HISbox®

DC/AC string boxes

part of HIS CONNECT®

DC Combiner

HDC, HDC1500

HMP, HMP1500

INSTALLATION MANUAL V1.2

HIS

the power behind re:energy

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Legal Requirements

Guarantee terms and conditions

The current terms and conditions of the guarantee can be found for download at our website www.his-solar.com or can be requested by phone.

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1 Notes on the manual

1.1 Scope of validity

This manual is valid for all HIS*box*® DC Combiners HDC, HDC1500, HMP und HMP1500 (**L**ow-voltage switchgear assemblies, PV array combiner box, PV string combiner box) hereinafter called „DC Combiner". As well as this general installation manual, please observe the product-specific description and the relevant product data sheets of specific products.

1.2 Target groups

HIS*box*® products must only be installed, opened or serviced by qualified electrical specialists. For more detailed information, see Section 2.3.

1.3 Symbols

In this manual the following safety advice and references are used:

Symbol	Description
	Danger sign the non-observance of which can lead directly to death or to serious injury
	Danger sign, the non-observance of which can lead to serious injury
	Warning sign the non-observance of which can lead to property damage
	Information

2 Safety

2.1 Intended use

The HIS*box*® DC Combiner is an enclosure where PV strings are connected which may also contain overcurrent protective devices and/or switch-disconnectors for PV strings between the PV generator and the inverter. The respective PV strands are switched in parallel and have the option of being safeguarded with overcurrent protective devices. Depending on the version, the HIS*box*® DC Combiner is supplied with measuring systems for string monitoring. For this purpose, please note the additional requirements for monitoring.

Please check the technical data of the PV equipment, like module and inverter and ensure that these are conform with requirements when the plant is in operation.

The DC Combiner has been designed exclusively for the intended use outlined above. Deviating applications or deviating from the installation, erection, commissioning or maintenance instructions as well as modifications or any other changes render guarantee claims null and void.

This manual is part of the DC Combiner. It must be stored accessible at all times. HISbox® products are exclusively intended for use in photovoltaic systems. Any other use is considered improper use.

2.2 Safety advice

This section gives safety advice which must be followed as a matter of principle and without exception, when working with the product. Please read the section with care and note fully and at every step all safety advice to prevent personal injury and damage to property and to guarantee lasting operation of the product.

DANGER!

Danger to life from high voltages!

On conducting elements high voltages can occur. Contact with these live parts can cause death or serious injury.

- When working on the assembly wear personal protective equipment
- Do not touch any live components or connected/disconnected conductors
- Before performing any work on the assembly, it must be isolated
  - Switch off the DC load-break switch
  - Switch off the relevant sub-array field conductor at the inverter or the main splitter Remove the DC fuses in the central inverter or in the main splitter when de-energised
  - Only open the DC fuse holders in the DC Combiner when de-energised
  - To isolate the supply (string cables), disconnect the solar plugs on the outside of the DC Combiner
- Secure any isolators to prevent them being switched on again and ensure that the equipment and its modules are voltage-free
- Earth and short circuit
- Protective covers must remain in place. Adjoining parts or live parts must be covered

DANGER!

Danger to life from live conductors!

The connected DC conductors are live. Contact with live parts can cause death or serious injury.

DANGER!

Danger to life from earthing faults!

PV plants can become live when there is an earthing fault. If there is contact with plant parts which have faulty earthing, it can cause death or serious injury. Before undertaking any work, ensure that there are no earthing faults. Furthermore, damage to the equipment can cause danger to life! The integrity of the DC Combiner must be inspected regularly and only be operated in a perfect and safe condition.
The functionality of all fuse configurations must be ensured.

Danger to life due to damage to the device!
The DC Combiner must be checked regularly to ensure that it is intact and may only be operated if it is in perfect, operationally safe condition. The functionality of all safety devices must be guaranteed.

Risk of fatal electric shock from unsecured DC Combiner.
Contact with live components can cause death or serious injury. The DC Combiner must be secured against entry by unauthorized persons. On completion of the work, lock the DC Combiner, remove the key from the door and keep it in a safe place.

Risk of fire from faulty installation of connecting cables and not adhering to torque specifications.
The current carrying capacity of these connections is reduced if the required torques applied to the conducting connections are not adhered to. Contact resistance increases and can overload components and can lead to overheating and the risk of fire. Furthermore, only appropriate tools must be used.

Risk of fatal electric shock due to damaged DC load-break switch and DC fuse holder!
The DC load-break switch and the DC fuse holder must not be switched at temperatures outside of their specification, as a perfect disconnection function cannot be guaranteed outside of these data. High voltages are present on components that are not properly disconnected or are damaged. Touching live components can result in death or serious injury from electric shock.

Attention! Risk of burns!
Parts or components can reach very high temperatures during operation or in case of a failure.

Danger from incorrectly rated DC fuses.
PV module can be damaged by excessive reverse currents. The optimal current values of the DC Combiner and derating factors of the fuse link must be considered.

Components can be damaged by dust or penetration of moisture.
Only open the DC Combiner when the environment is dry and dust-free. Always keep the equipment closed and do not open during a sandstorm, precipitation or extremely high humidity.

Damage to electrical components from electrostatic discharge.
Electronic components can be damaged or destroyed by electrostatic discharge. ESD regulations must be observed for all work.

Always observe:

- The generally recognized rules of the technology and the legal and official regulations
- The rules DIN VDE 0100 standards, in particular the VDE 0100-551 (low voltage generating sets, VDE 0100-520 (wiring systems) as well as VDE 0100-712 (PV power supply systems)
- Occupational protection and accident prevention regulations of the trade association responsible
- The rules and guidelines of the grid operator as well as the Technical Connectivity terms and conditions
- If necessary, it is the responsibility of the erectors to implement additional protection measures subject to the local conditions.
- The installation and commissioning of the DC Combiner must only be carried out by qualified electrical specialists!

If an operator modifies the DC Combiner unilaterally, the operator is deemed to be a manufacturer and must therefore provide proof of compliance with DIN EN 61439-1 standards.

2.3 Qualification of the electrical specialists

All the functions described must be carried out only by qualified electrical personnel who must have the following qualifications:

- The ability to recognize risks and avoid possible dangers of electricity due to training and experience.
- Knowledge of the risks and dangers which can arise during the installation, service and maintenance of DC Combiners in photovoltaic plants.
- Comprehensive knowledge of relevant standards and guidelines.
- Knowledge of the content of this document and observance of all safety advice

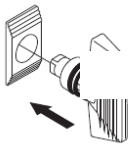
2.4 Nomenclature of the type label

Symbol	Designation
	The DC Combiner must be disposed of in accordance with the current regulations for the disposal of electronic waste
CE	The DC Combiner complies with the relevant EU guidelines.
IEC 61439	The DC Combiner conforms to the requirements of IEC 61439
	The DC Combiner has protective isolation and conforms to the requirements in protection category II.
IP__	The DC Combiner is protected against the ingress of water and foreign bodies in accordance with DIN EN 60529 *The degree of protection can be found in our article description*

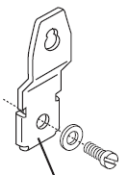
3 Scope of supply

A*)

B*)

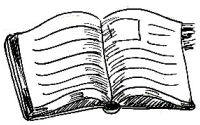


C*)



D*)

E*)



	Description
A	1x GRP enclosure with installed cable entry points and pressure equalization element
B	1x key set (2-Bit keys) or integrated locking screws.
C	1x set of wall fixing brackets, if shown of data sheet
D	1x multiple entry gasket, pending on the configuration. Blind stops as option available upon request.
E	Installation manual

* The product supplied can differ from the image

4 Installation

Do not carry out any work on the DC Combiner in rainy, foggy or very humid conditions (>95%), in environments with high dust development in close proximity or other adverse external conditions.

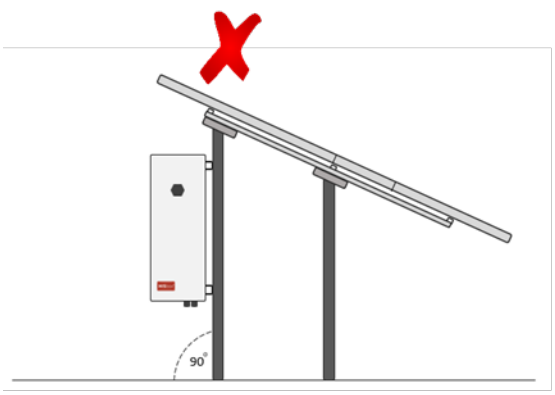
4.1 Choice of installation site

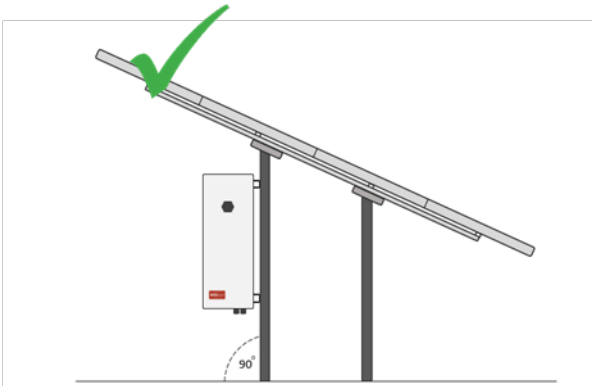
Danger to life from fire and explosion. Do not,

- install the DC Combiner on flammable materials.
- install the switchgear in areas where there are easily combustible materials.
- install the DC Combiner in areas where there is a danger of explosion.

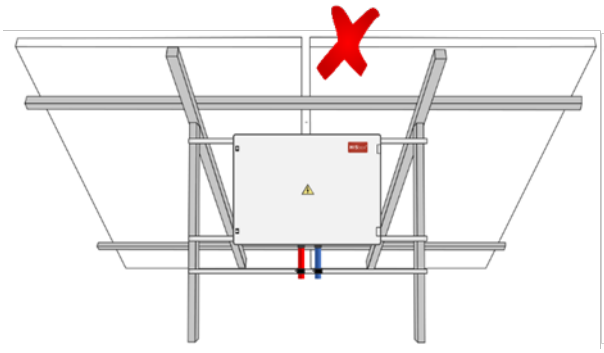
4.2 Requirements

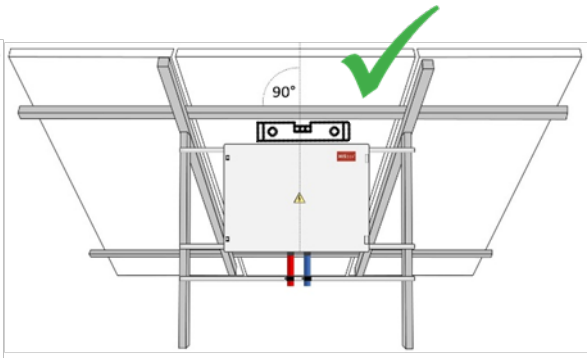
- The installation site must be accessible at all times, emergency exits must not be blocked and must not be located in residential or office spaces.
- The installation site must be solid.
- The installation site must be suitable for the weight and measurements of the product supplied.
- The installation site is sufficiently stabilized and secured against vibration and movement in all directions.
- Protection from extreme temperatures: climatic conditions must be complied with (see data sheet)
- The installation site must not be in direct sunlight and must be protected from rain and splashing water. DC Combiner shall be installed under the shadow of the photovoltaic modules or a protective cover.





- DC Combiner shall be mounted in a way that guarantees that is not in the path of rainwater flowing off/between the module frames.





- Cable glands of the DC Combiner shall not be used as a cable strain relief element. An external cable support rail shall be installed to eliminate the weight of the cables before entering to the DC Combiner.
- Connecting cables and wiring systems must be selected and erected so that damage from condensation, water penetration or other damaging effects does not occur.
- The connecting cables face downwards, and the DC Combiner must not be installed horizontally or at an angle.
- The technical data of the DC Combiner such as rated current, rated voltage must never be exceeded during operation.
- Technical Connectivity terms and conditions of the grid operators must be complied with.
- The minimum spacing (see Section „Minimum spacing “) must be observed.

4.3 Minimum spacing

WARNING

Please note the required spacing for optimum air circulation: HIS generally recommends minimum spacing of at least 30 cm between all parts which could prevent heat dissipation or could generate heat themselves.

4.4 Installing the DC Combiner

Cable glands and plug connectors can be damaged by incorrect transport, storage or installation.
Any additional installation material required is not included in the scope of supply. *(For all necessary information on the wall mounting brackets provided, see our article description)*

Procedure:

1. Affix the wall mounting brackets supplied to the DC Combiner.
2. Fix the DC Combiner with suitable screws and washers on the mounting supports.
3. Check that the DC Combiner has been mounted firmly and ensure that the screws have been sufficiently tightened.

WARNING

DC Combiner shall be mounted through the mounting brackets without applying horizontal or vertical forces which may lead to the distortion/deformation of the enclosure and consequently to water penetration.

4.5 Cabinet Dimensions

For the cabinet dimensions, please see our article description.

5 Electrical connection

DANGER

Danger to life from high voltages!
There can be high voltages on the conducting components Contact with these live parts can cause death or serious injury.

- Ensure that the main load-break switch is switched off (OFF position)
- Ensure that all string fuse holders are open and that the string fuses are removed. Warning: never operate string fuses under load!
- Ensure that string cables are not connected to the live PV generator.
- Ensure that the main cable of the sub-array is de-energized.
- Ensure that the DC Combiner is de-energized.
- Personal protective clothing must be worn while working on the DC Combiner.
- Do not come into contact with any conducting components or connected /disconnected conductors.
- Secure any switches to prevent them being switched on and ascertain that the equipment and parts are de-energized.
- Earth and short circuit
- Do not remove protective covers. Adjoining or energized parts must be covered.

When retightening conducting screw connections, observe the specified torque.

5.1 PE conductor

When connecting the surge arrester, please consider the whole over-voltage scheme.

- Pass the earth cable through the glands provided for this purpose *(For information on cable diameters please see our article description)*
- Connect the earth cable to the PE terminal provided for this purpose. *(For information on conductor type and cross-sectional area as well as applicable torques, please see our article description)*
- Tighten the cable gland so that the degree of protection of the DC Combiner and the strain relief is ensured. Unused cable glands must be fitted with blanking plugs *(For information on the cable gland torques, please see our article description)*

5.2 Data bus cable/Power supply

- Pass the data / power supply cables through the glands provided for this purpose *(For information on cable diameters see our article description)*
- Connect the data / power supply cables to the shield terminals and connection terminals provided for this purpose. *(For information on terminal connections, conductor type and cross-sectional area as well as the required torques, please see our article description)*
- Tighten the cable gland so that the degree of protection of the DC Combiner and the strain relief is ensured. Unused cable glands must be fitted with blanking plugs *(For information on the cable gland torques please see our article description)*

5.3 PV String cables (Input)

DANGER

Danger to life from polarity reversal: the DC Combiner is not protected against polarity reversal. Polarity reversals can lead to serious faults.

- Pass the PV string cables through the cable glands provided for this purpose *(For information on cable diameters, please see our article description)*
- Connect the PV string cables to the terminal blocks or fuse holders provided for this purpose. Make sure, that the string cable and its active parts show enough gap between conductive materials or active parts of the junction box *(For information on conductor type and diameters and torques to be observed, please see our article description)*
- Tighten the cable gland in order to guarantee the protection degree and the strain relief of the DC Combiner Fit unused cable glands with blanking plugs *(For information on cable gland torques, please see our article description)*

5.4 Sub-array field cable (Output)

DANGER

Danger to life from polarity reversal: the DC Combiner is not protected against polarity reversal. Polarity reversals can lead to serious faults.

- Pass the sub-array field cables through the cable glands provided for this purpose *(For information on cable diameters, please see our article description)*
- Connect the sub-array field cables to the terminal blocks or fuse holders provided for this purpose. Make sure, that the sub-array field cable and its active parts show enough gap between conductive materials or active parts of the junction box. *(For information on conductor type and diameters and torques to be observed, please see our article description)*
- Tighten the cable gland in order to guarantee the protection degree and the strain relief of the DC Combiner. Fit unused cable glands with blanking plugs *(For information on cable gland torques, please see our article description)*

6 Commissioning

DANGER

Danger to life from high voltages!

There can be high voltages on the conducting components. Contact with these live parts can cause death or serious injury.

- Ensure that the main load-break switch is switched off (OFF position)
- Ensure that all the protective covers provided for this purpose are fitted.
- Ensure that all string fuse holders are open and that the string fuses are removed. Warning: never operate string fuses under load!
- Ensure that string cables are not connected to the live PV generator.
- Ensure that the DC Combiner is de-energized.
- Personal protective clothing must be worn while working on the DC Combiner.
- Do not come into contact with any conducting components or connected /disconnected conductors.
- Secure any switches to prevent them being switched on and ascertain that the equipment and parts are de-energized.
- Earth and short circuit
- Do not remove protective covers. Adjoining or energized parts must remain covered.

6.1 Voltage testing

DANGER

Use only appropriate voltmeters. Ensure that the voltmeter operating and isolating voltmeters are high enough for the application. The operating voltage can be up to 1500V DC!

- Ensure that the PV inverter is switched off and isolated from the DC side.
- Ensure that the main load-break switch is switched off (OFF position)
- Ensure that the fuse holders are open.
- Measure the open-circuit voltage of each string.
- Note the sign (+ /-) of the reading. Never connect polarity reversed strings.
- Establish that the polarity of the strings is the same and ensure that the measured values are the same. Never connect largely differing voltage levels together by closing the fuse holders. The fuse holders are not suitable for load switching purposes. Close the fuse holders only when they are voltage-free and of the same voltage level.

6.2 Closing the fuse holders

DANGER

- Ensure that the PV inverter is switched off and separated from the DC side.
- Ensure that the main load-break switch is switched off (OFF position)
- Ensure that the fuse holders are open.
- Wear personal protective clothing.

When the voltage testing (see 6.1) has been carefully carried out and all the safety rules followed, closing of the fuse holders can begin.

6.3 Closing the main load-break switch

DANGER

- Ensure that the PV inverter is ready for operation.
- Ensure that the main load-break switch is switched off (OFF position)
- Ensure that the fuse holders are closed.
- Wear personal protective clothing.

Ensure that DC Combiners connected in parallel, DC main distribution boards and the inverters are ready for connection and that all work on the inverters, DC main cables and DC main distribution boards has been completed and that there is no potential danger to personnel.

7 De-Commissioning

Note the safety advice in Sections 2.2 and 2.3.

7.1 Fault check

DANGER

Ensure that the DC Combiner is operating correctly. Ensure that there are no faults which could lead to endangering operating personnel.

The following describes how to isolate the DC Combiner.

7.2 Opening the main load-break switch

DANGER

- Ensure that no danger can occur by switching operations.
- Units with external handles: please establish that the door is unlocked only after the switch is in the OFF position. WARNING: Also note that when the DC main switch is switched off (OFF position) all active parts still have a voltage which can endanger life.
- Units with internal handles: open the enclosure.
- Switch the main load-break switch to the OFF position.
- To isolate the sub-array field cable, open the upstream fuse / switch elements or all DC Combiners connected in parallel. Switch off the inverter.

7.3 Opening the fuse holders

DANGER

The fuse holders are not suitable for switching when under load. Ensure that there is no current flowing using appropriate instruments.

- Open all fuse holders and remove the fuse links. Ensure that inadvertent closing cannot occur. Fuse holders are not suitable for switching under load.
- WARNING: both the string cables and the sub-array field cable are still under voltage which can endanger life.
- To isolate the string cables, open the solar plug on the outside of the DC Combiner and mark them to prevent polarity reversals/ mix-ups.
- To isolate the sub-array field cable, open the upstream fuse /switch elements or all DC Combiners connected in parallel. Switch the inverter off.

7.4 Determining voltage free status

Before starting work on the DC Combiner: see the general safety advice in Sections 2.2 and 2.3 and determine voltage-free status.

7.5 Removal

Procedure

1. Disconnect all supply input and output cables from the terminals.
2. Isolate the earth cable.
3. Loosen cable glands.
4. Pull out all cables through the cable glands and gland plates. Remove DC Combiner.

8 Maintenance

DANGER Note the safety advice in Sections 2.2 and 2.3

You must check the DC Combiner regularly for function and safety. This means in particular.

	Check	Recommended frequency
There is no sign of corrosion on parts which ensure the function and safety	Visual inspection	Annually
There are no harmful amounts of water or dust inside the DC Combiner	Visual inspection	Annually
Cable glands and pressure equalization elements are undamaged and functional	Visual inspection	Annually
Insulation properties	Insulation test	Every 5 years
Connections are in order and show no signs of heat or burn marks	Visual inspection	Annually
Internal covers, doors, hinges and locking mechanisms are in order and functional	Visual inspection	Annually

Electrical plants and fixed electrical equipment are to be maintained regularly according to the current relevant standards. Maintenance is the responsibility of the plant operator.

When replacing equipment, only use equipment identical to the original. If you have any questions, please contact the manufacturer.

9 Further Information

For detailed information please see the Datasheet and Manual of your specific HIS Product.

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solar wiring system

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