CHARX PS-M2/825DC/1000DC/30KW

Power module

Data sheet
110335_en_02

 2024-11-19

1 Description

CHARX power, which includes power modules, is an integral part of a device family for professional solutions for operating DC charging infrastructure.

The power module was designed especially for the fast charging of electric vehicles. The modular concept enables the performance-based scaling of charging points in the 19" control cabinet. Alternatively, operation in a local DC grid is also possible.

DC charging is supported with high DC voltages and DC currents up to High Power Charging (HPC).

Features

- Digitally controlled power level
- Electrical isolation between DC input voltage and DC output voltage
- Maximum power point tracking (MPPT) for optimum operating point control when using a photovoltaic system
- >95% efficiency at 50% load supply
- Low power dissipation in standby mode
- CAN bus communication with the controller, e.g., a CHARX control controller
- Management of 48 power modules as CAN bus devices within one CHARX control controller
- High power density at just 3RU (134 mm)
- Can be mounted and operated in any location
- Approved in accordance with IEC 61851-1

Technical data (short form)	
Input voltage range	300 V DC ... 825 V DC
Nominal output voltage	30 V DC ... 1000 V DC
Output current range	0 A ... 100 A
Nominal power	30 kW
Degree of efficiency	> 95 % (P_{Out} >50%)
Ambient temperature (operation)	-40 °C ... 70 °C
Dimensions (W x H x D)	483 x 134 x 550 mm
Rack unit	3 U
Weight	27000 g
Standards/specifications	IEC 61851-1 IEC 61851-21-2 (Class B) IEC 61851-23 ANSI/UL 2202

All technical specifications are nominal and refer to a room temperature of 25 °C and 70 % relative humidity at 100 m above sea level.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
CHARX power basic, Fast charging module for setting up DC charging stations, 19" rack mounting, output: 30 V DC...1000 V DC / 0 A...100 A	CHARX PS-M2/825DC/ 1000DC/30KW	1296467	1

Documentation	Type	Item No.	Pcs./Pkt.
CAN-based communication protocol between one or more power modules and a charging controller	DB EN CHARX PS... CAN BUS GCP Protocol V1.30	-	-

Accessories	Type	Item no.	Pcs./Pkt.
Network cable, degree of protection: IP20, cable length: 2 m, number of positions: 8, 1 Gbps, CAT6, cable outlet: straight, Ethernet	VS-IP20-OE-94F-LI/2,0	1415255	1
Programmable charging controller for DC and AC charging of electric vehicles in accordance with IEC 61851-1,-23, DIN SPEC 70121, and CHAdeMO, with integrated cellular modem	EV-PLCC-AC1-DC1	1624130	1
CHARX control integrated, Power control unit for the construction of DC charging stations, 19" rack mounting, input: 0 V DC...1000 V DC, output: 0 V DC...1000 V DC / 0 A DC...500 A DC	CHARX CONTROL-M2/ 150KW	1311433	1
CHARX connect standard, DC charging cable, with vehicle charging connector and open cable end, for charging electric vehicles (EV) with direct current (DC), with connected PP contact, with replaceable mating face frame, with analog temperature sensors, CCS type 2, IEC 62196-3, 250 A / 1000 V (DC), PHOENIX CONTACT logo, cable: 5 m, black, straight	EV-T2M4CC-DC250A-5,0M70ESBK11	1107339	1
CHARX connect standard, DC charging cable, with vehicle charging connector and open cable end, for charging electric vehicles (EV) with direct current (DC), with charging connector holder, with analog temperature sensors, CCS type 1, SAE J1772, IEC 62196-3, 200 A / 1000 V (DC), PHOENIX CONTACT logo, cable: 5 m, black, straight	EV-T1G2CC-DC200A-5,0M1ASBK11	1051695	1
Direct current energy meter with direct measurement up to 1000 V / 650 A, with RS-485 interfaces for the programming software and the DC charging controller, correction of charging cable losses, operating temperature up to +80°C, certified in accordance with measuring and calibration law	EEM-PM157-SLP	1269236	1
CHARX control modular, RFID device, for connection to CHARX control modular AC charging controllers, in housing	EV-RFID-ELT-IP65	1309687	1

Accessories	Type	Item no.	Pcs./Pkt.
Web panel with 46.9 cm / 18.5"-TFT display (projective-capacitive (PCAP)), 1920 x 1080 pixel(s) (Full HD), 16.7 million colors, Arm® Cortex®-A53, 1.6 GHz, 2x USB Host 2.0, 1x USB Type C 3.0, 1x COM (RS-232/422/485), 1x Ethernet (10/100/1000 Mbps), RJ45, Yocto/Linux® and user software: QT browser. (bus system: without)	WP 6185-WHPS	1290807	1
Relay base RIF-1..., for miniature power relay with 1 or 2 changeover contacts or solid-state relays of the same design, Push-in connection, plug-in option for input/interference suppression modules, for mounting on NS 35/7,5	RIF-1-BPT/2X21	2900931	10

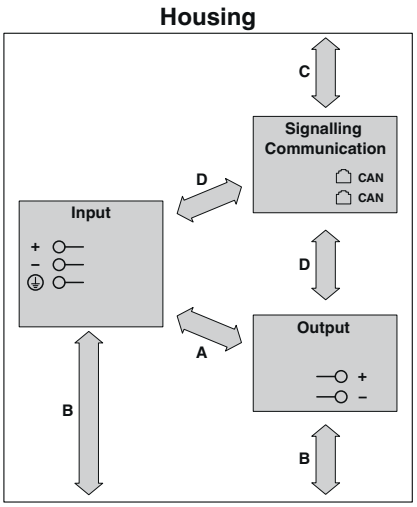
You will find the latest accessories for the item at phoenixcontact.com/products.

4 Technical data

Input data	
Input voltage range	300 V DC ... 825 V DC
Nominal input voltage range	650 V DC ... 825 V DC
Current consumption	48 A (650 V DC) / 38 A (825 V DC)
Inrush current limitation	< 60 A
Insulation resistance	> 10 MΩ
Overvoltage category	II (IEC 60664-1)

Maximum Power Point Tracking (MPPT)	
Input voltage range	300 V DC ... 740 V DC
Nominal input voltage range	650 V DC ... 740 V DC
Start-up voltage	min. 375 V DC
Current consumption	< 50 A (650 V DC)
Efficiency	> 99.5 % (>5 kW)

Electric strength of the insulation



	Insulation distance	Insulation voltage
Insulation voltage input/output	A	2121 V DC
Insulation voltage input, output / housing	B	2121 V DC
Insulation voltage signal, communication/housing	C	707 V DC
Insulation voltage input, output/signal, communication	D	4242 V DC

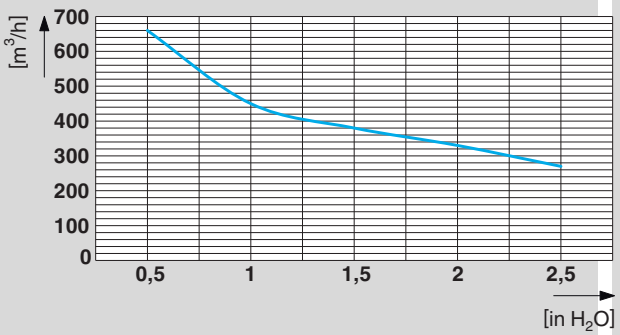
Connection data: Input	Connection capacity Terminal block	recommended
Connection method	Push-in connection	
Stripping length	18 mm (rigid/flexible)	
1-conductor rigid	1.5 mm² … 16 mm²	10 mm²
1-conductor flexible	1.5 mm² … 16 mm²	10 mm²
1-conductor rigid (AWG) (Cu)	15 … 5	7

Output data	
Output voltage range	30 V DC … 1000 V DC
Protection against overvoltage at the output (OVP)	> 1040 V DC
Output current range	0 A … 100 A
Control deviation	< 0.5 % (Voltage deviation static load change 20% … 100%) < 1 % (Current deviation Static load change 20 % … 100 %) ± 0.2 % (Input voltage change ±20 %)
Switch-on delay	< 8 s
Overshoot behavior	± 3 % (Switch-on procedure)

Connection data: Output	Connection capacity Terminal block	recommended
Connection method	T-LOX knee lever connection	
Stripping length	20 mm (10 mm² … 25 mm² = 18 mm, 35 mm² … 50 mm² = 20 mm)	
1-conductor rigid	10 mm² … 50 mm²	25 mm²
1-conductor flexible	16 mm² … 50 mm²	25 mm²
1-conductor rigid (AWG) (Cu)	8 … 0	16

Data interface	
Connection method	2x RJ45
Interface designation	CAN bus
Number of interfaces	1
Locking	Locking clip
Transmission physics	wired
Topology	Daisy Chain
Transmission speed	125 kbps (Default), 500 kbps
Transmission length	max. 20 m
Supported protocols	CAN 2.0B
Number of power modules as CAN bus devices	max. 48
Termination resistor	120 Ω (Terminating the end device)

General data	
Degree of protection	IP20
Protection class	I
Internal fan	✓



Flow direction	from front to back
Noise level	< 60 dB (1 m)
Mounting type	19" rack mounting
Dimensions (W x H x D)	483 x 134 x 550 mm
Rack unit	3 U
Weight	27000 g

Power consumption	
Nominal power	30 kW
Efficiency	> 95 % (P_{Out} >50%)
Power dissipation standby	< 14 W

Ambient conditions	
Degree of pollution	2
Ambient temperature (operation)	-40 °C … 70 °C
Derating	> 55 °C (3.2 A/K) > 55 °C (1 kW/K)
Overtemperature protection (OTP)	> 75 °C
Ambient temperature (storage/transport)	-40 °C … 70 °C
Max. permissible relative humidity (operation)	≤ 95 % (non-condensing)
Installation height	≤ 4000 m (Derating >2000 m: 10% / 1000 m)
Noise level	< 60 dB (1 m)

Standards/specifications	
Electric vehicle conductive charging system - Part 1: General requirements	IEC 61851-1
Electric vehicle conductive charging system - Part 21-2: EMC requirements for off board electric vehicle charging systems	IEC 61851-21-2 (Class B)
Conductive charging systems for electric vehicles – Part 23: DC supply equipment for electric vehicles	IEC 61851-23
Standard for Safefy for Electric Vehicle (EV) Charging System Equipment	ANSI/UL 2202

EMC data	
Interference emission	IEC 61000-6-3
Noise immunity	IEC 61000-6-2

5 Safety and installation notes

Symbols used

Instructions and possible hazards are indicated by corresponding symbols in this document.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible personal injuries.

There are different categories of personal injury that are indicated by a signal word.

WARNING

This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The following symbols are used to indicate potential damage, malfunctions, or more detailed sources of information.

NOTE

Together with the signal word NOTE and the accompanying text, this symbol alerts readers to a situation that may cause damage or malfunction to the power module, surrounding property, or hardware/software.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

Safety notes and warning instructions

WARNING: Danger to life by electric shock!

- Only qualified specialist personnel may install, commission, and operate the power module.
- Never carry out work when voltage is present.
- Establish connection correctly and ensure protection against electric shock.
- Cover termination area after installation in order to avoid accidental contact with live parts (e. g., installation in control cabinet).
- Protection may be impaired if the power module is used in a manner not specified by the manufacturer.

NOTE

- Observe the national safety and accident prevention regulations.
- Assembly and electrical installation must correspond to the state of the art.
- The power module is a built-in device and is designed for mounting in a control cabinet.
- The IP20 degree of protection of the device is intended for use in a clean and dry environment.
- Observe mechanical and thermal limits.
- Connect the protective conductor device terminal block (PE) with ground.
- Make sure that the wiring on the primary side and the secondary side is adequately dimensioned and protected.
- The connection parameters for wiring the power module, such as the required stripping length with and without ferrule, are listed in the section: Technical data.
- To wire the input and output terminals on the device side, use double insulated cables with a test voltage >1000 V DC.
- Use copper cables for operating temperatures of
  >75 °C (ambient temperature <55 °C)
  >90 °C (ambient temperature <75 °C).
- The power module is approved for connection to a DC power grid with protective conductor connection and a supply voltage of maximum 825 V DC.

- Protect the device against foreign bodies penetrating it, e.g., paper clips or metal parts.
- The power module is maintenance-free. Repairs may only be carried out by the manufacturer. Opening the housing invalidates the warranty.
- The power module may only be used for its intended use.
- The power module is a built-in device and is designed for horizontal mounting in a 19″ control cabinet.
- The 19" control cabinet must be securely anchored to the base surface and sufficiently protected against tipping over.
- The high intrinsic weight of the power module requires two side-mounted high-load support rails in the 19″ control cabinet.
- Power modules must be assembled in the 19" control cabinet in the specified sequence from bottom to top. They are removed in reverse order.
- The length of the M5 mounting screws in the front panel of the power module is designed in such a way that the effectively usable screw length behind the front panel is 8 mm. Tighten the M5 mounting screws to a maximum torque of 1 Nm either by hand or using a tool.

6 Design

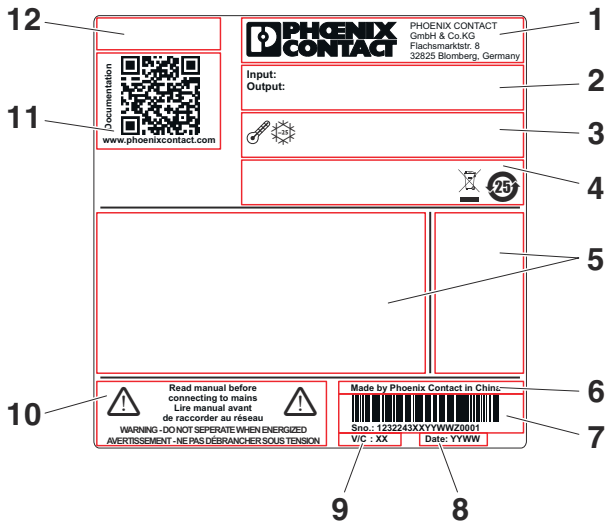
6.1 Rating plate

In accordance with the German Product Safety Law (ProdSG) it is only permissible to make such products available on the market if they meet certain safety standards. It must be ensured at all times that users are not exposed to hazards.

In accordance with ProdSG, the power module must therefore be fitted with a rating plate. All relevant information on the safe use of the power module must also be included.

The device rating plate for the power module is located on the right-hand side of the housing (as viewed from the front).

Figure 1 Rating plate information



Key

No.	Designation
1	Identification of the provider
2	Device connection data
3	Ambient conditions
4	Disposal and recycling notes
5	Device approvals/conformities
6	Phoenix Contact Group production facilities
7	Bar code and serial number for identification
8	Date of manufacture
9	Version designation
10	Designation of product-related device documentation
11	QR code as web link to the device documentation
12	Product designation

6.2 Device connections and functional elements

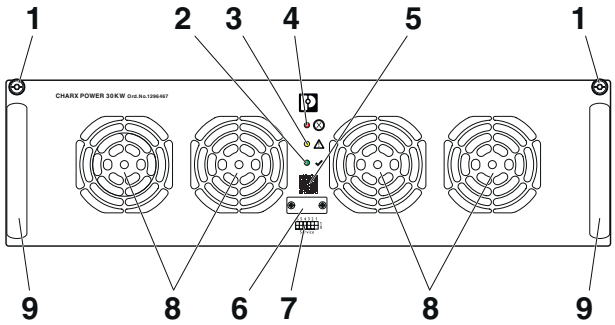
Device connections are labeled with connection tags to ensure clear and definitive identification.

The connection tags are split into the following connection levels:

Connection level	Marking
DC supply voltage	DC IN: +/-/PE⏚
DC output voltage	DC OUT: + / -
2x CAN bus communication interface	CAN

6.2.1 Front view

Figure 2 Position of the function and operating elements

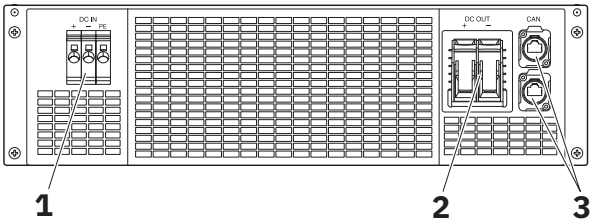


Key

No.	Designation
1	Mounting screws for 19″ control cabinet mounting
2	Power module in operation: LED display (green)
3	Power module in alarm state: LED display (yellow)
4	Power module in malfunction state: LED (red)
5	QR code web link
6	DIP switches for manually assigning a group number (behind the cover)
7	Marking field for the manually assigned group number
8	Fan unit (speed-controlled)
9	Handle for mounting/removing the power module

6.2.2 Rear view

Figure 3 Position of the function elements

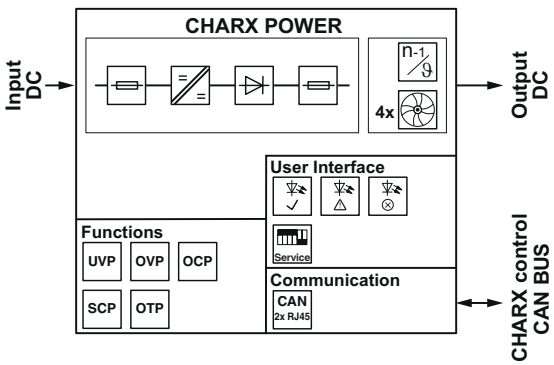


Key

No.	Designation
1	DC feed-in terminals with protective conductor connection PE (supply voltage)
2	DC output terminal blocks
3	2x CAN bus communication interface

6.3 Block diagram

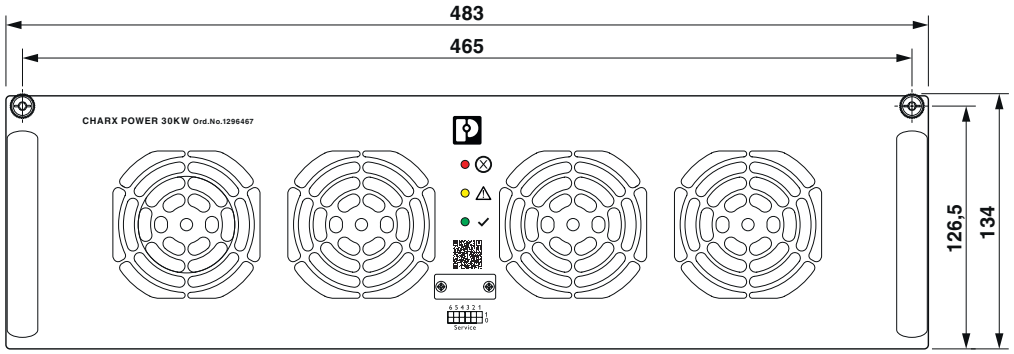
Figure 4 Block diagram (schematic diagram)



6.4 Device dimensions

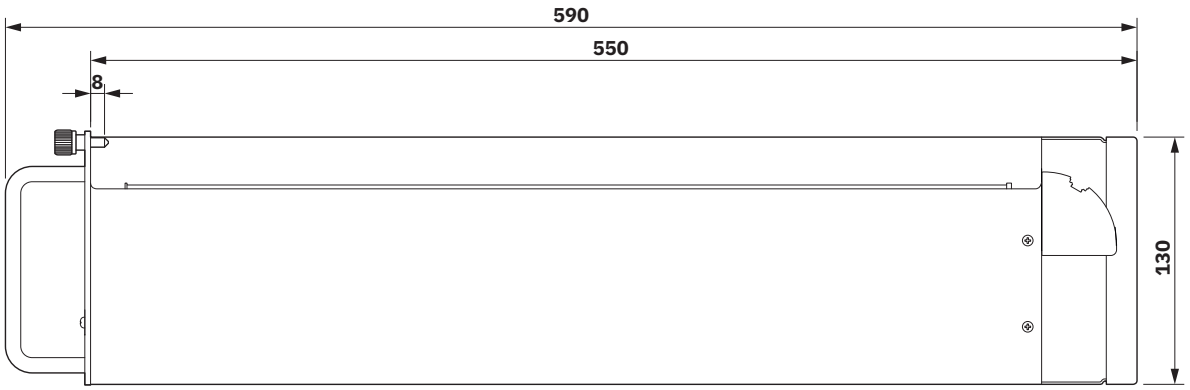
6.4.1 Front view

Figure 5 Device dimensions (dimensions in mm)



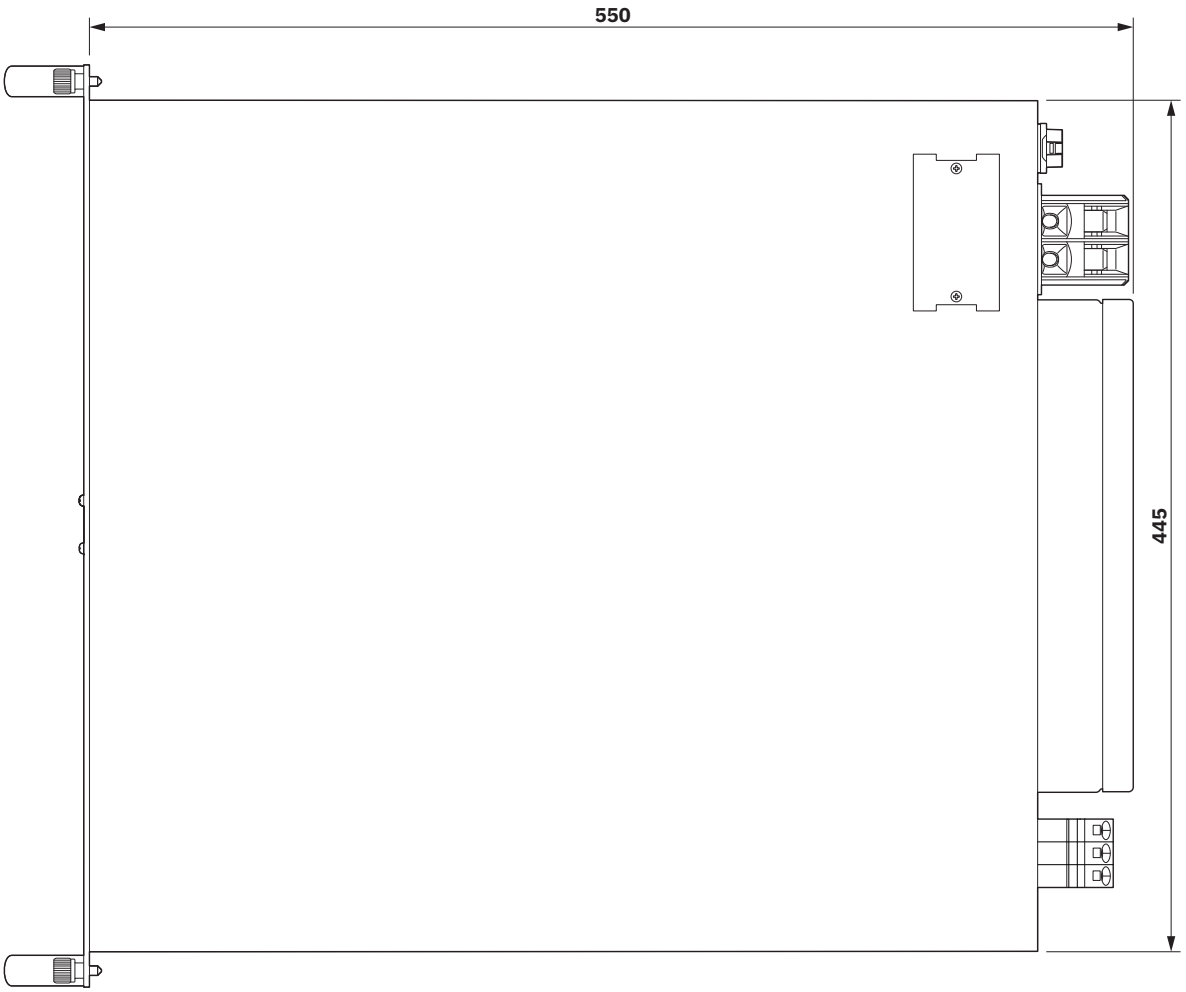
6.4.2 Side view

Figure 6 Device dimensions (dimensions in mm)



6.4.3 Top view

Figure 7 Device dimensions (dimensions in mm)



7 Mounting/remove

7.1 Installation location

Select a suitable installation location for erecting the DC charging infrastructure. Two mounting versions are available, depending on the nominal power required.

7.1.1 19" control cabinet

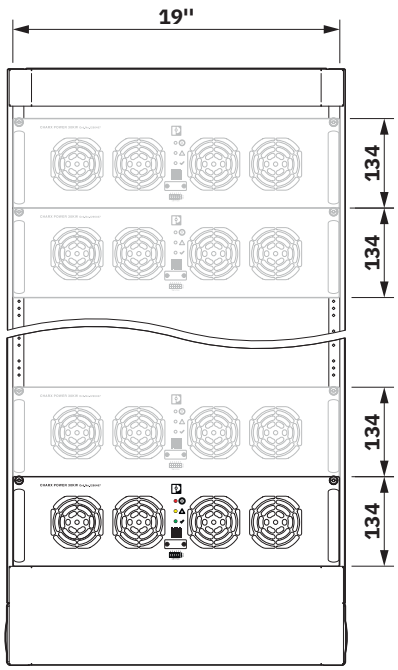
The power module is designed to be mounted and operated horizontally in a 19″ control cabinet. Two mounting screws integrated into the front panel are used to attach the power module.

In a 19″ control cabinet, twelve power modules can be scaled for a charging point with up to 360 kW of total power.

WARNING: Danger due to heavy weight

Ensure that the 19" control cabinet is installed securely and that it is not subject to tensile loads. Use sufficient and suitable mounting material to securely fix the 19" control cabinet in place.

Figure 8 Power modules mounted in the 19" control cabinet (schematic diagram)



7.1.2 DC home charger

Operation of the power module in a DC home charging station, for example, is also possible as an alternative to the 19" control cabinet installation.

The preferred position for installing the power module is based on the available space

The power module can be mounted and operated in any location.

NOTE: Avoid overheating

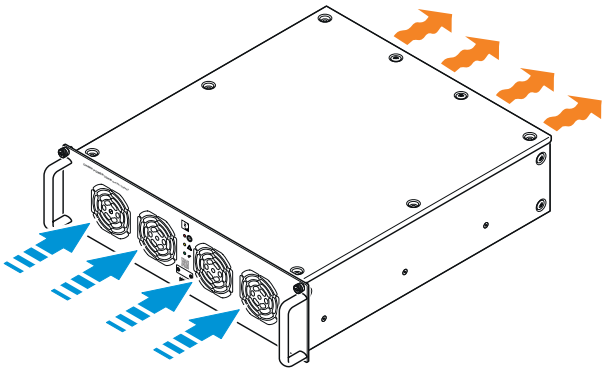
Ensure sufficient space at the installation location. The device-side ventilation grid on the power module may not be obstructed by neighboring equipment. Otherwise, despite active cooling, there is a DANGER that trapped heat will lead to the power module switching off.

7.2 Fan unit flow direction

The power module is equipped with an internal fan unit for active cooling of the device-internal power levels. The inflow for the ambient air for air cooling is through the device front and the outflow is through the device rear.

For the volumetric flow required for cooling for each power module, please refer to section: Technical data.

Figure 9 Flow direction (schematic diagram)



7.3 Installation height

You can operate the power module without power limitations up to an installation altitude of 2000 m. For altitudes higher than 2000 m, different specifications apply due to the differing air pressure and the reduced air cooling associated with this (see section: Derating).

7.4 Mounting the power module

Due to the high intrinsic weight of the power module, a second person should always help when mounting the power module in the 19" mounting frame and when removing it.

Two side-mounted high-load support rails are necessary to ensure that the high intrinsic weight of the power module is safely supported in the 19" mounting frame.

WARNING: Danger of tipping due to center of gravity offset

Power modules must be assembled in the 19" mounting frame in the specified sequence from bottom to top. They are removed in reverse order.

WARNING: Observe the national safety regulations for working on electrical systems

In Germany, this work may only be carried out by electrically skilled persons with additional training.

Furthermore, the five basic safety rules apply:

– Disconnect safely
– Ensure power cannot be switched on again
– Verify safe isolation from the supply for all positions
– Ground and short circuit
– Cover or safeguard adjacent live parts

7.4.1 Mounting in a 19'' control cabinet

To mount the power module in a 19" control cabinet, proceed as follows:

1. Ensure that the necessary side-mounted support rails have been installed at the required installation pitch (3RU) in the mounting frame.
2. Place the power module in its normal mounting orientation on the side-mounting support rails in the 19" mounting frame. When doing so, ensure that the power module sits securely on at least 1/3 of the housing depth.
3. Then carefully push the power module into the 19" mounting frame without tilting it. Ensure that the two mounting screws on the front panel protrude into the opening of the cage nuts in the 19" mounting frame.
4. Next, tighten the mounting screws using a suitable screwdriver. The front panel of the power module must lie flush on the 19" mounting frame.
5. Check that the power module is firmly and securely positioned in the 19" mounting frame.
6. Connect the electrical DC connecting cables and the CAN bus communication (see section: Device connection terminals).

Figure 10 Mounting in a 19'' control cabinet

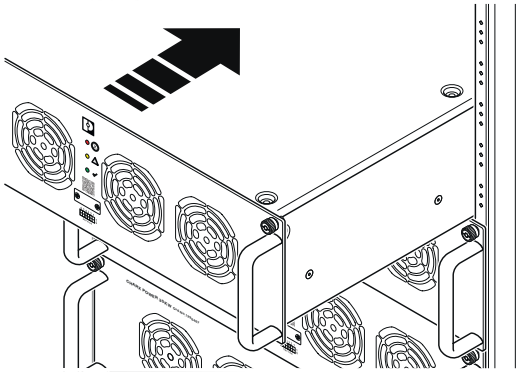
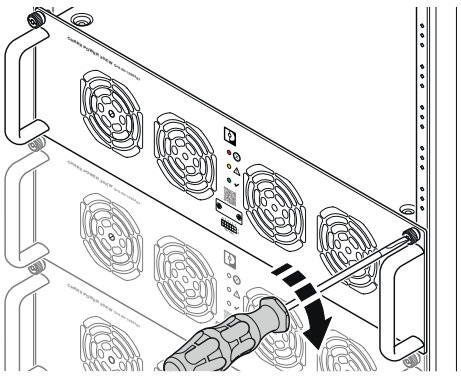


Figure 11 Fixing the power module securely in place



7.4.2 Mounting in a DC home charger

An individual mounting bracket is necessary for installing the power module in a DC home charger. The bracket selected depends on the available installation space.

NOTE: Insufficient air cooling may cause damage

The power module can also be mounted in a vertical mounting position. Make sure that the required supply air and exhaust air for air cooling is ensured.

7.5 Removing the power module

Due to the high intrinsic weight of the power module, a second person should always help when mounting the power module in the 19" mounting frame and when removing it.

WARNING: Observe the national safety regulations for working on electrical systems

In Germany, this work may only be carried out by electrically skilled persons with additional training.

Furthermore, the five basic safety rules apply:

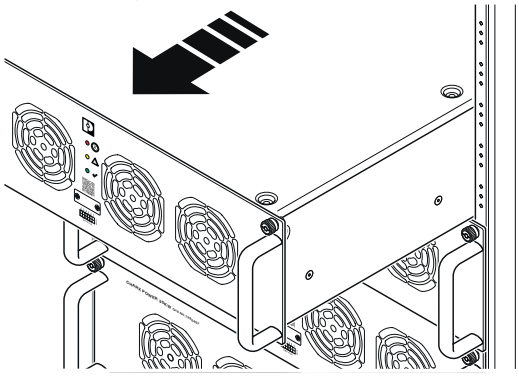
– Disconnect safely
– Ensure power cannot be switched on again
– Verify safe isolation from the supply for all positions
– Ground and short circuit
– Cover or safeguard adjacent live parts

7.5.1 Removing from a 19" control cabinet

To remove the power module from a 19" control cabinet, proceed as follows:

1. Ensure that the power module is disconnected from all power sources.
2. Begin with the preparatory work at the rear of the power module.
3. Disconnect the electrical DC connecting cables (DC IN) from the power module. Secure the uninsulated connecting cables using suitable insulating clamps.
4. Disconnect the electrical DC connecting cables (DC OUT) from the power module. Secure the uninsulated connecting cables using suitable insulating clamps.
5. Disconnect the CAB bus communication from the power module.
6. Continue with the preparatory work on the front of the power module.
7. With a suitable screwdriver, completely unscrew the two mounting screws on the front panel out of the cage nuts on the 19" mounting frame.
8. Next, use the two handles to carefully pull the power module 2/3 of the way out of the 19" mounting frame. When doing so, ensure that the power module does not tilt downwards.
9. Remove the power module and carefully put it down on a secure surface.

Figure 12 Removing from a 19" control cabinet



7.5.2 Removing from a DC home charger

To remove the power module from a DC home charger, proceed as follows:

1. Ensure that the power module is disconnected from all power sources.
2. Begin with the preparatory work at the rear of the power module.
3. Disconnect the electrical DC connecting cables (DC IN) from the power module. Secure the uninsulated connecting cables using suitable insulating clamps.
4. Disconnect the electrical DC connecting cables (DC OUT) from the power module. Secure the uninsulated connecting cables using suitable insulating clamps.
5. Disconnect the CAB bus communication from the power module.
6. Continue with the preparatory work on the front of the power module.
7. With a suitable screwdriver, completely unscrew the two mounting screws on the front panel out of the mounting bracket.
8. Now use the two handles to lift the power module carefully out of the mounting bracket.
9. Put the removed power module down carefully on a secure surface.

8 Device connection terminal blocks

The connection terminal blocks of the DC feed-in, DC load supply, and CAN bus communication are located at the rear of the power module.

For the necessary connection parameters for the connection terminal blocks, refer to the technical data section.

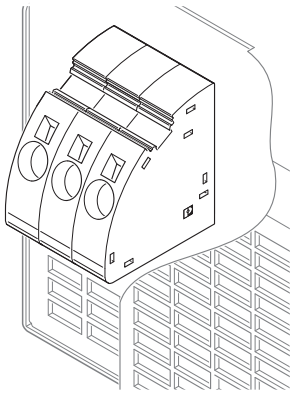
8.1 DC input terminal

The power module is operated on a DC grid with protective conductor connection. The primary-side DC connection is via connection terminal blocks DC IN +/-/PE.

No additional tools are necessary for wiring the primary side connection terminal blocks.

The power module is approved for connection to a DC power grid with protective conductor connection and a maximum supply voltage of 825 V DC.

Figure 13 Position of the DC IN connection terminal blocks (detail section)



8.2 Primary side connection and fuse protection

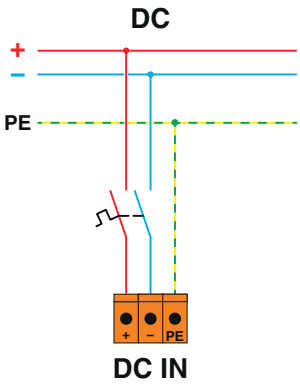
The power module must be installed in accordance with the provisions in EN 61851-1. It must be possible to switch the power module off using a suitable disconnection device from the outside. The line protection on the primary side, for example, is suitable for doing so (see section: Technical data).

8.2.1 DC supply network

DANGER: Hazardous voltage

When operating the power module on a DC supply network, observe the maximum permissible line voltage (see section: Technical data).

Figure 14 Schematic diagram, two-phase fuse protection



8.2.2 Connecting connection terminal blocks DC IN +/-/PE

To wire the power module with the feeding connecting cables, proceed as follows:

1. Strip the individual connecting cables and, if necessary, fit the conductor ends with ferrules (see section: Technical data)
2. Guide the stripped ends of the connecting cables into the center of the round cable openings in the connection terminal blocks until they stop.
3. Then check that the connecting cables are fixed securely in the connection terminal blocks.

If you use rigid connecting cables or flexible connecting cables with ferrules to wire the power module, no additional tools are required. Simply plug the connecting cables into the terminal openings provided.

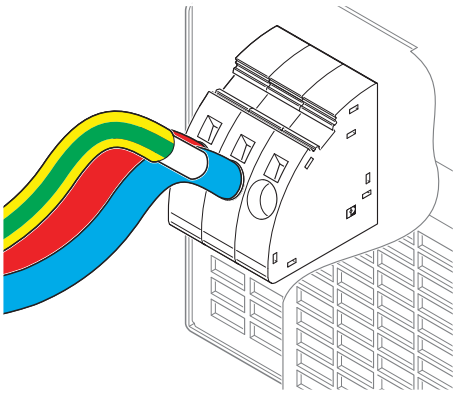
NOTE: Observe mechanical loads

Avoid any mechanical loads on the connecting cables, otherwise the electrical contact is at risk. Make sure there is enough space for the wiring in the wiring space.

DANGER: Life-threating mains voltage

Only perform wiring work on the DC feed-in terminals when no voltage is present. The protective conductor of the feed-in system must be connected to the ground terminal PE on the power module. Operating the power module without a protective conductor connection is not permitted.

Figure 15 Connecting the connecting cable

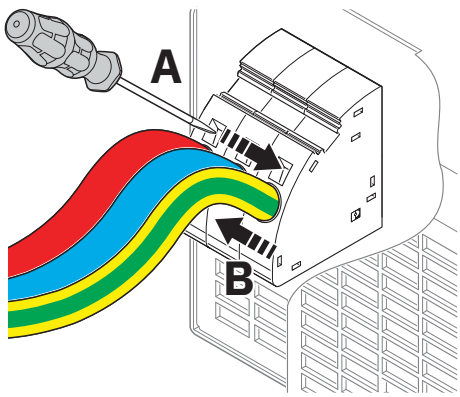


8.2.3 Removing connection terminal blocks DC IN +/- /PE

To remove the feeding connecting cables from the power module, proceed as follows:

1. Ensure that the power module is disconnected from all power sources.
2. To open the connection terminal blocks, insert a screwdriver into the square opening. Then carefully push the screwdriver to release the connection terminal block.
3. Pull the connecting cables from the connection terminal blocks. Secure the uninsulated ends of the connecting cables using suitable insulating clamps.

Figure 16 Removing connecting cables



8.3 DC output terminal blocks

The power module features a digitally controlled power level and provides electrical energy to the DC OUT+/- connection terminal blocks.

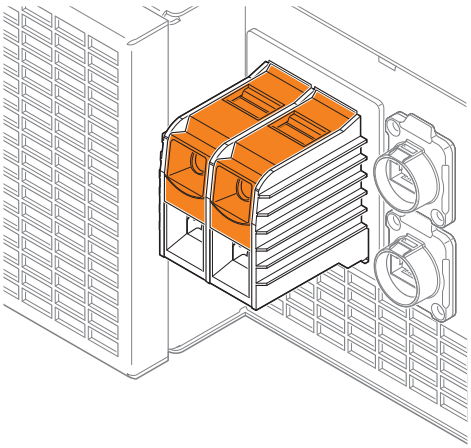
Using a screwdriver as a locking lever is helpful when wiring the DC connection terminal blocks.

The DC output voltage is electrically isolated from the feeding DC input voltage.

8.4 Secondary-side connection and fuse protection

Connect the DC load to be supplied to the DC OUT connection terminal blocks in accordance with EN 61851-1.

Figure 17 Position of the DC OUT connection terminal blocks (detail section)



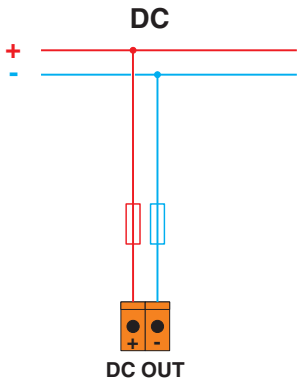
The power module has one connection terminal block with positive potential and one with negative potential for supplying the DC load. The power module is electronically short-circuit-proof and idling-proof. In the event of a fault, the output voltage is limited.

DANGER: Hazardous voltage

2-position fuse protection is necessary for the positive and negative potentials.

In the event of a short circuit on the secondary side, the power module is shut down. In order for the power module to restart, a switch-on command must be sent by the controller.

Figure 18 Wiring principle, 2-position fuse protection



8.4.1 Connecting connection terminal blocks DC OUT+/-

To wire the power module to the DC load that is to be supplied, proceed as follows:

1. Strip the individual connecting cables and, if necessary, fit the conductor ends with ferrules (see section: Technical data)
2. To open the respective connection terminal blocks, insert a screwdriver into the round opening on the cover flap. Now pry the screwdriver upwards.
3. Guide the stripped ends of the connecting cables into the open connection terminal blocks until they stop.
4. To contact the connecting cables in the connection terminal blocks, pry the relevant cover flaps back down.
5. Check to make sure that the cover flap has been completely pried down to the stop. If not, a seamless electrical connection is not guaranteed.

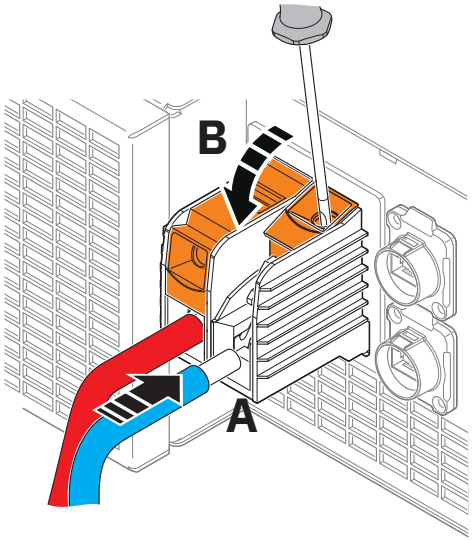
NOTE: Observe mechanical loads

Avoid any mechanical loads on the connecting cables, otherwise the electrical contact is at risk. Make sure there is enough space for the wiring in the wiring space.

DANGER: Life-threatening DC voltage

Only perform wiring work on the DC connection terminal blocks when the power module is disconnected from all power sources.

Figure 19 Connecting the DC connecting cable

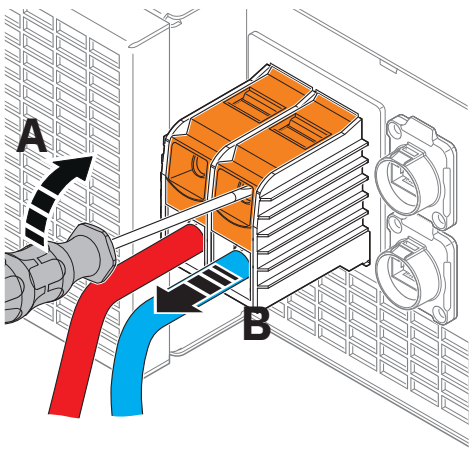


8.4.2 Removing connection terminal blocks DC OUT+/-

To remove the connecting cables of the power module from the DC load that is to be supplied, proceed as follows:

1. Ensure that the power module is disconnected from all power sources.
2. To open the respective connection terminal blocks, insert a screwdriver into the round opening on the cover flap. Now pry the screwdriver upwards.
3. Lift the stripped ends of the connecting cables out of the open connection terminal blocks. Secure the uninsulated ends of the connecting cables using suitable insulating clamps.

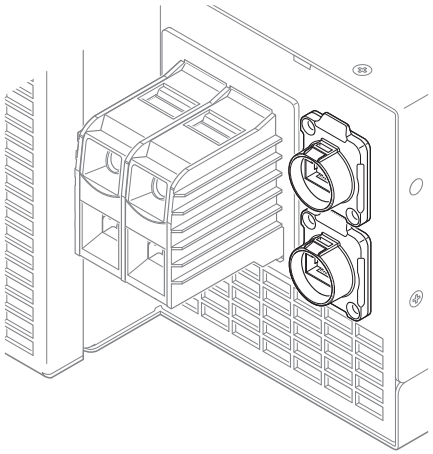
Figure 20 Removing connecting cables



8.5 Can bus connection jacks (RJ45)

The power module is equipped with two CAN bus interfaces for communication with a higher-level CHARX control controller (CAN bus master).

Figure 21 Position of the CAN bus communication interfaces (detail section)



8.5.1 CAN bus topology

The power module supports the CAN 2.0B protocol. The maximum number on a linear CAN bus is 30 power modules.

CAN bus communication between the higher-level CHARX control controller and the power module is realized as a daisy-chain connection with an RJ45 connection.

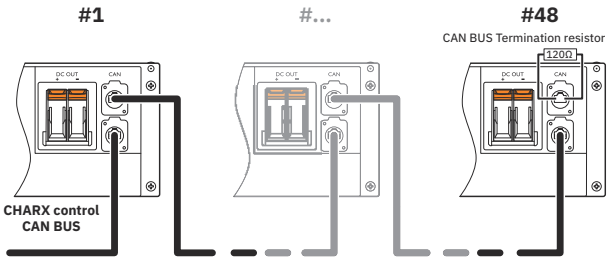
Use CAT 3, CAT 4, or CAT 5 cables with RJ45 connection plugs as CAN bus lines. The functional assignment of the CAN bus communication (CAN-IN, CAN-OUT) has not been specified on the power module.

When cabling the CAN bus communication interfaces, uniform assignment of the RJ45 jacks will simplify troubleshooting in the event of errors.

This can be, for example: CAN-IN (lower RJ45 jack), CAN-OUT (upper RJ45 jack)

The end devices on the maximum 20 m long CAN bus are each terminated with a 120 Ω termination resistor.

Figure 22 CAN bus communication as a daisy-chain connection (schematic diagram)



8.5.2 Connecting/removing CAN bus lines

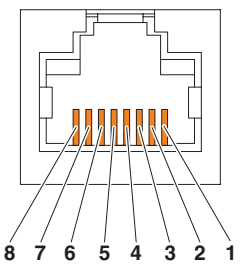
The CAN bus line is connected in exactly the same way as a standard network cable. When you plug the bus line RJ45 connection plug into the RJ45 jack on the power module, you will hear the typical click when it locks into place.

To unlock it, press the unlocking lever on the RJ45 connection plug and pull the plug out of the RJ45 jack.

8.5.3 CAN bus interface RJ45 contact assignment

Pin	Description
1	CAN_H signal (active high)
2	CAN_L signal (active low)
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved
8	Reserved

Figure 23 CAN bus interface pin assignment



The controller CAN_GND must be connected to functional ground (FE) to ensure interference-free data transmission between the power module and the superordinate controller.

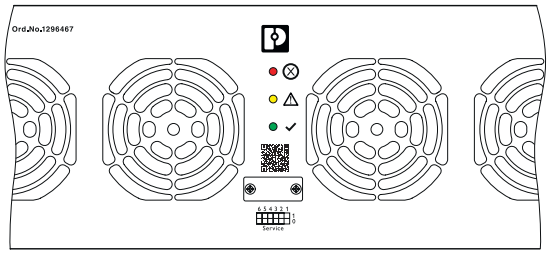
9 Function elements

The functional elements of the power module are located on the front of the housing and are categorized as follows:

– LED status indicators
– DIP switch

The functional elements also include a row of internal fans for active cooling of the power levels.

Figure 24 LED status indicators (detail section)



9.1 LED status indicators

Various LED status indicators are available for preventive power module function monitoring. Various indicator modes provide information on the current device status of the power module.

9.1.1 Operation

LED status indicator - operation

The possible indicator modes and their descriptions are listed in the following table:

Operation	Description
○	Primary-side DC supply voltage not present
●	Normal operation
✷	Device-internal function monitoring active

○ = off, ● = on, ✷ = flashing (green)

9.1.2 Alarm

LED status indicator - alarm

The possible indicator modes and their descriptions are listed in the following table:

Alarm	Description
○	Normal operation
●	Primary-side under- or overvoltage
	Internal device temperature above limit value
	Internal bus voltages outside the limit values
✷	CAN bus communication interrupted

○ = off, ● = on, ✷ = flashing (yellow)

For further information on the alarm messages, see section: Protective functions (device-internal and external)

9.1.3 Malfunction

LED status indicator - malfunction

The possible indicator modes and their descriptions are listed in the following table:

Error	Description
○	Normal operation
●	Overvoltage at the DC output
	Output current limitation at the DC output
	Device-internal address conflict and bus error
✷	Malfunction in the fan unit

○ = off, ● = on, ✷ = flashing (red)

For further information on the malfunction messages, see section: Protective functions (device-internal and external)

9.2 DIP switch

DIP switch

The DIP switch with dual function is intended for manually assigning the group number and one of two optional transmission speeds. To prevent tampering, the DIP switch is located behind a cover.

9.3 Fan unit

The power module is equipped with an internal fan unit for active cooling of the power levels. The power-dependent electrical heat that is generated during operation (self-heating) is dissipated to the ambient air via the heatsinks of the power levels. The prevalent ambient temperature at the installation location is acquired via temperature sensors. The fan controller regulates the speed via processors.

10 Addressing/transmission speed

The power module (CAN bus device) is automatically assigned a unique module number and module address for CAN bus communication with the higher-level CHARX control controller as the CAN bus master.

The module number depends on the power modules connected to the CAN bus. Upon each system start, the participating power modules are determined, and the module numbers are assigned based on their start-up sequence.

If no new power modules are determined on the CAN bus during a system start, the previous numbering will remain unchanged. The numbering is always assigned in ascending order beginning from 0.

The maximum number of CAN bus devices is limited to 48 power modules.

10.1 Manually assigning the group number

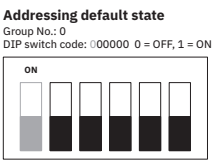
As an alternative, a permanently assigned group number can be manually assigned using the DIP switch on the device.

For manually assigning the group number, the five DIP switches located on the right are available for binary coding from 0 to 31.

NOTE: Malfunction

A manual change of the group number cannot be carried out if the power module is active (DC load supply).

Figure 25 DIP switches, default setting



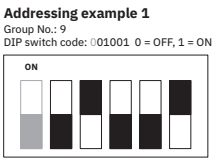
Addressing examples

The following addressing examples provide you with a general overview of the power module group number in binary code.

When addressing the power module manually, the assigned group number (in binary code) should be entered into the marking field for unique identification. Copy the DIP switch positions into the fields specified. The unique assignment of the power module simplifies any potential troubleshooting.

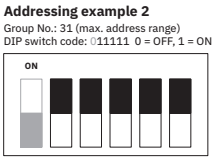
10.1.1 Addressing example 1

Figure 26 DIP switch (detail section)



10.1.2 Addressing example 2

Figure 27 DIP switch (detail section)



10.1.3 Manual selection of the transmission speed

In the delivery state, the transmission speed is preset to 125 kbps. Alternatively, you can increase the transmission speed to 500 kbps, if required.

NOTE: Malfunction

A manual change of the transmission speed is not permitted if the power module is active. Changes to the configuration are only applied when the power module is restarted.

Figure 28 DIP switch (detail section)

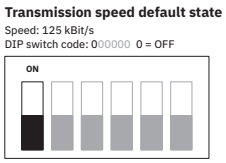
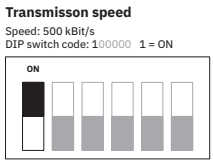


Figure 29 DIP switch (detail section)



11 Protective functions (device-internal and external)

The power module supports various protective functions for device-internal protection and for protection of the connected DC load.

Depending on the type of protective function, it is possible to automatically return to normal operation once the cause of the malfunction has been remedied.

The following device-internal and external protective functions are executed and signaled as an alarm or malfunction message.

11.1 Alarm message triggers

Detection of the following events will trigger an alarm message. The alarm message is signaled with an LED status indicator (see section: LED status indicator - alarm).

11.1.1 DC UVP/OVP (Undervoltage/overvoltage protection)

The DC undervoltage/overvoltage protection function protects the DC input circuit of the power module against damage if the input voltage is too low or too high. If the DC input voltage leaves the permissible voltage range, the power module is switched off.

When the DC input voltage returns to the permissible voltage range, the power module switches back to normal operation. The DC output is enabled and the DC load supplied.

11.1.2 OTP (Overtemperature protection)

The overtemperature protection function protects the power module against damage in case of impermissibly high self-heating caused by electrical heat or external heating (e.g. due to solar irradiation). If the temperature limit value is exceeded, the DC output is switched off.

Once the power module has cooled down and the device-internal temperature falls below the triggering temperature limit value, the power module switches back to normal operation. The DC output is enabled and the DC load supplied.

11.1.3 Internal bus voltages

The bus module operates with different device-internal bus voltages. If impermissible deviations from the parameter limits are detected during cyclic checks, an alarm message is triggered.

11.1.4 CAN bus communication

The power module internally monitors whether CAN bus communication with the higher-level CHARX control controller is being executed. Irregularities in CAN bus communication trigger an alarm message.

11.2 Malfunction message triggers

Detection of the following malfunctions will trigger an alarm message. The malfunction message is signaled via an LED status indicator (see section: LED status indicator - malfunction).

11.2.1 DC OVP (Overvoltage protection)

The DC overvoltage protection function protects the DC output of the power module and the connected DC load against damage in the event of a device-internal overvoltage. The power module switches the DC output off.

When the DC output voltage returns to the permissible voltage range, the power module switches back to normal operation. The DC output is enabled and the DC load supplied.

11.2.2 DC OCP (Overcurrent protection)

The overcurrent protection function protects the DC output of the power module and the connected DC load against damage in the event of an impermissibly high current load. In addition, the DC output is short-circuit-proof. The power module switches the DC output off.

When the output-side current load drops back below the limit value, the power module switches to normal operation again. The DC output is enabled and the DC load supplied.

11.2.3 Internal address conflict and internal bus error

The power module performs cyclic checks for device-internal address conflicts and internal communication bus errors. If an internal bus communication interruption of >10 s is detected, an alarm message is triggered. If the internal bus communication returns within 10 to 20 s, the alarm message is reset. The power module returns to normal operation.

11.2.4 Fan unit

The power module checks cyclically that the device-internal fan unit is functioning correctly. If impermissible deviations from the parameter limits are detected during the device-internal check, an alarm message is triggered.

12 Output power

The output power provided by the power module when required depends on the state of charge of the connected DC load, e.g., a battery.

12.1 Increasing power

In a fully assembled 19" control cabinet, twelve power modules each with an individual power of 30 kW can be scaled for one charging point.

When supplying the DC load, the higher-level CHARX control controller regulates the balanced capacity utilization of the power modules. With a constant output voltage, the regulated asymmetrical deviation of the charging current is max. ±0.5 A.

12.1.1 Parallel operation

When n power module DC outputs are connected in parallel in a 19" control cabinet, the output current is increased to n x I_N. When 12 power module DC outputs are connected in parallel, the output current is increased to 12 x I_N. Each power module supplies a maximum output power of 30 kW at an output current of 100 A.

12.1.2 Fundamental prerequisites for parallel operation (power increase)

In order to ensure correct parallel operation of the power modules, observe the following rules:

Conductor cross-sections:

The connecting cables for supplying DC loads must be rated for the maximum occurring total current of all power modules.

Ambient conditions:

Select the installation location of the power modules such that the prevailing ambient conditions are identical. This is of particular importance if the power modules are installed in different installation locations. Large temperature differences between installation locations have a negative effect on the operating points of the power modules.

13 Derating

The power module is subject to derating influences that exist as individual influences or from combinations of influencing conditions.

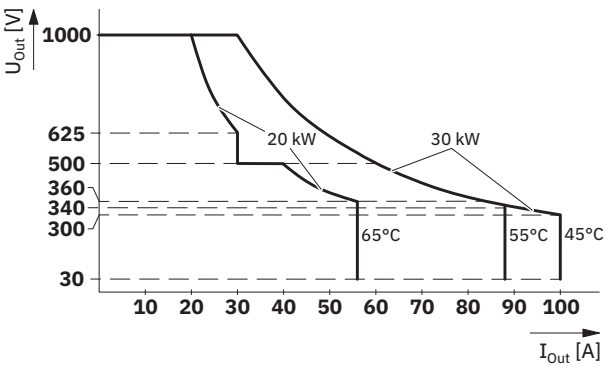
13.1 Ambient temperature

When operated within the permissible temperature range for nominal operation, the power module provides the full output power. If the power module is operated outside the temperature range for nominal values, note the reduced output power for the supply of DC loads.

13.2 Output power

The output power of the power module depends directly on the prevailing ambient temperature at the installation site, output voltage, output current, and installation altitude. The following figure shows the interdependencies of the parameters.

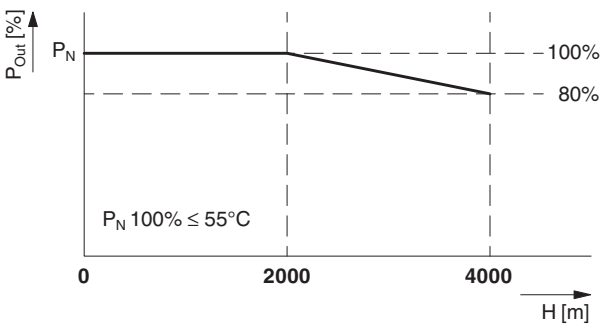
Figure 30 Output power and its dependencies



13.3 Installation height

The power module can be operated at an installation altitude of up to 2000 m without any limitations. Different data applies for installation locations above 2000 m due to the differing air pressure and the reduced cooling associated with it.

Figure 31 Output power depending on the installation height



13.4 Position-dependent derating

The specified technical data for the power module is based on nominal operation in the horizontal mounting position. The power module is not subject to position-dependent derating. Operation in different mounting positions is also possible without limitations.

14 Disposal and recycling

Ensure the correct disposal of electronic components

Do not dispose of the power module as household waste.

Observe the applicable national standards and regulations.

Ensure correct disposal or recycling

Dispose of or recycle packaging material that is no longer needed as household waste.

Observe the applicable national standards and regulations.

15 Attachment

15.1 Application example with EV-PLCC-AC1-DC1 DC charging controller (1624130)

This application example describes the principle hardware and software connection of the CHARX PS/... power module to the superordinate EV-PLCC-AC1-DC1 charging controller (1624130).

The goal of this application example is:

- The communication path between the power module and superordinate charging controller is physically established
- CAN bus communication is established
- The charging controller transmits the specified output values (default values) to the power module
- Measure the following values at the DC output terminals of the power module. DC output voltage 300 V DC (without DC load), DC output current 50 A (only with suitable DC load)

The following hardware and software components are required for this:

Quantity	Designation	Item No.
1	CHARX PS-M2/825DC/100DC/30KW power module	1296467
1	EV-PLCC-AC1-DC1 charging controller	1624130
1	CAN bus communication cable, RJ45 plug connection, open cable end	1415255
1	PC WORX DEMO software package for PC-based automation solutions	2985725
1	Application note AX SW SUITE CHANGE NOTES AUTOMATIONWORX Software Suite - Change notes at a glance (see download area - PC WORX DEMO)	
1	PC WORX StartUpPackage (see the download area of the charging controller)	
1	CANopen® termination resistor for RJ45 connectors	
1	Description of the CAN bus protocol CHARX PS-M2/... CAN BUS GCP Protocol Vx.x (see the download area of the power module)	
1	Service PC or notebook (state of the art)	
1	Ethernet communication cable (for connecting the service PC or notebook to the charging controller)	

15.2 CAN bus communication cable connection

Establish a physical communication path so that the power module can communicate bi-directionally with the DC charging controller.

Figure 32 Schematic diagram of the communication path

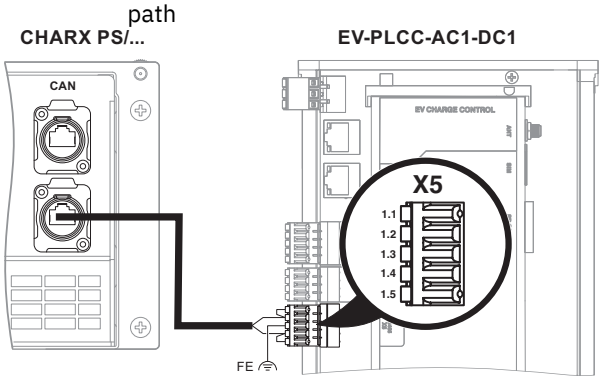


Figure 33 Connection assignment of the communication path

CHARX PS/...

Pin	Description
1	CAN_H signal (active high)
2	CAN_L signal (active low)
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved
8	Reserved

EV-PLCC-AC1-DC1

X5	Signal	Description
1.1	R-	Termination resistor (internal 1.1/1.2)
1.2	CAN-L	Non-inverted CAN signal
1.3	CAN-GND	Ground
1.4	CAN-H	Inverted CAN signal
1.5	R+	Termination resistor (internal 1.4/1.5)

FE

Terminate the power module with a CANopen® termination resistor for RJ45 connectors. To do this, plug the CANopen® termination resistor into the unassigned RJ45 connection socket.

On the charging controller, activate the termination resistor of the CAN bus communication interface. To do so, bridge connection terminal blocks X5:1.1 with 1.2 and X5:1.4 with 1.5, respectively.

Connect connection terminal block X5:1.3 on the charging controller to functional ground (⏚) at the installation location (control cabinet).

15.3 Downloading PC WORX StartUpPackage

The PC WORX StartUpPackage is necessary to operate the charging controller with the PC WORX engineering tool.

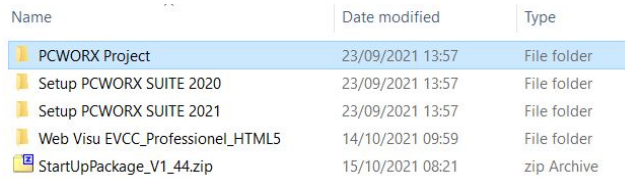
You will find the latest downloads for the item at phoenixcontact.com/products.

15.4 Unzipping and installing the PC WORX StartUp-Package

15.4.1 Step 1: Unzip StartUpPackage

Unzip the PC WORX StartUpPackage in your preferred folder on your service PC or notebook.

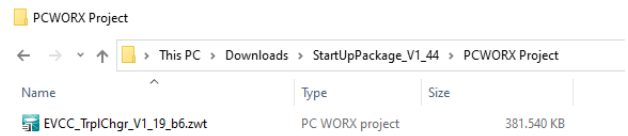
Figure 34 Unzipping StartUpPackage



15.4.2 Step 2: Start project

In the ...\PCWORX Project folder, start the CHARX_Example-CCS.zwt project.

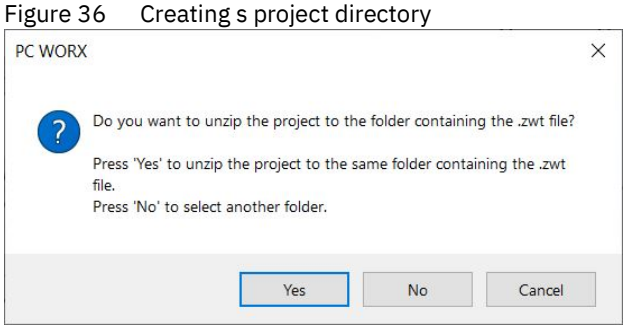
Figure 35 Starting a project



15.4.3 Step 3: Select the target directory

Select the target directory in which the project is to be installed. If the project is to be unzipped in the preset directory, click the *[Yes]* button. If you want to create your own target directory, click the *[No]* button and then specify the target directory.

Figure 36 Creating s project directory



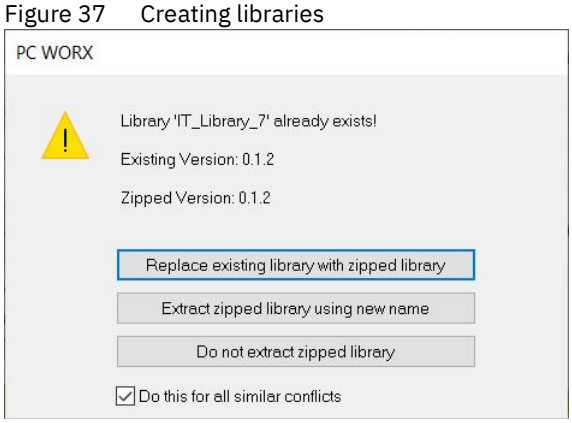
15.5 Step 4: Create a library

Install further libraries during the unzip process. These libraries contain functions that simplify the implementation of a charging point and communication with the power module. First select the *Do this for all similar conflicts* checkbox. Then click on the *[Replace existing library with zipped library]* button.

The following libraries will then be made available for selection:

Modbus, ReSyBasic, ReSyOCPP, SYS_PLC, IT_Libary, IP-_Com, EVCC_PROF_COM, EVCC_PROF_LIB, SE_Basic

Figure 37 Creating libraries



15.5.1 Step 5: Project tree in PC WORX

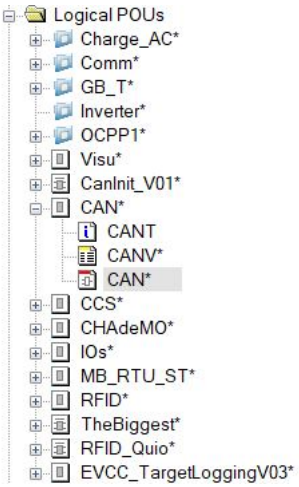
You will now find the installed libraries in the project tree on the left-hand side of the PC WORX interface. Each library contains a wide range of function blocks for electric vehicle charging stations.

Figure 38 Project tree in PC WORX

15.5.2 Step 6: Select a CAN* instance

Open the ...\LogicalPOUs directory and select the CAN* instance from the subordinate directory structure.

Figure 39 Selecting CAN* instance



15.5.3 Step 7: Replace input variables

To enable the power module to activate the DC output and, at the same time, to be able to measure the specified static values at the DC output terminals, replace the specified variables with the following default values.

Input variable	Default value	Function
usiLinkStateCcs	USINT#13	Power module activation
diTargetVoltageEvCcs	DINT#300	Output voltage 300 [V]
diTargetCurrentCcs	DINT#50	Output current 50 [A]

Figure 40 Value supply via input variables

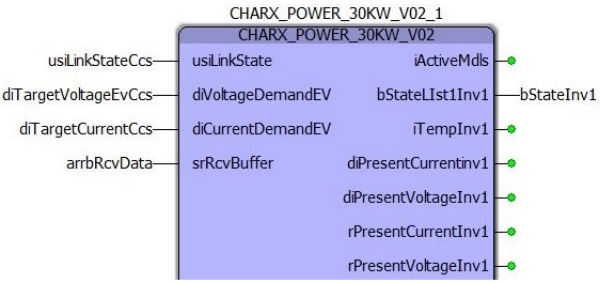
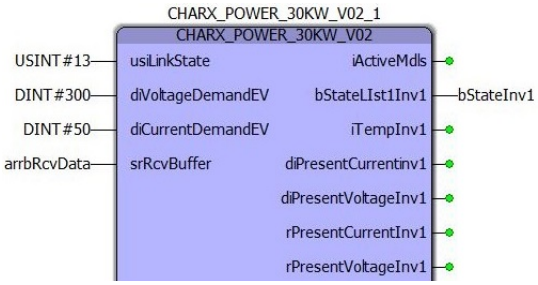


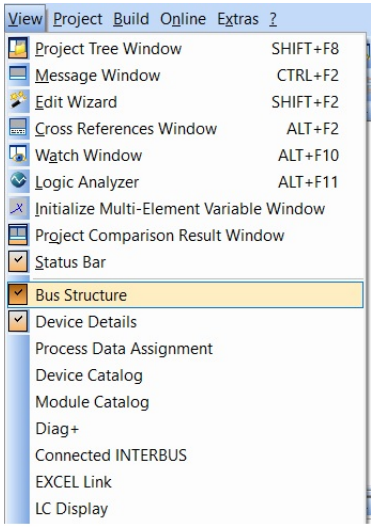
Figure 41 Value supply via default values (fixed value)



15.5.4 Step 8: IP address of the charging controller

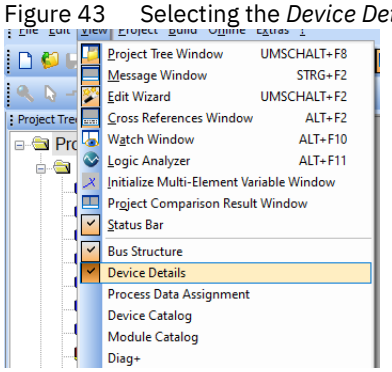
- Select the *View|Bus Structure* menu command.

Figure 42 Selecting the *Bus Structure* menu command



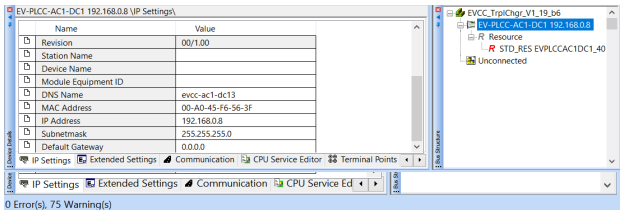
- To be able to display the IP address of the default charging controller, select the *View|Devices Details* menu command.

Figure 43 Selecting the *Device Details* menu command



- The default IP address assigned to the charging controller (192.168.0.8) will now be displayed. If the IP address needs to be adjusted, do this in this dialog window.

Figure 44 Creating s project directory



15.5.5 Step 9: Generate a program code

- Now generate the program code and load this onto the charging controller.
- Three buttons in the toolbar are necessary for this.
- Here, proceed in the order the buttons are described in.

1. *[Rebuild Project]* button

Click on this button to generate the program code.

2. *[Download changes]* button

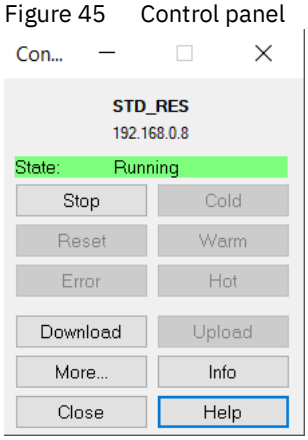
Click on this button to transfer the program to the charging controller. The *Run* state will then be displayed in the control panel.

3. *[Project Control Dialog]* button

Click on this button to open the control panel.

If the charging controller does not switch to the *Run* operating state, click on the *[Download]* button in the control panel. Then click on the *[Cold]* button.

Figure 45 Control panel



15.5.6 Step 10: Power module starts to operate

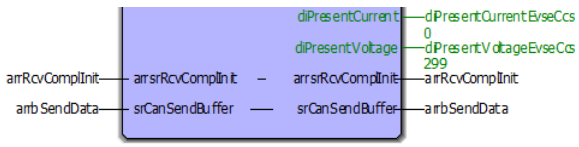
The charging controller now enables the power modules, and the program functions are executed. The DC output of the power module is controlled with the default values configured in the charging controller.

1. *[Debug on/off]* button

Click on the button to view the variables for the program runtime.

Output variable	Function
diPresentCurrentCcs	Shows the value of the output current 0 [A]
diPresentVolt-ageEvCcs	Shows the value of the output voltage 300 [V]

Figure 46 Output data of the current/voltage values



You now measure an output voltage of 300 V DC at the DC output terminals of the power module, even without a connected DC load.

To check the new output current value, connect a suitable DC load to the DC output terminals.