SIEMENS

SINVERT PVM

Operating Instructions

11/2012

A5E02758225C/004

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

1.1 About this manual

Purpose of this manual

These operating instructions contain all the information for the installation, commissioning, and operation of the SINVERT PVM10, PVM13, PVM17 (4DC and 6DC), and PVM 20 inverters.

The SINVERT PVM17 4DC inverter is no longer available to order.

Validity of the documentation

The operating instructions apply to the inverters

- SINVERT PVM10, PVM13, PVM17 (4DC and 6DC), and PVM20 with firmware versions FW25, FW26, FW27 and FW29

Basic knowledge required

- Training as an electrical technician
- Experience of working with PV systems
- Experience of installing and commissioning PV systems
- Experience of working with inverters

Conventions

In this manual, the abbreviation SINVERT PVM is also used to refer to inverters of type SINVERT PVM10, SINVERT PVM13, SINVERT PVM17 4DC, SINVERT PVM17 6DC, and SINVERT PVM20.

The latest version of the operating instructions is available on the Internet.

These operating instructions are regularly updated. For this reason, always download the latest version from the Internet so that you always have the valid operating instructions for any variant of the SINVERT PVM inverter.

Follow the link below to access the instructions:

SINVERT support (http://www.siemens.com/sinvert-support)

Trademarks

SINVERT® is a registered trademark of Siemens AG.

1.2 History of changes in this documentation

Release	Remark
12/2009	First edition (German only)
01/2010	Changes (German only)
03/2010	Changes (German and English)
07/2010	Addition of the SINVERT PVM17 6DC and SINVERT PVM20 inverters; changes
08/2011	Compliance with the German Energy and Water Association (BDEW) guideline; new national approvals
11/2012	Compliance with VDE-AR-N 4105, changes

Safety instructions

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To avoid personal injury or material damage, the following instructions must be read before commissioning the unit for the first time. These safety instructions must be followed at all times.

⚠ WARNING

Improper handling of these devices and failure to follow the warnings given here, as well as improper interference with the safety equipment and the unit, can lead to property damage, bodily injury, or electric shock, and in extreme cases can cause death.

⚠ WARNING

Risk of electric shock

Do not open the device! The unit interior can contain fatal voltage, even after it is switched off.

⚠ CAUTION

Safety hazards associated with using unsuitable PV modules

The SINVERT PVM inverter is not suitable for use with PV modules for which pole grounding is an essential requirement. Modules of this type must not be connected to the SINVERT PVM inverter. Failure to provide suitable grounding poses a safety risk to personnel and the installation itself.

NOTICE

Invalidation of the warranty

The device is only permitted to be opened by authorized specialist personnel, otherwise the warranty will be invalidated.

2.1 Qualified personnel

These operating instructions are intended for the following persons:

- Electrical technicians who commission the unit and connect it to other units in the PV system
- Service and maintenance engineers who are installing upgrades or performing error analyses

This documentation is written for trained specialists. It does not provide basic information about PV systems.

- Only trained specialists may install the unit.
  - The installation engineer must be qualified according to the national guidelines.
  - Approval by the relevant electrical utility may also be necessary.
- **Operation, maintenance, and repair of this device may be made only by qualified staff who are trained to work on or with electrical devices.**

2.2 Protection against touching electrical parts

⚠ WARNING

Risk of electric shock

- Before switching on, ensure the connectors are seated properly.
- Remove the PV generator connectors only when the following conditions have been met:
  - Switch the DC disconnector on the SINVERT PVM to "OFF".
  - Measure at the DC end to make sure that no current is flowing.
  - Disconnect the power supply and take measures to prevent the power being switched back on again.

⚠ WARNING

Electric shock and fire hazard due to high leakage current

Create a ground connection before connecting to the PV field and the power supply circuit.

2.3 Protection against magnetic and electromagnetic fields in operation and installation

The magnetic and electromagnetic fields that are present in the immediate vicinity of electrical conductors can represent a serious danger to people with pacemakers, metal implants, and hearing aids.

⚠ WARNING

People with pacemakers, metal implants, and hearing aids are at risk of damaging their health in the immediate vicinity of electrical equipment.

- Access to the following areas is prohibited for people with pacemakers and metal implants:
  - Areas in which electrical devices and components are installed, operated, or commissioned.
- If it is necessary for a pacemaker wearer to enter such areas, this requires a doctor's prior approval. The resistance to interference of pacemakers that have been implanted or are yet to be implanted varies greatly, and general guidelines are therefore not possible.
- People with metal implants or fragments and those with hearing aids must consult a doctor before entering such areas, as dangers to health can be expected.

2.4 Protection against burn hazards

⚠ CAUTION

Surfaces of device enclosure may be hot! Risk of injury! Hot parts – burn hazard!

- Do not touch cooling fins and the upper area of the enclosure during operation. Hot parts – burn hazard!
- Before touching the unit, let it cool down for 15 minutes.
- At an ambient temperature of 45 °C, the upper part of the enclosure and the heat sink can assume a surface temperature of 75 °C!

2.5 Protection during handling and installation

Improper handling and installation of certain parts and components can result in injury under unfavorable conditions.

⚠ CAUTION

Danger of injury due to improper handling! Injury by crushing, jackknifing, cutting, bumping, or lifting!

- The general construction and safety regulations must be observed in handling and installation.
- A SINVERT PVM inverter weighs approximately 40 kg.
- Suitable installation and transport equipment must be used.
- Only use suitable tools.
- Lifting equipment and tools must be used correctly.
- Suitable protective equipment (e.g. safety goggles, safety shoes, protective gloves) must be used.
- Never stand underneath suspended loads.

2.6 Selecting the country setting

The country setting determines the country-specific line monitoring parameters. In selecting the country setting, the menu language is set automatically. The menu language is then independent of the country setting and can be freely selected at any time using the menu.

No country setting is selected when the device is delivered. The device prompts you to select the country setting. You can choose among the countries listed. The term "country setting" itself does not appear in the menu.

NOTICE

The selected country setting can be changed by service personnel only!

After selecting and confirming the country setting, you can no longer change the country setting yourself. According to the regulations, the country setting can be changed by service personnel only.

If the unit has been in operation, the country setting is already selected. In this event, you will not be asked to enter the country setting. The country setting can be changed by service personnel only.

From firmware version FW27, the country setting can be modified within the first 40 operating hours via the menu command "Configuration->Country".

NOTICE

Withdrawal of operating permit

If you operate SINVERT PVM with an incorrect country setting, the electrical utility can withdraw your operating permit.

Note

No liability is accepted if the country setting is incorrect

We accept no liability for the consequences of an incorrect country setting.
The relevant regulations of the competent power supply utility must be observed.

Note

Resetting of an incorrect country setting is subject to a charge

Only Siemens can reset an incorrect and no longer modifiable country setting. Please note that this requires return of the device or local deployment of service personnel and this involves a cost.

Description

3

3.1 Design

The following figure shows the basic design of the SINVERT PVM inverter.

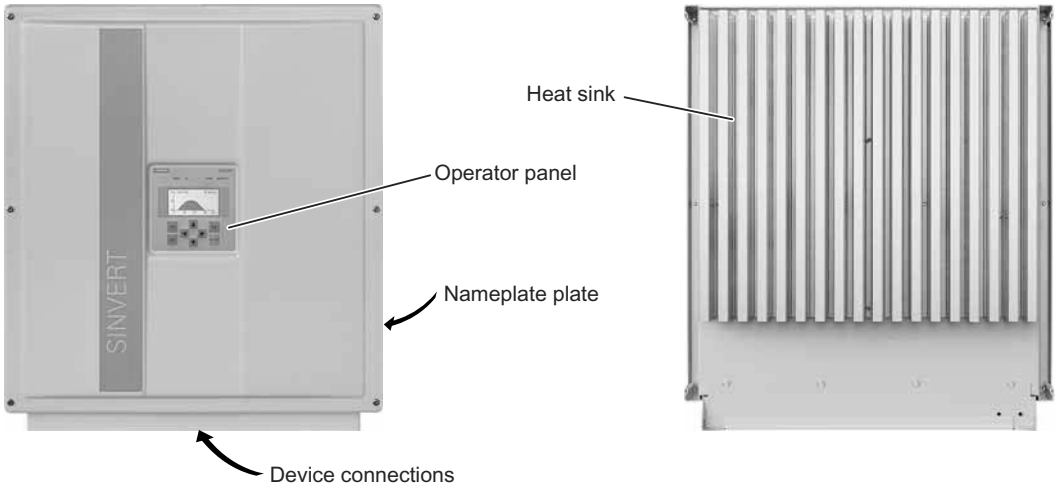


Figure 3-1 Design of the SINVERT PVM

3.2 Features

SINVERT PVM is a transformerless, three-phase inverter with the following features:

- SINVERT PVM has an especially high efficiency.
- PV generators with power outputs up to 21.6 kWp can be connected.
- The device does not have to be opened for mounting and connecting.
- All electrical connections have lockable connectors.
- SINVERT PVM has an integral DC disconnector in accordance with EN 60947-3.
- Heat dissipation purely by convection
- Internal temperature monitoring protects the device against impermissible ambient temperatures.
- Interfaces: Ethernet, RS485, connection for an insolation sensor or a combined insolation temperature sensor
- Operator input is via keys below the display.
- An illuminated graphics display represents the waveform of the infeed power and other data.
- Almost unrestricted area of application thanks to version in degree of protection IP65.

3.3 Scope of supply

The scope of supply of the SINVERT PVM inverters includes the following:

- SINVERT PVM inverter:
  SINVERT PVM10 or SINVERT PVM13 or SINVERT PVM17 or SINVERT PVM20
- Wall bracket
- Accessory pack
  - 2 x flat-head screw M5x20,
    for mechanically securing the inverter in the wall bracket
  - 1 x contact insert 5-pin VC-TFS5-PEA
  - 1 x socket shell IP67 VC-K-T3-R-M25-PLOMB
  - 1 x cable gland Schlemmer-Tec M25x1.5/21532
- Operating instructions (compact) as hard copy
- CD with operating instructions

Note

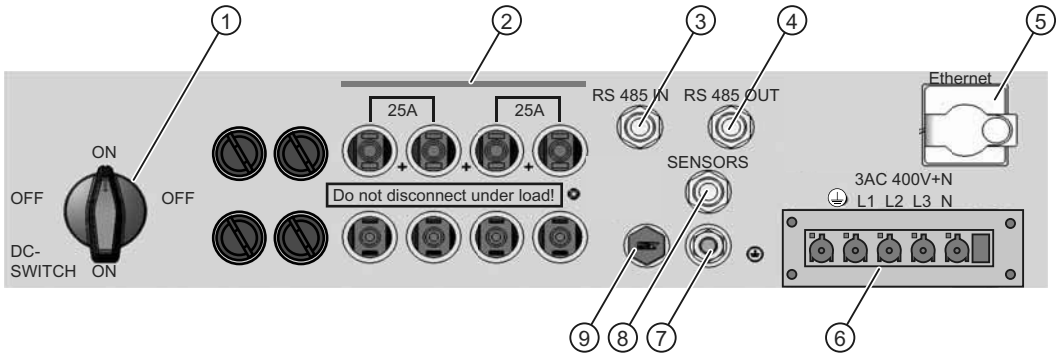
Spare parts

The wall bracket and the accessory pack with the connector set can be ordered separately as spare parts. See section Spare parts and accessories (Page 111)

3.4 Device connections and operator controls

The figure below shows the connections of the SINVERT PVM inverter on the underside of the device.

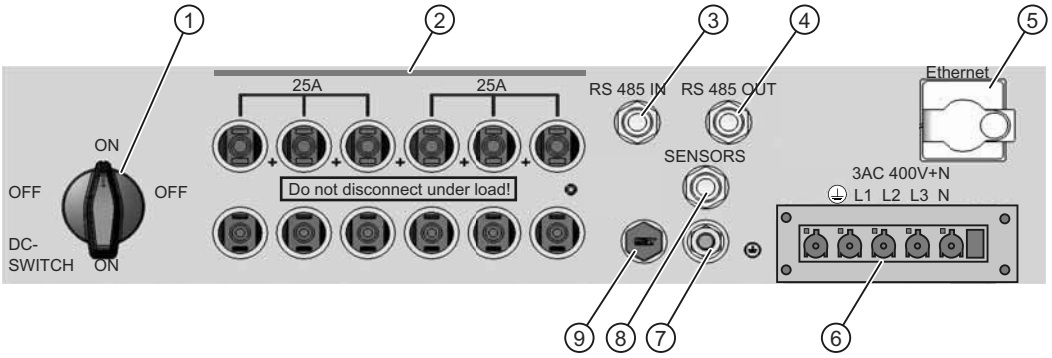
Device connections for SINVERT PVM10 4DC, SINVERT PVM13, and SINVERT PVM17 4DC



① DC circuit breaker
② 4 pairs of PV generator connections: MC4 connectors/sockets
Top row: +, bottom row: -
③ RS485 connection: IN
④ RS485 connection OUT
⑤ Ethernet interface connection
⑥ Mains connection
⑦ Ground connection M8
⑧ Connection for insolation sensor
⑨ Overpressure compensation

Figure 3-2 Device connections for SINVERT PVM10, SINVERT PVM13, and SINVERT PVM17 4DC

Device connections for SINVERT PVM17 6DC and SINVERT PVM20



① DC circuit breaker
② 6 pairs of PV generator connections: MC4 connectors/sockets
Top row: +, bottom row: -
③ RS485 connection: IN
④ RS485 connection OUT
⑤ Ethernet interface connection
⑥ Mains connection
⑦ Ground connection M8
⑧ Connection for insolation sensor
⑨ Overpressure compensation

Figure 3-3 Device connections for SINVERT PVM17 6DC and SINVERT PVM20

Note

Avoid frequent, successive switching of the DC circuit breaker

The DC circuit breaker is intended for commissioning and service purposes.
It is not designed for frequent, successive switching.

3.5 Firmware version

The operating instructions are valid for the SINVERT PVM10, PVM13, PVM17 and PVM20 inverters with firmware versions FW25, FW26, FW27 and FW29 .

Firmware version	Modification
25	First edition
26	New control concept, additional country codes
27	Modification of the country setting up to 40 hours after switching on, compliance with the German Energy and Water Association (BDEW) guideline, additional country codes
29	Compliance with VDE-AR-N 4105

Firmware version identification

You can recognize the firmware version of your device as delivered from:

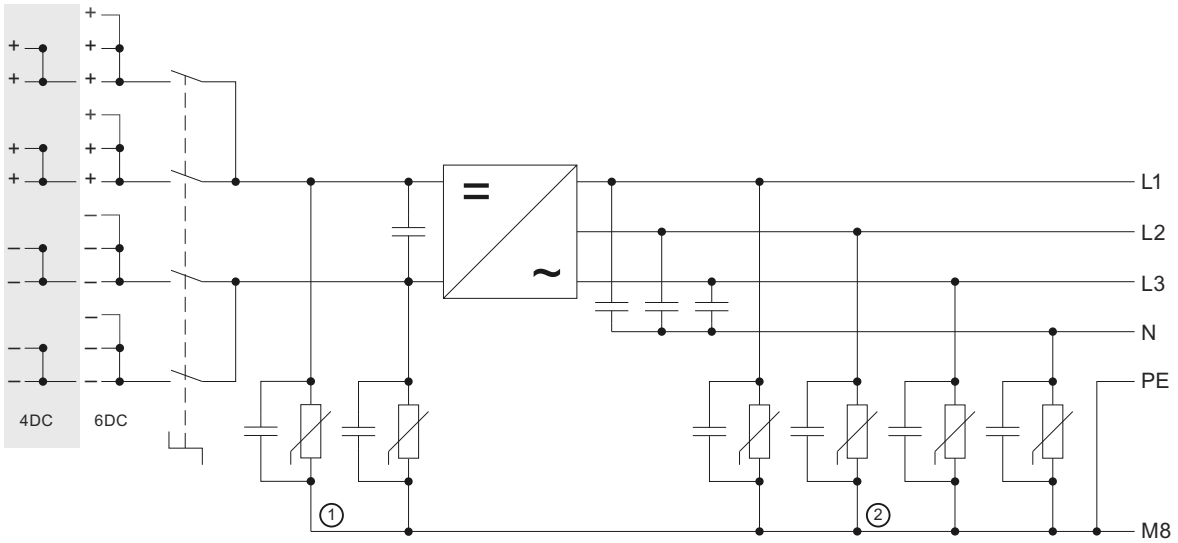
- The serial number on the rating plate of the device
  Example: Serial Number: LBA502**27**1000389 (27 = Firmware version)
- The operator panel: F1, menu command "Device information -> Version number"
  Example: 802S017-**27-**14-S (27 = Firmware version)

In the case of **updates** , the changed firmware version is labeled separately by the technical personnel.

3.6 Block diagram

The SINVERT PVM inverters are equipped with a surge arrester of Category 3 both on the AC side and the DC side.

Block diagram for SINVERT PVM



① DC surge arrester Type 3
② AC surge arrester Type 3

Figure 3-4 Block diagram with 4/6 DC inputs

3.7 Operator panel

The waveform of data such as the infeed power can be represented with the 128 x 64-pixel graphics display integrated on the front. The necessary parameters are selected and entered using the 8-key operator panel. The display is illuminated when a key is first pressed. The lighting goes out automatically after a few seconds.

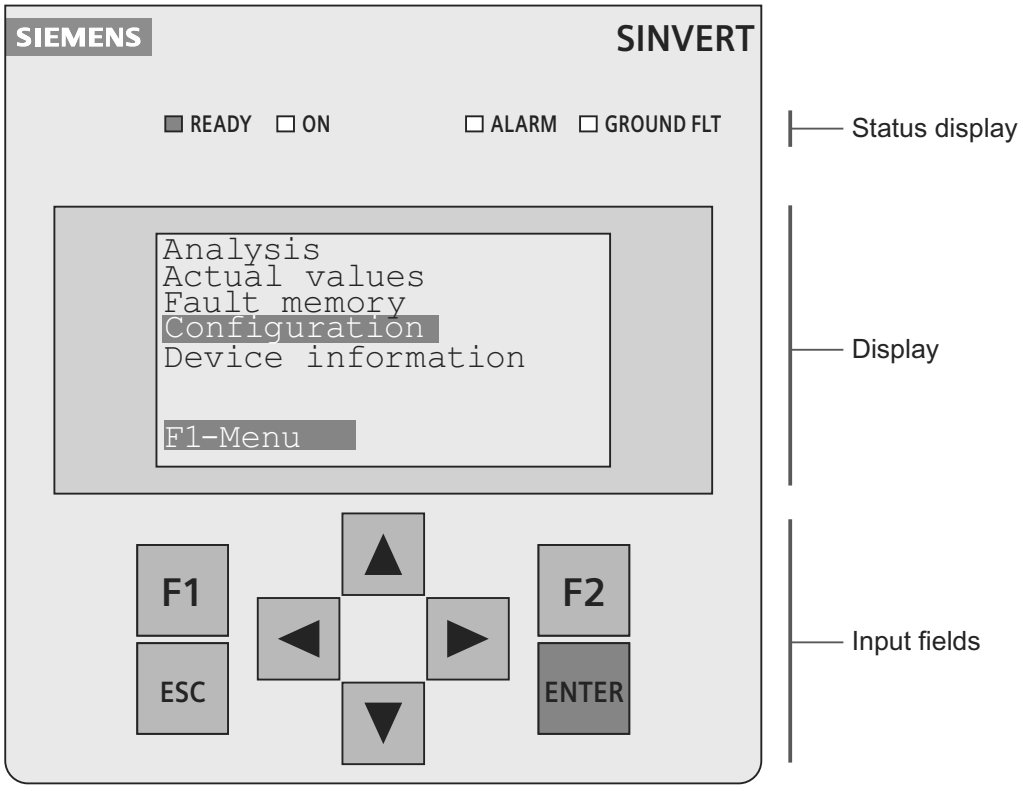


Figure 3-5 Operator panel

Status display

Designation	Description	
READY	LED flashing:	Initialization
	LED is lit:	Initialization of the unit is complete, but the inverter itself is not yet switched in. The inverter is not yet drawing current. For further details, see Chapter Switching on the device and switch-on procedure (Page 59)
ON	LED flashing:	Switching in the inverter
	LED is lit:	Infeed operation For further details, see Chapter Switching on the device and switch-on procedure (Page 59)
ALARM	LED flashes red:	Transient fault. The error message is saved in the fault memory, safe from power outages. For further details, see Chapter Transient fault (Page 93)
	LED lit red:	Fault: The error message is saved in the fault memory, safe from power outages. For further details, see Chapter Faults (Page 94)
GROUND FLT	LED lit	The insulation value in the PV array is too low. See Chapter Isolation faults (Page 94)

Display

- Depending on the selection, the display shows the following information:
  - Status display
  - Infeed power
  - Energy data
  - Device menu
- Selection via the input keys.
- The display is illuminated as soon as a key is pressed and it switches off automatically.

Input keys

Designation	Description
F1	Calling up the device menu
▲ ▼	Selection of the menu level
◄ ►	Function in the menu: Navigation within the menu level Function on parameter change: Position left, position right (skip screen)
ESC	Acknowledging a failure, deleting an input, one menu back
ENTER	Confirmation of a selection or entry

3.8 Communication scenarios

In this chapter, you will learn more about the communication options of the SINVERT PVM products. Different, frequently occurring communication scenarios will be presented. These are intended as examples, since local conditions such as cable lengths, Internet access method, etc., must be taken into account in each plant.

Legal requirements and standards such as the active power limitation in accordance with §6 EEG or the medium voltage guideline of the German Energy and Water Association (BDEW) must be observed.

The telecontrol of the power utility companies for this purpose, such as ripple control receivers for active power limitation, are only represented in schematic form here since they can differ significantly from power utility to power utility.

You can find more information on cabling in the operating instructions of the SINVERT PVM ControlBox in the Chapter "Connecting".

The data volume transferred is typically 1.5 MB/month/inverter.
Data volumes of up to 10 MB are possible at initial connection or when reloading.

Example 1:

Configuration of several PVM inverters and connection to the WebMonitor portal

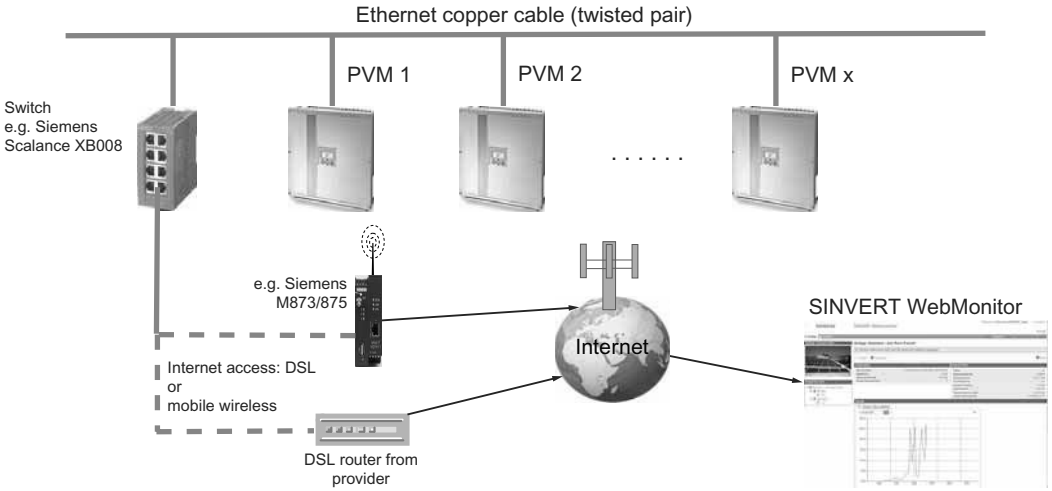
The figure shows a simple configuration with several SINVERT PVM inverters and connection to the SINVERT WebMonitor portal. Internet access is via the DSL modem provided by the Internet service provider (e.g. Telekom, 1&1, …).

The inverters are cabled using patch cables CAT5/6 SFTP (screened foil twisted-pair). For this purpose, each inverter is connected with the switch (star topology).

The switch must have as many ports as there are inverters connected plus one port for connecting the DSL modem. We recommend the use of switches from the Siemens Scalance range. They are rugged, suitable for industrial use and can be installed on standard mounting rails in the subdistribution board.

For setting the necessary parameters on the inverter, see Chapter "Connecting a SINVERT PVM to the WebMonitor portal via Ethernet (Page 66) ".

Please note that in Germany, this scenario is only permissible up to a plant output of less than 100 kWp. For larger plants, the SINVERT PVM ControlBox is required.



Example 2:

Configuration of several PVM inverters and one PVM ControlBox

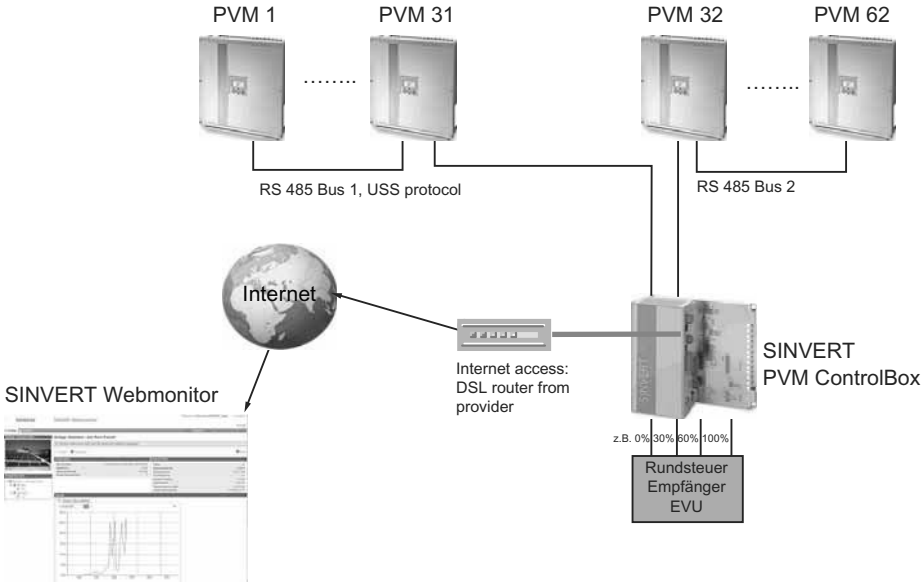
The figure shows the simple configuration with several SINVERT PVM inverters and connection to the SINVERT WebMonitor portal for plant outputs greater than 100kWp. Internet access is via the DSL modem provided by the Internet service provider (e.g. Telekom or 1&1).

Due to the plant size, in Germany you require active power reduction in accordance with §6 EEG, e.g. the SINVERT PVM ControlBox.

The inverters are cabled via the RS485 interface. This supports the USS protocol (universal serial interface protocol) that is used on the SINVERT WebMonitor portal for data transmission. The SINVERT PVM ControlBox has two RS485 bus connections. Up to 31 SINVERT PVM inverters can be operated on each bus so that up to max. 62 inverters can be connected in this configuration.

For setting the necessary parameters on the inverter, see Chapter "Communication (Page 65) " and "Connecting a SINVERT PVM to the WebMonitor portal via Ethernet (Page 66) ".

Please note that in Germany, this scenario is only permissible up to a plant output of less than 30 kWp. For larger plants, the SINVERT PVM ControlBox is required. For more information, see the Chapter "Feed-in management" there.

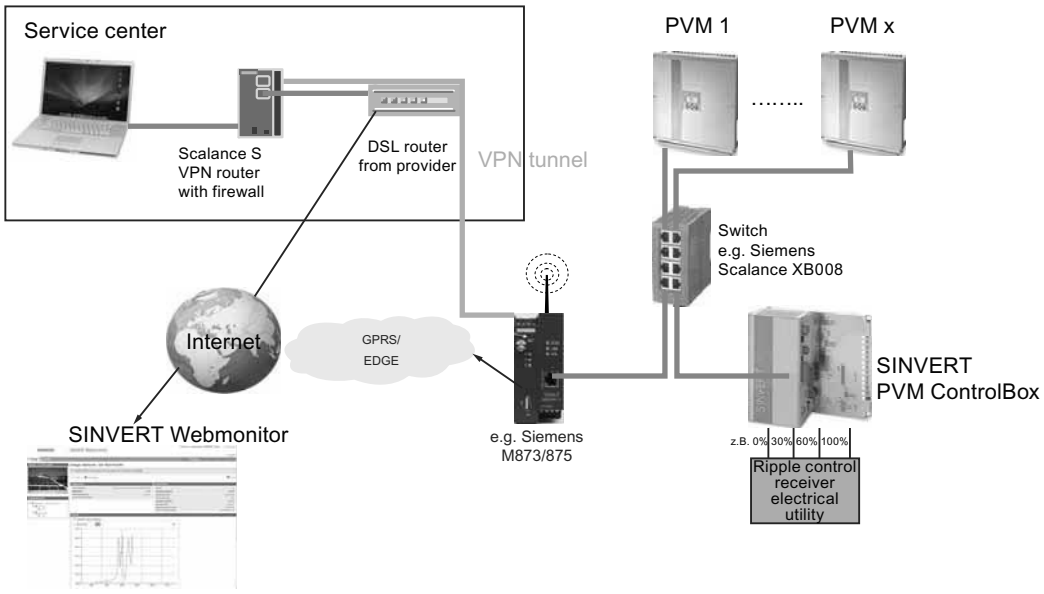


In plants with no DSL Internet access, the DSL modem can be replaced with a GPRS router that establishes the Internet connection by mobile wireless means. We recommend the Siemens MD843 UMTS router for establishing the wireless connection.

Example 3:

Configuration of several PVM inverters, PVM ControlBox, GPRS router, and VPN tunnel

This example differs from the previous one in that remote access to the plant is additionally possible. A secure connection (VPN tunnel) to the plant is established from a service center. This ensures that no-one but the service center personnel have access to the plant. This means it is possible to log onto the plant securely for service and diagnostics purposes. The connection to the SINVERT WebMonitor portal remains in place during such work.

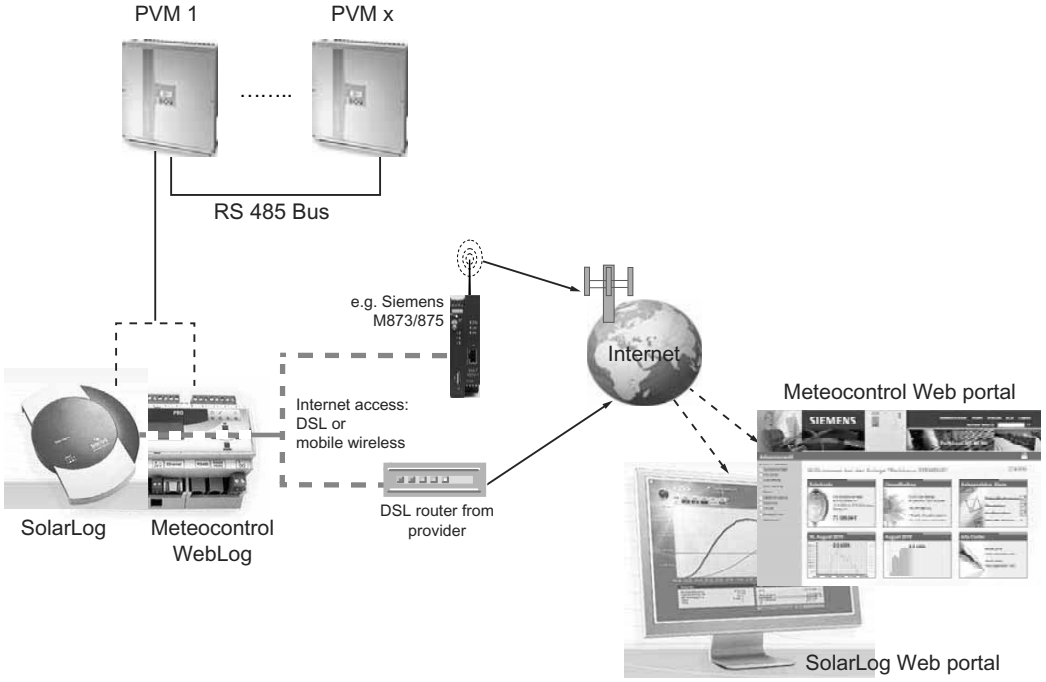


Example 4:

Configuration of several PVM inverters with connection to the Meteocontrol or Solarlog Portal

The figure shows how you can connect the SINVERT PVM inverters to the Web portal of the companies Meteocontrol GmbH or Solare Datensysteme GmbH. You require the respective product for this. Access to this portal involves costs.

For setting the necessary parameters on the inverter, see Chapter "Connecting a SINVERT PVM to the WebMonitor portal via Ethernet (Page 66) ".



Remark: Data loggers from other vendors can also be compatible with Sinvert PVM. Contact the manufacturer of the devices in this regard.

Example 5:

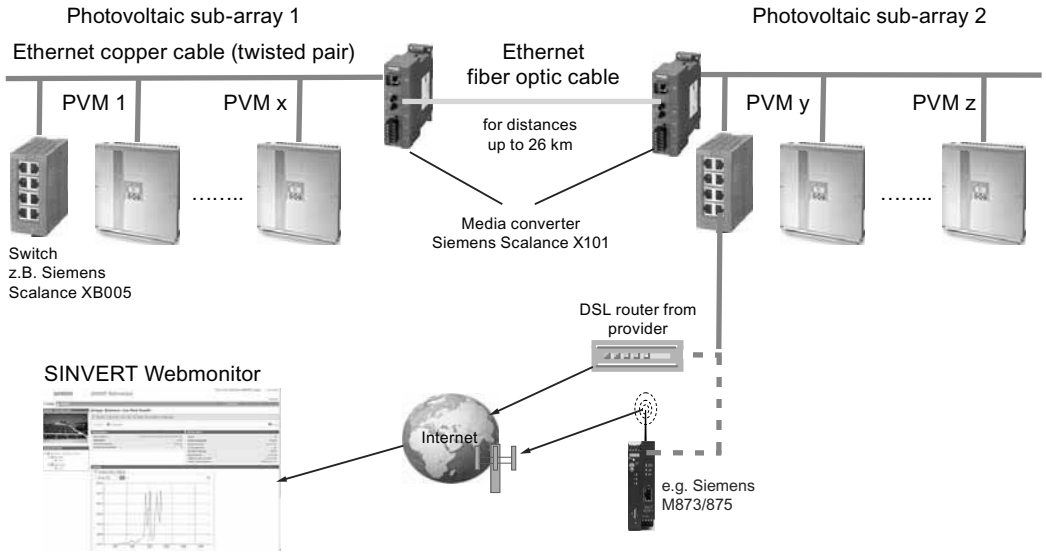
Configuration of 2 PVM inverter groups and one fiber optic connection

In this configuration, you can see the use of fiber optic cables instead of copper cables. Fiber optic cables are used when large distances have to be bridged between the communication partners, e.g. the SINVERT PVM inverters. With fiber optic switches of the Siemens Scalance series, distances of up to 26 km can be bridged. A further benefit is the immunity of fiber optics to EMI compared to copper cables.

In the following example, two groups of inverters located far from each other in 2 photovoltaic sub-arrays are connected to each other by fiber optic cable.

The inverters are connected to each other as described in scenario 1 with copper cables. The Siemens Scalance X101 media converter is used for converting to fiber optic cable.

The communication components can be installed in the subdistribution board.

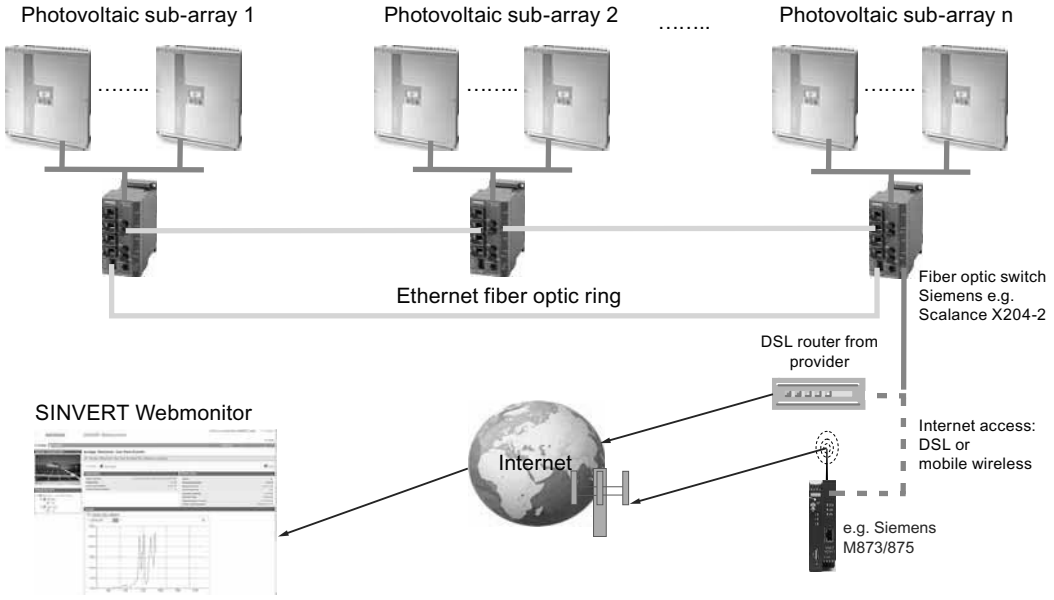


Example 6:

Configuration of several PV sub-arrays and connection to a fiber optic ring

In contrast to Scenario 7, a fiber optic ring topology is established in this configuration. The photovoltaic sub-arrays are connected to a fiber optic ring. The distance of the sub-arrays can be up to 26 km. The advantage of a fiber optic ring, in contrast to the linear topology shown in Scenario 7, is the high availability of the ring. Disconnecting the ring at one point has no effect on the availability of communication. The switches of the Siemens Scalance X204 series autonomously establish an alternative path to the node within a second if an interruption occurs on on the ring.

The status of the switch can be monitored via a Web browser and an isolated signaling contact.



3.9 Internal datalogger

The SINVERT PVM inverter contains an internal datalogger that enables the parallel recording of measured values in the form of parameters. The data logger is designed as a ring buffer. If the memory capacity is exceeded, the oldest measured values are overwritten.

In the standard scope of delivery, the values relevant to the WebMonitor are logged. The values can be stored for up to approximately 5 years, depending on the recording cycle selected.

Recording cycle	Storage time
Every minute	Approx. 6 months
Every 2 minutes	Approx. 12 months
Every 5 minutes	Approx. 2.5 years
Every 10 minutes	Approx. 5 years

Note

Do not change the standard setting

We recommend that you do not change the standard setting of 10 minutes.
If a shorter recording cycle should be necessary, e.g. for analysis purposes, please contact our Technical Support.

Application planning

4

4.1 Requirements to be met by the PV field

To be observed concerning the operating data of the PV generator

The following operating data must on no account be exceeded by the PV generator!

Device type	PVM10 4DC	PVM13	PVM17 4DC	PVM17 6DC	PVM20
Maximum permissible no-load voltage per input	1,000 V				
Maximum DC voltage per input in operation	950 V				
Maximum DC current per switch contact (see connection methods below)	25 A				
Maximum DC current at the input via all connections	36 A	36 A	41 A	41 A	41 A

The following points should be observed for grounding

⚠ WARNING

No pole grounding of the PV generator in the case of transformerless solar inverters

With transformerless solar inverters without galvanic isolation, the positive or negative pole of the PV generator must not be grounded!
Failure to observe this presents danger to life and can result in destruction of the PV modules.

The inverter carries out an isolation measurement before connecting to the grid. With pole grounding, an isolation fault is detected and grid connection does not take place.

The isolation resistance on the generator side upstream of grid switch-in must be at least 500 kΩ.

The following points should be noted for the connection method:

The power of the PV array must be distributed across all inputs of the inverter as evenly as possible for even loading of the components.

- The SINVERT PVM10 4DC, PVM13, and PVM17 4DC inverters each have four DC inputs for the PV array, for this reason ...
  - with 2 PV connecting cables: use inputs 1 and 3 or 2 and 4
  - with 3 PV connecting cables: use inputs 1, 2, 3 or 1, 3, 4 or 2, 3, 4
  - with 4 PV connecting cables: use inputs 1, 2, 3, 4

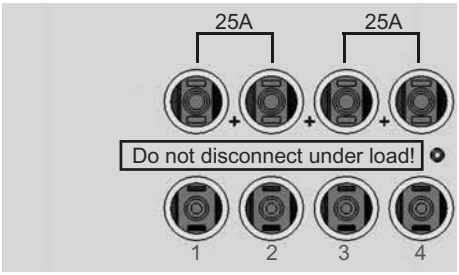


Figure 4-1 PV array connection with four DC inputs

- The SINVERT PVM17 6DC and PVM20 inverters each have six DC inputs for the PV array, for this reason ...
  - with 2 PV connecting cables: use inputs 1 and 4 or 2 and 5 or 3 and 6
  - with 3 PV connecting cables: use inputs 1, 3, 5 or 2, 4, 6
  - with 4 PV connecting cables: use inputs 1, 2, 4, 5 or 2, 3, 5, 6
  - with more than 4 PV connecting cables, any connections can be used.

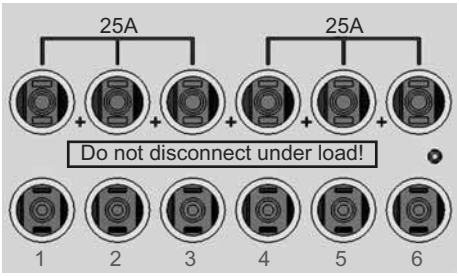


Figure 4-2 PV array connection with six DC inputs

4.2 Reverse power flow due to module defects

Reverse currents are fault currents that can occur in PV systems consisting of lines switched in parallel.

Reverse currents can have the following causes:

- Short-circuits of individual modules
- Short-circuits of cells in a module
- Double ground fault

As a result, the open-circuit voltage of the affected string can decrease (e.g. through defective modules or parts of modules) to such an extent that the intact parallel-switched strings cause a reverse current through the defective string. This can destroy the string in the worst case.

The sometimes intense overheating of the damaged string caused by the reverse current can also result in secondary damage.

To avoid such damage to PV systems, appropriate precautions must be taken. Generally, a distinction must be made here between two scenarios:

1. The PV system is designed in such a way that the reverse current flowing in the event of a fault results in neither destruction of the damaged lines nor in any secondary damage. In the worst case, the reverse current comprises the sum of the short-circuit currents of all intact lines. The current-carrying capacity of the plant components (connectors, cables) and the reverse current resistance of the modules are decisive here. Please refer to the manufacturer's data sheet for the current-carrying capacity.
2. The PV system is designed in such a way that the reverse current occurring in the event of a fault exceeds the destruction limit. In this case, each string must be fused individually using a string fuse switched in series. In the event of a fault, the line is isolated from the intact lines and destruction is prevented.

Note

Please note that fuses may be required in the module data sheet.

4.3 Communication

The Ethernet interface and the RS485 interfaces are used for remote monitoring of the SINVERT PVM inverters:

- Remote monitoring via SINVERT WebMonitor
- Standardized setting of setpoints for certain system configurations via the SINVERT PVM ControlBox

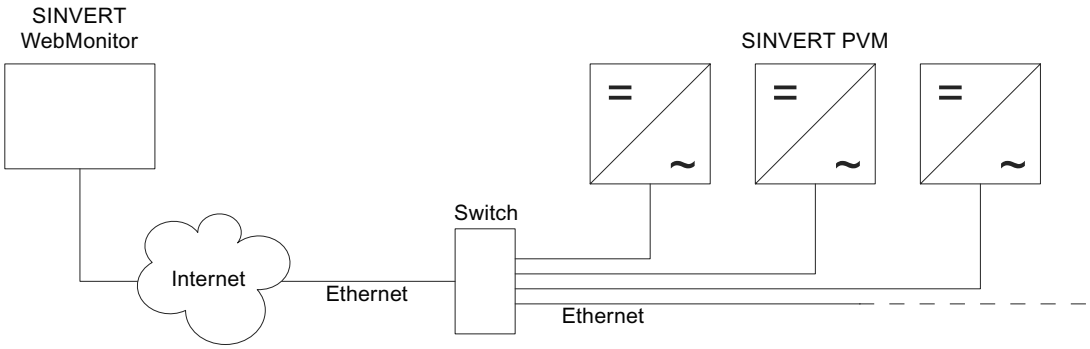


Figure 4-3 Communication via Ethernet

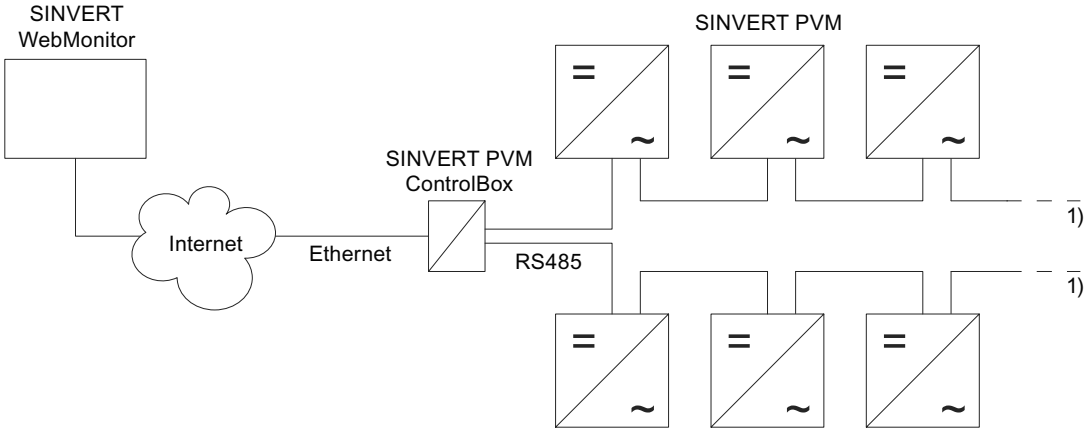


Figure 4-4 Communication via RS485 interface

Up to 31 devices can be connected to one RS485 bus.

4.4 Infeed into the AC system

Note

Possible EMC problems caused by inadequate grounding

In order to satisfy EMC standards, ground the inverter at the M8 grounding point with at least 10 mm²! The ground connection to the potential compensating line or ground spike must be as short as possible.

Infeed into the low-voltage system

TN-S system

In a TN-S system, the protective conductor PE is connected separately. Loads can be connected directly to PE.

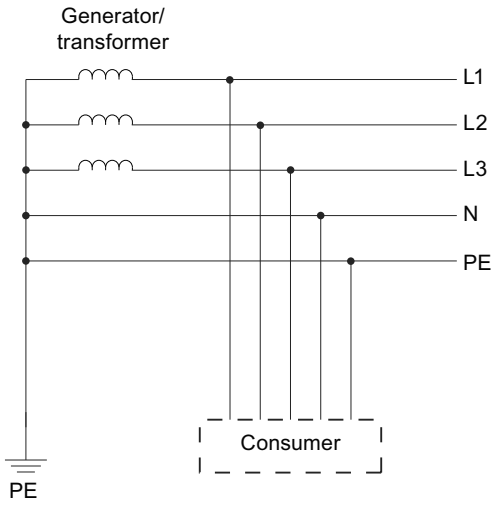


Figure 4-5 TN-S system

TN-C-S system

With a TN-C-S system, a PEN conductor is used that is simultaneously the protective conductor (PE) and the neutral conductor (N). At a certain point, the PEN conductor is divided into the neutral conductor and the protective conductor. Loads can be connected directly to PE.

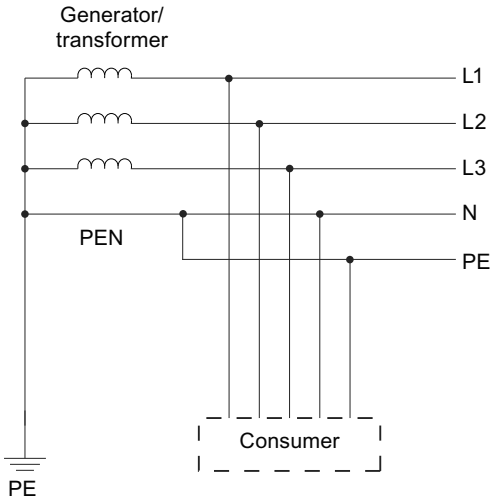


Figure 4-6 TN_C_S_system

TT system

In a TT system, there is no separate protective conductor PE. The load must be connected via ground.

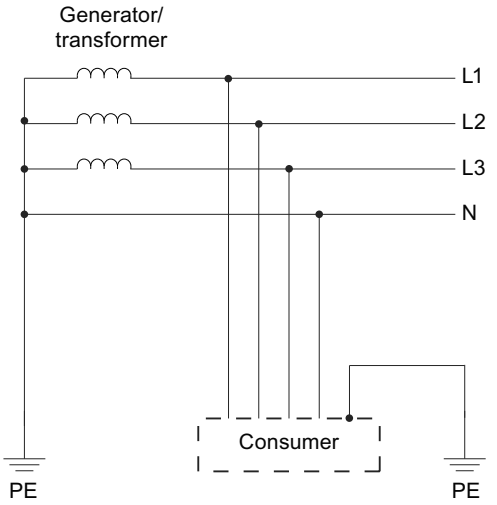


Figure 4-7 TT system

When it is connected to a TT system without a separate protective conductor PE, a separate PE cable with a cross-section of at least 10 mm^2 must be connected to and grounded on the SINVERT PVM inverter.

4.5 Feed-in management

EEG Guideline for PV plants

In accordance with the current amendment to the EEG (Renewable Energy Sources Act), PV plants in the Federal Republic of Germany must participate in feed-in management.
The primary significance of this ruling is that grid operators now have the option of reducing the power of the plant by remote means in the case of grid overload.

Feed-in management for PV plants larger than 30 kW

To enable grid operators to reduce the power output of a PV plant larger than 30 kW by remote means, you require technical equipment for remote-controlled power limitation, e.g. the SINVERT PVM ControlBox or the SINVERT PVM ParkControl with S7-1200.

Feed-in management for PV plants up to 30 kW

In the case of PV plants up to 30 kW, the operator selects whether to reduce the infeed to 70% of the rated power on a sustained basis, or to technically equip the plant for remote-controlled power limitation.

In the case of SINVERT PVM, a fixed limit value can be parameterized (see Chapter "Fixed limitation of the active output power (Page 86)").

4.6 Transportation

The devices must be transported in a clean and dry state, preferably in their original packaging.

- The transport temperature must be between - 25 °C and + 70 °C.
- Temperature fluctuations greater than 20 °C per hour are not permitted.
- The SINVERT PVM original packaging must be used for transport and storage.
- When transporting, the load must be protected against slipping and tipping.
- Transport with fork-lift truck and/or crane must only be carried out by authorized specialists.

NOTICE
Warranty exclusion in the case of improper transport or storage The product warranty and/or service warranty does not apply if the claim is made in respect to improper transport or improper storage.

Transport with euro pallet

In the upright position, a euro pallet encompasses four SINVERT PVM inverters. A maximum of two pallets can be stacked one on top of the other.

4.7 Storage

The devices must be stored in clean and dry rooms, preferably in their original packaging. The storage temperature must be between - 25 °C and + 55 °C. Temperature fluctuations greater than 20 °C per hour are not permitted.

Note

The SINVERT PVM inverter contains electrolytic capacitors. These capacitors can be stored at zero voltage for up to 2 years at a storage temperature of ≤ 40 °C.

If the storage period of two years is exceeded, please contact Service & Support before connecting the SINVERT PVM inverter to the system, see Technical support (Page 117).

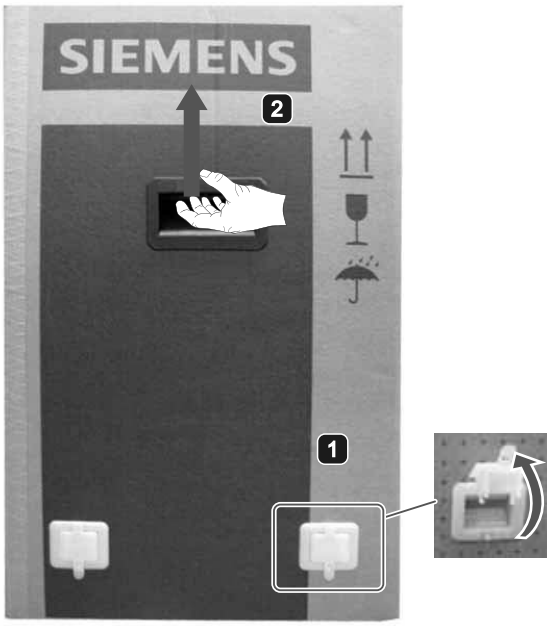
Installation

5

5.1 Unpacking the device

The devices are top-heavy and are therefore stored upside-down in the packaging for ease of transport. On opening the packaging, you will see the bottom of the device (device connections).

To unpack the device, follow the instructions on the packaging.

	Steps	Sketches
1	Pull the 4 clip fasteners on the carton out and up. • There are 2 on each face	
2	Lift the sleeve carton up using the two recessed grips.	

	Steps	Sketches
3	Lift the device up and out of the base section using the metal profiles on the side. • When setting the device down, ensure that the surface of the device is not scratched.	
4	Lift the retaining clip up and remove the wall bracket from the device.	

5.2 Requirements regarding the installation location

The SINVERT PVM inverter uses pure convection cooling, and is therefore designed for mounting on a vertical wall. Installation is carried out by means of a wall bracket.

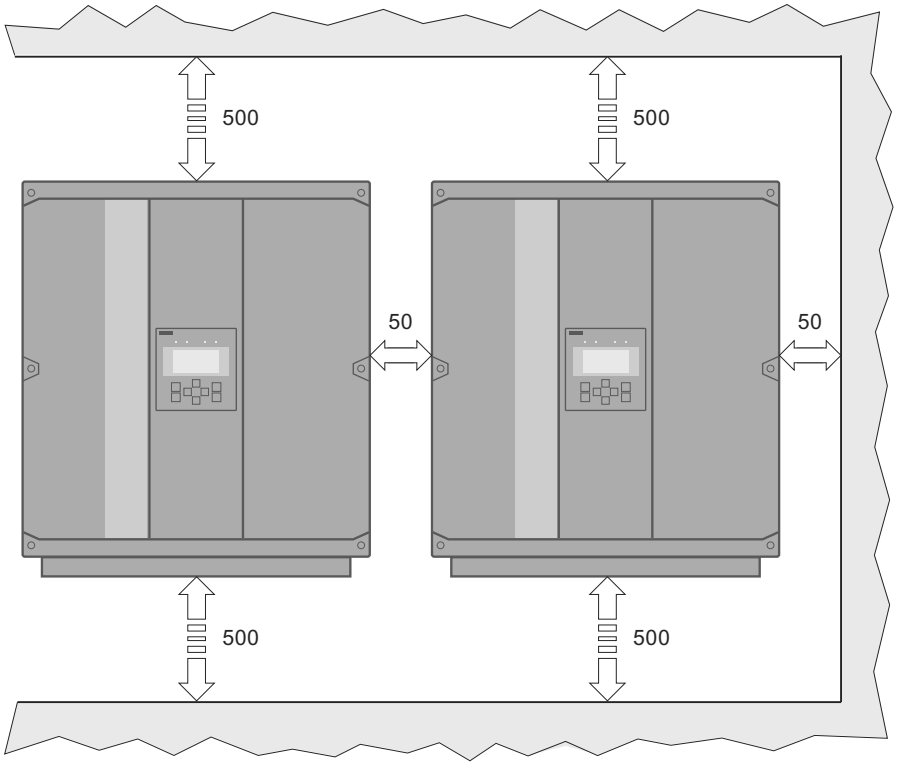
- The unit must be freely accessible for installation and service activities.
- A shaded installation location must be selected (no direct sunlight).
- Only vertical mounting is approved.
- Use a solid wall or metal structure. It must be ensured that module racks made of wood can bear the weight.
  Ensure that the wall is strong enough. At least 40 kg per unit is required.
- Maintain sufficient distance from flammable materials.

- Installation at eye level is recommended to facilitate operation.
- Outdoor installation is also possible thanks to IP65 degree of protection.

Note

To ensure the IP65 degree of protection, the connectors and sockets must be used to connect the SINVERT PVM, following the connector manufacturer's installation instructions. To protect against the ingress of moisture and dirt, unused inputs and outputs must be closed. Failure to follow this guideline may void the warranty!

- The rating plate must be legible since it contains important information, such as the activation code.
- The cooling fins on the heat sink must never be covered.
  Failure to follow this guideline may void the warranty.
- To allow the necessary heat dissipation, the following **minimum distances** to the ceiling and wall, or adjacent units, must be observed. If the minimum distances are violated, heat dissipation is reduced and thus also the inverter power.



At the side	50 mm
Up	500 mm
Down	500 mm

Figure 5-1 Minimum spacing

5.3 Installation of SINVERT PVM inverter

A supplied wall bracket is used in installation.

Note the following before installation

⚠ CAUTION

Improper handling can result in injury and damage

Improper handling can result in a device malfunction or even in serious injury as a result of crushing, jackknifing, cutting, bumping and fire.

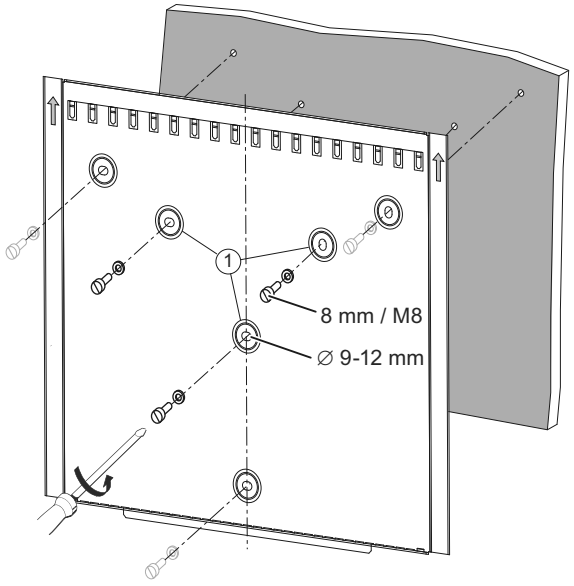
- The SINVERT PVM inverter's weight of approx. 40 kg must be taken into account.
- Appropriate care must be taken when transporting and installing.
- Two persons are required for installation.

NOTICE

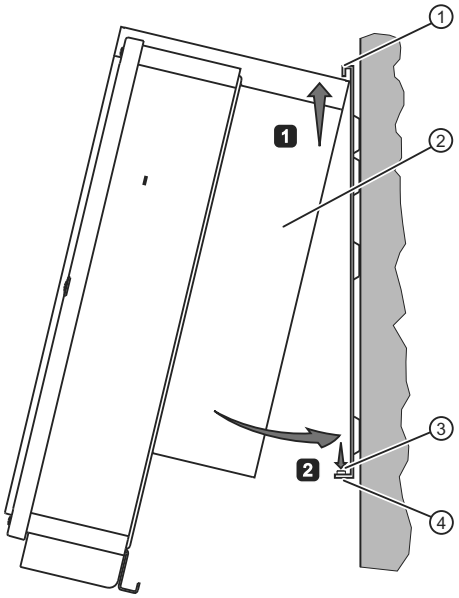
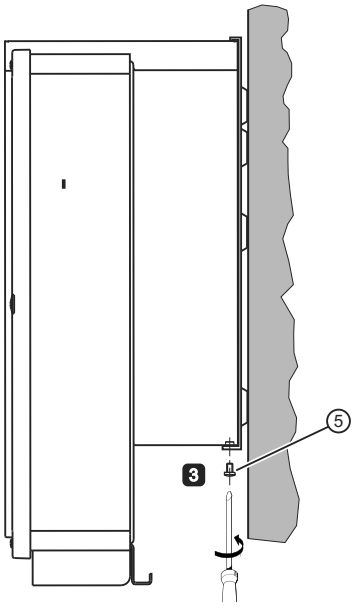
Do not put any weight on the edge of the cover when installing!

Never grip the device by the cover!
Use only the four hand grips for moving the device.

Installing the wall bracket

Wall bracket	Installation instructions
	• In setting up the wall mount, the weight of the SINVERT PVM inverter of approx. 40 kg must be accounted for. • Use the wall bracket as a drilling template to mark the drill holes. • If possible, use all the holes in the bracket, but at the very least use the middle three holes. • Screw the bracket firmly into place using suitable screws. • **Notice**! You must observe the correct mounting direction. The arrows on the wall bracket identify the upper edge.

Installing the inverter

Installation steps		
1	Hook the cooling channels of the inverter ② onto the tabs ① at the top on the wall bracket.	
2	Swing the SINVERT PVM inverter onto the wall and place it on the edge of the bracket ④. Then lift the inverter a little so you can reach the insert nut ③ and push the inverter all the way to the wall.	
3	Secure the SINVERT PVM inverter by inserting the screws (M5x20) ⑤ included in the accessory pack from below into the insert nuts of the wall bracket. • If the screws get lost, use only stainless steel screws as a substitute.	

Connecting

6

⚠ CAUTION

Safety hazards associated with using unsuitable PV modules

The SINVERT PVM inverter is not suitable for use with PV modules for which pole grounding is an essential requirement. Modules of this type must not be connected to the SINVERT PVM inverter. Failure to provide suitable grounding poses a safety risk to personnel and the installation itself.

Note

Loss of degree of protection

The IP65 degree of protection is retained only if you connect the connector from the accessory pack correctly. If you use different connectors, or the connectors are not properly connected, you lose the IP65 protection. Close all unused openings with blind plugs.

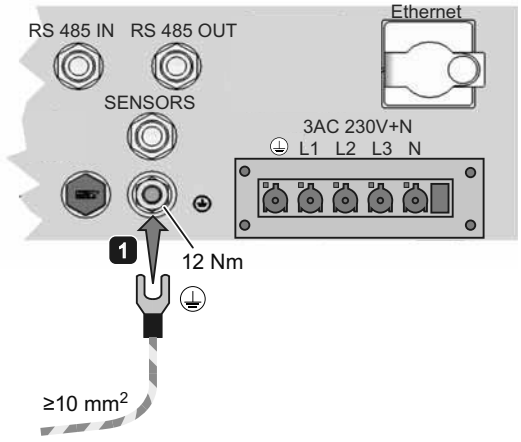
6.1 Grounding

Basic information regarding grounding

The SINVERT PVM inverter must be grounded. Otherwise, a difference in potential can arise resulting in a danger of electrocution.
If the grounding is insufficient, EMC problems can also result.

- The M8 threaded bolt is to be used on the connection side for grounding.
- Grounding can also be considered an overvoltage protection measure. Therefore, for grounding, choose a cable cross section that is larger than the cross section of the supply line (at least 10 mm ²).
- Correctly installed grounding of the module frame can be additionally used as equipotential bonding for overvoltage protection.
- Even if the AC connector is disconnected, the unit may still have live DC voltage.
  The unit is not grounded without the connection to the ground via the grounding bolt.
- The ground wire should be installed at the greatest possible distance to the mains supply line and not directly parallel to it. (Separate installation is necessary in order to prevent electromagnetic interference at the cables, i.e. injection of interference).
- The unit must be connected to a TN-S system where possible. When it is connected to a TT system without a separate protective conductor PE, a separate PE cable with a cross-section of at least 10 mm^2 must be connected to and grounded on the SINVERT PVM inverter.

Connect grounding

PVM unit connection	Installation steps
	1. Connect the SINVERT PVM inverter to ground using the indicated grounding bolt (8). – The grounding nut must be tightened applying a maximum torque of 12 Nm.

6.2 Choice of power supply cable

Selecting the cable cross-section

Select the cross-section of the AC grid connecting cable in such a way that the line losses are as low as possible.

The following points must be kept in mind:

- A finely stranded cable is recommended as the feeder conductor for all cross-sections as it is easier to work with.
- The cable gland of the supplied connector housing permits a maximum external diameter of the supply cable of 18 mm. This results in supply cables of up to 5 x 6 mm² (e.g. Lapptherm 145, 5 x 6 mm²).
- You can order a larger connector housing optionally that allows a maximum external diameter of the cable of 24 mm. This allows you to connect a cable of 5 x 10 mm², and 5 x 16 mm² if applicable. See Chapter Spare parts and accessories (Page 111)

Connector	Connection area of the connector housing
AC connector from the accessory pack	External diameter: 9 ... 18 mm
AC connector available as an accessory	External diameter: 14 ... 25 mm

- Resistive and inductive line losses must be ≤ 1%
- System inductance must be ≤ 30µH
- To guarantee degree of protection IP65, the connectors and connecting cables must match. Use the equipment from the accessories pack.

Maximum cable lengths

For a voltage drop ≤ 1% in the cables, the following guide values for cross-sections and cable lengths typically apply.

Cable cross-section	Maximum cable length				
	PVM10 4DC	PVM13	PVM17 4DC	PVM17 6DC	PVM20
6.0 mm²	43 m	43 m	31 m	27 m	27 m
8.0 mm²	57 m	57 m	41 m	36 m	36 m
10.0 mm²	72 m	72 m	52 m	44 m	44 m
16.0 mm²	114 m	114 m	82 m	71 m	71 m

System impedances with long single-core supply lines

To prevent high system impedances and unfavorable power grid conditions, the mains supply conductor must be twisted where possible.

If twisted installation is not possible, you must observe the following in all cases when installing the single cores:

- When installing single cores, a minimum gap must be maintained between the cores.
- Do not install the single cores in closed magnetically conductive materials (e.g. steel piping)
- Avoid installation along magnetically conductive materials

6.3 AC power connection

Connecting principle based on an example configuration

The figure below shows an example configuration of a PV system with the PVM inverter (5), including line protection (6), residual-current protection (7), and overvoltage protection (8).

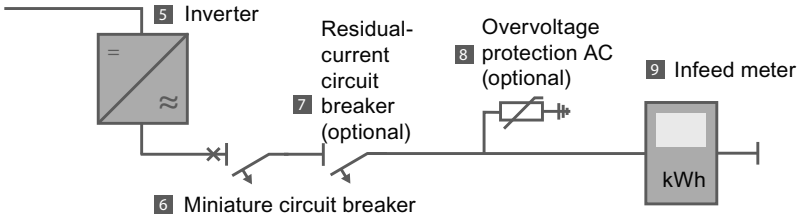


Figure 6-1 Example configuration of a PV system - AC side

Requirements using the example of Germany with low-voltage power system (Low-Voltage Directive - LVD)

- The following **standards** must always be observed:
  - IEC 60364-5-523: Current-carrying capacities in wiring systems
    As well as the relevant local standards such as DIN VDE 0298-4 for Germany
  - IEC 364-4-43: Erection of high-current systems with rated voltages up to 1000 V
  - IEC 364-4-473: Protective measures; protecting cables and lines against overcurrent
    As well as the relevant local standards such as DIN VDE 0100; Part 430 for Germany
  - IEC 60364-4-41: Protective measures and protection against electric shock
    As well as the relevant local standards such as DIN VDE 0100; Part 410 for Germany
- **Ground connection** is available.

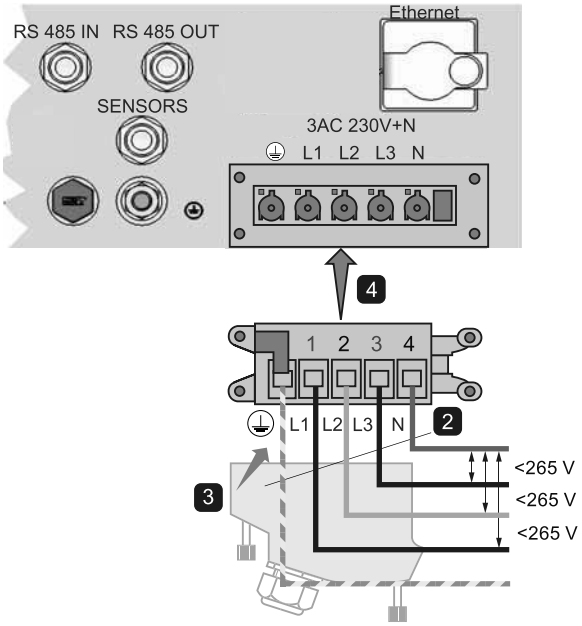
- The grid connecting cable must be equipped with a suitable **line protection** (6):
  - 32 A rated current, characteristic B (maximum rated device current: 29 A per phase)
  - Take account of reduction factors when wiring miniature circuit breakers in series.
  - Neozed fuses can also be used
  - With adequate cable cross-sections, line side switches with higher rated current can also be used.
- If additional residual current protection is explicitly requested for the PV plant, each inverter can be protected separately by means of a **residual-current circuit breaker** Type A (7).
  - Rated residual current per inverter: 100 mA
  - See also Chapter Residual current protection (RCD) (Page 53).
- In addition, the following points from the local **power supply company** should be observed:
  - The relevant technical and specific rules
  - There must be approval for the installation.
- Suitable **overvoltage protection** (8) is to be provided (optional).
- **The power connection is isolated** and a voltage-free state is ensured.

Connecting

WARNING

Danger to life due to electrocution on the AC power supply

Before connecting the SINVERT PVM inverter to the AC power supply, the power connection must be isolated, absence of power must be determined, and a safeguard must be provided to prevent it being switched on again.

Connection procedure		
1	Check that the line voltage complies with local regulations. If line voltages are too high, the responsible grid operator must provide a remedy.	
2	Insert the power cord connector on the supplied plug, following the diagram.	
3	Close the connector housing and tighten the cable gland to prevent the ingress of moisture.	
4	Connect the power connector on the SINVERT PVM inverter and screw the plug firmly into position.	
5	Provide all unused connections with dummy plugs to guarantee degree of protection IP65.	

6.4 Residual current protection (RCD)

The SINVERT PVMs are transformerless photovoltaic grid-connected inverters that meet the requirements for residual current protection in accordance with IEC 60364-7-712. They also comply with the local standards DIN VDE 0100-712 for Germany and CEI 64-8/7 for Italy.

If, however, additional residual current protection is requested for the PV plant, each SINVERT PVM inverter can be operated separately with a residual current circuit breaker (RCCB) of Type A, without impairing the functionality of the circuit breaker or the inverter.

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

⚠ WARNING

Protecting several inverters by means of an RCCB is dangerous to life

Each inverter must be separately protected by an RCCB. To protect a group of inverters by a single RCCB with a higher residual current rating could have potentially fatal consequences and is therefore prohibited.

6.5 Selection of the DC connecting cable

The PV generator is connected via the MC4 connectors and sockets built into the housing.

- To connect the PV cables, we recommend that only the original components from Multi-Contact are used (see Chapter Spare parts and accessories (Page 111)).
  Please note the manufacturer's installation instructions!
- MC4 circular connectors and sockets usually allow a cable cross-section of 4 - 10 mm².
- Short-circuit-proof PV supply lines are recommended.

NOTICE

Degree of protection IP65 only when using MC4 connectors

Degree of protection IP65 is only retained if MC4 connectors and MC4 sockets are used and correctly connected.

6.6 DC connection of the PV strings

Connecting principle based on an example configuration

The following figure shows an example configuration of a PV system with the PVM inverter (5).

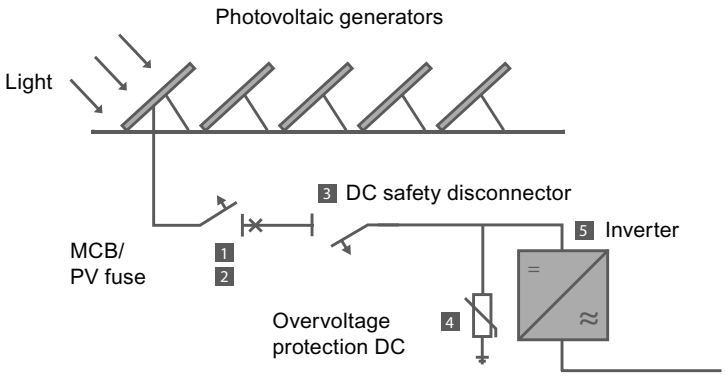


Figure 6-2 Example configuration of a PV system - DC side

Requirements

- The device is grounded.
- The device is connected to the AC supply and connected safely to PE.
- The PV strings are disconnected (3) or the no-load voltage is under 50 V.
- The DC disconnector on the inverter is switched to the "OFF" position.

Note

The MC4 unlocking tool for removing the PV cable must be provided

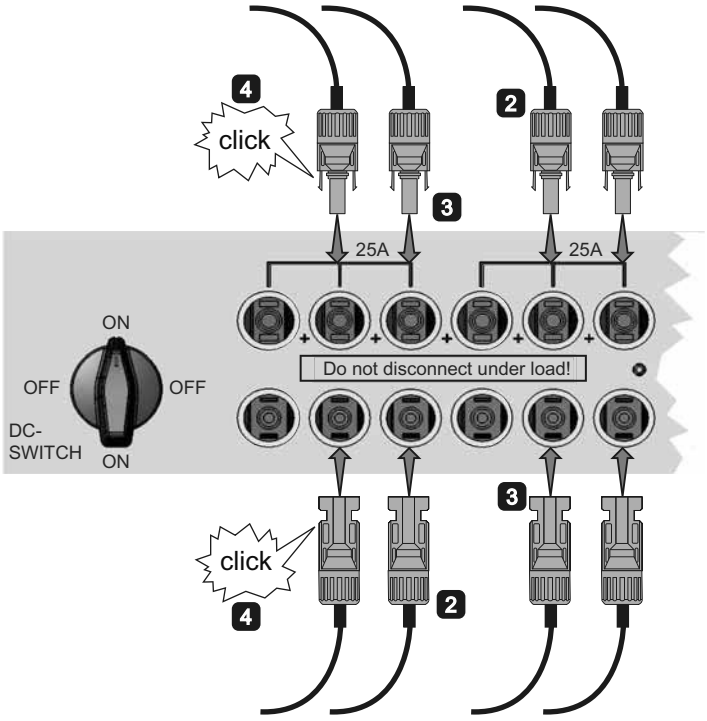
The use of unsuitable tools can cause considerable damage to the PV cables and the inverter and thus will immediately invalidate the warranty. Therefore the MC4 unlocking tool must be used for removing the PV cables.

Connecting

⚠ WARNING

Active PV strings can carry hazardous voltages!

- The PV strings must only be connected when power is disconnected, ideally in the dark when the PV strings are not active.
- The open-circuit voltage must therefore be checked before connecting the PV strings. This voltage must not exceed 50 V.
- The device itself is not damaged if DC voltage is applied when the PV strings are connected.

Connection procedure		
1	Check the PV strings to be connected for a possible ground fault. • Rectify any existing ground fault before connecting the PV strings to the inverter.	
2	Connect the MC4 connectors and sockets in accordance with the connector manufacturer's installation instructions. • Ensure correct polarity when connecting the PV strings. +pole on MC4 socket; -pole on MC4 connector • We recommend the use of the hand crimping tool from MultiContact for applying the crimp contacts. • You can find the ordering data of the MC4 connectors, sockets, and tools in Chapter Spare parts and accessories (Page 111) .	 Example: PVM with 6 PV inputs
3	Connect the PV strings to the provided device sockets. • If individual strings are connected incorrectly, module lines can be damaged. The SINVERT PVM inverter is protected by am integrated reverse polarity protection diode. • Use DC connecting plugs and sockets that are suitable for the cable diameter. If inadequate connectors are used, the enclosure's IP65 degree of protection cannot be guaranteed! • Several inputs are connected in parallel. The maximum permissible current of 25A for the contacts of the DC disconnector must be maintained. **Important**! Failure to do so can result in destruction of the DC disconnector.	
4	When inserting the MC4 connectors and sockets of the PV strings, it is essential that they latch so that they are protected against unintentional removal.	
5	Close unused connections with blanking plugs. Otherwise, the device's degree of protection (IP65) is not provided.	

6.7 Insolation sensor

An insolation sensor is available as an optional accessory.

To connect the insolation sensor, you require an associated connector.
You can find the ordering data for the insolation sensor and the connector in Chapter Spare parts and accessories (Page 111).

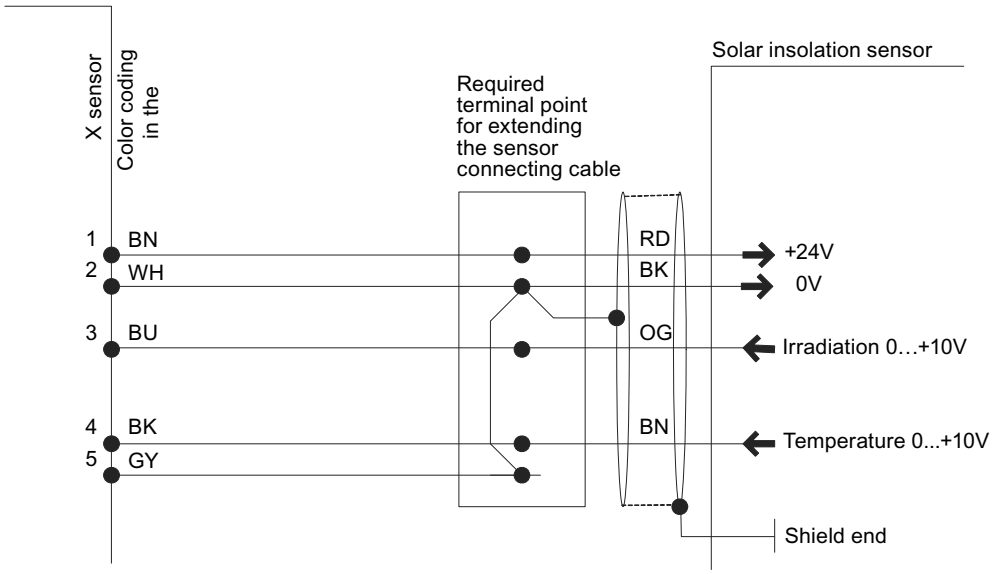


Figure 6-3 Connection of the insolation sensor

Table 6- 1 Terminal assignment

Color	Signal	Connector
Red	line voltage (12 to 24 V DC)	Pin 1
Black	GND	Pin 2
Orange	Measuring signal insolation (0 to 10 V)	Pin 3
Brown	Measuring signal temperature (0 to 10 V)	Pin 4
Shield	Shield	Pin 2 and pin 5

Note

Damage to the device or malfunction possible if shield not connected

The shield of the sensor cable must be applied to PIN 2 and PIN 5, otherwise malfunctions or damage to the device may occur.

6.8 Interface connection

RS485

To connect the RS485 interface, you require an associated connector.
You can find the ordering data for the RS485 connector in Chapter Spare parts and accessories (Page 111).

Table 6- 2 Terminal assignment

RS485 out		**RS485 in**	
Pin 1	Bus terminator +	Pin 1	Reference +
Pin 2	RS485+ out	Pin 2	RS485+ in
Pin 3	RS485- out	Pin 3	RS485- in
Pin 4	Bus terminator - / Ref.	Pin 4	Reference - / Ref.

The RS485 interface supports the USS (Universal Serial Interface) protocol that can be used for data transfer, for example, to a datalogger of a remote monitor.

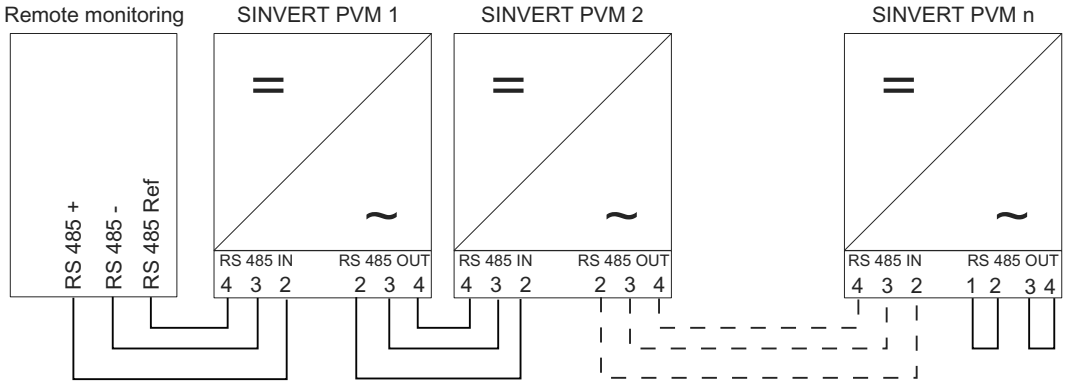


Figure 6-4 Connection of the standard interface

When operating this interface, you must ensure that every bus node receives a unique address, and that the correct data transfer rate is set with the relevant USS protocol.

Connecting cable

Use LiYCY 2x2x0.5 (max. 1000 m) as the connecting cable

Bus terminator

The bus must be terminated with 120 ohms at the RS485 out connection of the last bus node. You can use either the internal 120-ohm resistor or an external 120-ohm resistor for this purpose.

- Bus terminator with internal 120-ohm resistor:
  Short-circuit the following pins with two wire bridges:
  - RS485 out Pin 1 with RS485 out Pin 2
  - RS485 out Pin 3 with RS485 out Pin 4
- Bus terminator with external 120-ohm resistor:
  An external 120-ohm resistor is not included in the scope of supply.
  Connect a 120-ohm resistor between RS485 out Pin 2 and RS485 out Pin 3.

Overvoltage protection

At each connection point, we recommend the use of overvoltage protection or lightning protection
(e.g. 5SD7 5... from Siemens).

Ethernet

The Ethernet interface can be used to connect the inverter to a router, for example.

- One connector for degree of protection IP67 can be ordered as an accessory.
- Use a CAT5/6 patch cable with SFTP (shielded foiled twisted-pair) construction.

Overvoltage protection

Depending on the installation method, use of a suitable overvoltage protection device is recommended.

Commissioning 7

7.1 Prerequisites

The following activities must be completed before commissioning the SINVERT PVM inverter:

- Correct grounding (see Chapter Grounding (Page 48))
- Correctly installed power connection
- Correct installation of PV lines
- All connections are securely locked in place.

Important safety information for removing the PV cable

⚠ WARNING

Risk of electric shock when removing the PV cable

Remove the PV generator connectors only when the following conditions have been met:

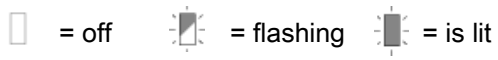
- Switch the DC disconnector on the SINVERT PVM to the "OFF" position.
- Disconnect the power supply and take measures to prevent the power being switched back on again.

7.2 Switching on the device and switch-on procedure

The overview below shows the switch-on and power-up procedure of the PVM and the accompanying status indicators.

Assuming that the PV array is receiving sufficient sunlight and there is no error present, the process described below should occur, which you can follow on the display.

Switching on the device and switch-on procedure		Status indicators on the PVM				Display information
		READY	ON	ALARM	GROUND FLT	
1.	Connect line voltage to the device (use external line fuse, or actuate miniature circuit breaker)					
2.	DC disconnector on the PVM inverter is at the "ON" position					
3.	Start of the inverter from a DC voltage of approximately 200 V • Status indicators, display and control keys are active. • Self-test (approx. 10 s) • Display information: "Power on disabled"					PAC UAC UDC E Day Power on disabled
4.	Selection of the country code - **One-off** (see below) **Recommendation**: Check the date and time of day on the inverter and ControlBox, and correct if applicable (synchronization of the system time)					
5.	Initialization • Check the conditions for grid connection (approx. 1 min) • Display information: "Power on disabled"					PAC UAC UDC E Day Power on disabled
6.	Activation of the inverter from a DC voltage of approximately 350 V The following DC tests are run (approx. 3 mins) 1. DC-link test 2. Symmetry monitoring 3. Insulation test Following a successful test, the name of the respective executed test appears on the display. If errors occur in one of the tests, the name of the executed test does not appear on the display (instigate troubleshooting)					*DC tests* PAC UAC UDC E Day Activation
7.	Start of infeed to the AC grid • The infeed power and line voltage are displayed • Display information: "Run"					PAC UAC UDC E Day Operation

 = off = flashing = is lit

NOTICE

Check the date and time of day following initial commissioning

Following initial commissioning, the date and the time of day must be checked and corrected if necessary to obtain a correct time stamp of the operating data logged by the data logger.

7.3 Selecting the country setting and menu language

The country setting determines the country-specific line monitoring parameters. In selecting the country setting, the menu language is set automatically. The menu language is then independent of the country setting and can be freely selected at any time using the menu.

No country setting is selected when the device is delivered.

NOTICE

The selected country setting can be changed by service personnel only!

After selecting and accepting the country setting, you can no longer change the country setting yourself. According to the regulations, the country setting can be changed by service personnel only.

If the unit has been in operation, the country setting is already selected. In this event, you will not be asked to enter the country setting. The country setting can be changed by service personnel only.

From firmware version FW27, the country setting can be modified within the first 40 operating hours via the menu command "Configuration->Country".

NOTICE

Withdrawal of operating permit

If you operate SINVERT PVM with an incorrect country setting, the electrical utility can withdraw your operating permit.
We assume no responsibility for the consequences of an incorrect country setting.

Commissioning is prohibited until the total system conforms to the national regulations and safety rules of the application.

Note

Resetting of an incorrect country setting is subject to a charge

Only Siemens can reset an incorrect and no longer modifiable country setting. Please note that this requires return of the device or local deployment of service personnel and this involves a cost.

Selecting the country setting

Immediately after switching on the DC power, the following window appears on the display and prompts you to select the country setting. You can choose among the countries listed. The term "country setting" itself does not appear in the menu.
The display is illuminated when a key is first pressed.

1. Choose the country-specific country setting for your location using the "▼" and "▲" keys.
   – By selecting the country setting, you also select the menu language.
   – The menu language can be changed at any time in the menu.
2. Confirm selection with the "ENTER" key

Note

Special features in the case of countries with several settings

There are three country settings for Germany:

- "Deutschland ENS" for feeding into the low-voltage network in the case of existing plants
- "Deutschland NSR" for feeding into the low-voltage network in accordance with VDE-AR-N 4105
- "Deutschland MSR" for feeding into the medium-voltage network via a medium-voltage transformer

When replacing devices previously set to the country code "Deutschland ENS", this country code must continue to be used.

For other countries with multiple settings, please contact the grid operator.

Accepting the country setting

For safety, a prompt appears asking whether you want to accept the choice of country setting. After accepting the country setting, you can **no longer** change the country setting yourself.

```
Accept ?
Yes       = Enter
No        = Esc
```

1. Only confirm the country setting if you are certain.
   - If you are not certain, abort the process by pressing "ESC". In this case, you cannot operate the unit, and you cannot continue to use the menu.
   - If you are certain you wish to accept the country setting, confirm it with "ENTER".

Changing the menu language

The choice of language has no effect on the country setting. To change the menu language, proceed as follows:

1. Press the "F1" key to call the menu.
2. Choose the menu command "Configuration" with the "↓" and "↑" keys.

```
Analysis
Actual values
Fault memory
Configuration
Inverter information


F1-Menu
```

3. Confirm selection with the "ENTER" key.
4. Choose the menu command "Languages" with the "▼" and "▲" keys.

```
Configuration
 Languages
 Limitation PAC
 Communication
 Date/Time
 Portal settings
 Password
 Extended
F1-Menu
```

5. Confirm selection with the "ENTER" key.
6. Choose the desired menu language with the "↓" and "↑" keys.
7. Confirm selection with the "ENTER" key.

   The menu switches to the desired language.

   The display is initially empty.
8. Press the "ESC" button to return to the menu.

7.4 Checking the time of day

If the electronic circuitry has been without line voltage for an extended period (approximately 2 to 3 weeks), the correct time of day may no longer be set.

Check the time of day and set the time as follows if required:

1. Call up the menu with "F1"
2. Select the menu command "Set clock" with the "▼" key
3. Use the "►" and "◄" keys to select Day, Month, Year, Hour, Minute and Second in sequence, and set the value with "▲" and "▼"
4. Confirm your input with "ENTER"

7.5 Activating WebMonitor

You need the activation code supplied with the device and printed on the rating plate to be able to monitor the inverter via the "SINVERT WebMonitor" web portal.

- The activation code is used to assign the SINVERT PVM inverter to the SINVERT WebMonitor web portal.
- The activation code is not required for commissioning the inverter.
- We recommend that you set up the WebMonitor as soon as possible after starting operation to avoid a later transfer of larger volumes of operating data.
- For further information about the inverter's communication settings and communication with the web portal, please refer to the available operating instructions in Chapter "Communication (Page 65) " and the operating instructions for the WebMonitor (see Technical support (Page 117)).

7.6 Communication

The "Communication" menu is used for configuring the Ethernet and RS485 interfaces.

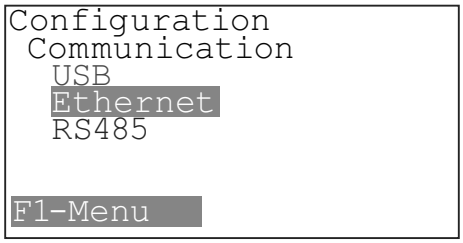


Figure 7-1 Communication menu

You will find an introduction to using the SINVERT PVM menu in Chapter Operator input (Page 71).

Note

Parameter settings are only applied after the inverter has been switched off and then back on again.

7.6.1 Enter user password

The user password is frequently required for configuring and for changing parameters.
It is "72555".

1. For this reason, select the menu command "Configuration / Password" before selecting the parameter to be changed.
2. Enter the user password "72555" as follows:
   - The digits must be entered from right to left.
   - That is, the cursor must be positioned manually to the left after entering each digit.

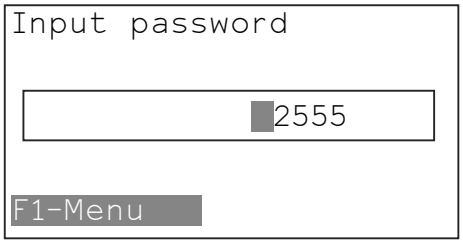


Figure 7-2 Enter password

7.6.2 Connecting a SINVERT PVM to the WebMonitor portal via Ethernet

7.6.2.1 Setting the IP address and standard gateway

What do I need to know in general?

Note

Parameter settings are only applied after the inverter has been switched off and then back on again.

Entering the IP address of the inverter

1. Enter the required IP address of the inverter under "Configuration/Communication/Ethernet/IP address".
   - Factory setting to FW29-08 is "192.168.0.123"
   - Factory setting from FW29-18 is "192.168.130.20"

Example: IP address 192.168.0.123

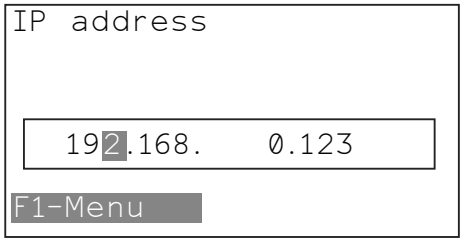


Figure 7-3 Display: Enter IP address

Setting the subnet mask

You do not usually have to change the subnet mask.

- The factory setting is 255.255.255.0.
- You can change the setting under "Configuration/Communication/Ethernet/IP subnet mask".

Example: Subnet mask: 255.255.255.0

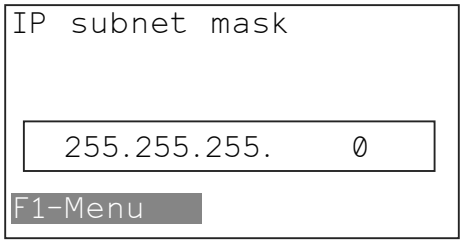


Figure 7-4 Ethernet: Enter subnet mask

Setting the standard gateway

1. Enter the IP address of the router in your LAN under "Configuration/Communication/Ethernet/Standard gateway".
   – The factory setting is "192.168.0.1".

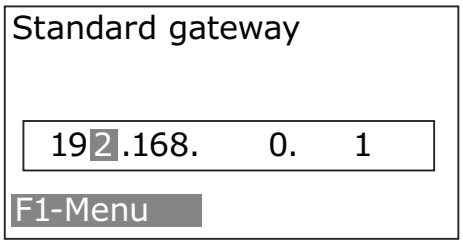


Figure 7-5 Standard gateway

Activating "Data transfer to portal" on the inverter

In the menu command "Portal settings -> Activation", you can set whether data is to be sent to the SINVERT WebMonitor.
The portal activation is deactivated on delivery (value = 0).

1. Set the value "1" under "Configuration -> Portal settings -> Activation".

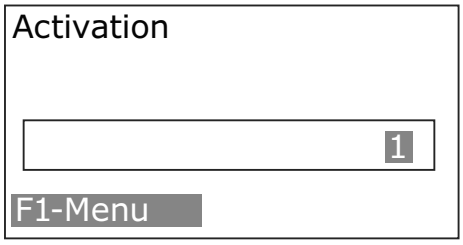


Figure 7-6 Portal activation

IP address assignment when using more than one inverter

1. If you are using more than one SINVERT PVM inverter, repeat the above steps for each of them.
   – Each inverter in the system must be assigned a dedicated IP address which has not previously been assigned.

Internet access to the SINVERT WebMonitor portal

The procedure for setting up Internet access to the portal and adding one or more inverters is described in the operating instructions for the SINVERT WebMonitor.

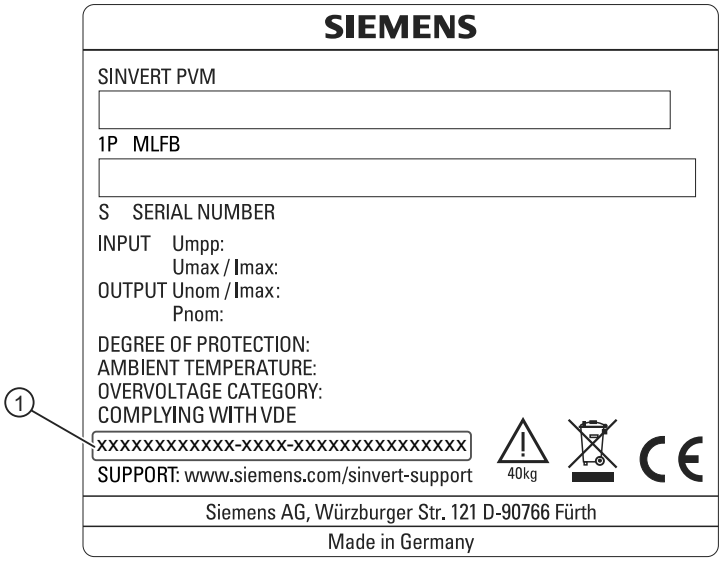
You will find the portal itself at:

SINVERT WebMonitor (https://www.siemens.de/sinvert-webmonitor)

7.6.2.2 Assignment in the web portal (activation code for the SINVERT WebMonitor)

You need an activation code to assign the SINVERT PVM in the SINVERT WebMonitor web portal. The SINVERT WebMonitor documentation contains more detailed information about this.

The activation code valid for your inverter is indicated on the SINVERT PVM rating plate (see the figure below). The rating plate is located on the right-hand side of the inverter. The activation code is not required for commissioning the inverter.



① Position of the activation code for the SINVERT WebMonitor

Figure 7-7 Rating plate with activation code

7.6.3 Connecting a SINVERT PVM to the Internet portal via RS485

The RS485 interface is used for connecting a PVM ControlBox or an external datalogger.

We recommend that you use the Siemens SINVERT WebMonitor web portal. However, you can also use other web portals such as SolarLog or MeteoControl for SINVERT PVM inverters.

Note

If you are using a SINVERT PVM ControlBox you can only use the SINVERT WebMonitor web portal.

Activating "Data transfer to portal" on the inverter

The following setting must be made or checked on the PVM for portal activation.

When using the PVM ControlBox:

When using a SINVERT PVM ControlBox, the parameter for portal activation must be set to "0".

- Ensure that the value "0" is set in the menu "Configuration -> Portal settings -> Activation". (The value is already factory-set to 0.)

When using an external web portal such as SolarLog or MeteoControl:

When using an external web portal such as SolarLog or MeteoControl, the parameter for portal activation is irrelevant. The default of "0" can be retained.

Monitoring using ControlBox, SolarLog or MeteoControl

To use ControlBox, SolarLog or MeteoControl to monitor the SINVERT PVM inverter, proceed as follows:

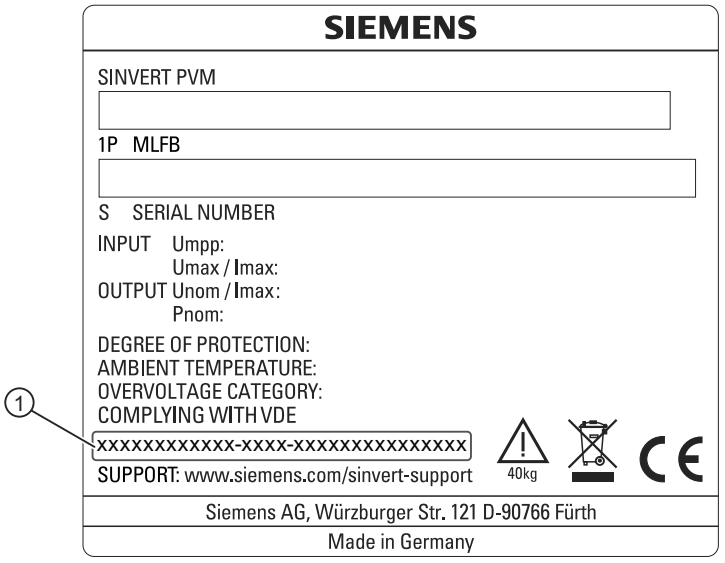
1. Press the "F1" key to call the menu.
2. Select the menu command "Configuration" with the "" and "" keys and press "ENTER".
3. Select the "Password" menu command and press "ENTER".
4. Enter the customer password 72555.
   – Enter the numbers from right to left: 5 5 5 2 7 and confirm with "ENTER".
5. Select the "Communication" menu command and press "ENTER".
6. Select the "RS485" menu command and press "ENTER".
7. Select the "USS address" menu command and press "ENTER".

8. Enter the required address for the inverter (1 to 31) and confirm with "ENTER".
   - We recommend setting consecutive addresses starting at 1, i.e. 1, 2, 3, etc.
   - The highest possible address is 31.
   - To apply the settings, switch the inverter off and then back on again.
9. Switch the SINVERT PVM off at the DC disconnector, wait about a minute, and then switch it back on again.

Assignment of the PVM in the "WebMonitor" portal (via ControlBox)

You need an activation code to assign the SINVERT PVM in the SINVERT WebMonitor web portal.

The activation code valid for your inverter is indicated on the SINVERT PVM rating plate (see the figure below). The rating plate is located on the right-hand side of the inverter. The activation code is not required for commissioning the inverter.



① Position of the activation code for the SINVERT WebMonitor

Figure 7-8 Rating plate with activation code

The SINVERT WebMonitor documentation contains more detailed information about the portal.

Assignment of the PVM in external web portals

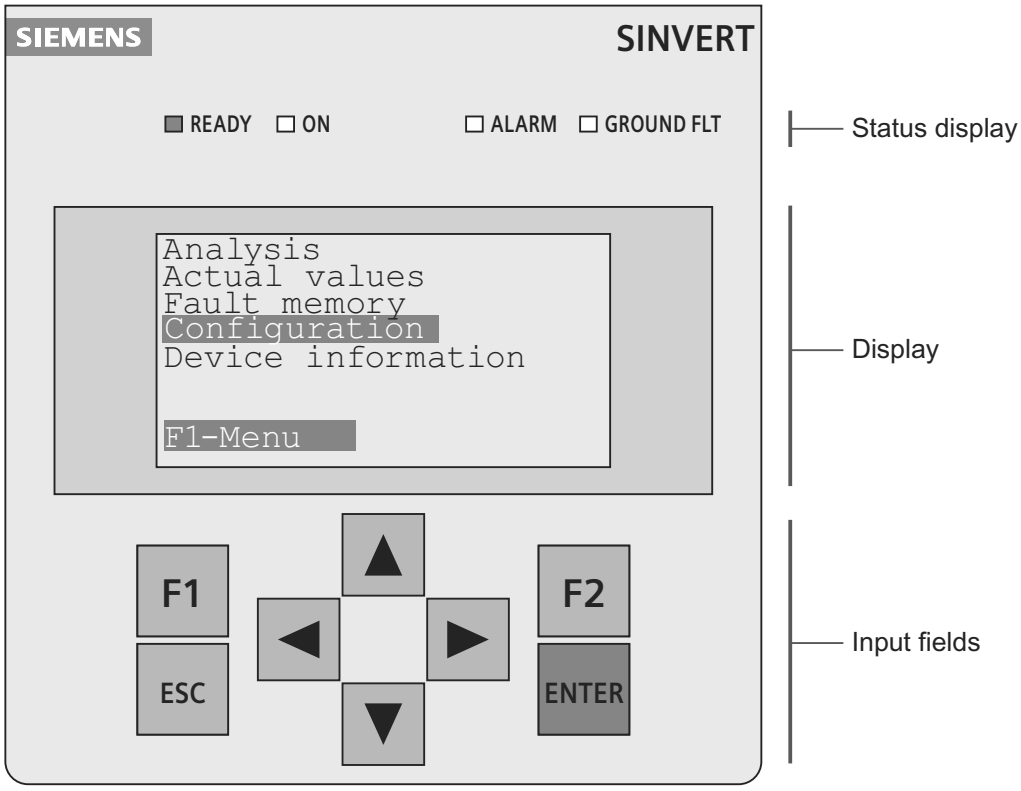
You can find information for the assignment of the SINVERT PVM inverter in the documentation of the relevant external web portals.

Operator input

8

8.1 Control elements and status display

Operator controls



Meaning of the operator controls

F1	Calling up the device menu
F2	Select entry of normalized energy data
▲ ▼	Selection
◄ ►	Function in the menu: Jump to first or last menu command Function in the case of parameter change: Position left, position right (skip screen)
ESC	Fault acknowledgement, entry deletion
ENTER	Confirmation of menu selection and input

Figure 8-1 Operator panel

You will find further information on the operator panel in the section Operator panel (Page 22)

Status display

The start screen is the status display. From here, you can call up the device menu and change to displaying the infeed power.

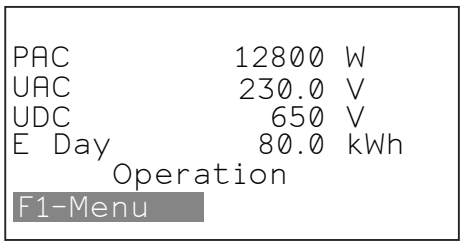


Figure 8-2 Display: Operation

P_{AC}: Instantaneous infeed power in watts (W)

U_{AC}: Line voltage in volts (V)

U_{DC}: PV array voltage in volts (V)

E Day: Daily energy in kWh

8.2 Overview of menu navigation

The following overview shows how you can go from the status display direct to the display of the energy data and infeed power level with the keys "◄" and "►".

The "F1" key takes you to the device menu. In the device menu, choose menu commands with the "▲" and "▼" keys, open submenus with "ENTER", and confirm entries with "ENTER". The "ESC" key cancels entries and takes you back to the next higher menu level.

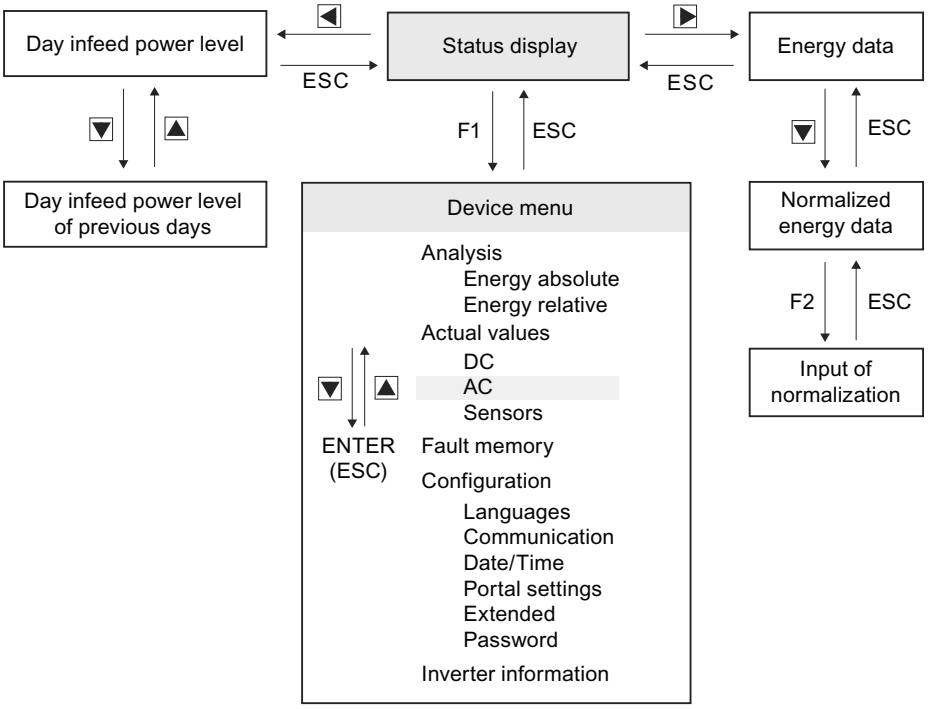


Figure 8-3 Menu navigation

8.3 Display of the infeed power and the energy data

Graphical display of the infeed power

Day infeed power level

To display the trend of the day infeed power level, press "◄" once.

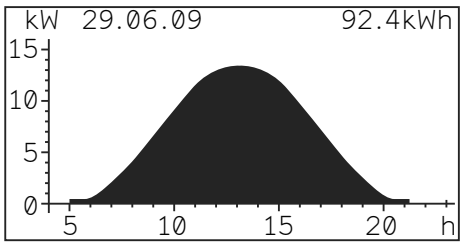


Figure 8-4 Example display

Infeed power level of previous days

To display the trend of the infeed power level for previous days, press "▼".

Return to the status display

To return to the status display, press "ESC".

Displaying the energy data

To show the current energy data, as well as the operating hours accumulated to-date, press "►" once.

Displaying the normalized energy data

To display the trend of the normalized energy data, press "►" once and "▼" once.

You can enter the actual connected generator power ("Power normalized") under the menu command "Numerical list" at Parameter P1155.

Return to the status display

To return to the status display, press "ESC".

8.4 Device menu

8.4.1 Overview

To display the device menu, press "F1".

The following menu commands are available:

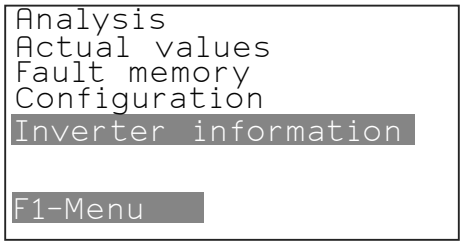


Figure 8-5 Device menu

8.4.2 Analysis

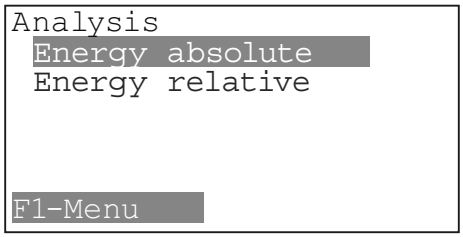


Figure 8-6 Analysis

You can choose whether the absolute energy or the relative energy is to be shown in the status display.

8.4.3 Actual values

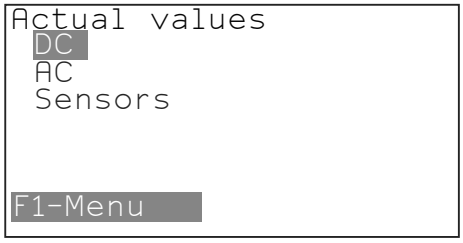


Figure 8-7 Actual values

Current measured values of the device. The status display also shows some of these values.

Parameter	Description
D1100	DC link voltage
D1104	Voltage of the PV array
D1105	Output current of the PV array
D1106	Fed-in line power (Watts)
D1107	PV array power (Watts)

8.4.4 Fault memory

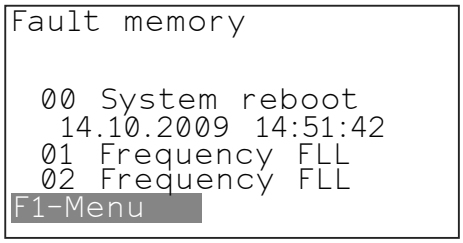


Figure 8-8 Fault memory

Indication of whether there is a fault in the controller or the power stack. The error message appears on the display. You can find more detailed information about current error messages and about the error message memory in Chapter Faults (Page 94).

- The fault memory is a circular buffer and can store up to 99 messages.
- The latest messages are shown on the display.
- Navigation to older error messages is via the arrow keys.
- With the left/right arrow keys, you can switch between date/time-of-day of the error message and the digital fault code of the error message.

8.4.5 Configuration

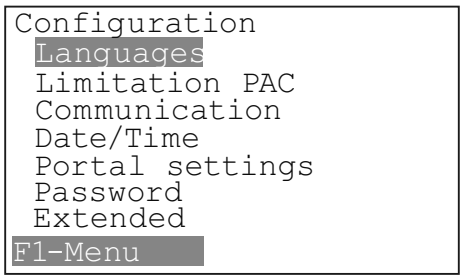


Figure 8-9 Configuration

Note

Parameter settings are only applied after the inverter has been switched off and then back on again.

Languages

The "Languages" menu is used for selecting the menu language. The choice of language has no effect on the country setting. For more details, see Section Selecting the country setting and menu language (Page 61).

Communication

The "Communication" menu is used for configuring the Ethernet and RS485 interfaces. For more details, see Chapter Communication (Page 65).

Date/time

The menu is used for setting the date and time. See Section Checking the time of day (Page 64).

Portal settings

You can use this menu command to set whether data is to be sent to an external portal, e.g. the SINVERT WebMonitor. The portal settings are deactivated on delivery. For more details, see Section Setting the IP address and standard gateway (Page 66).

Advanced

This menu contains menu commands for service purposes and is not significant for normal operation. For more details, see Section Specific parameter assignment via numerical list (Page 79).

Password

A password is required to change parameters. For more details, see Section Enter user password (Page 65).

8.4.6 Inverter information

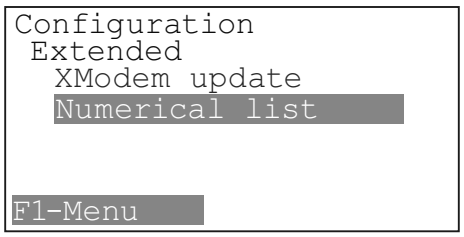
Contains information about the device, e.g. the firmware version.

Parameter assignment

9

9.1 Specific parameter assignment via numerical list

Specific parameter assignment of the SINVERT PVM is carried out via the menu "Configuration -> Extended -> Numerical list".



This function is intended only for technical personnel and specialists.

Numerical list

The "Numerical list" contains all the parameters of the Sinvert PVM.
Individual parameters can be displayed and modified (parameterized) via this list.

Display of the parameters

In various menu commands, the display shows parameters starting with a "P" or "D".

- You can monitor and set values that start with a "P".
  "P" stands for "programmable": Programmable
- You can only monitor values that start with a "D".
  "D" stands for "display": Can only be displayed

Procedure

1. Select the relevant parameter number with the help of the cursor control keys, and confirm with "Enter".
   The current value of the parameter is displayed.
2. To change parameters, confirm again with "Enter".
3. Then enter the desired value in the input window with the help of the cursor control keys.
   – Authorization using the valid password is a precondition for input
   (see the tables below).

Visualizable parameters

The parameters listed below are relevant operating values that can only be displayed. They cannot be adapted.
(Some of these values are also displayed direct in the device menu.)

Param. No.	Parameter name	Unit
0092:00	Heatsink temperature right	° C
0092:01	Internal device temperature top left	° C
0092:02	Internal device temperature bottom right	° C
0092:03	Heatsink temperature left	° C
0501	Current status • 0 = Initializing • 1 = Switched off • 2 = Activating • 3 = Ready • 4 = Operation • 5 = Stoppage • 6 = Transient fault • 7 = Failure	--
1104	DC voltage	Volts
1105	DC current strength	Amperes
1106	AC power	Watts
1107	DC power	Watts
1121:00	AC voltage peak L 1	Volts
1121:01	AC voltage peak L 2	Volts
1121:02	AC voltage peak L 3	Volts
1122:00	AC frequency L1	Hertz
1122:01	AC frequency L2	Hertz
1122:02	AC frequency L3	Hertz
1123:00	AC effective voltage average value	Volts
1124	AC current strength: Total L1 + L2 + L3	Amperes
1141:00	AC current strength L 1	Amperes
1141:01	AC current strength L 2	Amperes
1141:02	AC current strength L 3	Amperes
1150	Daily energy	kWh
1151	Total energy	kWh
1152	Operating hours	Hour
1153	Monthly energy	kWh
1154	Annual energy	kWh
1155	Rated output of the PV array	kWp
1162	Power limitation	Tenth %

Param. No.	Parameter name	Unit
1191 [1)]	Insolation sensor	Watt / m²
1193 [1)]	Temperature sensor	° C

[1)] Temperature sensor or temperature measurement of the insolation sensor, if available

Note

Note measuring tolerance of ± 2%

The measuring tolerance of the displayed values is approx. ± 2%.

Modifiable parameters

The parameters listed below can be displayed and changed.
The list of these parameters differs depending on the firmware version.

Parameters for FW25/26

Par.No.	Parameter name	Default	Unit
51 [3)]	Device-specific offset that is added to the angular offset.	0.07	Degree
1164 [2)]	Selection menu for entering the angular offset. • 0: Offset values (device-specific and plant-specific) are added together and set as the value for the angular offset. (P51 and P1165). • 1: Value of angular offset fixed P1166 is accepted. • 2: Value of angular offset variable P1167 is accepted. • 3: Cos phi as a function of the power: P1168; • 4: Cos phi as a function of P1169; The offset values of P51 and P1165 are added to all variants of angular offset specification from 1 to 4.	0	--
1165 [2)]	Plant-specific offset that is added to the angular offset.	0	Degree
1166 [2)]	Static value of the angular offset; added to the offset values, the resulting value is limited to ±30 degrees.	0	Degree
1167 [2)]	Variable value of the angular offset; added to the offset values, the resulting value is limited to ±30 degrees.	0	Degree

Par.No.	Parameter name	Default	Unit
1168:xx [2]	Angular offset as a function of the instantaneous rated power. The values of the X axis are permanently entered percentages of the rated power of the device.		Degree
1168:00	- 0% of the rated power of the device.	0	
1168:01	- 10% of the rated power of the device.	0	
1168:02	- 20% of the rated power of the device.	0	
1168:03	- 30% of the rated power of the device.	0	
1168:04	- 40% of the rated power of the device.	0	
1168:05	- 50% of the rated power of the device.	0	
1168:06	- 60% of the rated power of the device.	0	
1168:07	- 70% of the rated power of the device.	0	
1168:08	- 80% of the rated power of the device.	0	
1168:09	- 90% of the rated power of the device.	0	
1168:10	- 100% of the rated power of the device.	0	
	The 11 values of the angular offset, entered in 0.01 degrees, form the interpolation points of the curve to be traversed.		
	The angular offset is limited to arcos(0.90) = ±2584, after the addition of both offset values P51 and P1165.		
	Positive angular offset -> inductive phase shift Negative angular offset -> capacitive phase shift.		
1190:xx [1] [2]	Sensor input 1 configuration		
1190:00	Offset	0	mV
1190:01	Scaling of numerator	130	W/m²
1190:02	Scaling of denominator	1000	mV
	Example: Insolation sensor [:00]: 0 for 0 mV offset [:01]: 130 for 130 W/m² to 1000 mV [:02]: 1000 for 1000 mV		
1192:xx [1] [2]	Sensor input 2 configuration		
1192:00	Offset	-2268	mV
1192:01	Scaling of numerator	1	° C
1192:02	Scaling of denominator	87	mV/° C
	Example: Temperature sensor [:00]: -2268 for -1840 mV offset [:01]: 1 for 1 ° C [:02]: 87 for 87 mV / ° C		

[1] Temperature sensor or temperature measurement of the insolation sensor, if available

[2] The user password is required for this parameter

[3] The service password is required for this parameter

Parameters from FW27

Par.No.	Parameter description	Default [2]	Unit
51 [5]	Device-specific offset that is added to the angular offset.	0.07	Degree
0158 [3]	Lower voltage limits for voltage monitoring.	261.01	Volts
0159 [3]	Duration of monitoring of lower voltage limits	200	Milliseconds
0160 [3]	Upper voltage limits of voltage monitoring	374	Volts
0161 [3]	Duration of monitoring of upper voltage limits	200	Milliseconds
0162 [3]	Lower limits of frequency monitoring	47.5	Hertz
0163 [3]	Duration of monitoring of lower frequency limits	200	Milliseconds
0164 [3]	Upper limits of frequency monitoring	51.5	Hertz
0165 [3]	Duration of monitoring of upper frequency limits	200	Milliseconds
0166 [3]	Lower voltage limits of voltage average monitoring	0	Volts
0167 [3]	Duration of monitoring of lower voltage limits of voltage average monitoring	5999	Milliseconds
0168 [3]	Upper voltage limits of voltage average monitoring	357.7	Volts
0169 [3]	Duration of monitoring of upper voltage limits of voltage average monitoring	600000	Milliseconds
0170 [3]	Lower voltage limits of external conductor monitoring	450.62	Volts
0171 [3]	Duration of monitoring of lower voltage limits of the external conductor monitoring	200	Milliseconds
0172 [3]	Upper voltage limits of external conductor monitoring	647.77	Volts
0173 [3]	Duration of monitoring of lower voltage limits of the external conductor monitoring	200	Milliseconds
0174 [3]	Rates of frequency change for ROCOF monitoring	0	Millihertz/ second
0175 [3]	Monitoring times for ROCOF monitoring	0	Milliseconds
0176 [3]	Setting for drift in stand-alone operation. Values from -30 degrees to +30 degrees can be entered.	0	Degree
0177 [3]	Above this frequency, the active power is reduced if frequency-dependent power reduction is activated.	50.2	Hertz
0178 [3]	Recovery frequency; if this frequency is undershot, the power is increased again if frequency-dependent power reduction was previously active. If this value is equal to zero, the power is increased or reduced in accordance with the LV Directive dependent on the frequency.	0	Hertz
0179 [3]	Active power gradient for reducing the active power in the case of frequency-dependent power reduction	0.4	-

Par.No.	Parameter description	Default [2]	Unit
0180	Period after commissioning during which the country code can still be changed (in operating hours)	40	Hours
0181 [3]	This factor describes the proportion of reactive current during an LVRT (low-voltage ride through) in accordance with the formula: Delta U / U_{Rated} * k factor = Delta $I_{Reactive}$/ I_{Rated}	2	-
0182 [3]	Defines the duration of the power ramp traversed following a power failure.	600 000	Milliseconds
0183:xx 0183:00 [3] 0183:01	Defines the power-on limits for the line voltage. Only if the line voltage is within the defined limits can the device go to infeed mode. Lower voltage limit Upper voltage limit	 276.4 357.7	Volts
0184:xx 0183:00 [3] 0184:01	Defines the power-on limits for the frequency. Only if the line frequency is within the defined limits can the device go to infeed mode. Lower frequency limit Upper frequency limit	 47.5 50.05	Hertz
0185 [3]	Gradient with which the power can be increased after power reduction due to overfrequency has been active.	0.1	--
1020	Gradient limiting	60	Seconds
1140 [5]	Ideal sine	200	Tenth %
1163 [4]	Continuous power reduction as a percentage of the rated power specified by the customer. The value of the limitation must not exceed 100%.	100	%
1164 [4]	Selection menu for entering the angular offset. • 0: Offset values (device-specific and plant-specific) are added together and set as the value for the angular offset. (P51 and P1165). • 1: Value of angular offset fixed P1166 is accepted. • 2: Value of angular offset variable P1167 is accepted. • 3: Cos phi as a function of the power: P1168; • 4: Cos phi as a function of P1169; The offset values of P51 and P1165 are added to all variants of angular offset specification from 1 to 4.	0	--
1165 [4]	Plant-specific offset that is added to the angular offset.	0	Degree
1166 [4]	Static value of the angular offset; added to the offset values, the resulting value is limited to ±30 degrees.	0	Degree
1167 [4]	Variable value of the angular offset; added to the offset values, the resulting value is limited to ±30 degrees.	0	Degree

Par.No.	Parameter description	Default [2]	Unit
1168:xx [4]	Angular offset as a function of the instantaneous rated power. The values of the X axis are permanently entered percentages of the rated power of the device.		Degree
1168:00	- 0% of the rated power of the device.	0	
1168:01	- 10% of the rated power of the device.	0	
1168:02	- 20% of the rated power of the device.	0	
1168:03	- 30% of the rated power of the device.	0	
1168:04	- 40% of the rated power of the device.	0	
1168:05	- 50% of the rated power of the device.	0	
1168:06	- 60% of the rated power of the device.	0	
1168:07	- 70% of the rated power of the device.	0	
1168:08	- 80% of the rated power of the device.	0	
1168:09	- 90% of the rated power of the device.	0	
1168:10	- 100% of the rated power of the device.	0	
	The 11 values of the angular offset, entered in 0.01 degrees, form the interpolation points of the curve to be traversed. The angular offset is limited to arcos(0.90) = ±2584, after the addition of both offset values P51 and P1165. Positive angular offset -> inductive phase shift Negative angular offset -> capacitive phase shift.		
1180 [5]	The minimum power from which a transition is made from partial load operation to full load operation. The value is entered as a percentage of the rated power.	11	
1190:xx [1] [4]	Sensor input 1 configuration		
1190:00 1190:01 1190:02	Offset Scaling of numerator Scaling of denominator Example: Insolation sensor [:00]: 0 for 0 mV offset [:01]: 130 for 130 W/m² to 1000 mV [:02]: 1000 for 1000 mV	0 130 1000	mV W/m² mV
1192:xx [1] [4]	Sensor input 2 configuration		
1192:00 1192:01 1192:02	Offset Scaling of numerator Scaling of denominator Example: Temperature sensor [:00]: -2268 for -1840 mV offset [:01]: 1 for 1 ° C [:02]: 87 for 87 mV / ° C	-2268 1 87	mV ° C mV/° C

[1] Temperature sensor or temperature measurement of the insolation sensor, if available

[2] Default values using the example of Deutschland ENS

[3] For this parameter, the password for country settings is required in conjunction with SINVERT PVM InverterConfig

[4] The user password is required for this parameter

[5] The service password is required for this parameter

9.2 Reactive power control

The following methods are available for reactive power control:

- Reactive power specification via a cos φ static value
- Reactive power specification via a variable cos φ value
  This control can only be implemented with the PVM ControlBox.
- Reactive power specification via a cos φ power characteristic curve
- SINVERT PVM ParkControl

Defining the reactive power specification

Reactive power specification is defined via parameters 1164 - 1169 (see Chapter Specific parameter assignment via numerical list (Page 79)).

- cos φ static value -> Parameter 1164, 1166
- cos φ power characteristic curve -> Parameter 1164, 1168
- SINVERT PVM ParkControl -> Set parameter P1164 to "2"

You can find further information on reactive power specification via a variable cos φ value

- in the operating instructions of the SINVERT PVM ControlBox, in the chapter Commissioning - Configuration with "PVM ControlBox Config" - menu "Configuration" - Reactive power specification.
- SINVERT PVM ParkControl documentation

9.3 Fixed limitation of the active output power

Reduction in the active output power to a fixed value is possible using the menu **F1 → Configuration → Limitation PAC**.

- The value corresponds to the percentage number of the maximum power.
  Example: Enter the value 70 to reduce the actual power to 70% of the maximum possible output power.
- The user password is sufficient for parameterization.
- After input, switch off the inverter via the DC disconnector, and switch it on again after one minute.

Service and maintenance

10

10.1 Maintenance

The SINVERT PVM inverters are maintenance-free.

The following cleaning work must nevertheless be carried out at regular intervals to guarantee smooth operation of the device.

- Check regularly that the cooling ducts on the rear of the inverter are free from coarse dirt.

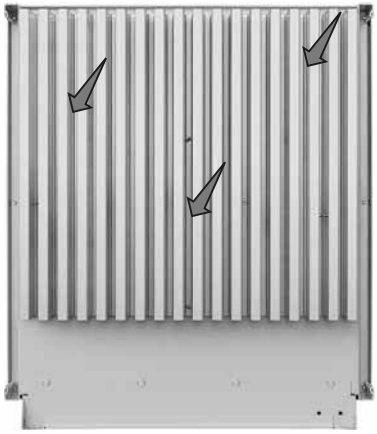
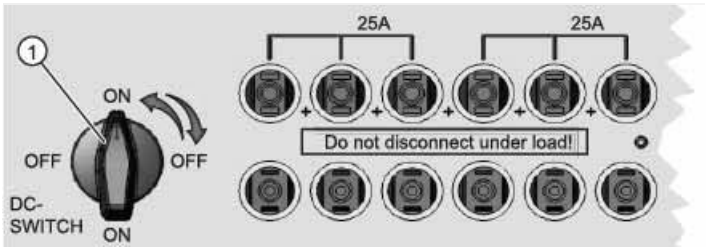


Figure 10-1 Checking cooling ducts

- Do not use abrasive cleaning agents to clean the operator panel. Use a dry cloth or water.
- Operate the DC switch-disconnector ① at least once a year to prevent dirt accumulating on the contacts.



10.2 Inverter replacement

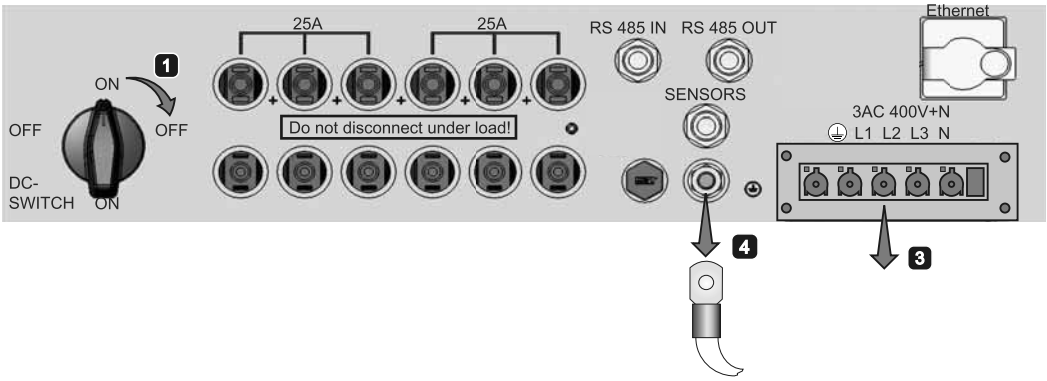
Unpacking the replacement inverter

You have to return the old inverter in the packaging in which you receive the replacement inverter. Therefore, when unpacking the replacement inverter, take note of how the package is assembled.

See also Chapter Unpacking the device (Page 41).

Decommissioning the old inverter

Decommissioning steps



1	Set the DC switch on the underside of the inverter to "OFF".
2	Switch the AC mains connection to the voltage-free state and make sure there is no power
3	Remove the AC mains connector from the old inverter.
4	Disconnect the ground connection from the grounding bolt of the inverter
5	Remove all remaining connectors from the old inverter • The connectors must be reconnected in the same way on the replacement inverter. Therefore, mark the connectors accordingly if necessary.

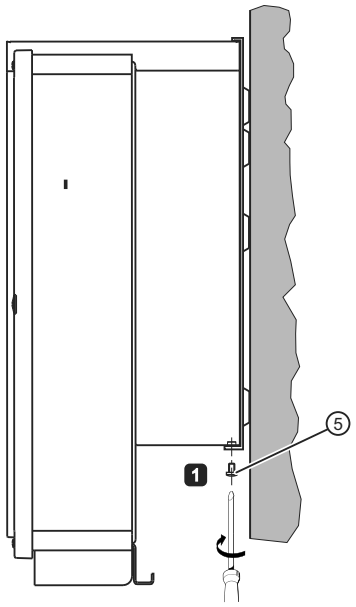
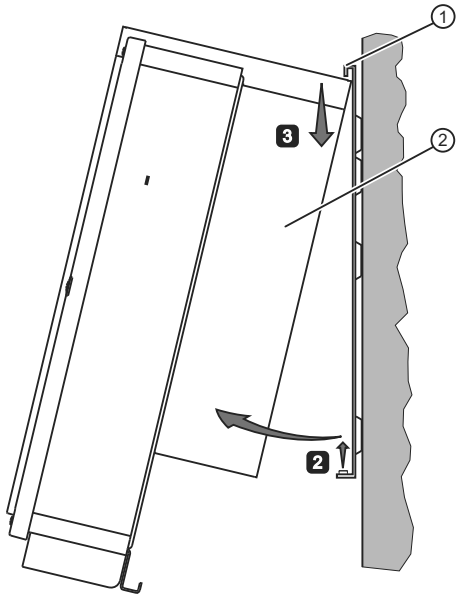
⚠ CAUTION

Risk of injury and damage to connectors caused by improper handling

If the connectors are not removed correctly they may sustain damage. The function of the inverter would no longer be assured.

- Do not pull on the cables.
- For the connectors at the DC inputs, use an unlocking tool for MC4 connectors. Without the unlocking tool, you can injure yourself when removing the connectors and you can damage the connectors.

Disassembling the old inverter

Disassembly steps		Sketches
1	Loosen the two screws ⑤ which attach the inverter to the wall bracket from below (see also Chapter Installation of SINVERT PVM inverter (Page 44)). • Please note that the SINVERT PVM inverter weighs approx. 40 kg.	
2	First, lift the inverter ② slightly and then swing the lower section forward.	
3	Then move the inverter down a little to release its cooling ducts from the tabs of the wall-mounting bracket ①.	
4	Set the inverter down in such a way that it cannot topple over or get scratched. Damage to the inverter can incur additional costs	

Installing the new inverter

Installation steps	
1.	Set the DC switch on the underside of the replacement inverter to "OFF".
2.	Mount the replacement inverter on the wall bracket. • Follow the safety instructions and the information on how to proceed described in Chapter Installation of SINVERT PVM inverter (Page 44):
3.	Connect the replacement inverter. • Make all of the connections as designated on the replacement inverter. • More information on connecting can be found in Chapter Connecting (Page 47)

Commissioning the new inverter

The settings on the replacement inverter must be aligned with your PV system.

Steps for commissioning	
1.	Set the DC switch on the underside of the inverter to "ON".
2.	Make the correct country setting.
3.	Set the date and time of day.
4.	Check the settings on the inverter.

You will find information on commissioning in Chapter Commissioning (Page 59).

Activating the replacement inverter on the WebMonitor

Steps for activating the WebMonitor	
1.	Change the inverter activation code in the WebMonitor. • See Chapter Assignment in the web portal (activation code for the SINVERT WebMonitor) (Page 68).

- The data of the old inverter is replaced with the data of the replacement inverter.
- The historical statistical data of the old inverter is retained.
- If you do not update the activation code when you replace the inverter, data may be lost.

See also

Technical support (Page 117)

10.3 Disposal

Note

The SINVERT PVM inverter is RoHS-compliant. This means the device can be disposed of at local sites for the disposal of household devices.

Troubleshooting 11

11.1 Self-test - error messages

The system carries out a self-test following the initialization routine. The individual parts of the microcomputer system, such as the firmware and the data set, are checked here and the data read in by the power control board. Possible remedial measures can be derived from the type of fault.

11.2 Transient fault

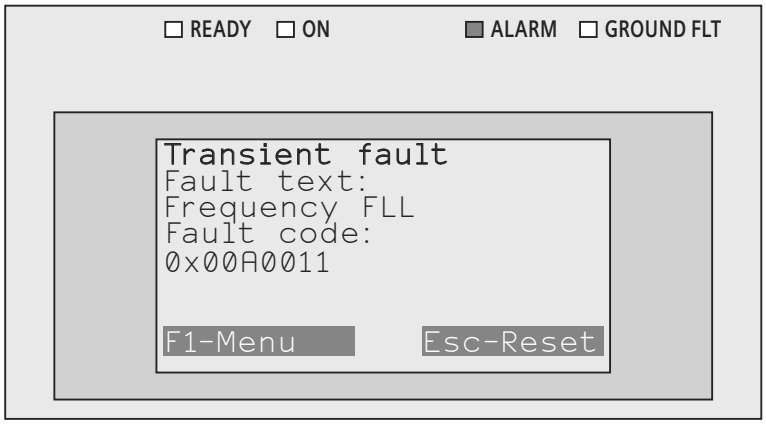


Figure 11-1 Transient fault

When certain faults occur, the inverter temporarily goes off-grid.

In contrast to faults, the "transient fault" is automatically acknowledged by the inverter and a new power-up attempt is made when the cause has been removed.

After a transient fault, the red status LED **ALARM** on the operator panel flashes. The associated error message is saved in the fault memory, safe from power outages. If there is a fault, the status LED **ALARM** is lit continuously. See section Faults (Page 94).

11.3 Faults

Permanently programmed and parameterizable limit values are continuously monitored during operation. To protect the power module of the SINVERT PVM inverter against damage, it is switched off-circuit when a limit value is exceeded or when a fault occurs. The appropriate error message is displayed.

In the event of a fault, the red status LED **ALARM** on the operator panel flashes.

Error messages are saved in the fault memory, safe from power outages. The fault memory is called via the display. The last 120 faults are stored in the fault memory. The last fault is stored in memory location S0, and the oldest is stored in S119. A new fault is always stored in memory location S0. All older faults are shifted up one location in the memory. The fault previously stored at S119 is lost.

11.4 Isolation faults

In the event of an isolation fault, the **GROUND FLT** status LED lights up.
The error message 0x0A010C (Gen.-Isolation LT) appears on the display.

⚠ WARNING

Risk of electric shock and fire

An isolation fault must be remedied as soon as possible. The fault must only be remedied by electrical technicians.

The isolation resistance must be greater than 1.05 Mohms.

11.5 Acknowledging a fault

Following a shutdown on faults, restart of the device is locked until the fault has been acknowledged. While the cause of the fault is still active, acknowledgment is not possible. Only when the cause of the fault has been removed can the fault be acknowledged.

- To acknowledge the error message, press "ESC"
  or
- switch the SINVERT PVM inverter off and on again at the DC switch.

11.6 Error messages

The list below contains all possible error messages, their causes, and how to rectify them.

Note

Information on controller voltage errors

"Controller voltage" errors can also occur in the case of rapid insolation changes and at sunrise and sunset.

If controller voltage errors occur frequently (more than 3 a day), contact the service department.

Error code	Error message	Cause	Remedy
0x000000	Error management	Internal error	Restart
0x030002 (196610 dec.)	Parameter error 1	Internal error	Contact the service department
0x030005 (196613 dec.)	Parameter error 2	Internal error	Contact the service department
0x030006 (196614 dec.)	Parameter error 3	Internal error	Contact the service department
0x040001 (262145 dec.)	Internal communication	Internal error	Single occurrence: Restart Multiple occurrences: Contact the service department
0x040010 (262160 dec.)	System error 1	Internal error	Contact the service department
0x050000 (327680 dec.)	System error 2	Internal error	Single occurrence: Restart Multiple occurrences: Contact the service department
0x060001 (393217 dec.)	Wrong time	RTC not initialized (possibly low voltage). Inverter supplies with the wrong time of day since the real-time clock has not been initialized	Set time of day
0x070000 (458752 dec.)	Update login	Internal error	Restart
0x070001 (458753 dec.)	Update is running	Internal error	Restart
0x080001 (524288 dec.)	Wrong time	Initialization of the real-time clock was not correct so the datalogger does not log in.	Set time of day
0x090001 (589825 dec.)	System restart	Initialization requires longer than 10 minutes	Single occurrence: Restart Multiple occurrences: Contact the service department
0x0A0000 (655360 dec.)	FPGA firmware	Internal error	Contact the service department

Error code	Error message	Cause	Remedy
0x0A0001 (655361 dec.)	Controller voltage 1	Asymmetry DC link "POS": This can happen at initial startup if the electrolytic capacitors are not yet formed.	At initial startup, leave the inverter in the fault state for 2-3 hrs. If it does not acknowledge automatically: Contact the service department
0x0A0002 (655362 dec.)	Controller voltage 2	Asymmetry DC link "NEG": This can happen at initial startup if the electrolytic capacitors are not yet formed.	At initial startup, leave the inverter in the fault state for 2-3 hrs. If it does not acknowledge automatically, contact the service department
0x0A0003 (655363 dec.)	Controller voltage 3	Asymmetry DC link "LOW": Possible at initial startup if the electrolytic capacitors are not yet formed. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0004 (655364 dec.)	Controller voltage 4	Asymmetry DC link "HIGH": Possible at initial startup if the electrolytic capacitors are not yet formed. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0005 (655365 dec.)	Controller voltage 5	Undershoot of the positive stepped-up DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0006 (655366 dec.)	Controller voltage 6	Undershoot of the negative stepped-up DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0007 (655367 dec.)	Controller voltage 7	Undershoot of the positive DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0008 (655368 dec.)	Controller voltage 8	Overshoot of the positive DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department

Error code	Error message	Cause	Remedy
0x0A0009 (655369 dec.)	Controller voltage 9	Undershoot of the negative DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A000A (655370 dec.)	Controller voltage 10	Overshoot of the negative DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A000B (655371 dec.)	Controller voltage 11	Overshoot of the positive stepped-up DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A000C (655372 dec.)	Controller voltage 12	Overshoot of the negative stepped-up DC link voltage. Fault can also be triggered by controller perturbances (e.g. rapidly changing insolation). It is therefore only relevant if it occurs several times.	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A000D (655373 dec.)	Overvoltage	Detection of line overvoltage (system phase overvoltage), possibly caused by switching operations on the grid	Re-measure line voltage; contact the service department if the line voltage is in the normal range:
0x0A000E (655374 dec.)	Line undervoltage	Detection of line undervoltage (voltage ride through), possibly caused by switching operations on the grid	Re-measure line voltage; contact the service department if the line voltage is in the normal range: Check AC fuse
0x0A000F (655375 dec.)	Overvoltage phase	Detection of line overvoltage on the external conductor; possibly caused by switching operations on the grid	Re-measure line voltage; contact the service department if the line voltage is in the normal range:
0x0A0010 (655376 dec.)	Undervoltage phase	Detection of line undervoltage on the external conductor; possibly caused by switching operations on the grid	Re-measure line voltage; contact the service department if the line voltage is in the normal range:
0x0A0011 (655377 dec.)	Frequency FLL	Detection of a line fault (FLL)	Check the frequency and line voltage; contact the service department if the frequency is in the normal range: Check AC fuse
0x0A0012 (655378 dec.)	Line frequency	Detection of a frequency fault (ENS)	Check the frequency; contact the service department if the frequency and the line voltage are in the normal range. Check AC fuse
0x0A0013 (655379 dec.)	PV isolation AFISR	Isolation fault of the control section	Check the isolation of the plant.

Error code	Error message	Cause	Remedy
0x0A0014 (655380 dec.)	No national code	Country code not set.	Set country code Contact the service department if required
0x0A0016 (655382 dec.)	Inferior frequency	Detection of undershoot of the line frequency	Check the frequency and line voltage; contact the service department if the frequency is in the normal range
0x0A0017 (655383 dec.)	Country not admitted	Country to be set is unknown.	Contact the service department
0x0A0018 (655384 dec.)	Voltage error max	The line voltage was too long above the limit value of Parameter 168 (Umax) of the voltage average monitoring	Check limit values
0x0A0019 (655385 dec.)	Voltage error min	The line voltage was too long below the limit value of Parameter 166 (Umin) of the voltage average monitoring	Check limit values
0x0A0100 (655616 dec.)	Power sec error mess	Group fault signal	Further faults are present. See fault memory.
0x0A0101 (655617 dec.)	System fault LT 1	Internal error	Contact the service department
0x0A0102 (655618 dec.)	Overtemperature LT 1	Temperature error	Check ambient temperature. Allow the inverter to cool down, acknowledge fault. Multiple occurrences: Contact the service department
0x0A0103 (655619 dec.)	Overtemperature LT 2	Temperature error	
0x0A0104 (655620 dec.)	Overtemperature LT 3	Temperature error	
0x0A0105 (655621 dec.)	Overtemperature LT 4	Temperature error	
0x0A0106 (655622 dec.)	Supply voltage LT	Internal error Also caused by strong changes in insolation	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0108 (655624 dec.)	Frequency LT	Line frequency fault; Possibly incorrect country code	Check the line frequency and line voltage; contact the service department if the frequency is in the normal range:
0x0A0109 (655625 dec.)	Overvoltage LT	Line overvoltage detection of the power unit	Re-measure line voltage; contact the service department if the line voltage is in the normal range:
0x0A010A (655626 dec.)	Undervoltage LT	Line undervoltage detection of the power unit	Re-measure line voltage; contact the service department if the line voltage is in the normal range:
0x0A010C (655628 dec.)	PV isolation LT	Inverter detects an isolation fault, ground fault in the plant	Check the isolation of the plant, Eliminate the ground fault, can also occur due to moisture alone (connectors not sealed tight) or the system will only run after it has dried out.
0x0A010D (655629 dec.)	Grid iso LT PEF	Residual current detection	Contact the service department

Error code	Error message	Cause	Remedy
0x0A010E (655630 dec.)	Device fault LT	Overload tripping without power unit See also 0x0A0106	Occasional occurrences: Wait until the controller has stabilized again. Frequent occurrences: Contact the service department
0x0A0110 (655632 dec.)	PV voltage LT 1	Overvoltage tripping of the power unit in the positive DC link	Check the solar cell voltage. Multiple occurrences: Contact the service department
0x0A0111 (655633 dec.)	PV voltage LT 2	Overvoltage tripping of the power unit in the negative DC link. PV voltage too high, too many PV modules switched in series	Check the solar cell voltage. Multiple occurrences: Contact the service department. Check and if necessary correct system dimensioning
0x0A0113 (655635 dec.)	Country setting LT	Internal error	Contact the service department
0x0A0114 (655636 dec.)	PV isolation AFILT	Isolation fault detection of the power unit	Check the isolation of the plant
0x0A0115 (655637 dec.)	AFI warning	Isolation fault detection of the power unit	Check the isolation of the plant
0x0A0117 (655639 dec.)	Iso meter defective	Internal error	Contact the service department
0x0A0118 (655640 dec.)	Voltage offset LT	Internal error	Contact the service department
0x0A0119 (655641 dec.)	Current sensor LT	Detection of failure of the current sensors of the power unit This can be caused by extreme controller perturbances	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011A (655642 dec.)	Activation LT 1	DC fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011B (655643 dec.)	Activation LT 2	Undershoot of the minimum DC voltage	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011C (655644 dec.)	Activation LT 3	Symmetry fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011D (655645 dec.)	Activation LT 4	Symmetry fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011E (655646 dec.)	Activation LT 5	DC link fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A011F (655647 dec.)	Parameter fault LT 5	Internal error	Contact the service department

Error code	Error message	Cause	Remedy
0x0A0120 (655648 dec.)	Communication LT	Internal communication fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A0121 (655649 dec.)	DC-offset	DC fault	Single occurrence: Acknowledge fault. Multiple occurrences: Contact the service department
0x0A200D (663565 dec.)	Over temperature 6	Excess temperature shutdown	Check ambient temperature, check cooling. Allow the inverter to cool down, acknowledge fault. Multiple occurrences: Contact the service department
0x0B0001 (720897 dec.)	System 1	Internal error	Contact the service department
0x0B0002 (720898 dec.)	System 2	Internal error	Contact the service department
0x0B0003 (720899 dec.)	System 3	Internal error	Contact the service department
0x0D0001 (851969 dec.)	System error	Internal error	Restart
0x0D0002 (851970 dec.)	Power sec bootloader	Internal error	Contact the service department
0x0D0003 (851971 dec.)	System restart	System has been restarted to carry out a firmware update	Information only
0x100001 (1048577 dec.)	Ethernet connection 1	Ethernet connection buildup failed; connection could not be established	Check Ethernet connection, check IP address, check server address, check server port
0x100002 (1048578 dec.)	Ethernet connection 2	Connection termination Ethernet; socket could not be established.	Check Ethernet connection
0x100003 (1048579 dec.)	Ethernet connection 3	no 100 Mbit/s Ethernet connection	Establish Ethernet connection at 100Mbit/s
000A0111	PV voltage LT	PV voltage too high; too many PV modules are connected in series	Check and if necessary correct system dimensioning

11.7 Plant faults

The tables below contain possible plant faults or malfunctions, their causes, and possible remedies.

DC faults

Possible fault	Solution/cause/result
Reverse DC polarity	No function - no danger for inverters
DC less than 250 V	No function since switched-mode power supply not active (line voltage)
DC greater than 1000 V	Destruction of the PVM! - Inverter does not protect itself
Strings with different voltages (incorrect dimensioning)	• Equalizing currents between the panels via connector/switch • Yield loss • Danger of damage to the PV modules and the PVM
Strings connected to each other with reverse polarity	Equalizing currents between the panels -> yield loss, danger of damage to the PV modules
DC insulation fault	• Insulation resistance DC to ground <1.05 MΩ undershot • Device does not switch on, check PV array • Usually weather-dependent – wait until the modules are dry • Plant problem (modules parasitic capacity to ground) • With persistent faults: Switch off and check strings individually (Iso check)
DC strings not correctly connected	Danger of arcing -> charred MC4 contacts, lower DC output
300 V DC to U_{mpp} min	Operation possible at reduced power max. power of the step-up converter -> efficiency reduced, temperature rise in the device
DC string fuses (external) tripped	Short-circuit in the PV array or incorrect or insufficient DC string fuses (external) -> Dimensioning

AC faults

Possible fault	Solution/cause/result
Only one phase with N conductor	Actual value display AC ~ 120 Vac No infeed
Only 2 phases with N conductor	Actual value display AC ~ 165 Vac No infeed
3 phase without N conductor	Transient fault line frequency and/or line voltage (N is the reference for voltage and frequency measurement)
Phase voltages too low/too high	Observe actual value AC
Line voltage too high during operation	Observe voltage drop of the AC cable at high power, cable cross-section!
AC fuses/MCBs tripped	Short-circuit on the AC side; note: Inverters have no increased startup current
Automatic RCCB tripped	Type A for AC residual current; 100 mA per inverter; operational discharge current in excess of 100 mA results in shutdown due to universal-current-sensitive residual current protection in the inverter!
Other devices on the grid are disturbed (e.g. Saeco coffee machine)	• Check protective conductor connection of the PVM for line filter neutral point; • Grounding also connected to the M8 grounding bolt? • EMC filter of the other devices sufficient? • Remedy: Line filter from LGF Please contact SINVERT Service Note: PVM meets all EMC requirements!
Line undervoltage detected on an external conductor	One of the causes of the fault is switching operations on the grid. • Re-measure line voltage, • check fuses.
No line voltage or frequency detected	Check line voltage/frequency/fuses.
Line undervoltage detected (Inverter draws insufficient AC voltage)	• Power failure; • check AC voltage and correct if necessary
Line overvoltage detected (Inverter draws too much AC voltage)	Possibly triggered by switching operations on the grid; • check AC voltage and correct if necessary, • check AC fuse, • check country settings
Frequent shutdown due to line overvoltage	• Larger conductor cross-section • cosPhi (0.9…..1.0) • Adaptation of the medium-voltage transformer (voltage reduction on the medium-voltage transformer) • If necessary, instruct the power supply utility to examine grid conditions

Possible fault	Solution/cause/result
Increased grid impedance/voltage distortions/ high-frequency faults/ increased operating noise of the inverters (error messages: Controller voltage/frequency/line overvoltage)	Select twisted-pair installation of the mains supply conductor. In the case of single cores (twisted-pair installation not possible): • Installation with minimum gap • Do not install in closed magnetically conductive materials (e.g. steel piping) • Avoid installation along magnetically conductive materials • Filter capacitors (e.g. Epcos Type B32356) between L1/N, L2/N and L3/N, guidance value capacitance 2.5-3uF per inverter, installation in subdistribution board; fusing using separate 16A/32A MCBs. In plants without PEN conductors (only PE), the capacitors from L1…L3 must be wired to the neutral point, and from the neutral point again to PE with an X capacitor of the same size.
Whistling noises and vibrations	Causes: • on long cables high impedance, in association with the fed-in current no longer satisfactory control. • With short cables to the medium-voltage transformer: Resonance with internal or additional capacities possible. • From FW26, the current controller is faster and also more sensitive to grid parameters. Remedy: • Connecting the PE bolt • If still possible, two cables in parallel or sectoral cable • Bunch single cores tightly, do not spread over large areas • Filter capacitors (e.g. Epcos Type B32356) between L1/N, L2/N and L3/N, guidance value capacitance 2.5-3uF per inverter, installation in subdistribution board; fusing using separate 16A/32A MCBs. In plants without PEN conductors (only PE), the capacitors from L1…L3 must be wired to the neutral point, and from the neutral point again to PE with an X capacitor of the same size.

Device faults

Possible fault	Solution/cause/result
No function	• Check switch, switch on if necessary; • Measure DC voltage in the PV array
MC4 contacts not correctly plugged in	Danger of arcing -> charred MC4 contacts, lower DC output
Switched-mode power supply/current controller module/ inverter module defective	No display, no function • Return inverter for repair
Current controller card stalled in boot mode	Yellow, green and red LEDs on the control panel show constant light • Return inverter for repair
No display or partial display, but device functioning	Display defective • Return inverter for repair
DC overlvoltage detected	Device switches off at Udc > 950V.
AC overvoltage detected	Voltage drop on AC lines too high (cross-section too small, high impedances); Inverter switches off in accordance with ENS limits
Controller voltage	Symmetry of the DC link electrolytic capacitors (startup phase 2 weeks); control characteristics of the step-up converter in the case of a "serious" change in insolation; In the case of frequent occurrences -> Return the inverter
Inverters switch off "sporadically", error messages such as overvoltage/undervoltage/frequency/ device fault LT; whistling noises	High-frequency faults on the AC side; caused by resonances due to excessively high line impedance or "unfavorable" network topology (power output/impedance/cables); Remedy: MK/X2 capacitors (3uF/device) between Lx and N + 16A. Install protection in subdistribution board
No data logger function	Set Parameter P0450 to the value 1 for data logger function
Device not starting up (Switching On Inhibited)	Parameter P0405.02 must be at the value 3
Damp in device	Device has been opened -> No warranty claim in the case of consequential damage

Device faults (communication)

Possible fault	Solution/cause/result
Problems with RS485 bus	• Only the baud rates 57,600 and 115,200 are supported. • Terminating resistor included in the inverter – only at the socket RS485_OUT. Plug in connectors with jumpers 1-2 and 3-4. • Check ground (Pin 4) • Check and if necessary improve the connection of the shielding
Fault in connection between RS485 port and PVM ControlBox	• Check wiring and parameter assignment (Baudrate as ControlBox e.g. P0420.03 = 57600 and protocol P0407.03 = 1; check USS address); • RS485Ref wired? • Terminating resistor available?
Fault in connection between RS485 port and SolarLog	• Reset SolarLog to factory settings and restart inverter search • Contact SolarLog hotline • RS485Ref wired? • Terminating resistor available?
Fault in connection between RS485 port and Meteocontrol	• Reset Meteocontrol to factory settings and restart inverter search • Contact Meteocontrol hotline • RS485Ref wired? • Terminating resistor available?
Sensor connection (5-pole connector) No data or incorrect data (temperature/insolation)	Check the wiring
No communication between inverter and ControlBox	Check both time-of-day settings
No communication via Ethernet • IP address • Subnet mask • Standard gateway • Portal activation • Configure router • Test function	Check Ethernet port • via menu command or P0410.00 – P0410.03 • via menu command or P0411.00 – P0411.03 • via menu command or P0414.00 – P0414.03 • via menu command or P0473 → 1 • Initiate test function
WebMonitor activation failed	The activation code is located in the lower third of the device rating plate

Technical data

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12.1 SINVERT PVM inverter

DC data

Type	PVM10	PVM13	PVM17 4DC [1]	PVM17 6DC	PVM20
Maximum DC power	10.2 kW	12.6 kW	16.8 kW	16.8 kW	19.6 kW
MPP tracking range (for P_{max})	380 to 850 V	420 to 850 V	525 to 850 V[3]	460 ... 850 V[3] 445 ... 850 V[2]	480 to 850 V
Maximum DC voltage	1,000 V				
Maximum DC power	29 A	30 A	32 A	37 A[3] 38.5 A[2]	41 A
Maximum DC power per input	25 A				
Number of inputs for the PV generator	4	4	4	6	6
Internal overvoltage protection	Type 3 protection				
Number of MPPs	1				

[1] No longer available to order

[2] Values for inverters for the domestic, business and commercial environments

[3] Values for inverters for the industrial area

AC data

Type	PVM10	PVM13	PVM17 4DC [1]	PVM17 6DC	PVM20
Rated AC output	10 kW	12.4 kW	16.5 kW	16.5 kW	19.2 kW
Maximum AC power	10 kW	12.4 kW	16.5 kW	16.5 kW	19.2 kW
AC power connection	400 V 3 AC +N, 50 ... 60 Hz				
Cos phi	1; may be set up to 0.9 with capacitive or inductive component				
Maximum AC power	18 A	18.5 A	25 A	29 A	29 A
Fusing at AC end: Circuit breaker	32 A				
THDI	< 2,5 %				
Maximum efficiency	98.0 %			98.2 %	
European efficiency	97.4 %	97.5 %	97.7 %	97.8 %	97.8 %
Supply from	60 W				
Intrinsic consumption, night	< 0.5 W				
Internal overvoltage protection	Type 3 protection				

[1] No longer available to order

Cooling, ambient conditions, EMC

Type	PVM10	PVM13	PVM17 4DC [1]	PVM17 6DC	PVM20
Cooling	Natural convection				
Ambient temperature during storage and transport	- 25 to + 70 °C				
Ambient temperature during operation (with derating)	- 25 to + 55°C				
Maximum ambient temperature for rated power	50 °C		45 °C	40 °C	
Installation altitude	Up to 2,000 m above sea level				
Noise	< 45 dBa				
Emitted interference	EN 61000-6-4 for inverters in the industrial area EN 61000-6-3 for inverters for the domestic, business and commercial environments				
Manufacturer's declaration of conformity	CE				
Interference immunity	EN 61000-6-2				
Environmental classes	4K4H in accordance with IEC 60721-3-4				
ENS	In accordance with VDE0126-1-1				

[1] No longer available to order

Mechanical properties

Type	PVM10	PVM13	PVM17 4DC [1]	PVM17 6DC	PVM20
Degree of protection	IP65 in accordance with IEC 60529				
Dimensions Width/height/depth	530 mm / 601 mm / 270 mm				
Minimum distances Side/top/bottom	50 mm / 500 mm / 500 mm				
Weight	Approx. 40 kg			Approx. 41 kg	

[1] No longer available to order

12.2 Insolation sensor

An insolation sensor is available as an optional accessory. You need a corresponding connector to connect the insolation sensor. The ordering data for the insolation sensor and the corresponding connector are listed in Section Spare parts and accessories (Page 111).

Type	Insolation temperature sensor SiS-13TC-T-K / SiS-13TC-T	Insolation sensor SiS-13TC-K
General		
Current measuring shunt	0.12 Ω (TK = 20 ppm/K)	
Ambient temperature	- 20 °C to + 70 °C	
Power supply	12 to 28 V DC	
Current consumption	0.3 mA	
Connecting cable	4 x 0.14 mm², 3 m (UV-stable)	
Cell size	50 x 33 mm	
External dimensions: Length/width/height	145 x 86 x 39 mm	
Weight	340 g	
Solar radiation (insolation)		
Measuring range	0 ... 1300 W/m²	
Output signal	0 ... 10 V	
Measuring accuracy	± 5% of the full-scale value	
Device temperature		
Measuring range	- 20 °C to + 90 °C	-
Output signal	2.268 V + T [°C] * 86.9 mV/°C	-
Measuring accuracy	+ 1.5% at 25 °C	-
Non-linearity	± 0.5 °C	-
Max. deviation	± 2 °C	-

Ordering data

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13.1 SINVERT PVM inverter

Inverters with emitted interference for the domestic, business and commercial environments

Designation	Order number
SINVERT PVM10	6AG3120-3JB02-0AC1
SINVERT PVM13	6AG3120-3JE02-0AC1
SINVERT PVM17 6DC	6AG3120-3JK02-0AC1
SINVERT PVM20	6AG3120-3JM02-0AC1

13.2 Spare parts and accessories

Spare parts

Spare part	Supplier	Product designation	Order number
AC connector, small	Siemens AG		A5E03316370
Wall bracket	Siemens AG		A5E03316290

Accessories

Accessories	Supplier	Product designation	Order number
4-pin RS485 connector	Phoenix Contact [1)]	SACC-M12MS-4SC SH	1513253
4-pin relay socket	Phoenix Contact [1)]	SACC-M12FS-4SC SH	1513279
Ethernet connector	Phoenix Contact [1)]	VS-08-RJ45-5-Q/IP67	1656990
AC connector, large (cable cross-section 14-25 mm Conductor cross-section 10 - 16 mm^2)	Siemens AG		6AG3920-3AA20-1AY0
Key for MC4 connector unlocking tool	MultiContact [1)]	PV-MS	32.6024
MC4 circular connector for connecting to the negative pole of the inverter (cable diameter 3 - 6 mm cable cross-section 4 - 6 mm^2)	MultiContact [1)]	PV-KST4/6I-UR	320015P0001

Accessories	Supplier	Product designation	Order number
MC4 circular connector for connecting to the negative pole of the inverter (cable diameter 5.5 - 9 mm cable cross-section 4 - 6 mm²)	MultiContact [1)]	PV-KST4/6II-UR	320017P0001
MC4 coupling socket for connecting to the positive pole of the inverter (cable diameter 3 - 6 mm cable cross-section 4 - 6 mm²)	MultiContact [1)]	PV-KBT4/6I-UR (∅ 3-6 mm)	320014P0001
MC4 coupling socket for connecting to the positive pole of the inverter (cable diameter 5.5 - 9 mm cable cross-section 4 - 6 mm²)	MultiContact [1)]	PV-KBT4/6II-UR (∅ 5.5-9 mm)	320016P0001
MC4 hand crimping tool	MultiContact [1)]	PV-CZM-19100	
Insolation sensor	Mencke&Tegtmeyer [1)]	Si-13TC-K	Product designation is sufficient
Insolation temperature sensor	Mencke&Tegtmeyer [1)]	Si-13TC-T-K	Product designation is sufficient
Insolation temperature sensor	Mencke&Tegtmeyer [1)]	SiS-13TC-T	Product designation is sufficient
Connector for insolation sensor	Phoenix Contact [1)]	SACC-M12MS-5SC SH	1512555
SINVERT PVM ControlBox	Siemens AG		6AG3600-3AB10-0AA0
Sealing cap for MC4 socket (positive pole)	MultiContact [1)]	PV-SVK4	32 07 17
Sealing cap for MC4 socket (negative pole)	MultiContact [1)]	PV-BVK4	32 07 16
Screw plug for RS485 in/out socket	Phoenix Contact [1)]	PROT-M12	1680539
Screw plug sensor socket	Phoenix Contact [1)]	PROT-M12	1680539
Sealing cap for relay socket	Phoenix Contact [1)]	PROT-M12-FS	1560251

[1)] Accessory not supplied by Siemens, must be ordered from the supplier specified.

Warranty extensions

SINVERT PVM WarrantyExtension to 20 years

Product name	Order number
SINVERT PVM10 WarrantyExtension – 20Y	6AG3820-3DA00-0WB0
SINVERT PVM13 WarrantyExtension – 20Y	6AG3820-3DA00-0WE0
SINVERT PVM17 WarrantyExtension – 20Y	6AG3820-3DA00-0WK0
SINVERT PVM20 WarrantyExtension – 20Y	6AG3820-3DA00-0WM0

SINVERT PVM WarrantyExtension to 10 years

Product name	Order number
SINVERT PVM10 WarrantyExtension – 10Y	6AG3820-3DA00-0LB0
SINVERT PVM13 WarrantyExtension – 10Y	6AG3820-3DA00-0LE0
SINVERT PVM17 WarrantyExtension – 10Y	6AG3820-3DA00-0LK0
SINVERT PVM20 WarrantyExtension – 10Y	6AG3820-3DA00-0LM0

Dimension drawings

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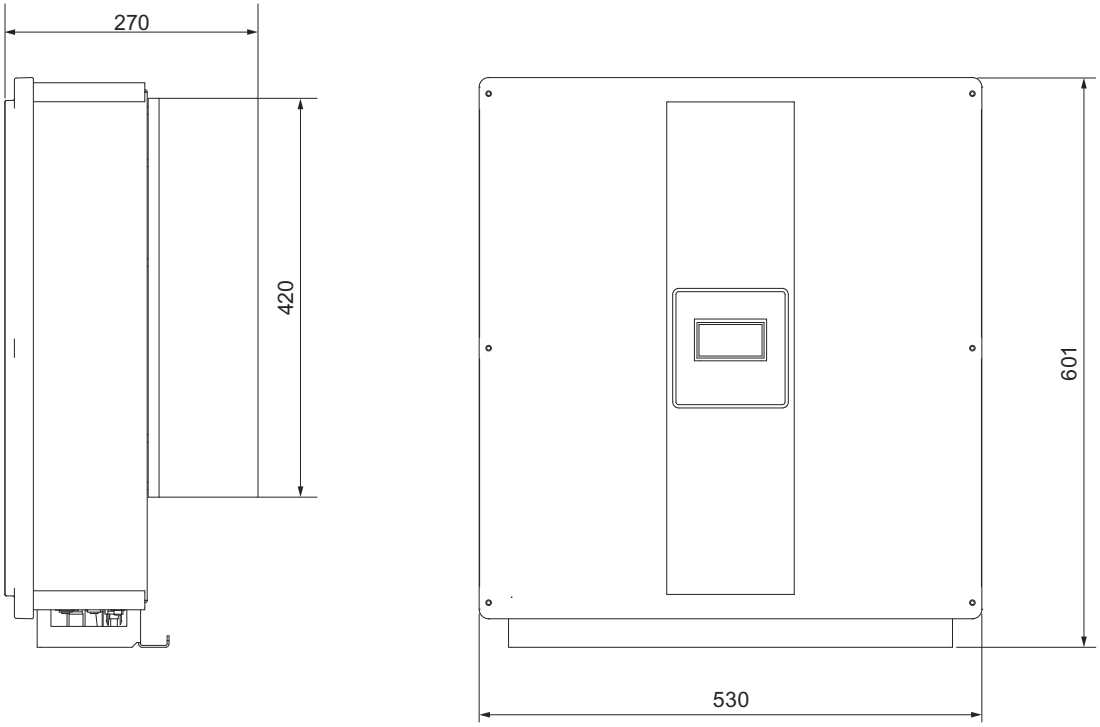

Figure 14-1 Dimension drawing of device

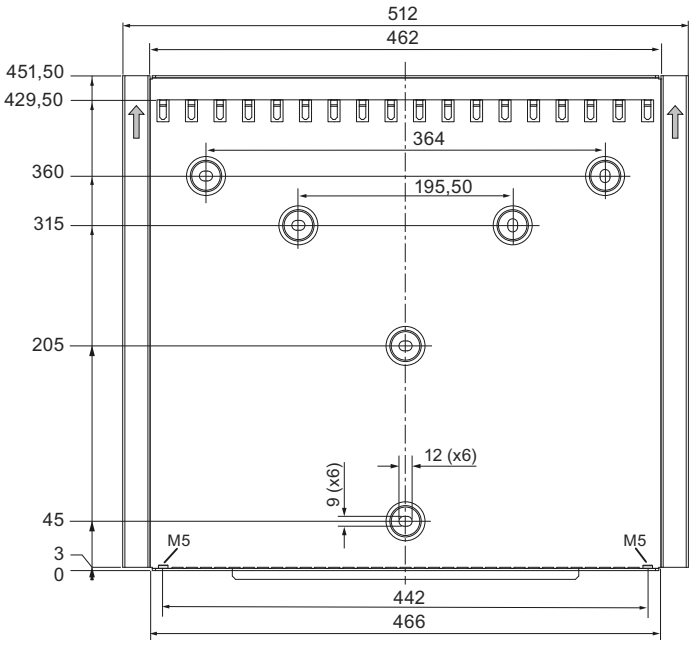

Figure 14-2 Dimension drawing of wall bracket

Appendix A

A.1 Technical support

Technical support for SINVERT products

- Information material and downloads for SINVERT products:
  SINVERT infocenter (http://www.siemens.com/sinvert-infocenter)
  Here you can find, for example:
  - Catalogs
  - Brochures
- Documentation on SINVERT products:
  SINVERT support (http://www.siemens.com/sinvert-support)
  Here you can find, for example:
  - Manuals and operating instructions
  - The latest product information, FAQs, downloads, tips and tricks
  - Characteristics and certificates

Technical assistance for SINVERT products

For all technical queries, please contact:

- Phone: +49 (911) 895-5900
  Monday to Friday, 8 am – 5 pm CET
- Fax: +49 (911) 895-5907
- E-mail: Technical assistance (mailto:technical-assistance@siemens.com)
- Online: Technical assistance online (https://www.siemens.com/automation/support-request)

Handling of replacements and returns for SINVERT products

For questions concerning replacing and returning devices, please contact:

Germany:

- Phone: +49 (911) 895-5999
  Monday to Friday, 8 am – 5 pm CET

International:

- Your competent sales partner

A.2 Latest documentation

The latest versions of the documentation for all SINVERT products can be found on the Internet by following this link:

SINVERT support (http://www.siemens.com/sinvert-support)

The available documents include:

- SINVERT PVM Operating Instructions (compact)
- SINVERT PVM Operating Instructions
- Inverter data sheets
- Data sheet for the SINVERT PVM ControlBox
- SINVERT PVM ControlBox Operating Instructions
- SINVERT Webmonitor Operating Instructions
- SINVERT solar PV plant control

Certificates

You can find the certificates for the SINVERT PVM inverters on the Internet:

SINVERT support (http://www.siemens.com/sinvert-support)

Glossary

ENS

Line monitoring device with allocated switching elements

EVU

Electrical utility

FLL

English: Frequency locked loop

Frequently locked loop

FW

Firmware

INV

Inverter

LVD

Low-Voltage Directive

MPP tracking

English: Maximum power point tracking

MSR

Medium Voltage Directive

P_{max}

Maximum output power

PV

Photovoltaic

RoHS

English: Restriction of the use of certain hazardous substances

EC Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic devices

Sea level

Sea level

THD

English: Total harmonic distortion

Total harmonic distortion Non-linear distortion of an electrical or acoustic signal

THDI

THD for electrical current

TN-S system

French: Terre Neutre Separé

Low-voltage system with neutral conductor N connected separately and protective conductor PE connected separately.

TT system

French: Terre Terre

Low-voltage system without protective conductor PE connected separately

USS protocol

Universal serial interface protocol

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