the inverter stops its operation within the configurable switch off time.

9.2.3. Configuration via sensor input

The external switch off signal takes place via the sensor input of the inverter.



The sensor plug can be separately ordered from AE under item no. 0030616.

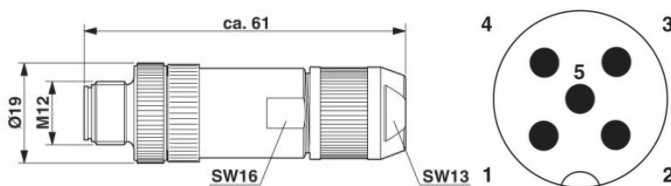


Fig. 47: Sensor plug M12 x 1 straight, shielded; pole arrangement: male M12, 5 pins, A-coded, view of male connector side, Phoenix designation: SACC-M12MS-5SC SH

In the following, the possible allocations of the sensors are described:

Standard configuration

| | | | | | | |
|-------------------|------------|-----------|--|--|--|--|
| Switch off signal | 0...10 VDC | Shielding | | | | |
|-------------------|------------|-----------|--|--|--|--|

| Connection Sensor | Pin1 | Pin2 | Pin3 | Pin4 | Pin5 | Sensor selection | |
|-------------------|------|------|-----------|------|---------------------|------------------|---|
| Inverter | 1 | NC | Shielding | NC | Signal (0...10 VDC) | GND | 3 |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | n | | | | | | |

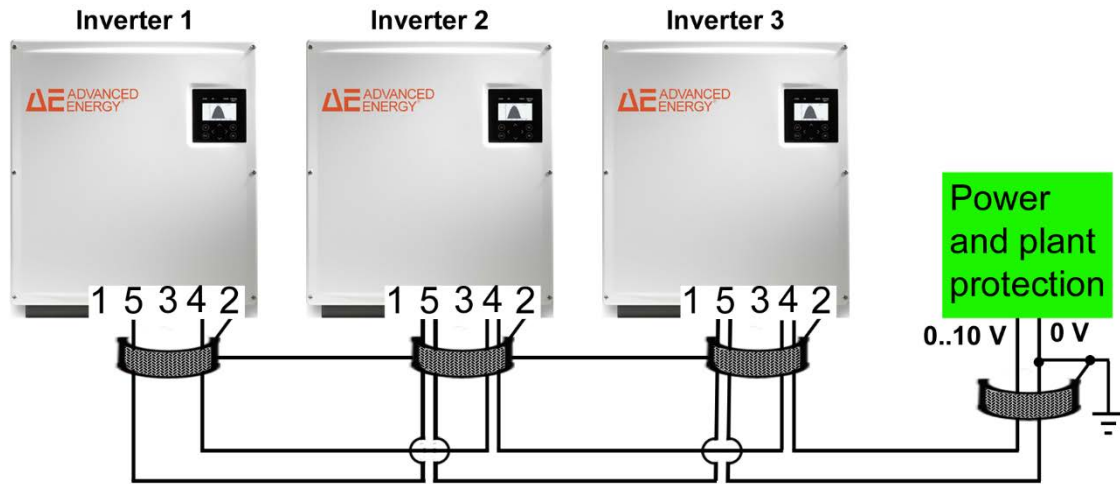


Fig. 48: Diagrammatic explanation of the standard configuration

Standard configuration with connected irradiation and temperature sensor

| | | | | | | |
|-------------------|------------|-----|--|--|--|--|
| Switch off signal | 0...10 VDC | GND | | | | |
|-------------------|------------|-----|--|--|--|--|

| Si-13TC-T-K connection | Red RD | Black BK | Orange OG | Braun BN | Gray GY | | |
|------------------------|---------------------|---------------------|---|---|---|------------------|---|
| | Voltage (12-28 VDC) | Shielding | Measurement signal for irradiation (0-10 V) | Measurement signal for temperature (0-10 V) | GND | | |
| Connection Sensor | Pin1 | Pin2 | Pin3 | Pin4 | Pin5 | Sensor selection | |
| Inverter | 1 | Voltage (12-28 VDC) | Shielding | Signal (0...10 VDC) | Measurement signal for temperature (0-10 V) | GND | 2 |
| | 2 | NC | Shielding | Measurement signal for irradiation (0-10 V) | Signal (0...10 VDC) | GND | 1 |

| | | | | | | | |
|--|---|----|-----------|----|---------------------------|-----|---|
| | 3 | NC | Shielding | NC | Signal (0...10 VDC) | GND | 1 |
| | n | | | | | | |

Redundant monitored switch off signal

| | | | | | | |
|-------------------|------------|-----|--|--|--|--|
| Switch off signal | 0...10 VDC | GND | | | | |
|-------------------|------------|-----|--|--|--|--|

| Connection Sensor | Pin1 | Pin2 | Pin3 | Pin4 | Pin5 | Sensor selection | |
|-------------------|------|------|-----------|---------------------------|---------------------------|------------------|---|
| Inverter | 1 | NC | Shielding | Signal (0...10 VDC) | Signal (0...10 VDC) | GND | 3 |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | n | | | | | | |

Monitoring of two different switch off signals

| | | | | | | |
|-------------------|------------------------|-----|--|------------------------|-----|--|
| Switch off signal | Signal 1 0...10 VDC | GND | | Signal 2 0...10 VDC | GND | |
|-------------------|------------------------|-----|--|------------------------|-----|--|

| Connection Sensor | Pin1 | Pin2 | Pin3 | Pin4 | Pin5 | Sensor selection | |
|-------------------|------|------|-----------|-----------------------------|-----------------------------|------------------|---|
| Inverter | 1 | NC | Shielding | Signal 1 (0...10 VDC) | Signal 2 (0...10 VDC) | GND | 3 |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | n | | | | | | |




Note:

In order to ensure the function of the switch off signal, the sensor selection must be correctly set in the inverters.

The sensor function can be entered on the display of the inverter via Configuration > External switch off.

The configuration of the inverter continues to be possible using the AE Setup tool. Other switch off times required by the EVU, for example, or other voltage ranges can be configured here. It is also possible to deactivate the internal NA protective function of the inverter if an external NA protective relay is connected and your grid supplier allows it.

| | |
|--|---|
|  DANGER | <p>Risk of electric shock and fire caused by high discharge current.</p> <p>⇒ Before connecting the device to the supply circuit, establish a ground connection.</p> |
|--|---|

9.3. REMOTE MONITORING SYSTEM

The following options are available for remote monitoring:

- AE SiteLink: A monitoring portal for the purpose of monitoring and recording solar system data. For more information and details, please refer to the AE SiteLink

(formerly REFU/og) manual, available for download at www.advanced-energy.de/de/1TL_3TL_Downloads.html.

For information about the configuration, please refer to the Operating Instructions of AE SiteLink.

9.4. INSTRUMENT SETTINGS FOR MONITORING WITH SOLARLOG® OR METEOCONTROL®

The RS485 interface (RS485 IN / OUT) is standard on all inverters.

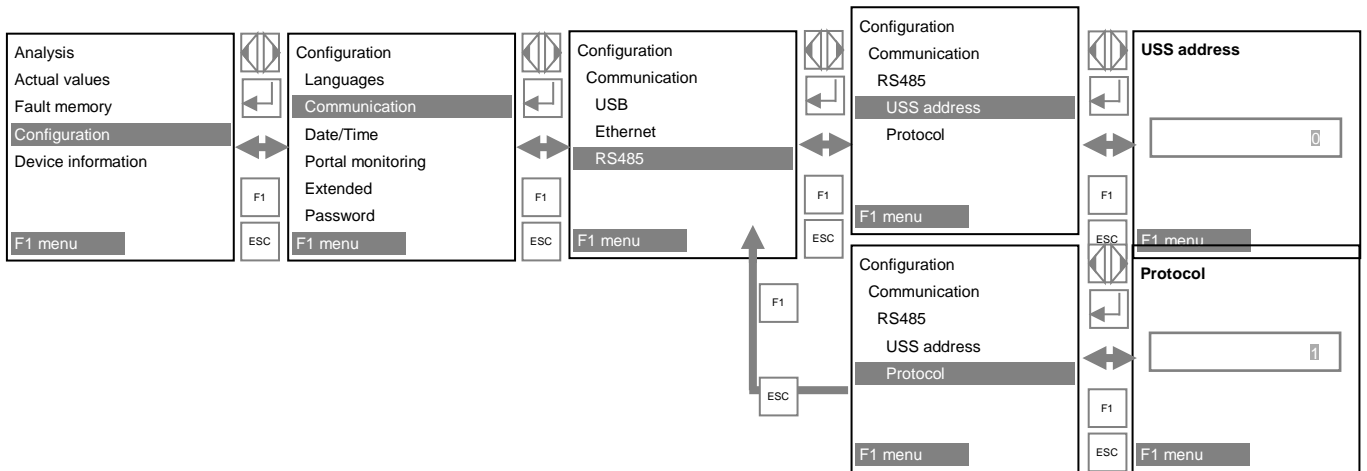
For communication via SolarLog® or MeteoControl® each inverter must be given a communications address. Predefining the addresses continuously starting with 1 (then 2, 3, etc. to max. 31) is recommended.



Note:

The maximum number of inverters systems that can be operated at one bus is 31.

These settings are applied to the operating field of the inverter:



Protocol: After successful entry, enter "1" for SolarLog® "2" for USS and "3" for Mete-oControl® and confirm each one with **OK**.



Note:

After successful entry turn the inverter off and after 1 minute turn back on!

9.5. DATA LOGGER PARAMETERS

The data loggers can be configured in AE Setup.

9.6. DEVICE CONNECTION BOXES (AE COMBINERBOX)

A device connection box (AE ConnectionBox) is optionally available. The ConnectionBox reduces up to 12 strings to the 4 available DC connections in the inverter. It has a DC circuit breaker, 3 slots for optional overvoltage protection and a fuse for every string.

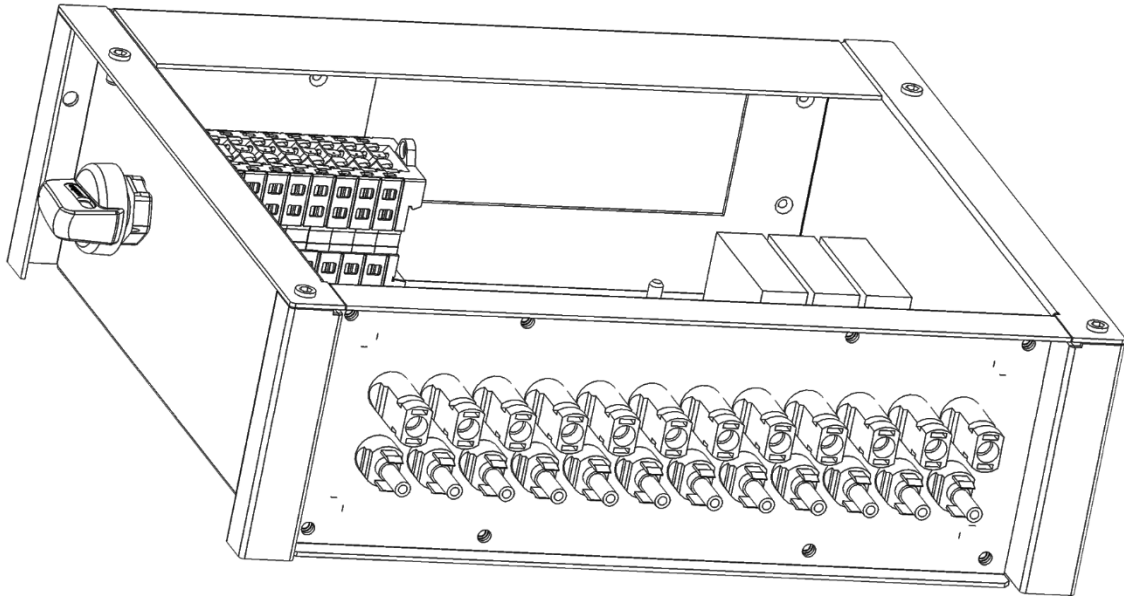


Fig. 49: ConnectionBox with on/off switch left and 12 DC connections

10. Maintenance

10.1. INVERTER

The cooling of the inverters is done exclusively through the natural convection. For safe operation according to the environment the cooling fins on the heat sink should be checked against dirt and if necessary clean up of dust / dirt.

Cleaning with high-pressure cleaners is prohibited.

According to the plant-specific maintenance intervals, the PV string fuses and the optional surge protector devices can be checked in the ConnectionBox.


Replacing the PV string fuses or the optional overvoltage protection modules must be done corresponding to the PV system documentation exclusively with type and identical inserts.

10.2. DISASSEMBLE CONNECTIONBOX

Proceed to disassemble the ConnectionBox as follows:

1. Disconnect power, Connection with AE ConnectionBox.
2. Remove the housing cover of the ConnectionBox.
3. Disconnect internal PV connectors from the inverter.
4. Disconnect internal PE-connection from the inverter.
5. Disassemble ConnectionBox in reverse order as described in chapter [<dg_ref_source_inline>](#).

11. Decommissioning

| | |
|---|---|
|  CAUTION | <p>Danger of injury or damage to property</p> <ul style="list-style-type: none"> ⇒ Do not use the cover to hold the device. Only use the four holding grips to move the device. ⇒ When decommissioning the inverter, take the 74.0 kg weight into account, plus, 4.5 kg for the optionally usable ConnectionBox. ⇒ Do not open device. Opening the device voids the warranty. |
|---|---|

11.1. REMOVE INVERTER

1. Make the inverter absent of voltage.
2. Remove all cables from the inverter.
3. Loosen the 3 screws (M5x20) with the inverter above to the wall-mounting bracket.
4. Remove the inverter from the wall-mounting bracket (See "Installation", p. 25).

11.2. PACKAGE INVERTER

If possible, package the inverter in its original packaging or a similar packaging.

11.3. DISPOSAL



Dispose of the packaging and replaced parts according to the rules applicable in the country where the inverter is installed. Do not dispose of the inverter with normal domestic waste. The inverter conforms to RoHS. That means that the device can be taken to municipal disposal sites for household appliances. AE takes the inverter back completely. Please contact the Service team!

12. Technical data

12.1. INVERTER

| TYP | AE 3TL 40 | AE 3TL 46 |
|--|---------------------------------------|-------------|
| Art.No. | 840R040.000 | 840R046.000 |
| DC DATA | | |
| Max. recommended PV power (kWp) | 48 | 55.2 |
| MPPT Range at nominal power (V) | 490 ... 850 | 575 ... 850 |
| Max. voltage DC (V) | 1000 | |
| DC start voltage (V) | 350 | |
| Max. operational current DC (A) | 84.0 | 82.0 |
| Max. short circuit current ISC of PV system (A) | 160 | |
| MPP trackers | 1 | |
| No. DC inputs | 4 x Plus, 4 x Minus | |
| Type DC inputs | Phoenix Sunclix® | |
| Max. PV short circuit current ISC per DC input (A) | 40 | |
| String Monitoring | 4 measurement channels integrated | |
| DC load break switch | Available with optional ConnectionBox | |
| AC DATA | | |
| AC Nominal power (kW) | 40.0 | 46.0 |
| Max. apparent power (kVA) | 40.0 | 46.0 |
| AC grid connection / Feed-in phases | L1, L2, L3, N, PE | |
| Nominal Power Factor / Range | 1 / 0.8i ... 0.8c | |
| Nominal voltage AC (V) | 400 | 460 |
| Voltage range AC (V) | 320 ... 480 | 368 ... 529 |
| Nominal Frequency / Frequency Range (Hz) | 50, 60 / 45...65 | |
| Max. AC current (A) | 3 x 59 | |
| Max. THD (%) | < 3% | |
| Max. AC protection (A) | 80 | |
| AC circuit breaker | external | |
| Max. Efficiency (%) | 98.2% | 98.3% |
| European Efficiency (%) | 97.8% | 98.1% |
| Feed-in from (W) | 40 | |
| Self consumption night (W) | < 0,5 | |

| | |
|---|---|
| Permissible Conductor nominal cross-sections (mm ²) | 25, 35 |
| AMBIENT CONDITIONS | |
| Cooling | natural convection |
| Ambient Temperature (°C) | -25 ... +55 |
| Rel. Air humidity (%) | 4% ... 100% |
| Elevation (m above sea level) | 4000 |
| Noise (dBA) | < 45 |
| Environment classification (IEC 721-3-4) | 4K4H |
| Pollution degree (IEC 62109-6-3) | 3 |
| Type of protection (IEC 60529) | IP65 |
| SAFETY AND PROTECTION FUNCTIONS | |
| DC circuit breaker | in AE ConnectionBox |
| Isolation monitoring | yes |
| Overload behaviour | DC working point adjustment |
| String Fuses | in AE ConnectionBox |
| Grid monitoring | Voltage, Frequency, Anti Islanding, DC injection |
| Grid separation | 0 |
| Residual Current Monitoring (RCD) | yes |
| Internal Overvoltage Protection (EN 61643-11) | Type 3 (Type 2 module optional in AE ConnectionBox) |
| Protection Class (IEC 62103) | I |
| Overvoltage Category (EN 60664-1) | DC: II, AC: III |
| GENERAL DATA | |
| Interfaces | Ethernet, RS485, Irradiation and Temperature Sensor, Auxiliary equipment power supply, external stop signal |
| Dimensions W x H x D (mm) | 760 x 820 x 300 |
| Weight (kg) | 74.0 |
| Certification | latest certificates you find at http://www.advanced-energy.com/3TLcerts |

12.2. OPTIONAL AE CONNECTIONBOX

| | |
|---------------------------------|--------------|
| Art. No. | 934R210.1850 |
| GENERAL DATA | |
| Max. recommended PV power (kWp) | 55.2 |

| | |
|--|--------------------------------------|
| Dimensions W x H x D (mm) | 410 x 310 x 130 |
| Connection to Inverter | 4 x Plus, 4 x Minus Phoenix Sunclix® |
| Number of String connections | 12 x Plus, 12 x Minus |
| Max. DC current per string (A) | 10,66 |
| DC connection type | Phoenix Sunclix® |
| DC connector area (mm ²) | 2,5 ... 6,0 |
| String fuses | 15 A (Plus) |
| Optional DC Overvoltage Protection | Type 2 module optional |
| Weight (kg) | 4.5 |
| AMBIENT CONDITIONS | |
| Cooling | natural convection |
| Ambient Temperature (°C) | -25 ... +55 |
| Rel. Air humidity (%) | 4% ... 100% |
| Elevation (m above sea level) | 4000 |
| Noise (dBA) | < 45 |
| Environment classification (IEC 721-3-4) | 4K4H |
| Pollution degree (IEC 62109-6-3) | 3 |
| Type of protection (IEC 60529) | IP65 |
| SAFETY AND PROTECTION FUNCTIONS | |
| DC circuit breaker | integrated |
| Protection Class (IEC 62103) | I |
| Overvoltage Category (EN 60664-1) | DC: II, AC: III |

12.3. SENSOR

| | |
|---|---|
| TYPE | Si-13TC-T-K |
| GENERAL | |
| Shunt resistor | 0.10 Ω (TK = 22 ppm/K) |
| Working temperature | -20 °C to +70 °C |
| Power supply | 12 to 24 VDC |
| Current draw | 0.3 mA |
| Connecting cable | 4 x 0.14 mm ² , 3 m (UV-resistant) |
| Cell dimension | 50 mm x 34 mm |
| Exterior Dimensions Length / Width / Height | 145 mm x 81 mm x 40 mm |
| Weight | 340 g |
| INSOLATION | |
| Measuring range | 0 to 1,300 W/m ² |

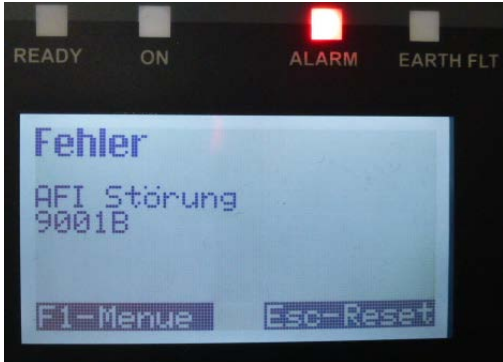
| TYPE | Si-13TC-T-K |
|---------------------------|--|
| Output signal | 0 to 10 V |
| Measuring accuracy | ±5% of final value |
| MODULE TEMPERATURE | |
| Measuring range | -20° C to +90° C |
| Output signal | $2.268V + T [^{\circ}C] * 86.9 \text{ mV}/^{\circ}C$ |
| Measuring accuracy | ±1.5% at 25 °C |
| Non-linearity | 0.5 °C |
| Max. deviation | 2 °C |
| PIN ASSIGNMENT | |
| Orange | Measurement signal for insolation (0 to 10 V) |
| Red | Supply voltage (12 - 24 VDC) |
| Black | GND |
| Brown | Measurement signal for temperature (0 - 10 V) |
| Power supply | Temperature and radiation sensor or Power cap |

13. Contact

Please address any questions on malfunctions or technical problems to:
Service hotline: +49 (0)7123 / 969 – 202 (Monday – Friday, 8 a.m. to 5 p.m)
E-mail: service.aei-power@aei.com

You should have the following data at hand:

- Exact description of the error with error code.



- Data from the type plate, particularly the device type on the top left of the type plate.

14. Certification

The following certificates

- EU Declaration of Conformity
- Clearance certificate
- Unit certificate according to BDEW Medium Voltage Directive. VDE AR-N 4105
- Country certification

can be downloaded from the AE website at www.advanced-energy.de/de/1TL_3TL_Downloads.html.

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