

SINVERT

PVS CombinerBox

Manual · 09/2011



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SINVERT PVS CombinerBox

Manual

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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
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the relevant information is not taken into account.

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 Preface

Purpose of the manual

This Hardware Installation Manual is aimed at personnel involved in mechanically installing and connecting a SINVERT PVS CombinerBox, as well as at service and maintenance engineers.

This manual is aimed at qualified personnel in the following target groups:

- Planners
- Installation personnel
- Commissioning engineers
- Service and maintenance personnel
- Operators

Validity of the documentation

This Hardware Installation Manual is valid for

- PVS CombinerBox 1xx with 8, 20 or 24 strings
- PVS CombinerBox 2xx with four inputs

Conventions

Within this manual, photovoltaic system is referred to as PV system for short.

Trademarks

SINVERT® is a registered trademark of Siemens AG.

1.2 Where to store this manual

These operating instructions must be stored in the immediate vicinity of the SINVERT inverter(s). Installation, operating and maintenance personnel must have access to the instructions at all times.

1.3 History of changes in this documentation

The following versions of this documentation have been released to date. The changes apply to the previous version:

Edition	Comment / change
06/2011	Description of the product family

1.4 Recycling and disposal

Devices described in this programming manual can be recycled owing to the low content of noxious substances in their version. Please contact a certified waste disposal company for eco-friendly recycling and to dispose of your old devices.

Safety information

2.1 Notes on handling the product

General safety instructions



! DANGER

Danger, high voltage!
Risk of death or serious bodily injury.

Photovoltaic systems can generate hazardous voltages.

Before starting work, ensure that the system and the devices are disconnected from the power supply.

Protection against unauthorized opening



! DANGER

Danger, high voltage!
Risk of death or serious bodily injury.

Unauthorized persons must not open the junction box.

Violation of the installation instructions

CAUTION

Warranty claims void!

If the installation regulations are violated, all warranty and liability claims are void.

Observe the generally valid local installation regulations.

Specialist personnel

Note

The tasks described in this documentation must only be carried out by qualified electricians who are familiar with the system. The relevant national regulations apply. For example, in Germany: Qualified electrical/electronic specialists as defined by DIN VDE 0105.

General safety instructions

Photovoltaic systems can generate hazardous voltages.

The tasks described in this documentation must only be carried out by qualified electricians who are familiar with the system. The relevant national regulations apply. For example, in Germany: Qualified electrical/electronic specialists as defined by DIN VDE 0105.

The requirements regarding the installation location and the installation itself (e.g. connection cross-sections, torques, etc.) listed in this document must be taken into account.

If the installation regulations are violated, all warranty and liability claims are void.

The generally valid local installation regulations must be complied with.

Unauthorized persons must not open the junction box.

Description

3.1 Design of a photovoltaic system

Connection concept

With the SINVERT PVS CombinerBox, the individual strings of a photovoltaic field (PV array) are collected (switched in parallel), and the energy conveyed across large cross-sections of cable to the inverter. The module strings are collected in the PVS CombinerBox 1xx. Then several PVS CombinerBoxes 1xx are routed to the PVS CombinerBox 2xx.

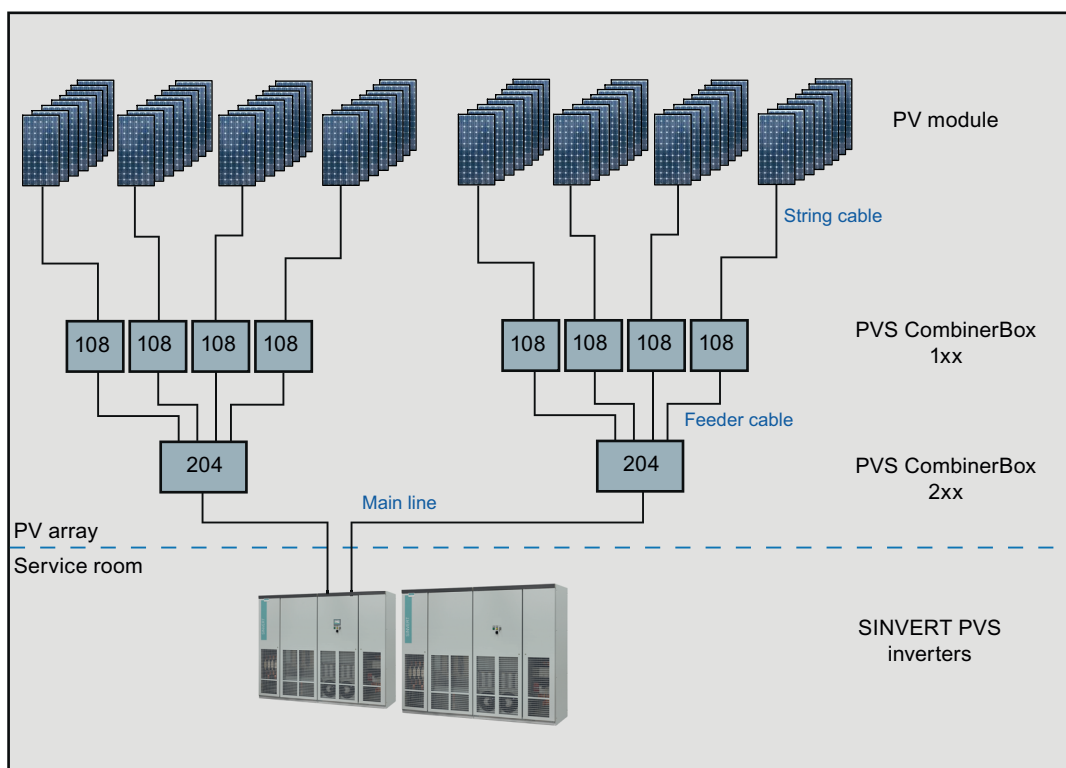


Figure 3-1 System configuration

The PVS CombinerBox 1xx and PVS CombinerBox 2xx can be combined depending on the design of the module field.

3.2 Overview of PVS CombinerBox 1xx

Depending on the version, the PVS CombinerBox 1xx collects up to 8, 20 or 24 strings.

The following table provides an overview of the components of the PVS CombinerBox 1xx. The individual versions are described in the following sections.

DC switch disconnectors allow actuation during operation, that is, when current is flowing.

PVS CombinerBox 1xx

Table 3- 1 Versions

Designation	Order No.	Components
PVS CombinerBox 108 for 8 strings	6AG3611-3FF21-1AA0	8 inputs, fuse holders for 10x38 fuse links*
	6AG3611-3FF21-1CA0	8 inputs, fuse holders for 10x38 fuse links*, switch disconnectors
	6AG3611-3FF21-1BA0	8 inputs, fuse holders for 10x38 fuse links*, surge arrester
	6AG3611-3FF21-1DA0	8 inputs, fuse holders for 10x38 fuse links*, switch disconnectors, surge arrester
PVS CombinerBox 120 for 20 strings	6AG3611-3FL21-1AA0	20 inputs, fuse holders for 10x38 fuse links*
	6AG3611-3FL21-1CA0	20 inputs, fuse holders for 10x38 fuse links*, switch disconnectors
PVS CombinerBox 124 for 24 strings	6AG3611-3FM21-1AA0	24 inputs, fuse holders for 10x38 fuse links*
	6AG3611-3FM21-1CA0	24 inputs, fuse holders for 10x38 fuse links*, switch disconnectors

* Fuse links can be ordered as accessories

3.3 Overview of PVS CombinerBox 2xx

The PVS CombinerBox 2xx collects the strings of the PVS CombinerBox 1xx.

The PVS CombinerBox 2xx has 4 inputs and is equipped with LV HRC fuses in the input. Each PVS CombinerBox 2xx is connected to one DC input of the inverter.

The LV HRC fuse cannot disconnect under load. For this reason, you must always check whether voltage is present before removing a fuse. Even if the inverter is switched off, there may be voltage present; in the case of a short-circuit or double ground fault, for example.

PVS CombinerBox 2xx

Table 3- 2 PVS CombinerBox 2xx

Designation	Order No.	Components
PVS CombinerBox 204	6AG3611-3FD01-1AA0	4 inputs, 4 LV HRC fuses ¹⁾

¹⁾ Fuse links can be ordered as accessories.

3.3 Overview of PVS CombinerBox 2xx

Application planning

4.1 Checking the consignment

Please check that the consignment is complete against the accompanying dispatch documentation. If any items are missing from the consignment, please notify the relevant contact person immediately.

Check the unit for damage before you commence installation.

4.2 Storage

For storage of the PVS CombinerBox 1xx as well as the PVS CombinerBox 2xx, the storage conditions described in Chapter Ambient and environmental conditions (Page 49) must be observed. In the event of ingress of dirt, pollutants or liquid into the equipment, formation of condensation, damage or any other failures to comply with the prescribed storage conditions, the equipment must not be commissioned until the correct remedial procedure has been discussed with and approved by Siemens AG.

CAUTION
Lay the devices flat for storage
The devices must be stored flat to avoid damaging screw glands and similar fittings on the enclosure.
In the case of noncompliance with the above, Siemens will not accept liability for damage arising from unauthorized commissioning.

4.3 Installation location

Selecting the installation location

The junction box is suitable for protected installation outdoors.

The following points must be considered in the selection of an installation site:

- Select a location that is protected from the weather and is easily accessible for installation work and later maintenance work.
- When selecting the location, ensure unauthorized personnel cannot access the junction box.
- The installation foundation area must be stable enough to allow installation/maintenance work to proceed safely.
- When installing, ensure rain cannot penetrate the junction box.
- The installation location must offer the option of horizontal installation. The cable feed-throughs must be installed vertically, leading down. The junction box must not be installed horizontally with the cover uppermost.
- The installation site must not be in close proximity to easily inflammable materials, gases or vapors.
- The installation site must be inaccessible to rodents. The junction box and especially the feeder conductors must be installed in such a way that damage cannot be caused by rodents. For example, lay feeder conductors in metal conduits.
- The permissible ambient temperature range is -20 °C to 45 °C.
- Please take account of the existing circulation of air when selecting the installation site.
- The installation engineer must decide on the basis of the installation height whether additional strain relief, such as a cable propping bar, is to be attached. The relevant national regulations apply, e.g. DIN VDE 100-520 in Germany.

CAUTION
Risk of damage as a result of very high or very low temperatures or rain
Exposure to direct sunlight, or excessively high or low temperatures can result in damage to the internal components of the junction box.
Protect the junction box against direct sunlight and rain. For this purpose, you can install the junction box under a solar module or protective canopy. Take air circulation into account.

PVS CombinerBox 1xx

5.1 PVS CombinerBox 108

Features

The PVS CombinerBox 108 is available in the following versions:

- With or without DC switch disconnecter
- With or without surge arrester.

The sleeves or PV fuses to be used can be ordered as accessories.

System configuration overview

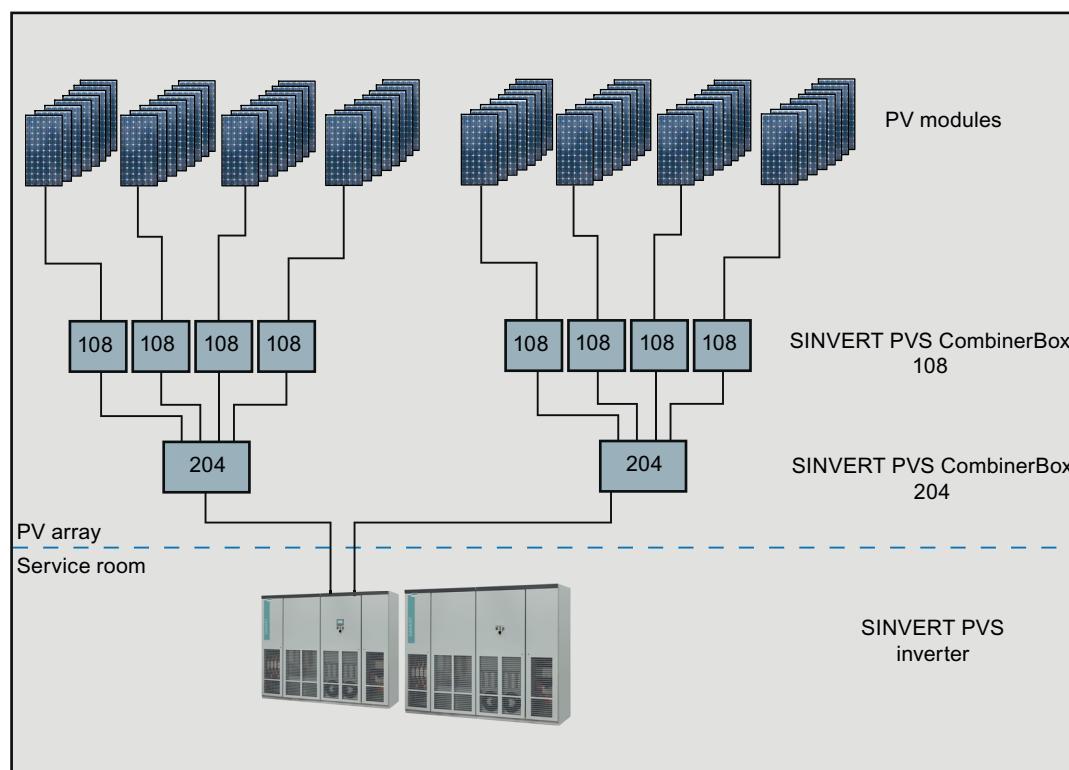


Figure 5-1 Photovoltaic system with PVS CombinerBox 108

Design

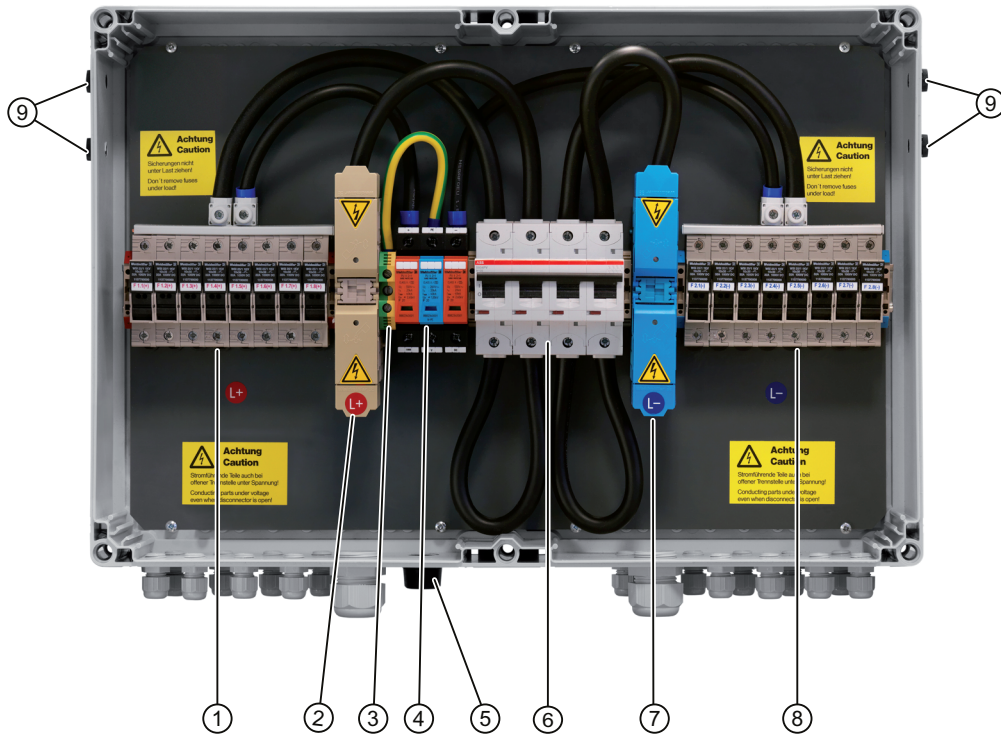


Figure 5-2 Design of the PVS CombinerBox 108 (example with DC switch disconnector and surge arrester)

①	Terminals/fuse holders for DC string connection positive poles
②	Terminals for DC feeder cables L+
③	Equipotential bonding
④	Surge arrester
⑤	Drainage plugs
⑥	DC switch disconnector
⑦	Terminals for DC feeder cables L-
⑧	Terminals/fuse holders for DC string connection negative poles
⑨	Pressure compensation valve

The arrangement and number of components used can vary depending on the version of the PVS CombinerBox.

Block diagram

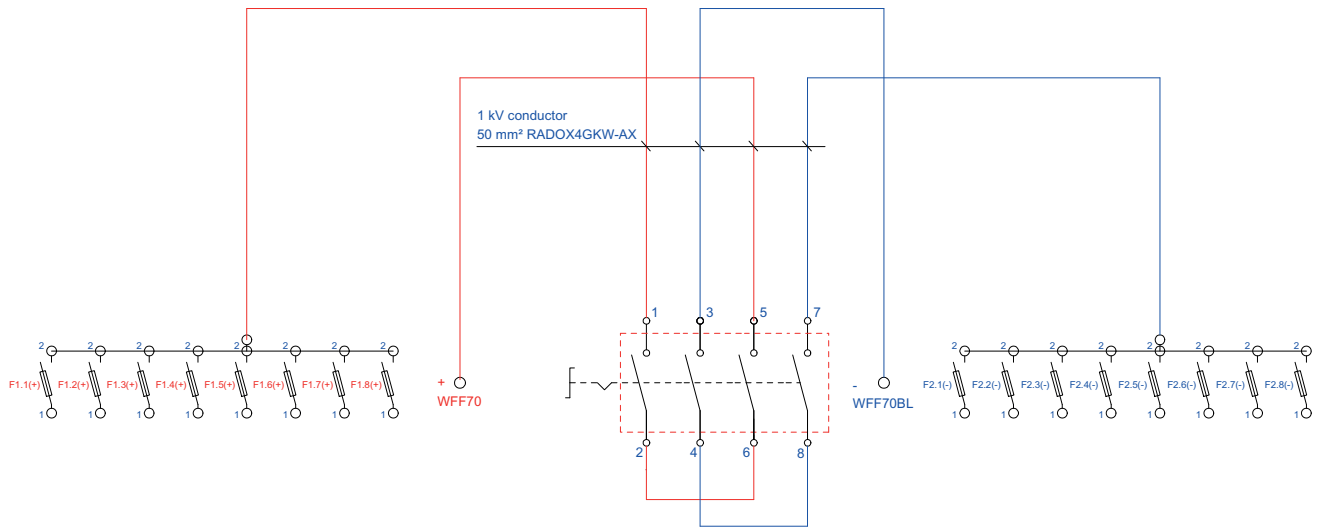


Figure 5-3 Circuit diagram of the PVS CombinerBox 108 (example with DC switch disconnector)

5.2 PVS CombinerBox 120

Features

The PVS CombinerBox 120 is available in the following versions:

- With DC switch disconnecter
- Without DC switch disconnecter

The sleeves or PV fuses to be used can be ordered as accessories.

System configuration overview

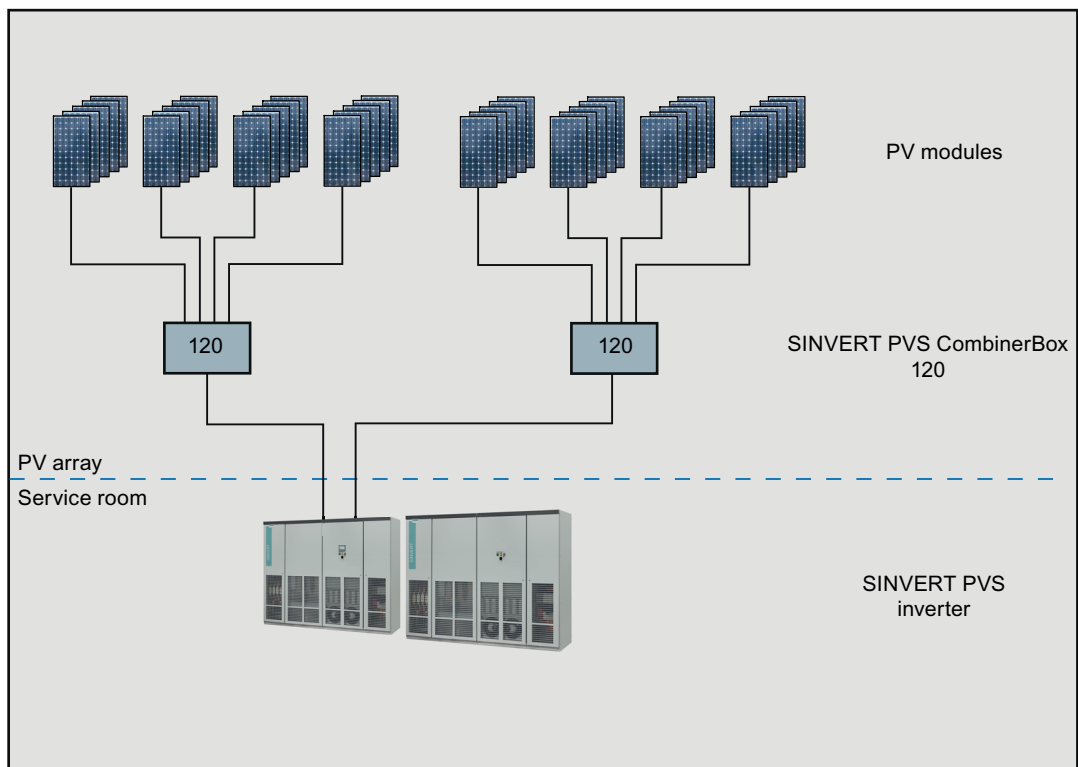


Figure 5-4 Photovoltaic system with PVS CombinerBox120

Design

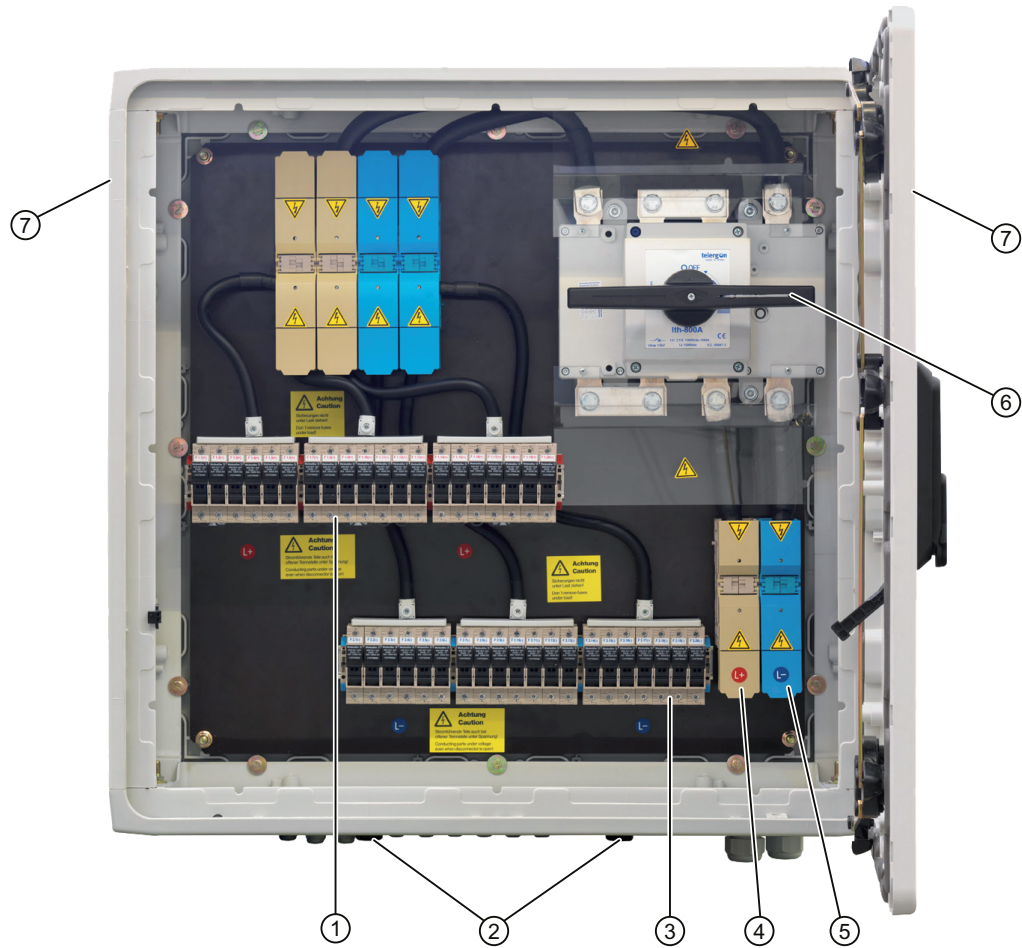


Figure 5-5 Design of the PVS CombinerBox 120 (example with DC switch disconnector)

①	Terminals/fuse holders for DC string connection positive poles
②	Drainage plugs
③	Terminals/fuse holders for DC string connection negative poles
④	Terminal for DC main line to the inverter L+
⑤	Terminal for DC main line to the inverter L-
⑥	DC switch disconnector
⑦	Pressure compensation valve

The arrangement and number of components used can vary depending on the version of the PVS CombinerBox 120.

Block diagram

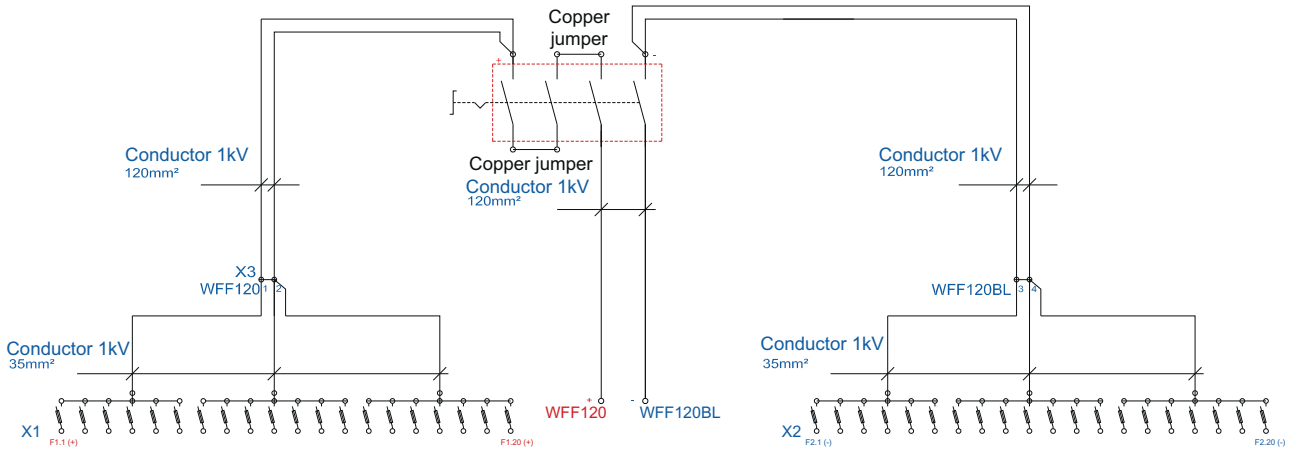


Figure 5-6 Circuit diagram of the PVS CombinerBox 120 (example with DC switch disconnecter)

5.3 PVS CombinerBox 124

Features

The PVS CombinerBox 124 is available in the following versions:

- With DC switch disconnector
- Without DC switch disconnector

The sleeves or PV fuses to be used can be ordered as accessories.

System configuration overview

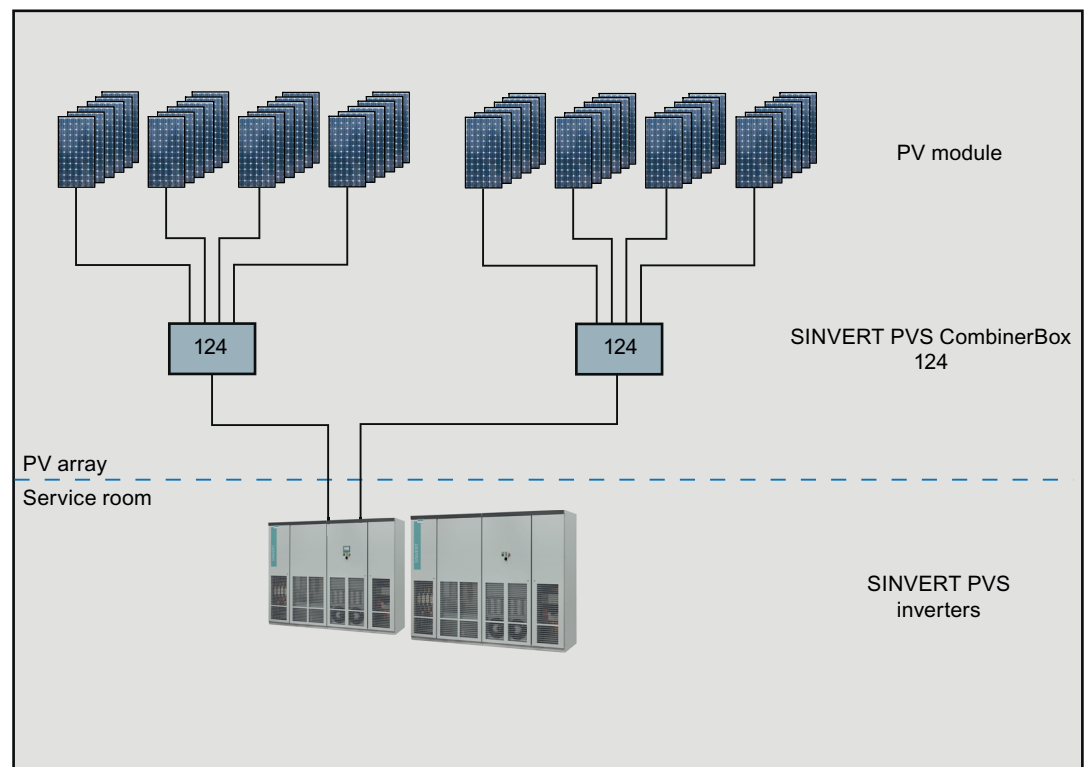


Figure 5-7 Photovoltaic system with PVS CombinerBox 124

Design

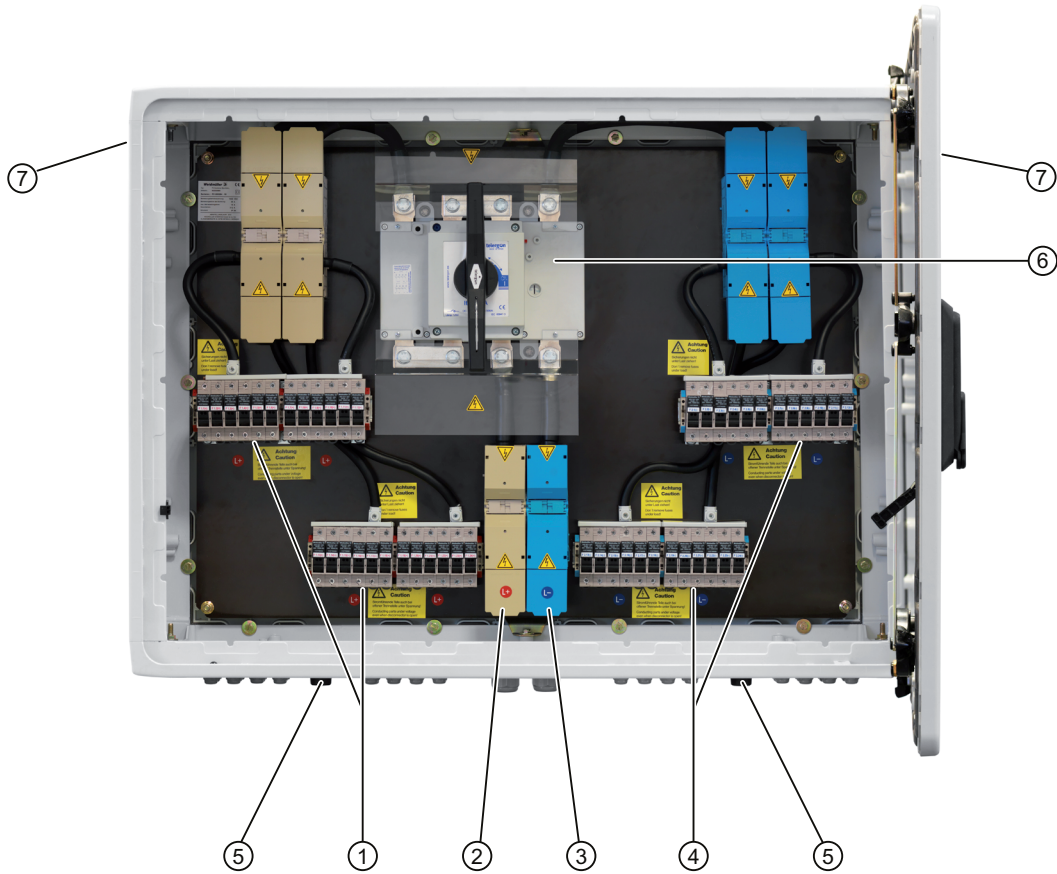


Figure 5-8 Design of the PVS CombinerBox 124 (example with DC switch disconnector)

①	Terminals/fuse holders for DC string connection positive poles
②	Terminal for DC main line L+
③	Terminal for DC main line L-
④	Terminals/fuse holders for DC string connection negative poles
⑤	Drainage plugs
⑥	DC switch disconnector
⑦	Pressure compensation valve

The arrangement and number of components used can vary depending on the version of the PVS CombinerBox.

Block diagram

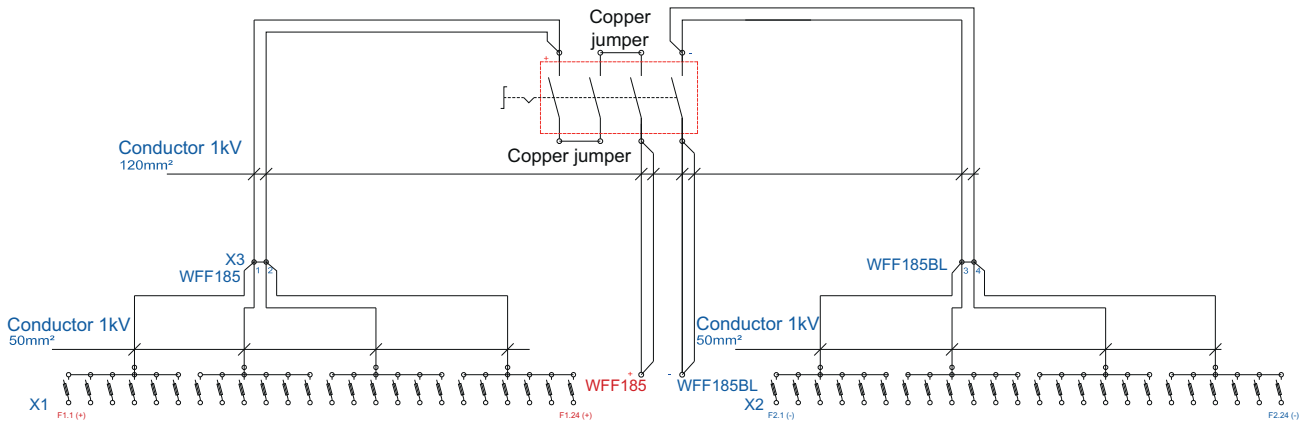


Figure 5-9 Circuit diagram of the PVS CombinerBox124 (example with DC switch disconnecter)

5.4 Installing

5.4.1 Installing the PVS CombinerBox 1xx

For wall-mounting of the PVS CombinerBox 1xx, proceed as follows.

PVS CombinerBox 108:

1. Drill the holes for fastening the boxes in accordance with the drilling template.
 - Use the appropriate drilling and mounting material for the foundation area.

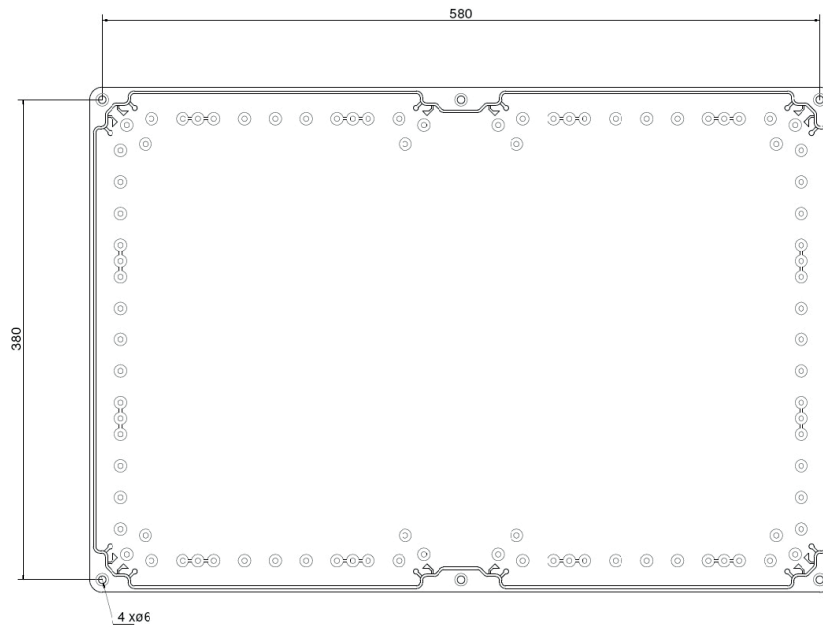


Figure 5-10 Drilling template for PVS CombinerBox 108

2. Install the PVS CombinerBox 1xx using the holes at the corners of the enclosure (d=6mm).

PVS CombinerBox 120 and 124:

The PVS CombinerBox includes a set of mounting lugs that are hooked onto the rear.

1. Drill the 4 holes for fastening the boxes in accordance with the drilling template.
 - Decide whether you want to attach the tabs at the top and bottom, or on the sides.
 - Use the appropriate drilling and mounting material for the foundation area.

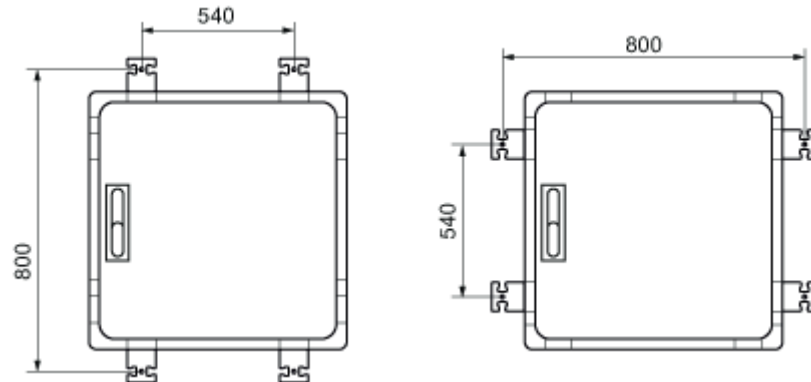


Figure 5-11 Drilling template for PVS CombinerBox 120

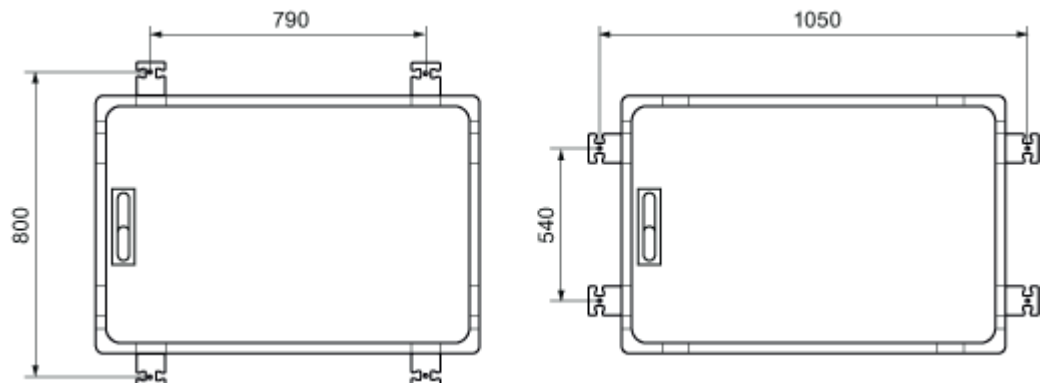


Figure 5-12 Drilling template for PVS CombinerBox 124

- Hook the 4 mounting lugs in position and slide the plastic securing brackets over the lugs as shown in the diagram below.

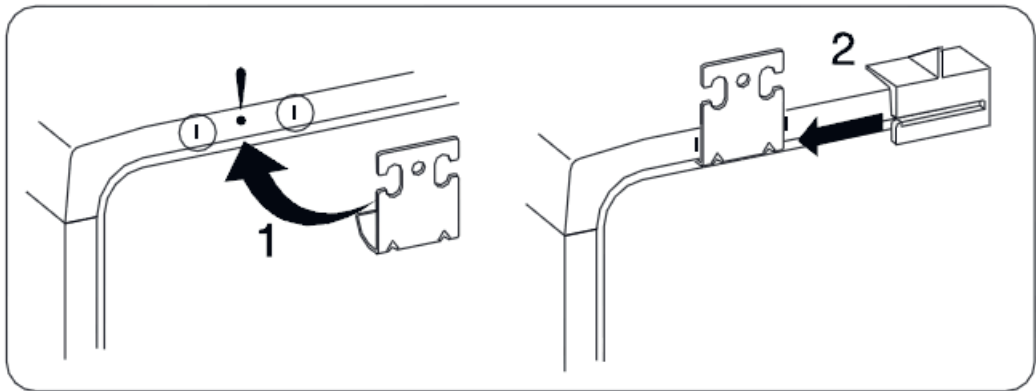


Figure 5-13 Hook the mounting lug in position and attach the securing bracket - example of top mounting

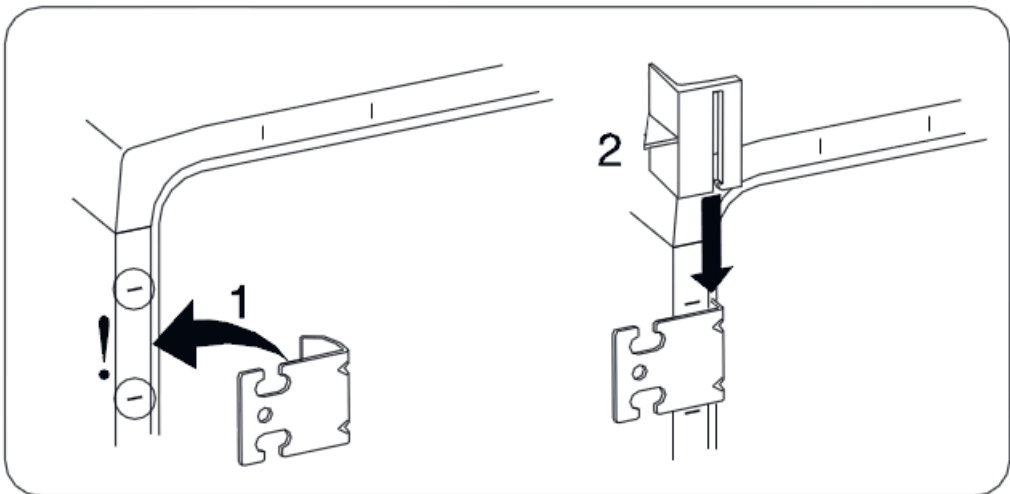


Figure 5-14 Hook the mounting lug in position and attach the securing bracket - example of side mounting

- Mount the PVS CombinerBox using the holes in the lugs (d=9mm).

5.4.2 Mounting on column or PV module frame

The example below shows the procedure for mounting the PVS CombinerBox on a column or PV module frame.

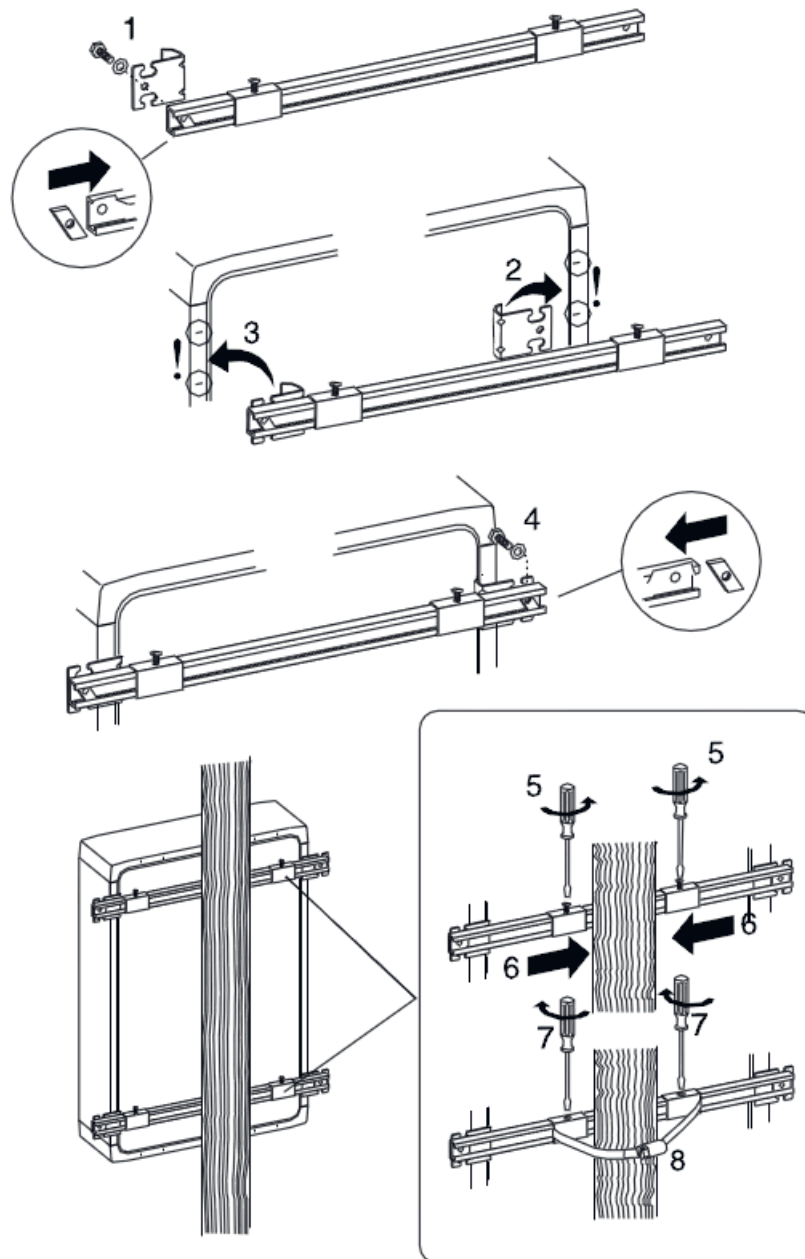


Figure 5-15 Example of mounting on a column or PV module frame

5.5 Connecting

5.5.1 General procedure

Requirements

- DC string cables must only be connected when the power supply is disconnected!
- The DC main lines must be isolated on the DC input of the inverter.

General procedure

1. Connect the DC main line/DC feeder cable.
2. Connect the DC string cable.
3. Close all unused cable bushings with blanking plugs.
4. Insert the neutral links/fuse links.
 - Before inserting PV fuses/neutral links, determine the voltage, polarity and absence of ground faults of the string inputs.
5. Mount the plexiglass cover.
6. Connect the inverter to the system on completion of all installation and connection work.

5.5.2 Information on laying the cables

General information

- Use only electrical cables rated for the voltages, currents and environmental conditions (temperature, UV, etc.) expected at the installation site.
- Ensure that you lay all cables with short-circuit protection and ground fault protection.
- Use single-core cables with double or reinforced insulation (in accordance with DIN VDE 0100-520:2003-06, Section 521.13 or IEC 60364-5-52:1993 Part 5, Chapter 5.2) for the positive and the negative pole feeders.
- To ensure short-circuit-proof and ground-fault-proof installation in accordance with VDE 0100-520 (VDE 0100-520:2003-06 Section 521.13 c) or IEC 60364-5-52 (IEC 60364-5-52:1993 Part 5, Chapter 5.2), the following requirements must be fulfilled:
 - Cables must not be installed in the proximity of combustible materials
 - Cables must be accessible
 - Cables must be protected against mechanical damage.
- The equipotential bonding for the surge arrester used (optionally available for PVS CombinerBox 108) must be connected with a cable cross-section of at least 6 mm².
- Do not lay the feeder conductors over edges.

CAUTION

Damage to the housing

The weight of the cables can subject the housing to mechanical forces. For this reason, attach a strain relief underneath the CombinerBox depending on the installation height.

National regulations apply for strain relief requirements, e.g. DIN VDE 0100-520 in Germany.

Cable cross-sections and tightening torques


Table 5- 1 Cable cross-sections and tightening torques for the PVS CombinerBox 1xx

Terminal	Terminal type	Cable	Tightening torque
DC string cables	Screw terminal	0,75 ... 25 mm ²	2 ... 2.5 Nm
DC feeder cable 108	Stud terminal	2.5...70 mm ²	6 ... 12 Nm
DC main line/feeder cable 120	Stud terminal	6...150 mm ²	10 ... 20 Nm
DC main line/feeder cable 124	Stud terminal	10...185 mm ²	14 ... 31 Nm

5.5.3 Connecting DC main lines/DC feeder cables

Requirement

- The DC main lines/DC feeder cables must be isolated and de-energized.
 - In general, isolation can be achieved by switching off the inverter.
If necessary, the DC fuse in the input can be opened here and the inverter can resume operation.
- The cable cross-sections and tightening torques can be found in the tables in Chapter Information on laying the cables (Page 31)

 WARNING
Risk to life as a result of arcing and electric shock
The DC main lines/DC feeder cables must only be connected when the power supply is disconnected! Failure to do so will result in a risk to life from arcing and electric shock.

Procedure

1. Run the DC main lines/DC feeder cables through the cable glands into the interior of the enclosure.
 - Make sure you connect the DC main lines/DC feeder cables with the correct polarity.
2. Connect the DC main lines/DC feeder cables direct to the stud terminals.
3. Tighten the cable glands.
4. Check the tightening torques of the connections.
5. Make sure there is sufficient strain relief for the DC main lines/DC feeder cables.
6. Close all unused cable glands with blanking plugs to prevent moisture penetrating the PVS CombinerBox.

5.5.4 Connecting DC string cables

The DC string cables are connected direct to the fuse bases. The DC string cables must be run into the enclosure interior through a sealed bushing.

Requirement

- The DC string cables must be isolated and de-energized.
- The cable cross-sections and tightening torques can be found in the table in Chapter Information on laying the cables (Page 31).

 WARNING
--

Risk to life as a result of arcing and electric shock
--

The DC string cables must only be connected when the power supply is disconnected! Failure to do so will result in a risk to life from arcing and electric shock.
--

Procedure

1. Run the DC string cables through the cable glands into the housing interior.
2. Connect the DC string cables direct to the fuse bases.
3. Tighten the cable glands.
4. Check the tightening torques of the connections (see Chapter Information on laying the cables (Page 31)).
5. Check the DC string cables for voltage and polarity.
6. Close all unused cable glands with blanking plugs to prevent moisture penetrating the PVS CombinerBox 1xx.

NOTICE

On no account remove or cover the "drainage plugs" on the enclosure.
--

5.5.5 Inserting fuses/neutral links

When the PV fuses/neutral links are inserted, the DC voltage is connected to the system if the string is connected. For this reason, make sure all installation work has been completed.

Procedure

1. Before inserting PV fuses/neutral links, determine the voltage, polarity and absence of ground faults of the string inputs.
2. Insert the PV fuses/neutral links.
3. Mount the plexiglass cover
4. Connect the inverter to the system on completion of all installation and connection work.

PVS CombinerBox 2xx

6.1 PVS CombinerBox 204

Features

The PVS CombinerBox 204 with 4 inputs is equipped with open fuse holders in the input. LV HRC fuses are available as accessories. Safe isolation of the PV strings to the inverter is carried out in the PVS CombinerBox 1xx.

Each PVS CombinerBox 2xx is connected to one DC input of the inverter.

System configuration overview

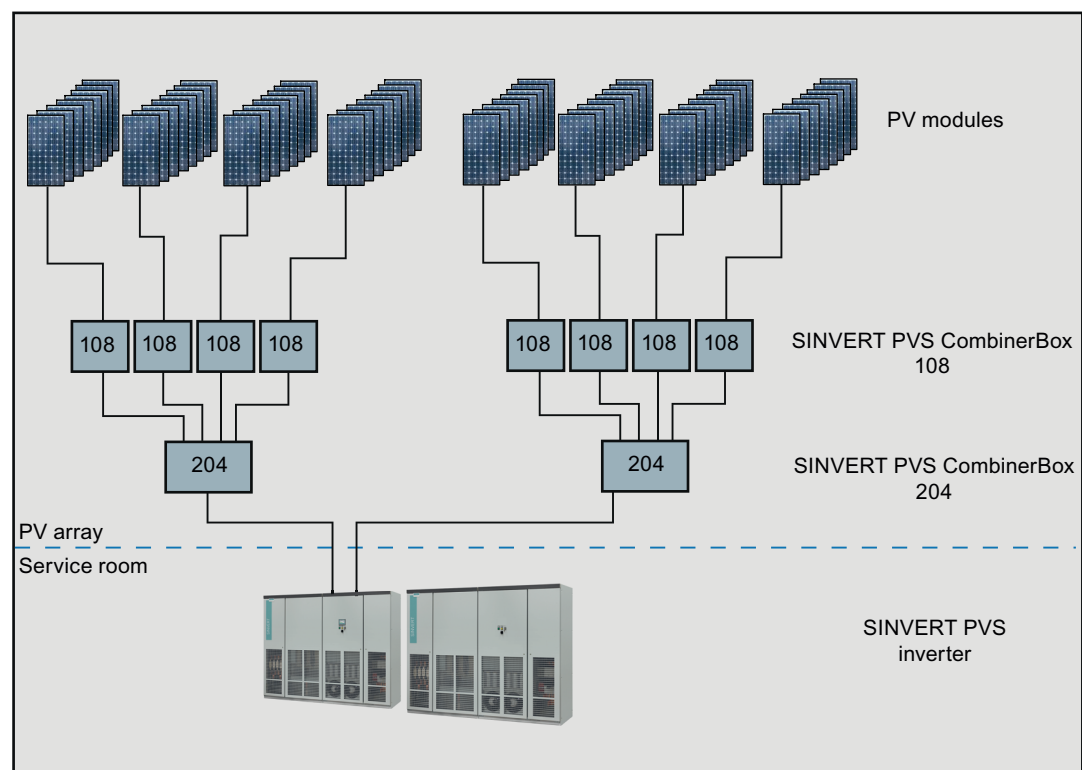


Figure 6-1 Photovoltaic system with PVS CombinerBox 204

Design



Figure 6-2 Design of the PVS CombinerBox 204

①	Terminals for DC main line to the inverter input: L+
②	DC feeder connection L+ / LV HRC fuse holders
③	Cable propping bar
④	DC feeder cable connection: L- / LV HRC fuse holders
⑤	Terminals for DC main line to the inverter input: L-
⑥	Drainage plugs

You require a fuse puller with sleeve for removing and inserting the LV HRC fuse links.

Block diagram

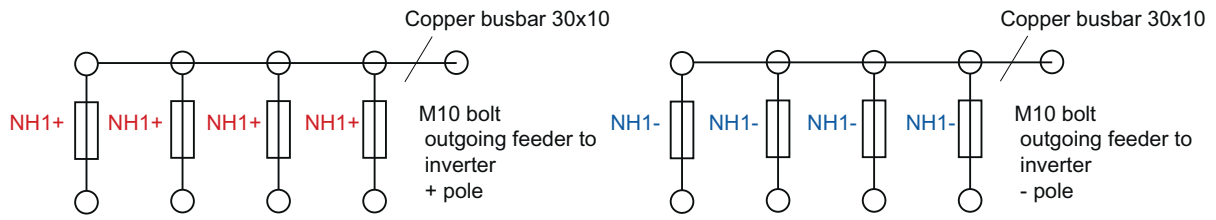


Figure 6-3 Circuit diagram of the PVS CombinerBox 204

6.2 Installing

6.2.1 Installing the PVS CombinerBox 2xx

The PVS CombinerBox 2xx includes a set of mounting lugs that are hooked onto the rear. Proceed as follows to mount the PVS CombinerBox 204:

1. Drill the 4 holes for fastening the boxes in accordance with the drilling template.
 - Decide whether you want to attach the tabs at the top and bottom, or on the sides.
 - Use the appropriate drilling and mounting material for the foundation area.

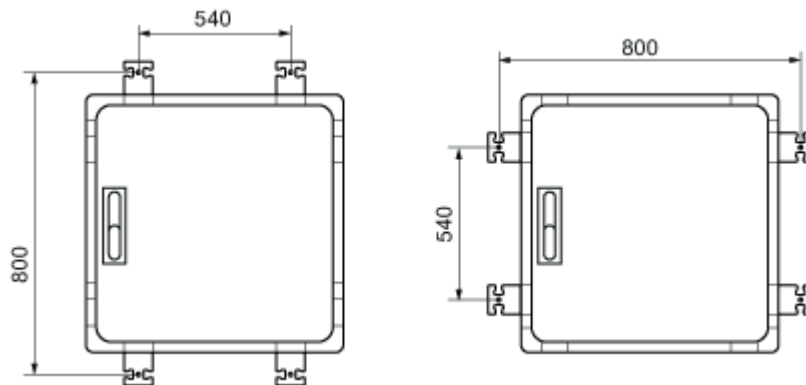


Figure 6-4 Drilling template for PVS CombinerBox 204

2. Hook the 4 mounting lugs in position and slide the plastic securing brackets over the lugs as shown in the diagram below.

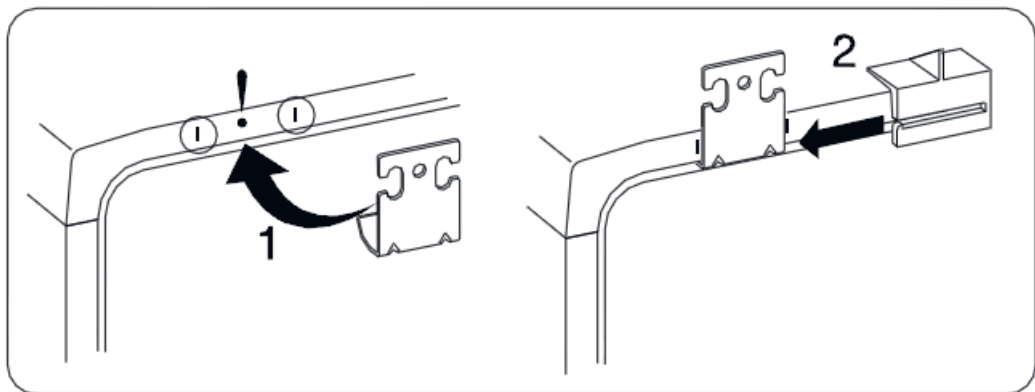


Figure 6-5 Hook the mounting lug in position and attach the securing bracket - example of top mounting

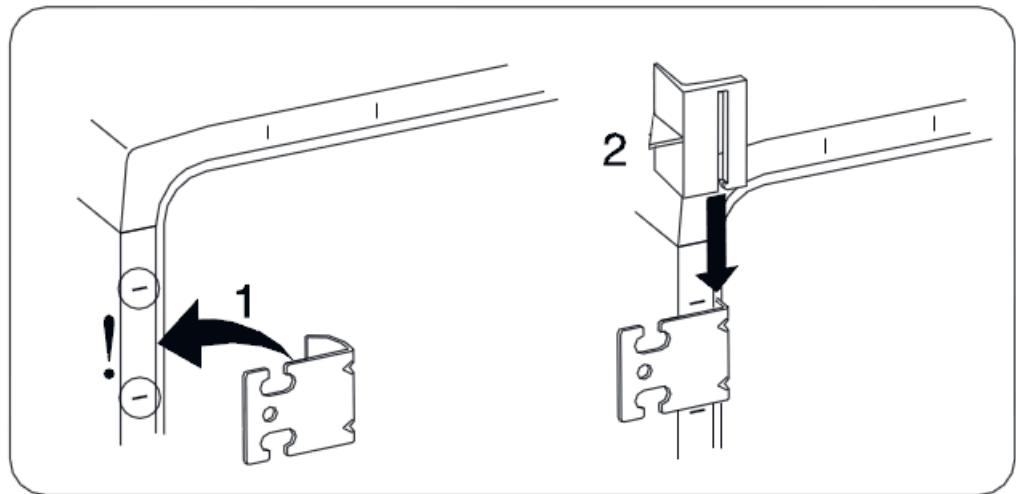


Figure 6-6 Hook the mounting lug in position and attach the securing bracket - example of side mounting

3. Mount the PVS CombinerBox 204 using the holes in the lugs ($d=9\text{mm}$).

Mounting on a column or a PV module frame

To mount the PVS CombinerBox 2xx on a column or a PV module frame, see the installation example in Chapter Mounting on column or PV module frame (Page 29).

6.3 Connecting

6.3.1 General procedure

Requirements

- The DC main lines must be isolated on the DC input of the inverter.
- The DC feeder cables must only be connected when the power supply is disconnected!
 - The DC switch disconnectors/fuses in the PVS CombinerBox 1xx should be opened to guarantee additional safety.

General procedure

1. Connect the DC main lines (see Chapter Connecting DC main lines (Page 42))
2. Connect the DC feeder cables from the PVS CombinerBox 1xx (see Chapter Connecting DC feeder cables (Page 43))
3. Close all unused cable bushings with blanking plugs.
4. Insert the LV HRC fuses.
 - The LV HRC fuses can be ordered as accessories.
5. Mount the plexiglass cover.
6. Connect the inverter to the system on completion of all installation and connection work.

6.3.2 Information on laying the cables

General information

- Use only electrical cables rated for the voltages, currents and environmental conditions (temperature, UV, etc.) expected at the installation site.
- Ensure that you lay all cables with short-circuit protection and ground fault protection.
- Use single-core cables with double or reinforced insulation (in accordance with DIN VDE 0100-520:2003-06, Section 521.13 or IEC 60364-5-52:1993 Part 5, Chapter 5.2) for the positive and the negative pole feeders.
- To ensure short-circuit-proof and ground-fault-proof installation in accordance with VDE 0100-520 (VDE 0100-520:2003-06 Section 521.13 c) or IEC 60364-5-52 (IEC 60364-5-52:1993 Part 5, Chapter 5.2), the following requirements must be fulfilled:
 - Cables must not be installed in the proximity of combustible materials
 - Cables must be accessible
 - Cables must be protected against mechanical damage.
- Do not lay the feeder conductors over edges.
- Ensure there is sufficient strain relief for the DC main lines when installing.

CAUTION

Damage to the enclosure from the weight of the cables if there is no strain relief

The weight of the cables can subject the housing to mechanical forces. For this reason, attach a strain relief underneath the CombinerBox depending on the installation height.

Cable cross-sections and tightening torques


Table 6- 1 Cable cross-sections and tightening torques for PVS CombinerBox 204

Terminal	Terminal type	Cable	Tightening torque
3, 4 DC feeder cables	M10 stud terminal / Connection of LV HRC fuse base	16 ... 120 mm ²	10 Nm
1, 2 DC main lines	Busbar connection M10	240 mm ²	10 Nm

6.3.3 Connecting DC main lines

Requirement

- The DC main lines must be isolated and de-energized.
 - In general, isolation can be achieved by switching off the inverter.
If necessary, the DC fuse in the input can be opened here and the inverter can resume operation.
- The cable cross-sections and tightening torques can be found in the table in Chapter Information on laying the cables (Page 41)

 WARNING
Risk to life as a result of arcing and electric shock
The DC main lines must only be connected when the power supply is disconnected! Failure to do so will result in a risk to life from arcing and electric shock.


Procedure

1. Run the DC main lines through the cable glands into the housing interior.
 - Make sure you connect the DC main line with the correct polarity.
2. Connect the DC main lines direct to the stud terminals.
3. Tighten the cable glands.
4. Check the tightening torques of the connections (see Chapter Information on laying the cables (Page 41)).
5. Make sure there is sufficient strain relief for the DC main lines.
6. Close all unused cable glands with blanking plugs to prevent moisture penetrating the PVS CombinerBox 2xx.

6.3.4 Connecting DC feeder cables

Requirement

- The DC feeder cables must be isolated and de-energized.
 - The DC switch disconnectors/fuses/sleeves of the PVS CombinerBox 1xx should be opened to guarantee additional safety.
- The cable cross-sections and tightening torques can be found in the table in Chapter Information on laying the cables (Page 41)

 WARNING
Risk to life as a result of arcing and electric shock
The DC feeder cables must only be connected when the power supply is disconnected.

Procedure

1. Run the DC feeder cables through the cable glands into the housing interior.
2. Connect the DC feeder cables direct to the stud terminals.
3. Tighten the cable glands.
4. Check the tightening torques of the connections (see Chapter Information on laying the cables (Page 41)).
5. Check the DC feeder cables for voltage and polarity.
6. Close all unused cable glands with blanking plugs to prevent moisture penetrating the PVS CombinerBox 2xx.

NOTICE
On no account remove or cover the "drainage plugs" on the enclosure.

6.3.5 Inserting fuses

When the LV HRC fuses are inserted, the DC voltage is connected to the system if the strings are connected. For this reason, make sure all installation work has been completed.

Procedure

1. Before inserting the LV HRC fuses, determine the voltage, polarity and absence of ground faults of the string inputs.
2. Insert the LV HRC fuses.
 - You require a fuse puller with sleeve for inserting the LV HRC fuse links.
3. Mount the plexiglass cover.
4. Connect the inverter to the system on completion of all installation and connection work.

Servicing and maintenance

The PVS CombinerBox 1xx and the PVS CombinerBox 2xx are maintenance-free devices. However, the following visual inspections should be made **annually** .

7.1 Annual visual inspection

Check seals

- Since the strong temperature fluctuations outdoors place a heavy load on the seals, you must ensure by means of visual inspection that the cover seals have not perished.
- Check the seals and screw connections as well as the ventilation and drainage inserts.

Check the surge arresters

- Check whether the inspection windows on the optional surge arresters are showing "green". Surge arresters showing "red" must be replaced.

Check fuses

- We recommend checking the fuses for continuity since tripped fuses diminish yield.

7.2 Isolating the photovoltaic system for maintenance work

When working on the photovoltaic system, the section to be worked on must first be isolated.

Isolation takes place at the relevant node points depending on the system constellation:

- Isolation on the PVS CombinerBox 1xx
 - On the PVS CombinerBox 1xx with DC switch disconnecter, you can use the switch disconnecter to disconnect under load.
 - On the PVS CombinerBox 1xx without DC switch disconnecter, disconnection under load is not possible. You can find the necessary procedure in Chapter Isolation on the PVS CombinerBox 1xx (Page 47).
- Isolation on the PVS CombinerBox 2xx
 - When using the PVS CombinerBox 2xx, you cannot disconnect under load on the PVS CombinerBox 2xx. You can find the necessary procedure in Chapter Isolation on the PVS CombinerBox 2xx (Page 48).
- Isolation on the inverter
 - When using the PVS CombinerBox 1xx without DC switch disconnectors and the PVS CombinerBox 2xx with fuses, only one switch disconnection can be carried out on the DC input of the inverter.

 **WARNING**

Danger of fatal electric shock when working on the photovoltaic system

When working on the photovoltaic system, the section to be worked on must always be previously de-energized to prevent the danger of electric shock.

7.2.1 Isolation on the PVS CombinerBox 1xx


Isolate the load on the PVS CombinerBox 1xx for working in the PV array

The procedure for isolating the PV array on the PVS CombinerBox 1xx depends on whether a switch disconnecter is available or not.

Only the PVS CombinerBox 1xx with switch disconnecter can disconnect under load.

Procedure

1. Isolate the load on the PVS CombinerBox 1xx:
 - When using the PVS CombinerBox 1xx **with** switch disconnecter:
Open the switch disconnecter.
 - When using the PVS CombinerBox 1xx **without** switch disconnecter:
Isolate the load on the inverter by switching the inverter off. If necessary, the DC fuse in the input can be opened here and the inverter can resume operation.
2. Measure the voltage at the fuse holders and verify safe isolation from the supply.
3. Open the string fuses/sleeves on the PVS CombinerBox 1xx.
4. Carry out the work in the PV array.

 WARNING
Risk to life as a result of arcing and electric shock The DC string cables must only be connected when the power supply is disconnected! Failure to do so will result in a risk to life from arcing and electric shock.

Restarting

1. Depending on the work carried out, the polarity and voltage of the connected strings must be checked.
2. Close the fuses/sleeves in the PVS CombinerBox 1xx.
3. Switch the load back on:
 - When using the PVS CombinerBox 1xx **with** switch disconnecter:
Close the switch disconnecter.
 - When using the PVS CombinerBox 1xx **without** switch disconnecter:
:Switch on the load on the inverter.

7.2.2 Isolation on the PVS CombinerBox 2xx

Isolate the load on the PVS CombinerBox 2xx for working in the PV array

The LV HRC fuses of PVS CombinerBox 2xx cannot disconnect under load. When disconnecting the PV array at the PVS CombinerBox 2xx, the following procedure must therefore be followed:

Procedure

1. Isolate the load on the DC input of the inverter
 - If necessary, the DC fuse in the input can be opened here and the inverter can resume operation.
2. Measure the voltage at the fuse holders and verify safe isolation from the supply.
3. Remove the fuses on the PVS CombinerBox 2xx using fuse puller with sleeve.
4. Carry out the work in the PV array.



WARNING

Risk to life as a result of arcing and electric shock

The DC string cables must only be connected when the power supply is disconnected! Failure to do so will result in a risk to life from arcing and electric shock.

Restarting

1. Depending on the work carried out, the polarity and voltage of the connected strings must be checked.
2. Insert the fuses on the PVS CombinerBox 2xx into the holder insert using fuse puller with sleeve.
3. Switch on the load at the DC input of the inverter.

Technical data

8.1 Ambient and environmental conditions

Conditions for long-term storage

Table 8- 1 Long-term storage

Ambient temperature	- 20 °C to + 45 °C
Atmospheric humidity (relative)	0 % ... 50 %

Conditions during transport

Table 8- 2 Transport

Ambient temperature	- 20 °C to + 45 °C
Atmospheric humidity (relative)	0 % ... 50 %

Conditions for commissioning and connection

Table 8- 3 Commissioning and connection

Ambient temperature	+ 10 °C ¹⁾ ... + 45 °C
Atmospheric humidity (relative)	0 % ... 50 %
Pollution degree	3
Height above sea level	Up to 2000 m

¹⁾ Recommended minimum temperature for connection work to ensure the required flexibility of the cables

Conditions during operation

Table 8- 4 Operation

Ambient temperature	- 20 °C to + 45 °C
Atmospheric humidity (relative)	0 % ... 50 %
Pollution degree	3
Height above sea level	Up to 2000 m

8.2 Mechanical data

CombinerBox 108

	Specification	Value
Enclosure (W x H x D)	Wall distributor	600 x 400 x 132 mm
Mounting plate		560 x 360 mm
Weight	Complete with packaging, without external cables	Approx. 10.5 kg
Color		RAL 7035
Material	Acc. to DIN 16913	Polycarbonate
Degree of protection	According to EN 60529-1	IP54
Outdoor installation		Yes
UV resistance		Yes
Burning characteristics		Non-combustible
Protective insulation		Yes
Locking		Cover fastening with 4x pozidrive screws, sealable

CombinerBox 120

	Specification	Value
Enclosure (W x H x D)	Wall distributor	750 x 750 x 320 mm
Mounting plate		640 x 640 mm
Weight	Complete with packaging, without external cables	approx. 45 kg
Color		RAL 7035
Material	Acc. to DIN 16913	Glass fiber reinforced polyester
Degree of protection	According to EN 60529-1	IP54
Outdoor installation		Yes
UV resistance		Yes
Burning characteristics		Non-combustible
Protective insulation		Yes
Locking		Wing handle prepared for the installation of a shaped semi-cylinder

CombinerBox 124

	Specification	Value
Enclosure (W x H x D)	Wall distributor	1000 x 750 x 320 mm
Mounting plate		640 x 640 mm
Weight	Complete with packaging, without external cables	approx. 52.5 kg
Color		RAL 7035
Material	Acc. to DIN 16913	Glass fiber reinforced polyester
Degree of protection	According to EN 60529-1	IP54
Outdoor installation		Yes
UV resistance		Yes
Burning characteristics		Non-combustible
Protective insulation		Yes
Locking		Wing handle prepared for the installation of a shaped semi-cylinder

CombinerBox 204

	Specification	Value
Enclosure (W x H x D)	Wall distributor	750 x 750 x 320 mm
Mounting plate		640 x 640 mm
Weight	Complete with packaging, without external cables	approx. 42 kg
Color		RAL 7035
Material	Acc. to DIN 16913	Glass fiber reinforced polyester
Degree of protection	According to EN 60529-1	IP54
Outdoor installation		Yes
UV resistance		Yes
Burning characteristics		Non-combustible
Protective insulation		Yes
Locking		Wing handle prepared for the installation of a shaped semi-cylinder

8.3 Electrical data

CombinerBox 108

	Value
Maximum permissible DC voltage	1000 V DC
Maximum permissible current per string	10 A
Number of DC inputs	8
DC main lines	2,5 ... 70 mm ²
DC string cables	0.75 to 25 mm ²
Tightening torque DC input	2 ... 2.5 Nm
Tightening torque DC output	6 ... 12 Nm
Fusing at input	10 x 38mm melting fuse
Maximum permissible current at the output	80 A

CombinerBox 120

	Value
Maximum permissible DC voltage	1000 V DC
Maximum permissible current per string	13 A
Number of DC inputs	20
DC main lines	6 ... 150 mm ²
DC string cables	0.75 to 25 mm ²
Tightening torque DC input	2 ... 2.5 Nm
Tightening torque DC output	10 ... 20 Nm
Fusing at input	10 x 38mm melting fuse
Maximum permissible current at the output	260 A

CombinerBox 124

	Value
Maximum permissible DC voltage	1000 V DC
Maximum permissible current per string	13 A
Number of DC inputs	24
DC main lines	10 ... 185 mm ²
DC string cables	0.75 to 25 mm ²
Tightening torque DC input	2 ... 2.5 Nm
Tightening torque DC output	14 ... 31 Nm
Fusing at input	10 x 38mm melting fuse
Maximum permissible current at the output	312 A

CombinerBox 204

	Value
Maximum permissible DC voltage	1000 V DC
Maximum permissible current per string	125 A
Number of DC inputs	4
DC main lines	240 mm ²
DC feeder cables	16 ... 120 mm ²
Tightening torque DC input	10 Nm
Tightening torque DC output	10 Nm
Fusing at input	Fuse LV HRC 1 (can be ordered as an accessory)
Maximum permissible current at the output	500 A

Ordering data

SINVERT PVS CombinerBox 1xx

Designation	Description	Order number
SINVERT PVS CombinerBox 108	8 strings	6AG3611-3FF21-1AA0
	8 strings, switch disconnecter	6AG3611-3FF21-1CA0
	8 strings, surge arrester	6AG3611-3FF21-1BA0
	8 strings, switch disconnecter, surge arrester	6AG3611-3FF21-1DA0
SINVERT PVS CombinerBox 120	20 strings	6AG3611-3FL21-1AA0
	20 strings, switch disconnecter	6AG3611-3FL21-1CA0
SINVERT PVS CombinerBox 124	24 strings	6AG3611-3FM21-1AA0
	24 strings, switch disconnecter	6AG3611-3FM21-1CA0

SINVERT PVS CombinerBox 2xx

Designation	Description	Order number
SINVERT PVS CombinerBox 204	4 inputs	6AG3611-3FD01-1AA0

Accessories

Designation	Description	Order number
LV HRC PV fuse size 1	80 A DC, 1000V	3NE1220-4
LV HRC PV fuse size 1	100 A DC, 1000V	3NE1221-4
LV HRC PV fuse size 1	125 A DC, 1000V	3NE1222-4

Appendix

A.1 Technical support

Technical support for SINVERT products

- Information material und 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
- Contacts for SINVERT are available at:
SINVERT partners (<http://www.siemens.com/sinvert-partner>)

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>)

General technical support

You can contact Technical Support for all IA and DT products that form the basis for SINVERT:

- Via the Internet using the **Support Request:**
Support Request (<http://www.siemens.com/automation/support-request>)
- Mail (<mailto:support.automation@siemens.com>)
- Monday to Friday from 08:00 till 17:00 CET:
Telephone: +49 (0) 180 5050 222
(0.14 €/min on German landlines, prices may vary for mobile systems)
- Fax: +49 (0) 180 5050 223
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Further information about our technical support is available in the Internet at Technical Support (<http://www.siemens.com/automation/csi/service>)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service & Support (<http://www.siemens.com/automation/service&support>)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
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- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have any questions about the products described in this manual and do not find the right answers.

Find your contact partner at:

Partner (<http://www.automation.siemens.com/partner>)

A signpost to the documentation of the various products and systems is available at:

SINVERT (www.siemens.com/sinvert)

A.2 List of abbreviations

Abbreviations	Explanations
LV HRC fuse	Low-voltage high-rupturing-capacity fuse
PV array	Photovoltaic array
PV	Photovoltaics
PV fuse	Photovoltaic fuse
INV	Inverter

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