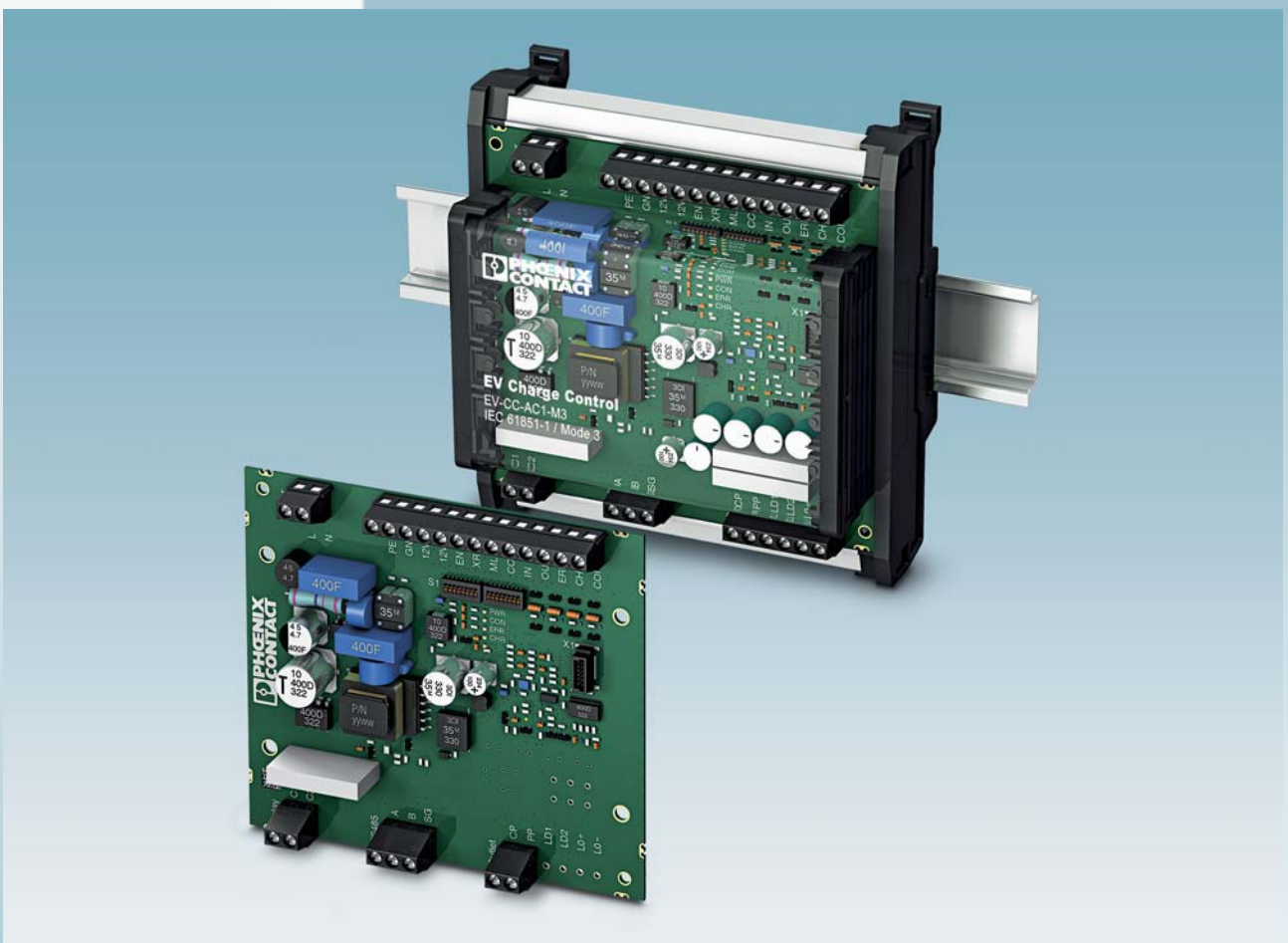

EV Charge Control Basic Installing and starting up the charging controller

User manual

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual
EV Charge Control Basic
Installing and starting up the charging controller

2015-12-17

Designation: UM EN EV-CC-AC1-M3-C

Revision: 04

Order No.: —

This user manual is valid for:

Designation	Version	Order No.
EV-CC-AC1-M3-CBC-SER-HS	4	1622452
EV-CC-AC1-M3-CBC-SER-PCB		1622453
EV-CC-AC1-M3-CC-SER-HS		1622459
EV-CC-AC1-M3-CC-SER-PCB		1622460

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

Explanation of symbols used and signal words

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 injury or death.

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

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

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.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

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

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Published by

PHOENIX CONTACT GmbH & Co. KG
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Table of contents

1 Properties of the charging controller

The EV Charge Control Basic charging controller is exclusively used to control and monitor the charging of electric vehicles on the 3-phase AC power grid in charging mode 3 according to IEC 61851-1, AC level 2 according to SAE J1772, and mode 3 according to GB/T 18487.1.

The charging controller is integrated in a defined charging infrastructure which is permanently connected to the power grid.

The charging controller is designed to control the switching element which is used to establish the connection between the power grid and the electric vehicle. It has a communication interface via which status data can be read and control signals can be written. The charging controller monitors the **Control Pilot** and **Proximity Plug** signals.

The **Control Pilot signal (CP)** has the following functions, for example:

- Detection of the protective conductor connection
- Detection of the vehicle status: vehicle not connected, vehicle connected, vehicle ready for charging, ventilation required, error
- Transmission of the charging controller status: ready, not ready, error
- Specification of the maximum available charging current for the vehicle via a PWM signal

The charging controller detects the inserted charging connector and the current carrying capacity of the charging connector and charging cable via the **Proximity Plug signal (PP)**. Resistor coding in the charging connector is used for this purpose.

The charging controller can be used to activate or deactivate the charging connector locking in the charging station depending on the status.

As an option, the charging process can also be influenced and monitored via the existing communication interface.

Technical features

- Evaluating and controlling the Control Pilot signal
- Monitoring the connection to protective earth ground (PE)
- Evaluating the Proximity Plug signal
- Controlling the charging contactor and locking actuators
- Maximum charging current that can be configured: 16 A, 20 A, 32 A, 63 A
- RS-485 communication interface/Modbus/RTU (slave)
- Digital inputs and outputs, can be configured
- Controlling and enabling the charging controller locking in the event of a mains failure
- Temperature range: -35°C ... +70°C
- Altitude: < 2000 m
- Versions available for charging stations with an infrastructure socket outlet (connection of case B) and vehicle connector (connection of case C)
- Available either as PCB or with housing for DIN rail mounting

1.1 Ordering data

Charging controller

Description	Type	Order No.	Pcs. / Pkt.
Charging controller for connection of case B and C, with housing for DIN rail mounting	EV-CC-AC1-M3-CBC-SER-HS	1622452	1
Charging controller for connection of case B and C, as PCB	EV-CC-AC1-M3-CBC-SER-PCB	1622453	1
Charging controller for connection of case C, with housing for DIN rail mounting	EV-CC-AC1-M3-CC-SER-HS	1622459	1
Charging controller for connection of case C, as PCB	EV-CC-AC1-M3-CC-SER-PCB	1622460	1

1.2 Technical data

Order number	1622452	1622453	1622459	1622460
EV-CC-AC1-M3-	CBC-SER-HS	CBC-SER-PCB	CC-SER-HS	CC-SER-PCB
Supply				
Input voltage range	100 V AC ... 240 V AC			
No-load power consumption	< 1 W			
Frequency range	50 Hz ... 60 Hz			
RS-485 interface				
Protocol	Modbus/RTU (slave)			
Transmission speed	9.6 kbps (default) Can be set: 9.6 kbps or 19.2 kbps			
Transmission mode data bits / parity / stop bits	8 / N / 1			
Relay output C1/C2				
Switching capacity, maximum	1500 VA			
Switching voltage, maximum	250 V AC			
Switching current, maximum	6 A			
Output, locking				
Voltage	12 V DC	12 V DC	–	–
Current, maximum	2 A	2 A	–	–
Adjustable switching time	600 ms (default)	600 ms (default)	–	–
Digital output				
Voltage range, supply input 12Va	5 V ... 30 V			
Maximum current per output	600 mA			
Maximum total current with internal supply	500 mA			

Order number	1622452	1622453	1622459	1622460
EV-CC-AC1-M3-	CBC-SER-HS	CBC-SER-PCB	CC-SER-HS	CC-SER-PCB
Digital input				
Nominal input voltage	12 V			
Nominal input current	< 1 mA			
Input voltage range	0 V … 3 V (OFF) / 9 V … 15 V (ON)			
General data				
Degree of protection	IP20	IP00	IP20	IP00
Overvoltage category	III (IEC 60664-1)			
Pollution degree	2 (IEC 60664-1)			
Ambient temperature (operation)	-35°C ... +70°C			
Ambient temperature (storage)	-40°C ... +85°C			
Humidity (non-condensing)	30% ... 95%, non-condensing			
Altitude	< 2000 m			
Dimensions W x H x D	124 mm x 128 mm x 64 mm	120 mm x 108 mm x 20 mm	124 mm x 128 mm x 64 mm	120 mm x 108 mm x 20 mm
Weight	275 g	140 g	260 g	125 g
Connection data				
Connection method	Screw connection			
Nominal cross section	2.5 mm^2			
Conductor cross section, solid	0.2 mm^2 ... 2.5 mm^2			
Conductor cross section, stranded	0.2 mm^2 ... 2.5 mm^2			
Stranded conductor cross section with ferrule without plastic sleeve	0.25 mm^2 ... 1.5 mm^2			
Stranded conductor cross section with ferrule with plastic sleeve	0.25 mm^2 ... 1.5 mm^2			
Conductor cross section AWG/kcmil	AWG 24 ... 14			
AWG according to UL/CUL	AWG 30 ... 12			
Conformance/approvals				
CE-compliant	√			
Low-voltage directive	2006/95/EC			
Safety test	IEC 61010-1			
Function test	IEC 61851-1, Appendix A			
Air clearances and creepage distances	IEC 61010-1			

Conformance with EMC Directive 2004/108/EC and Low-Voltage Directive 2006/95/EC

Noise immunity test according to EN 61000-6-2

Protection for housing connections

Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B	±6 kV (contact discharge) ±8 kV (air discharge)
Electromagnetic HF field	EN 61000-4-3	Criterion B	80 MHz ... 1 GHz, field strength 10 V/m, 80% AM (1 kHz) 1 GHz ... 3 GHz, field strength 10 V/m, 80% AM (1 kHz)

Protection for inputs and outputs, AC power connections

High frequency, asymmetrical	EN 61000-4-6	Criterion A	150 kHz ... 80 MHz, 10 V, 80% AM (1 kHz)
Fast transients (burst)	EN 61000-4-4	Criterion B	±2.2 kHz (peak) 5/50 ns (t_r/t_n) 5 kHz rep. frequency
Overvoltages	EN 61000-4-5	Criterion B	1.2/50 ns (8/20) µs (t_r/ t_h) Up to ±1 kV, wire-to-wire Up to ±2 kV, wire-to-ground
Voltage dip	EN 61000-4-11	Criterion B Criterion C Criterion C	0% for one period 40% for 10/12 periods 70% for 25/30 periods
Voltage interruption	EN 61000-4-11	Criterion C	0% for 250/350 periods

Protection for signal connections

High frequency, asymmetrical	EN 61000-4-6	Criterion A	150 kHz ... 80 MHz, 10 V, 80% AM (1 kHz)
Fast transients (burst)	EN 61000-4-4	Criterion B	±2.2 kHz (peak) 5/50 ns (t_r/t_n) 5 kHz rep. frequency
Overvoltages	EN 61000-4-5	Criterion B	1.2/50 ns (8/20) µs (t_r/ t_h) Up to ±1 kV, wire-to-ground

2 Connections, indicators, configuration switches

2.1 Connections

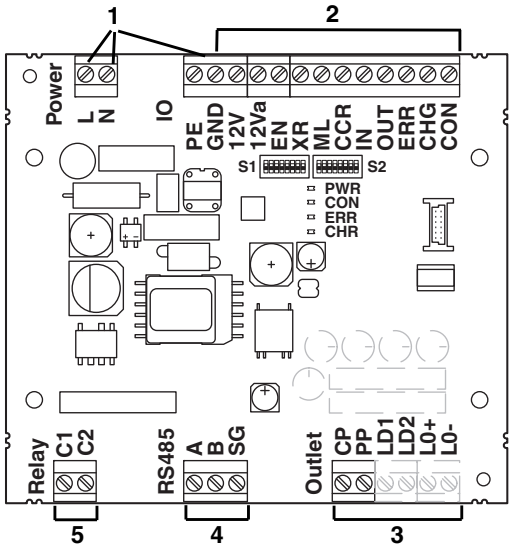

Figure 2-1 Connections

Table 2-1 Connections

No.	Name	Meaning	Description		
1	**L**	Line	Phase, power grid	100 V AC ... 240 V AC (L-N)	
	N	Neutral	Neutral conductor, power grid		
	PE	Protective Earth	Functional earth ground, connected to protective earth ground		
2	**GND**	Ground	System ground, connected to protective earth ground		
	12V	Power	Output	12 V DC, max. 500 mA	
	12Va	Auxiliary Power	Supply input of the outputs	5 V DC ... 30 V DC	
	EN	Enable	Digital input, can be configured, enable charging process		
	XR	External Release	Digital input, can be configured, charging station availability	Activation via S1/DIP 2, can be configured	
	ML	Manual Lock	Digital input, can be configured, manual locking	Activation via S1/DIP 3, can be configured	
	CCR	Charge Current Reduction	Digital input, charging current limit	Depending on the default settings by S1/DIP 5 + 6	
	IN	Auxiliary Input	Reserved for future expansions		
	OUT	Auxiliary Out	Digital output, can be configured	Default: output can be set via Modbus	*
	ERR	Error	Digital output, can be configured	Default: set when errors occur Error or status E or status F	*
	CHG	Charging	Digital output, can be configured	Default: set when the charging contactor is actuated	*
	CON	Connect	Digital output, can be configured	Default: set when a vehicle is connected to the charging controller	*

Table 2-1 Connections [...]

No.	Name	Meaning	Description		
3	**LO-**	Locking	Control of the locking actuator		†
	LO+				
	LD2	Lock Detection	Digital input, for connecting the locking confirmation, can be configured		†
	LD1				
	PP	Proximity Plug	Test signal	Current carrying capacity of the connected charging connector and charging cable according to IEC 61851-1	†
	CP	Control Pilot	Pilot wire signal	Communication between charging station and vehicle according to IEC 61851-1, SAE J1772 and GB/T 18487.1	
4	**SG**	Signal Ground	Ground signal for the RS-485 communication interface		
	B	RS-485	Communication interface		
	A				
5	**C2**	Contactor	Relay output, charging contactor	Switches the mains voltage to the vehicle via an external charging contactor when status C or D is reached and the enabled inputs and registers are active.	
	C1				

* Not protected against overload

† Not for EV-CC-AC1-M3-CC-...

For further information on the configuration options for the digital inputs and outputs, please refer to the “Modbus description” on page 55.

2.2 Diagnostic and status indicators

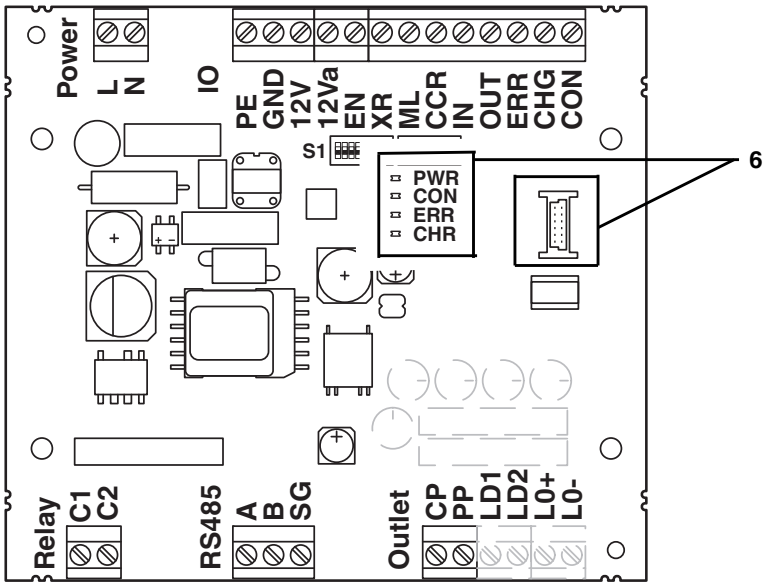

Figure 2-2 Diagnostic and status indicators

Table 2-2 Diagnostic and status indicators

No.	Name	Meaning	Color	Status	Description
6	**X1**	Diagnos-tics	Reserved for future expansions		
	PWR	Power	Green	On	Charging controller ready
				Flashing (1 Hz)	Charging controller is starting up
	CON	Connect	Yellow	On	Charging cable is connected to the charging station and the vehicle
				Flashing (1 Hz)	Charging cable is connected to the charging station and locked
	ERR	Error	Red	On	Error
				Flashing (1 Hz)	Errors that originate at the vehicle or charging cable
	CHR	Charging	Blue	On	Charging contactor closed
				Flashing (1 Hz)	Vehicle connected, charging current ready, PWM signal switched on, charging contactor open

2.3 Configuration switches S1 + S2

WARNING: Dangerous contact voltage
Electrical shock from unprotected live parts.
Only set the configuration switches when the device is disconnected from the mains.

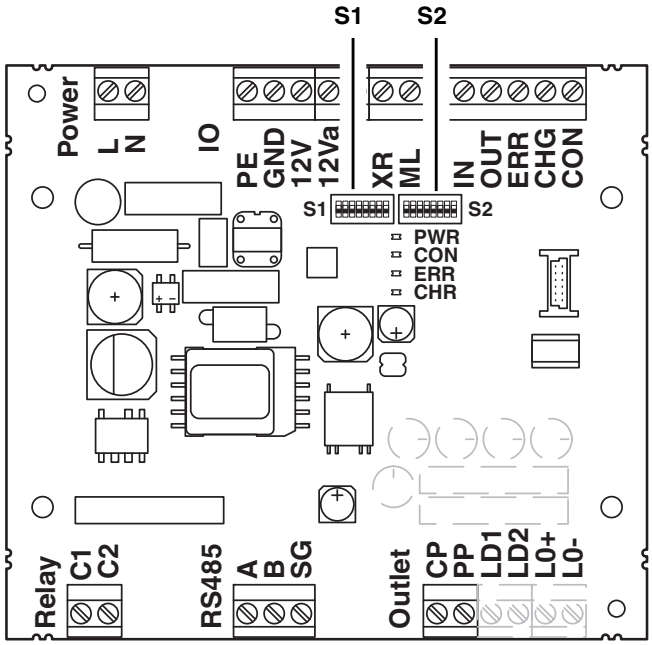

Figure 2-3 Configuration switches S1 + S2

Table 2-3 Configuration switches S1 + S2

No.	DIP	Name	Description					
S1	**1**	Connection, case B/C	ON	Charging station with vehicle connector (case C)				*
			OFF	Charging station with infrastructure socket outlet (case B)				
	2	XR evaluation	ON	XR input is evaluated, XR = 0 → status F				
			OFF	XR input is not evaluated or XR input is evaluated in a modified way according to Modbus register 4011				
	3	Locking function	ON	Connection locking upon signal at digital input ML, can be configured				*
			OFF	Connection locking at status B				
	4	Evaluation of 13 A charging cable	ON	13 A charging cable is not permissible				*
			OFF	13 A charging cable is permissible				
	5 + 6	Default setting for charging current		Depending on digital input CCR		CCR = 0	CCR = 1	
				5 = OFF	6 = OFF	16 A	8 A	
				5 = OFF	6 = ON	20 A	10 A	
				5 = ON	6 = OFF	32 A	13 A	
				5 = ON	6 = ON	63 A	20 A	
	7	Evaluation of Proximity Plug	ON	Evaluation according to GB/T 18487.1				*
			OFF	Evaluation according to IEC 61851-1				
	8	Optional locking	ON	No locking of the charging connector and evaluation of the locking confirmation LD1/LD2				*
			OFF	Locking of the charging connector and evaluation of the locking confirmation LD1/LD2				*
S2	**1**	Baud rate	ON	19200				
			OFF	9600				
	2 - 6	Modbus address	ON = 1 OFF = 0	0, 0, 0, 0, 1 = Modbus address 1 0, 0, 0, 1, 0 = Modbus address 2 … 1, 1, 1, 1, 0 = Modbus address 30 1, 1, 1, 1, 1 = reserved				
	7 + 8	Reserved for future expansions						

* Not for EV-CC-AC1-M3-CC-...

For additional information, please refer to “Flow charts for the charging process” on page 49.

3 For your safety

3.1 Safety notes

Startup only by specialist personnel

Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described. When installing and operating charging stations for electric vehicles, the applicable regulations and safety directives, as well as general technical regulations, must be observed. The data on safety technology is provided in this package slip and on the certificates, i.e., the conformity assessment and any further approvals.

For additional information, please visit phoenixcontact.net/products.

Danger - hazardous contact voltages

The EV-CC-...-PCB printed-circuit board devices do not provide any protection against dangerous contact voltage. With the EV-CC-...-HS DIN rail devices, parts with dangerous contact voltage can be accessed after the covering hood has been removed.

Only install, remove, and configure the device when it is disconnected from the voltage. The device may only be operated in a housing that corresponds to the currently applicable national requirements for charging stations.

Danger - mains voltage

On the EV-CC-...-PCB products, live parts are unprotected and can be accessed. When not installed, protection against electrical shock is not provided. Only operate the device in a closed housing that protects against electrical shock and corresponds to the applicable requirements for charging stations.

Operation only in a suitable housing

The device may only be operated in a housing that corresponds to the requirements for charging stations. Do not operate the device without a housing or in an inadequate housing.

Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to IEC 61340-5-1.

Observe these safety precautions, specifically for device EV-CC-...-PCB.

Operation in a clean and dry environment only

The degree of protection of the device is designed for an environment with a maximum pollution degree of 2 according to IEC 60664-1.

Product	Degree of protection
EV-CC-...-PCB	IP00 according to IEC 60529
EV-CC-...-HS	IP20 according to IEC 60529

If the device is to be used for an outdoor charging infrastructure, one option for achieving pollution degree 2 in the microenvironment is to provide a housing with IP5X protection according to IEC 60529.

Do not subject the device to any strain or load that exceeds the limits described.

3.2 Maintenance and disposal

Maintenance

With the exception of configuration, opening or modifying the device is not permitted. Do not repair the device yourself; replace it with an equivalent device instead. Repairs may only be carried out by the manufacturer.

Stop

For stopping, the device must be disconnected from the mains voltage. Only remove the device when disconnected from the voltage.

Provide a disconnecting device for disconnecting the charging station from the voltage.

Disposal

Do not dispose of the device with household waste, it should instead be disposed of in accordance with the currently applicable national regulations. The device can also be returned to Phoenix Contact.

4 Startup

WARNING: Dangerous contact voltage

Setup and startup may only be carried out by qualified personnel who are familiar with the necessary safety precautions.

Observe the relevant requirements for setting up and starting up a charging infrastructure, and, in particular, the applicable safety regulations.

NOTE: Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with IEC 61340-5-1.

4.1 Dimensions

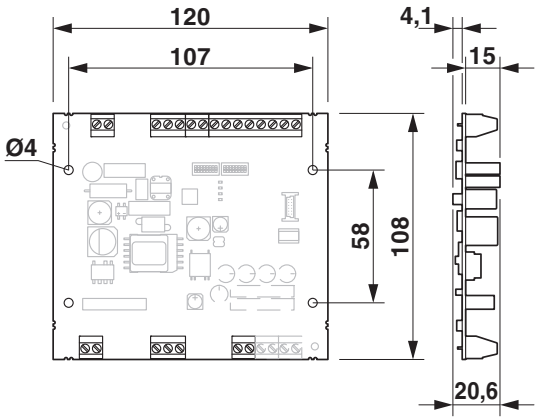

Figure 4-1 Dimensions of EV-CC-...-PCB

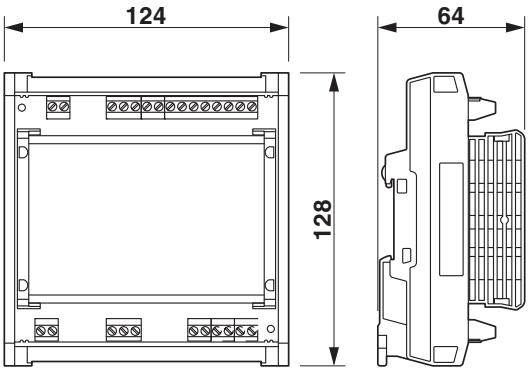

Figure 4-2 Dimensions of EV-CC-...-HS

4.2 Mounting the PCB (EV-CC-...-PCB only)

WARNING: Dangerous contact voltage

Electrical shock from unprotected live parts.

Only mount the PCB when the device is disconnected from the mains.

Only operate the device in a charging station housing that corresponds to the applicable requirements for charging stations.

For mounting the PCB, four bore holes (4 mm in diameter) are provided.

Ensure that there are sufficient air clearances and creepage distances from the conductive surfaces.

4.3 Mounting the housing (EV-CC-...-HS only)

WARNING: Dangerous contact voltage

Electrical shock from unprotected live parts.

Only remove the covering hood when the device is disconnected from the mains.

Only operate the device in a charging station housing that corresponds to the applicable requirements for charging stations.

Removing the covering hood

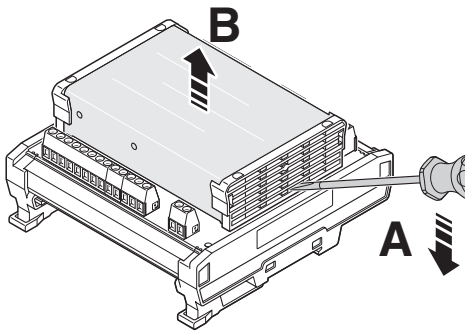

Figure 4-3 Removing the covering hood

The covering hood is not latched upon delivery. The covering hood must be removed in order to configure the device.

- To remove the latched covering hood, lift the side panel. To do so, insert the tip of a screwdriver into the lowest slot.

Fitting the covering hood

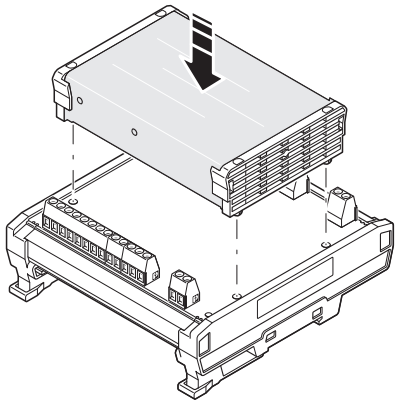

Figure 4-4 Fitting the covering hood

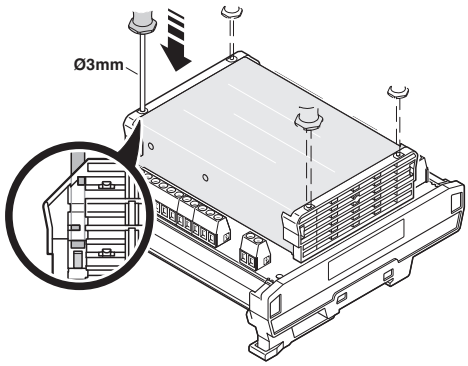

Figure 4-5 Latching the covering hood

For assembly, proceed as follows:

1. Fit the covering hood so that it engages with a click.
2. To latch the lateral elements, push the four safety elements into the PCB.
   Recommended tool: prong ø 3 mm

4.4 Mounting on the DIN rail

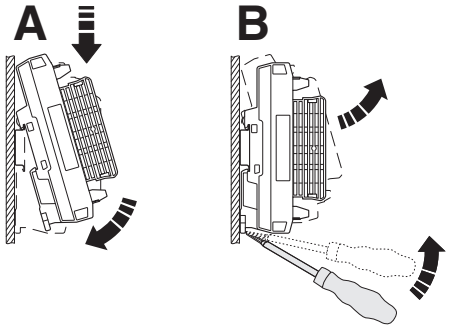

Figure 4-6 Mounting/removal

The device can be mounted in any position on the DIN rail.

Mounting on a DIN rail (A)

1. Place the device onto the DIN rail from above.
2. Push the front of the device toward the mounting surface until it engages with a click.

Removing from the DIN rail (B)

3. Push down the locking latch using a screwdriver, needle-nose pliers or similar.
4. Pull the bottom edge of the device slightly away from the mounting surface.
5. Pull the device diagonally upward from the DIN rail.

4.5 Connecting the supply voltage

WARNING: Risk of electric shock
Only connect the charging station to the supply line while it is disconnected from the power.

NOTE: Risk of damage to the device
Provide a circuit breaker when installing the device, which is labeled as the disconnecting device for this device.

The circuit breaker must be suitably located and easily accessible to the user.

The power supply leading to the device must be protected against overcurrent up to 6 A, maximum. Provide a disconnecting device for disconnecting the charging station from the voltage.

- Supply voltage to the device via the N, L and PE terminal blocks.
- Provide a disconnecting device for disconnecting the charging station from the voltage.

4.6 Connecting the charging contactor

NOTE: Risk of damage to the device
The C1 - C2 relay circuit must be protected against overcurrent up to 6 A, maximum.

- Connect the charging contactor, which is used for connecting the vehicle to the mains, via connection C1 - C2.
  The charging contactor is connected using a relay that can be loaded up to 250 V/6 A, maximum.
  For the relevant connection examples, please refer to Figure 7-1 on page 37.

4.7 Locking the Infrastructure Socket Outlet (EV-CC-...-CBC-... only)

The locking function of the Infrastructure Socket Outlet is controlled using connections LO+/LO- and LD1/LD2.

Via terminal blocks LO+ and LO-, a voltage of ±12 V and a corresponding polarity are applied to the locking actuator for a specific period. When reaching a defined state, the output becomes disconnected from the power.

In order to detect the locking state, the resistance between LD1 and LD2 is evaluated.

By default upon delivery, the device has the following configuration: A resistance of 0 ohms defines the locked state and an open connection (infinite resistance) between LD1 and LD2 defines the unlocked state.

If, after a locking or unlocking pulse, no corresponding feedback can be measured at LD, this process will be repeated automatically. The number of maximum permissible repetitions and maximum duty cycles to be observed is taken into account.

The default settings are adapted to the Infrastructure Socket Outlet from Phoenix Contact. For controlling other locking actuators, the parameters for controlling the socket and evaluating the locking feedback can be configured via Modbus. For the relevant parameters, please refer to Section 9, “Modbus description”.

For connection examples of an Infrastructure Socket Outlets from Phoenix Contact, please refer toFigure 7-1 on page 37.

4.8 Configuration

The charging controller is basically configured using **configuration switches S1 and S2.**

For additional information on configuration, please refer to:
- Table “Configuration switches S1 + S2” on page 15
- “Connection examples” on page 37
- “Flow charts for the charging process” on page 49
- “Modbus description” on page 55

5 Signal contacts and charging sequences

5.1 Proximity Plug (PP)

The Proximity Plug is used to detect a charging connector in the charging station, and to determine its current carrying capacity.

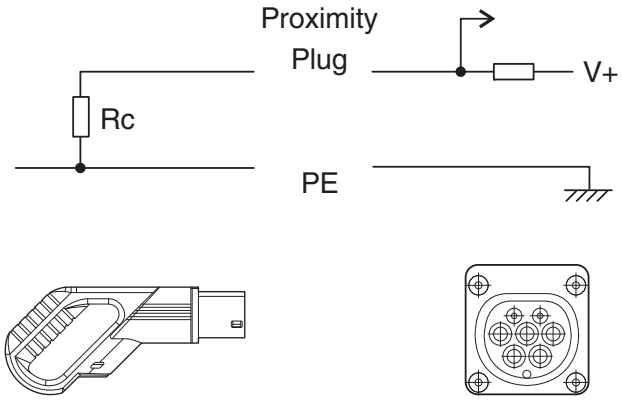

Figure 5-1 Proximity Plug (PP) wiring

The current carrying capacity is identified according to IEC 61851-1 by means of the Rc resistor. The device measures the resistance value via the PP signal (Proximity Plug) and determines the current carrying capacity of the connected charging cable. The coding of the permissible current for the resistance value is defined in IEC 61851-1.

Table 5-1 Coding of the permissible current for the resistance value according to IEC 61851-1

Rc resistance value according to the standard	Tolerance range	Resulting current carrying capacity
–	< 75 Ω	Error
100 Ω	75 Ω ... 150 Ω	63 (70) A
220 Ω	150 Ω ... 330 Ω	32 A
680 Ω	330 Ω ... 1000 Ω	20 A
1500 Ω	1000 Ω ... 2200 Ω	13 A
–	> 2200 Ω	0 A

Evaluation of the PP signal according to GB/T 18487.1

According to GB/T 18487.1, a charging connector is detected when S1/DIP 7 is set to ON, and a resistance value of 0 Ω is detected on the Proximity Plug. According to GB/T 18487.1, coding of the current carrying capacity on the charging station is not provided.

5.2 Control Pilot signal (CP)

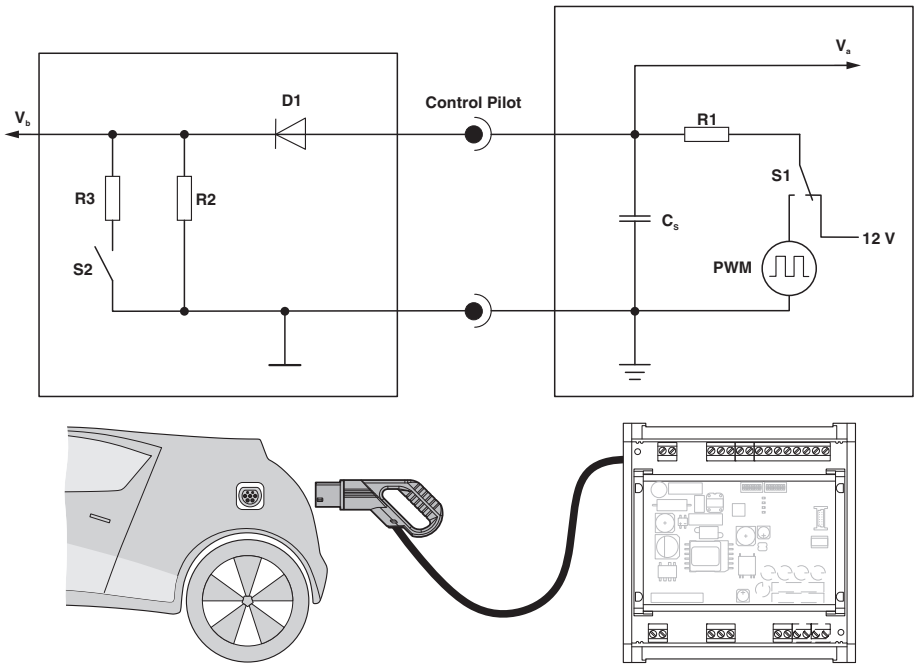

Figure 5-2 Control Pilot wiring

Via the CP signal (Control Pilot), the device specifies the permissible charging current value to the vehicle which is coded as a PWM signal. The vehicle indicates the current vehicle status via the voltage value Va. The assignment of the permissible charging current value to the pulse width of the PWM signal and the assignment of the voltage value to the vehicle states is defined in IEC 61581-1 (see table “Typical charging sequence” on page 29).

5.3 Charging cable connection (case B and C)

According to IEC 61851-1, the connection methods for the charging cables are defined as follows:

Table 5-2 Connection of case B and C according to IEC 61851-1

Connection	Description
Case B	Charging station with Infrastructure Socket Outlet
Case C	Charging station with Vehicle Connector

Connection of case B

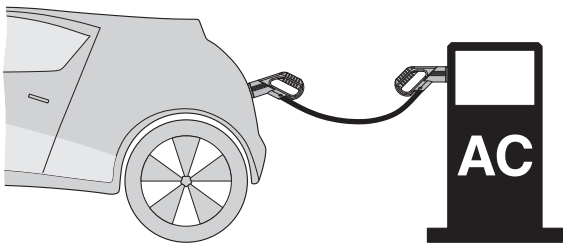

Figure 5-3 Charging station with Infrastructure Socket Outlet – connection of case B

Connection of case C

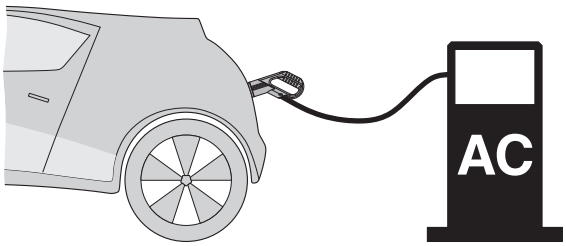

Figure 5-4 Charging station with Vehicle Connector – connection of case C

Observe the connection methods according to IEC 61851-1 for each product:

Charging controller for **connection of case B and case C** for EV-CC-AC1-M3-CBC-... products

Charging controller for **connection of case C** for EV-CC-AC1-M3-CC-... product

5.4 Vehicle status (status A - F)

Table 5-3 Vehicle status according to IEC 61851-1

Vehicle status	Vehicle connected	S2*	Charging possible	Va†	Description
A	No	Open	No	12 V	Vb‡ = 0 V **A1** (12 V DC): No vehicle connected **A2** (12 V PWM): Only temporary transition state, enters the A1 state
B	Yes	Open	No	9 V	R2 detected **B1** (9 V DC): EVSE** not ready yet **B2** (9 V PWM): EVSE ready††
C	Yes	Closed	Vehicle ready	6 V	R3 = 1.3 kΩ ±3% Ventilation not required **C1** (6 V DC): EVSE not ready, charging process aborted. Transition state; possible as a permanent state only in the event of a simplified Control Pilot. **C2** (6 V PWM): Charging process active
D				3 V	R3 = 270 Ω ±3% Ventilation of the charging area required **D1** (6 V DC): EVSE not ready, charging process aborted. Transition state; possible as a permanent state only in the event of a simplified Control Pilot. **D2** (6 V PWM): Charging process active
E	Yes	Open	No	0 V	Vb = 0: EVSE Mains problem or mains not available, short circuit on the Control Pilot
F	Yes	Open	No	EVSE not available	EVSE not available

* Switch S2 (see “Control Pilot wiring” on page 26)

† Va = measured voltage in the EV Charge Control Basic

‡ Vb = measured voltage in the vehicle

** EVSE = Electric Vehicle Supply Equipment (charging station)

†† The charging station can be set to an operational state using a signal at the Enable input, or the relevant Modbus command.

5.5 Typical charging sequence

Table 5-4 Charging sequence according to the vehicle status

Vehicle status	Status	Description	Signal CP
A	No vehicle connected		12 V
B	Vehicle connected	Voltage at the CP signal drops to 9 V. Resistance R2 in vehicle detected. The voltage value at the CP signal is the result of the series connection of resistor R1 in the charging controller, diode D in the vehicle, and resistor R2 in the vehicle at 12 V. When the charging station is ready to supply energy, the PWM signal is switched on. The ready-to-charge state can be reached using input EN or the RS-485 communication interface. The pulse width codes the permissible charging current that the vehicle may take from the charging infrastructure. The coding is shown in Table “Controlling the maximum charging current that may be taken according to IEC 61851-1” on page 30. B1 (9 V DC): EVSE not ready yet B2 (9 V PWM): EVSE ready	9 V
C	Charging without ventilation	If the vehicle detects the PWM signal, the vehicle connects another resistor R3 parallel to R2 via switch S2. The resulting voltage value is 6 V (ventilation not required) or 3 V (ventilation required). The charging controller connects the mains voltage to the vehicle via a charging contactor and a charging cable. The charging process begins. By default upon delivery, charging process D is not supported, and the charging process is aborted. Charging in status D can be supported using a configuration. When configuring a digital output for the “status D” event, an external ventilation can be connected. This ventilation is not monitored. The ventilation must be monitored using suitable measures.	6 V or 3 V
D	Charging with ventilation		

Table 5-4 Charging sequence according to the vehicle status

Vehicle status	Status	Description	Signal CP
B	Charging stopped	The charging process can be aborted via the charging station or via the vehicle. Switching off via the charging station: The charging station switches off the PWM signal and indicates the end of the charging process. The vehicle opens S2 and the charging controller disconnects the charging contactor again and with it the voltage from the charging cable. If S2 is not opened within 3 seconds after switching off the PWM signal, the charging process is stopped, independent of the vehicle status. Switching off via the vehicle: The vehicle disconnects resistor R3 again via S2. The vehicle stops the charging process and opens S2. The charging controller disconnects the charging contactor again and with it the voltage from the charging cable.	9 V
A	Vehicle disconnected from the charging station		12 V

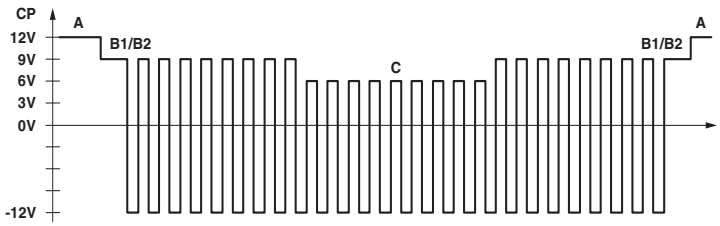

Figure 5-5 Typical curve of signal CP

Table 5-5 Controlling the maximum charging current that may be taken according to IEC 61851-1

Evaluation of nominal pulse duty factors by the vehicle	Maximum current according to IEC 61851-1 that the vehicle is permitted to take
Pulse duty factor < 3%	Charging is not permitted.
3% ≤ pulse duty factor ≤ 7%	Indicates that digital communication between vehicle and charging station is being used to specify the charging parameters. Charging is only permitted with digital communication. 5% pulse duty factor should be used if the Control Pilot is used for digital communication.
7% ≤ pulse duty factor ≤ 8%	Charging is not permitted.
8% ≤ pulse duty factor < 10%	6 A
10% ≤ pulse duty factor ≤ 85%	Available current = (% of pulse duty factor) x 0.6 A
85% < pulse duty factor ≤ 96%	Available current = (% of pulse duty factor - 64) x 2.5 A
96% < pulse duty factor ≤ 97%	80 A
Pulse duty factor > 97%	Charging is not permitted.

5.6 Simplified charging sequence

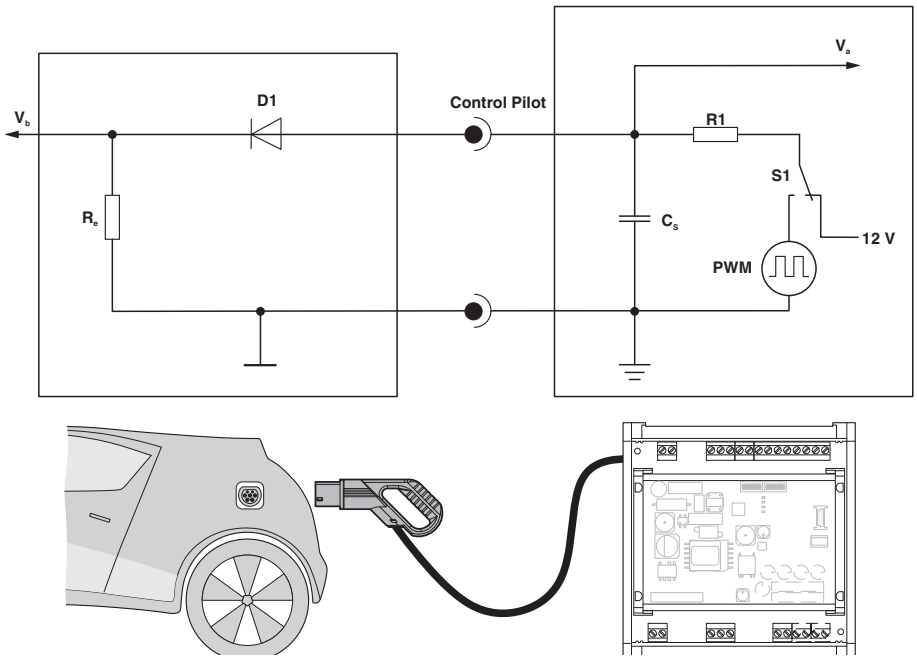

Figure 5-6 Wiring of simplified charging sequence

With the simplified charging sequence, interim status B is skipped. The permissible charging current value is limited to 10 A. Resistance value R_e corresponds to the parallel connection of resistors R2 and R3 from “Control Pilot wiring” on page 26.

Status C or D can be reached with the simplified charging sequence.

5.7 Activation mode

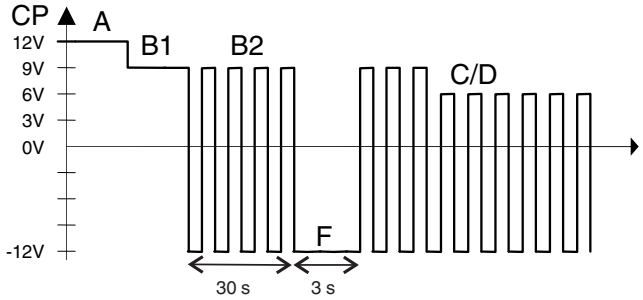

Figure 5-7 Typical curve of signal CP in activation mode

If the connected vehicle switches from status B1 (9 V DC) to status B2 (9 V PWM) and the vehicle does not enter status C or D within 30 seconds, the charging controller simulates the disconnection of the vehicle from the charging station.

The CP signal is set to -12 V DC for 3 seconds. It then switches back to the PWM signal.

After transition from status A1 or B1 to status B2, this process is performed not more than once.

Activation mode is performed again

– If the vehicle is disconnected from the charging controller and then reconnected again or
– If the charging process was interrupted by the charging station (e.g., for reasons of load management).

6 Wiring the outputs and inputs

The circuits that use lamps and LEDs are only examples. You can also connect other loads, such as optocouplers, relays or digital inputs of a controller.

6.1 Outputs

In status 0, the outputs are connected to GND and in status 1 they are connected to voltage input 12Va. A power supply of 5 V to 30 V DC can be applied at voltage input 12Va.

The maximum current carrying capacity of the switching transistors is 600 mA. If voltage input 12Va is supplied via the 12 V connection, then a maximum of 500 mA in total are available at all outputs.

NOTE: Possible damage to the transistors

A supply voltage must never be connected to the outputs, as one of the transistors is controlled at all times and the transistors would be destroyed as a result.

The outputs are not short circuit proof or protected against overload.

The function of the outputs can be configured. For details, please refer to the Modbus register description in Section 9.

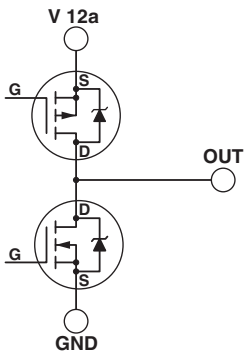

Figure 6-1 Transistor wiring of the outputs

Connection of high-power loads (e.g., lamps)

– The output stages are supplied with the required voltage of 5 V DC to 30 V DC maximum via voltage input 12Va.
– In status 0 (OFF), the outputs are connected to GND and in status 1 (ON,) they are connected to the potential of 12Va.
– GND is connected to PE internally.
– Please observe the maximum current capacity of 600 mA per output.

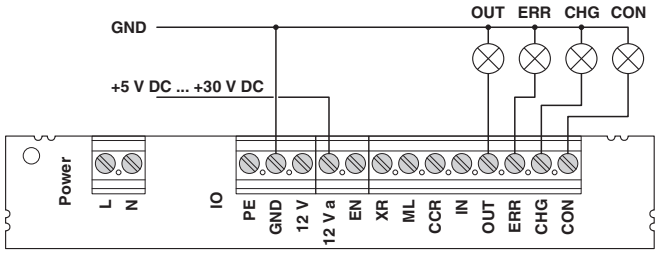

Figure 6-2 Output circuit with lamps

Connection of loads with low current consumption (e.g., LEDs)

– The output stages are supplied with the required voltage of 12 V DC from voltage output 12V via voltage input 12Va.
– Voltage output 12V can carry a maximum of 500 mA.
– In status 0, the outputs are connected to GND and in status 1, they are connected to 12Va.

GND is connected to PE internally.

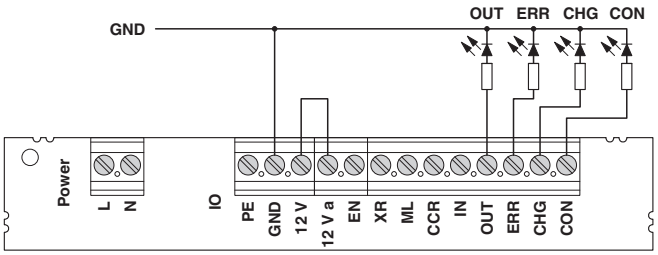

Figure 6-3 Output circuit with LEDs

6.2 Inputs

The inputs are designed as voltage dividers for a voltage from 0 V to +15 V. A current of < 1 mA flows across the resistor network at 12 V. Logic 0 is reliably detected at a voltage of 0 V to +3 V. Logic 1 is reliably detected at a voltage of +9 V to +15 V.

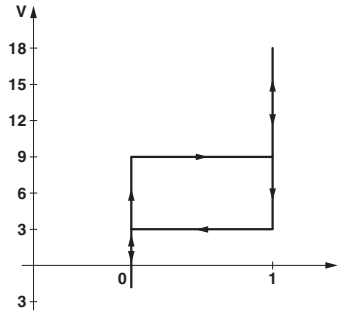

Figure 6-4 Assignment of the logic states to the voltages

The function of the digital inputs can be configured via Modbus/RTU. For details, please refer to “Modbus description” on page 55.

The circuits of the inputs are only examples. The inputs with switches can be supplied by the internal voltage source as well as by an external 12 V voltage source which uses GND as the common reference point. The inputs can also be controlled by an external higher-level controller with 12 V outputs. Here too, GND is used as the common reference point.

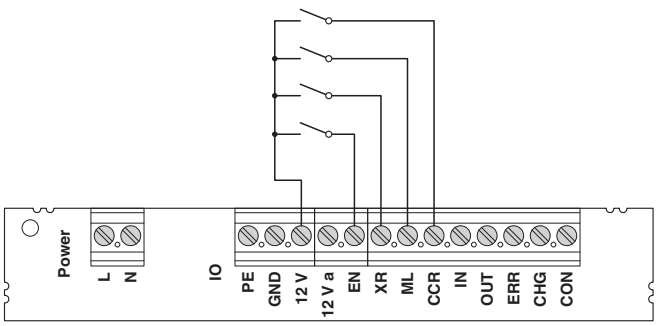

Figure 6-5 Inputs at switches with internal supply

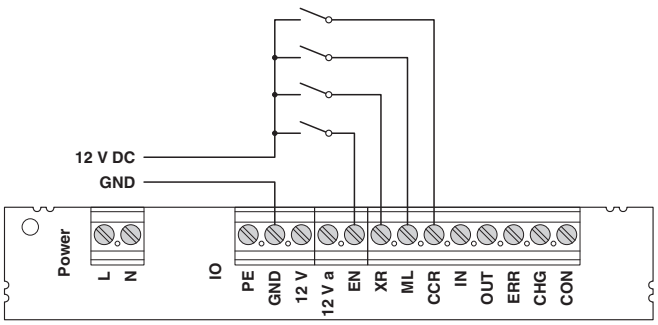

Figure 6-6 Inputs at switches with external supply

7 Connection examples

This section shows some connection examples how the charging controller can be used. Other options result from the configuration via configuration switches S1 and S2 and the configuration of the digital inputs and outputs via Modbus/RTU. For the configuration options, please refer to Table “Configuration switches S1 + S2” on page 15 and “Modbus description” on page 55.

7.1 Charging enabled with local release

S1/DIP 1 = OFF Charging station with Infrastructure Socket Outlet

S1/DIP 6 = ON Charging current preset to 20 A **or**

S1/DIP 5 = ON Charging current preset to 32 A

Locking is carried out if a vehicle is detected.

The **charging process** starts if the locking feedback is available, switch k1 is closed, and status C is present.

EV-CC-AC1-M3-CBC-..., connection of case B

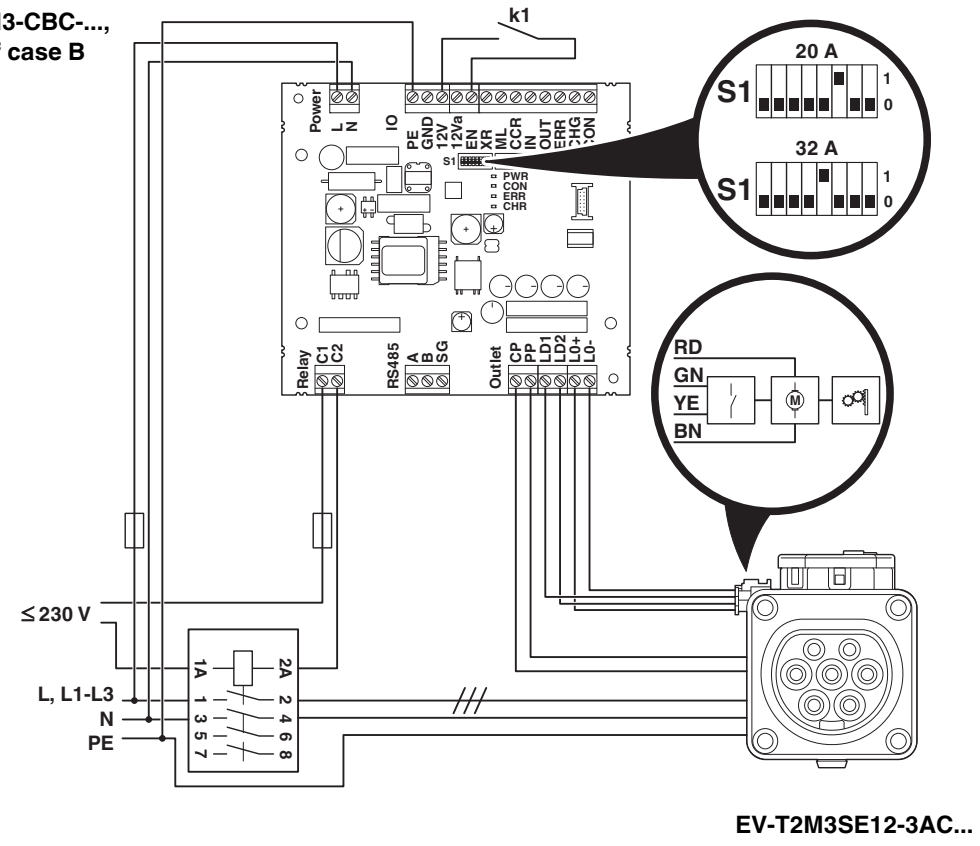

Figure 7-1 Connection example 1

7.2 Charging enabled with local release and status indication via external LEDs

S1/DIP 1 = ON

Charging station with Vehicle Connector

Status indication via external LEDs

The **charging process** starts if switch k1 is closed and status C is present.

- LED 1 is on when the vehicle is connected to the charging station.
- LED 2 is on during the charging process.
- LED 3 is on in the event of an error.

EV-CC-AC1-M3-CC-..., connection of case C

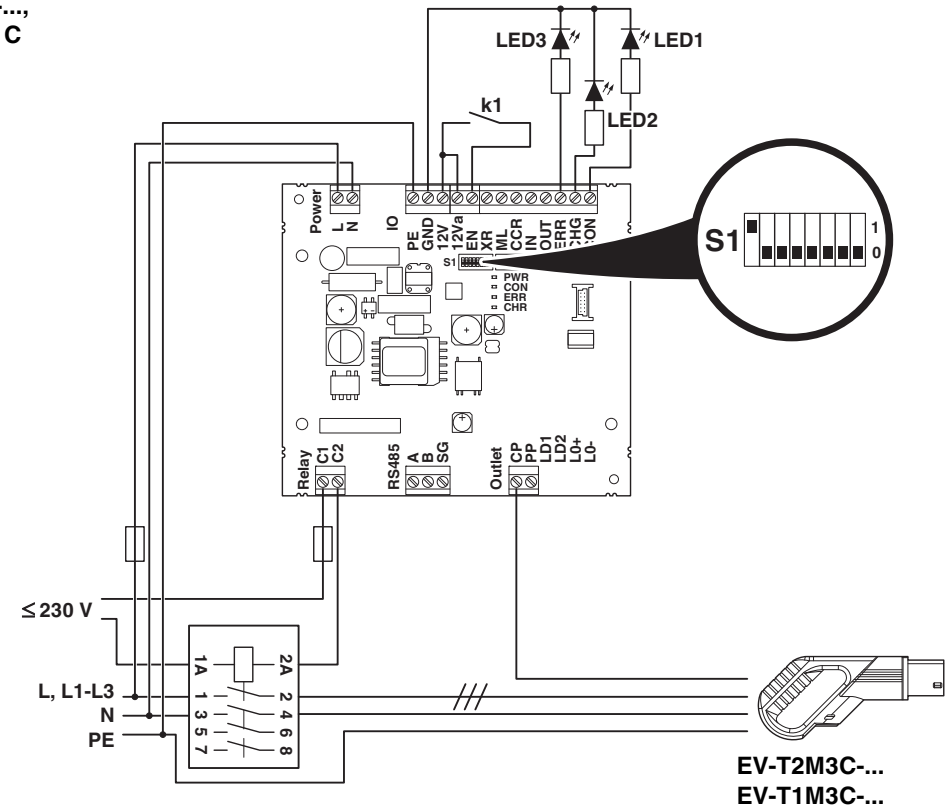

Figure 7-2 Connection example 2

7.3 Charging enabled with local release and charging current reduction

S1/DIP 1 = OFF Charging station with Infrastructure Socket Outlet

S1/DIP 5 = ON Charging current preset to 32 A

Locking is carried out if the vehicle is detected at the charging station.

The **charging process** starts if locking is detected, switch k1 is closed, and status C is present.

– If switch k2 is closed, the charging current (PWM signal) is reduced during this time (see Table 2-3 on page 15).

EV-CC-AC1-M3-CBC-..., connection of case B

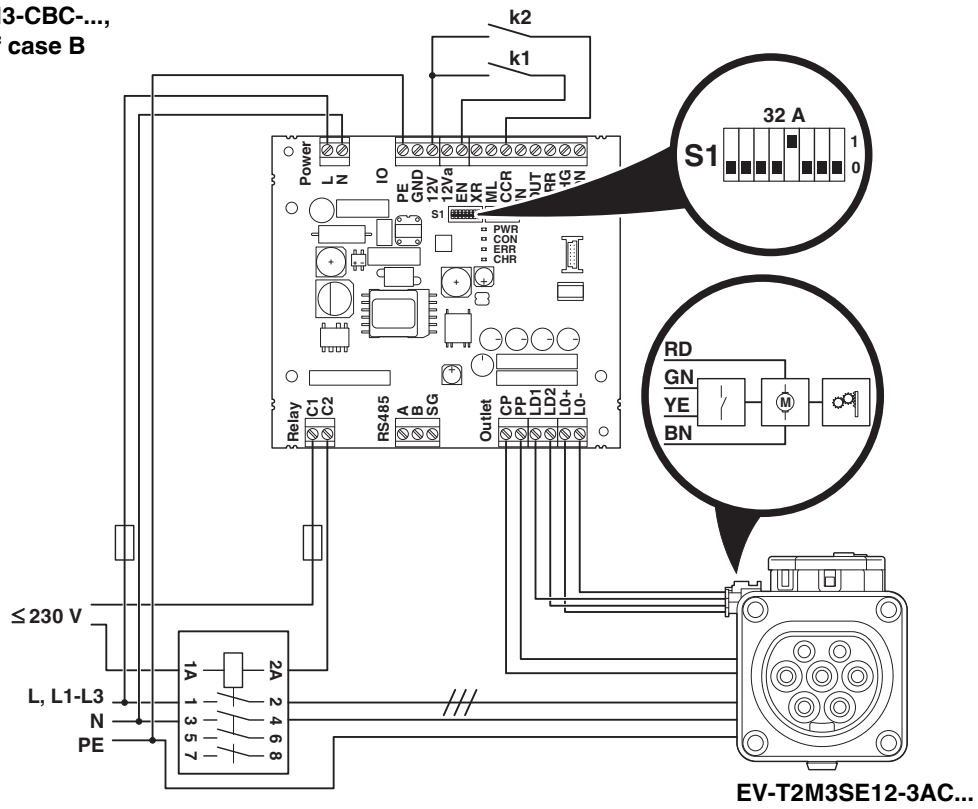

Figure 7-3 Connection example 3

7.4 Charging enabled with local release and locking

S1/DIP 1 = OFF Charging station with Infrastructure Socket Outlet

S1/DIP 3 = ON Connection locking upon signal at digital input ML

Locking is carried out if switch k1 is closed and a charging connector is detected.

The **charging process** starts if the locking feedback is available, a vehicle is connected, and status C is present.

EV-CC-AC1-M3-CBC-..., connection of case B

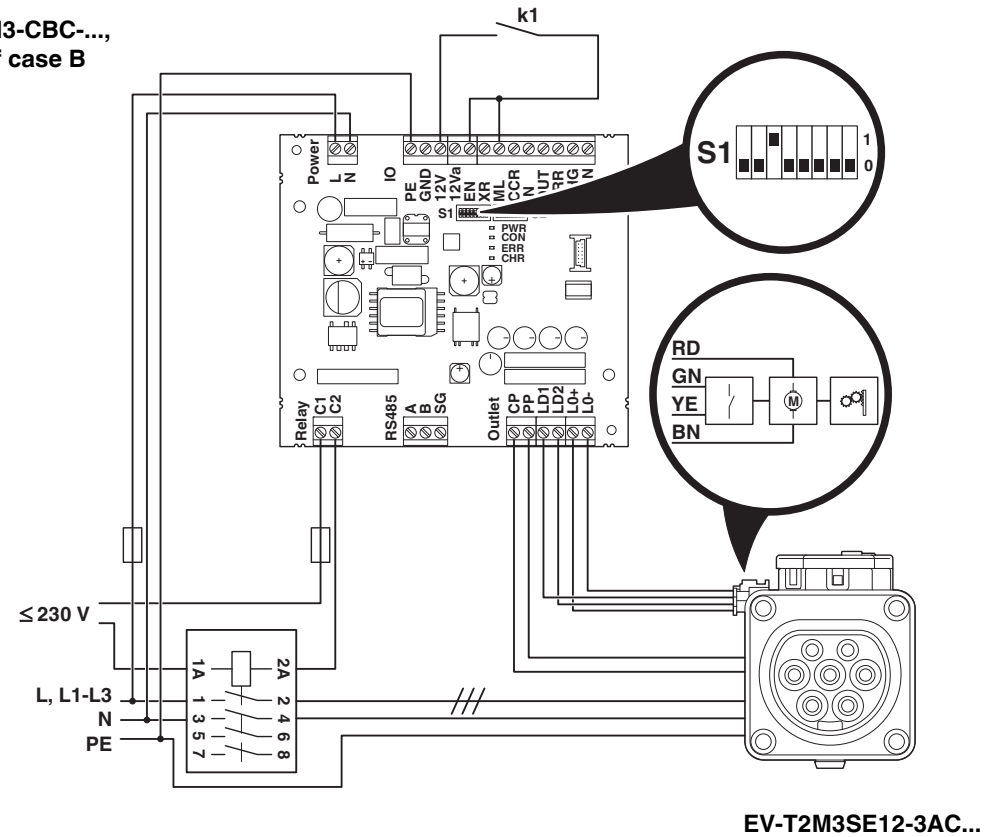

Figure 7-4 Connection example 4

7.5 Charging enabled via Modbus

S1/DIP 1 = OFF

Charging station with Infrastructure Socket Outlet

Value 3 is entered in Modbus register 4000; enable via Modbus register 20000.

Locking is carried out if the vehicle is detected at the charging station and status B is present.

The charging process starts if the locking feedback is available and value 1 is written to Modbus register 20000.

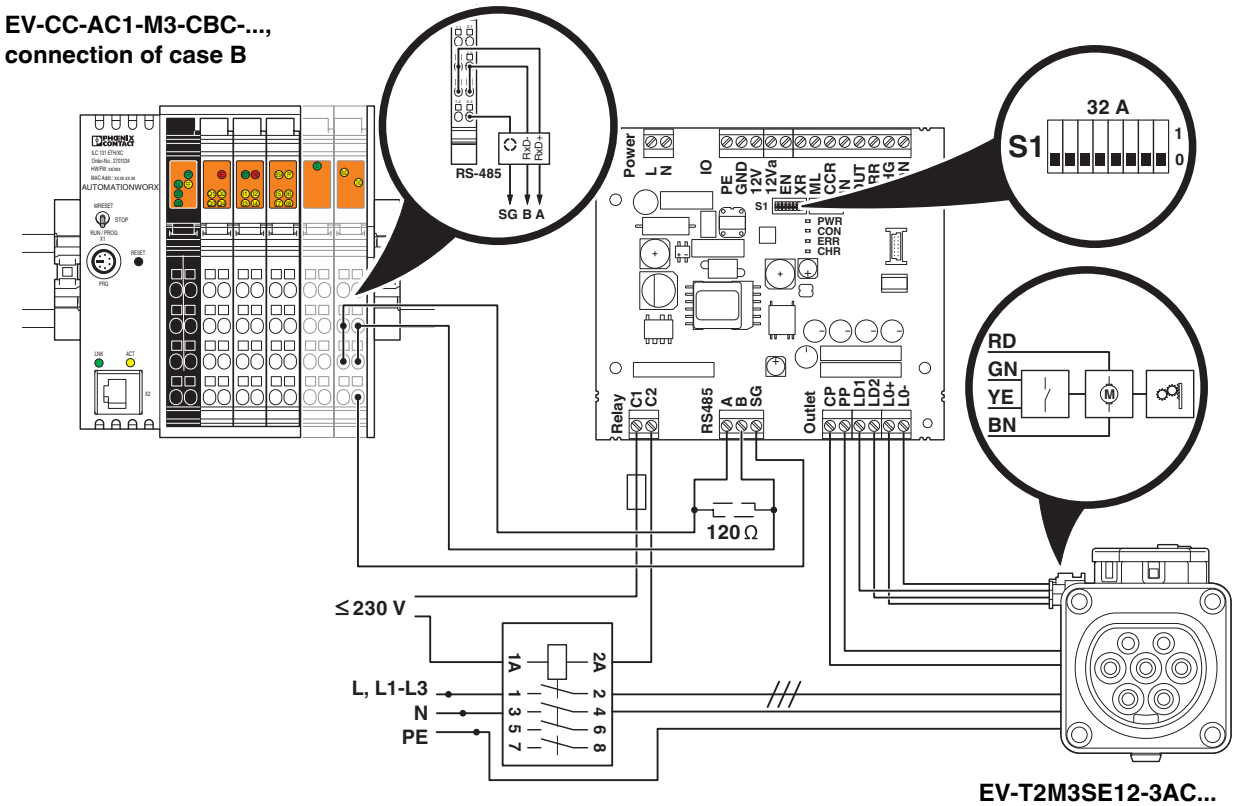

Figure 7-5 Connection example 5

Please observe that the RS-485 cable must be terminated at one point with a 120 Ω resistor.

7.6 Charging current control via analog CCR signal

The digital CCR input can be reconfigured to function as an analog input (see Table 9-2 “Register assignment”).

S1/DIP 1 = OFF Charging station with Infrastructure Socket Outlet

S1/DIP 5 = ON Charging current preset to 32 A

Locking is carried out if a vehicle is detected.

The **charging process** starts if the locking feedback is available, switch k1 is closed, and status C is present.

When changing the voltage at the analog CCR input, e.g., using a potentiometer, the maximum charging current can be adjusted.

EV-CC-AC1-M3-CBC-..., connection of case B

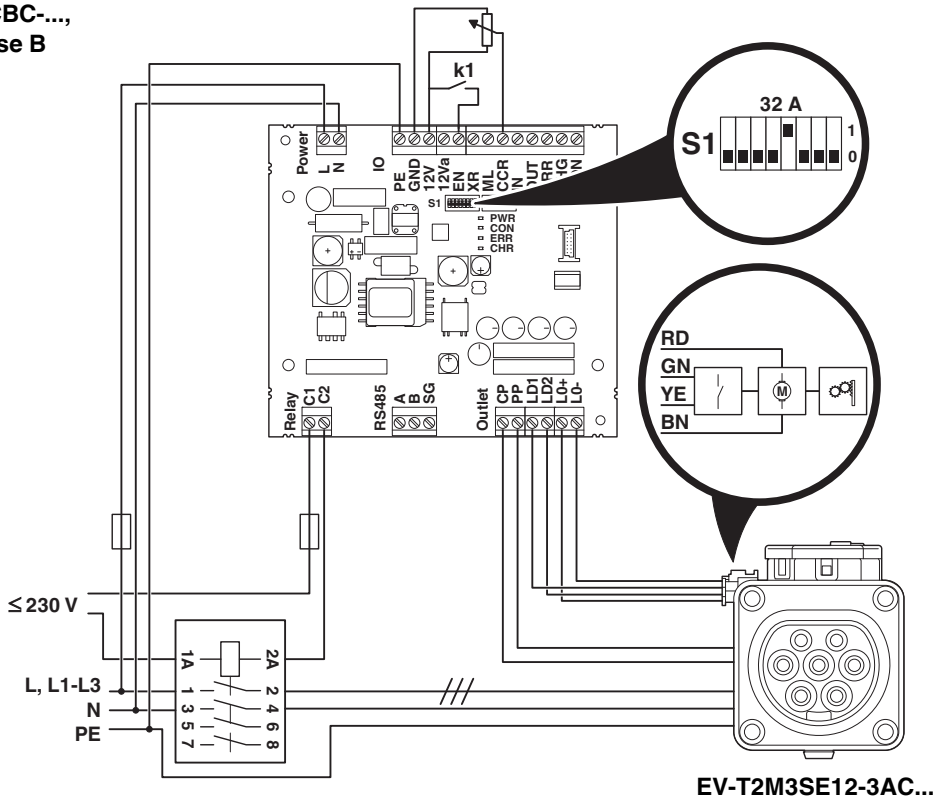

Figure 7-6 Connection example 6

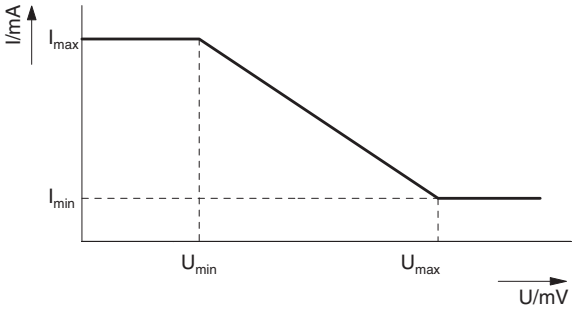

Figure 7-7 Charging current/voltage characteristic curve

The charging current/voltage characteristic curve describes the relationship between the voltage that can be set at input CCR and the corresponding charging current that can be used to charge the vehicle. In this way, the charging current can be controlled, e.g., for load management. The characteristic curve can either have a positive or a negative gradient.

Table 7-1 Device configuration example for charging current control

Address	Value	Unit	Explanation
4006	0	–	Contactor monitoring deactivated via CCR input
4012	2	–	Analog evaluation of CCR input
4013	3000	mV	Threshold value for charging with maximum current strength according to device configuration via S1/DIP 5 + 6
4014	10000	mV	Threshold value for charging with minimum current strength
4015	10	s	Update time of charging current output

Table 7-1 shows an example of how the Modbus registers can be configured in order to control the charging current via the CCR function at the analog output.

7.7 Charging contactor monitoring

S1/DIP 1 = OFF

Charging station with Infrastructure Socket Outlet

Locking is carried out if a vehicle is detected.

The **charging process** starts if the locking feedback is available and status C is present.

If no corresponding signal is detected at input CCR after completion of the charging process and switching off the charging contactor, the charging controller changes to an error state.

EV-CC-AC1-M3-CBC-..., connection of case B

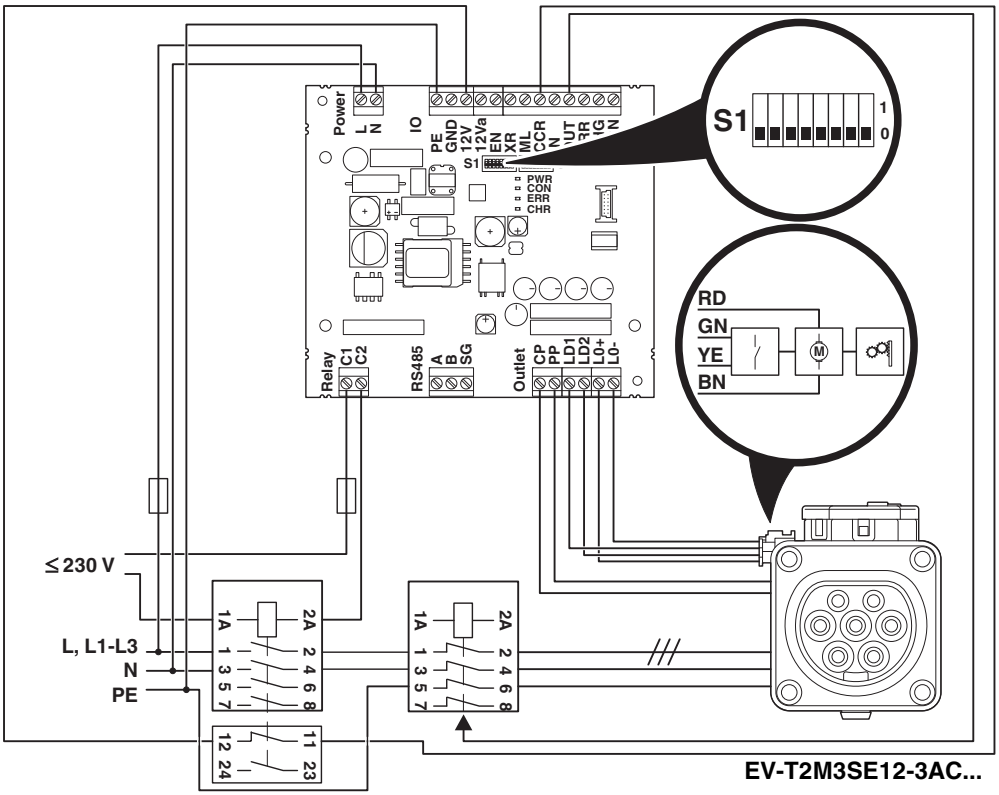

Figure 7-8 Connection example 7

Table 7-2 Device configuration example for charging contactor monitoring

Address	Value	Unit	Explanation
4012	0	–	CCR function for charging current adaptation is deactivated

Table 7-2 Device configuration example for charging contactor monitoring

Address	Value	Unit	Explanation
4006	1	–	Charging contactor monitoring via a force-guided N/C contact at the CCR input
4007	200	ms	Duration between switching off the contactor and evaluating the auxiliary contact
5500	35	–	The output is set if charging contactor monitoring has been triggered

Table 7-1 shows how the Modbus registers can be configured in order to monitor any welding of the charging contactor contacts. For charging contactor monitoring via input CCR, charging current adaptation via input CCR must be deactivated.

If an error is detected, a signal can be created via one of the digital outputs. This signal can be used to disconnect the voltage from the Infrastructure Socket Outlet using a redundant switching element. To do so, one of the OUT, ERR, CHG, or CON outputs must be configured to value “35” via the associated registers 5500 to 5503 (value “35” = “Charging contactor monitoring triggered” (see Table 9-3).

7.8 Connection to a residual current monitoring device

As of firmware version 1.2.0

S1/DIP 1 = OFF Charging station with Infrastructure Socket Outlet

S1/DIP 2 = OFF The XR input is evaluated in a modified way according to Modbus register 4011 (see Table 7-3 on page 47).

Locking is carried out if a vehicle is detected.

The **charging process** starts if the locking feedback is available and status C is present.

The charging process is interrupted if the EV-RCM residual current monitoring device detects a residual current of 6 mA DC. The charging controller then changes to the F status. Two EV-RCM differential current monitoring devices are available:

– EV-RCM-C1-AC30-DC6, 1622450 (1 channel)
– EV-RCM-C2-AC30-DC6, 1622451 (2 channels)

The charging connector unlocks with a time delay and can be removed from the Infrastructure Socket Outlet.

If the charging connector has been removed, the charging controller resets the EV-RCM. As soon as the EV-RCM has been reset, the charging controller is ready for charging again (status A).
A selftest on the EV-RCM is performed following every charging process.

NOTE: Notes on wiring the EV-RCM

To ensure that the charging contactor switches off independently in the event of a 6 mA DC residual current, please observe this installation note. The EV-RCM must be connected in series with the charging controller (terminal blocks C1 and C2) and the charging contactor (1A/2A) using the terminal blocks (13/14 and 23/24) (see Figure 7-9 on page 47).

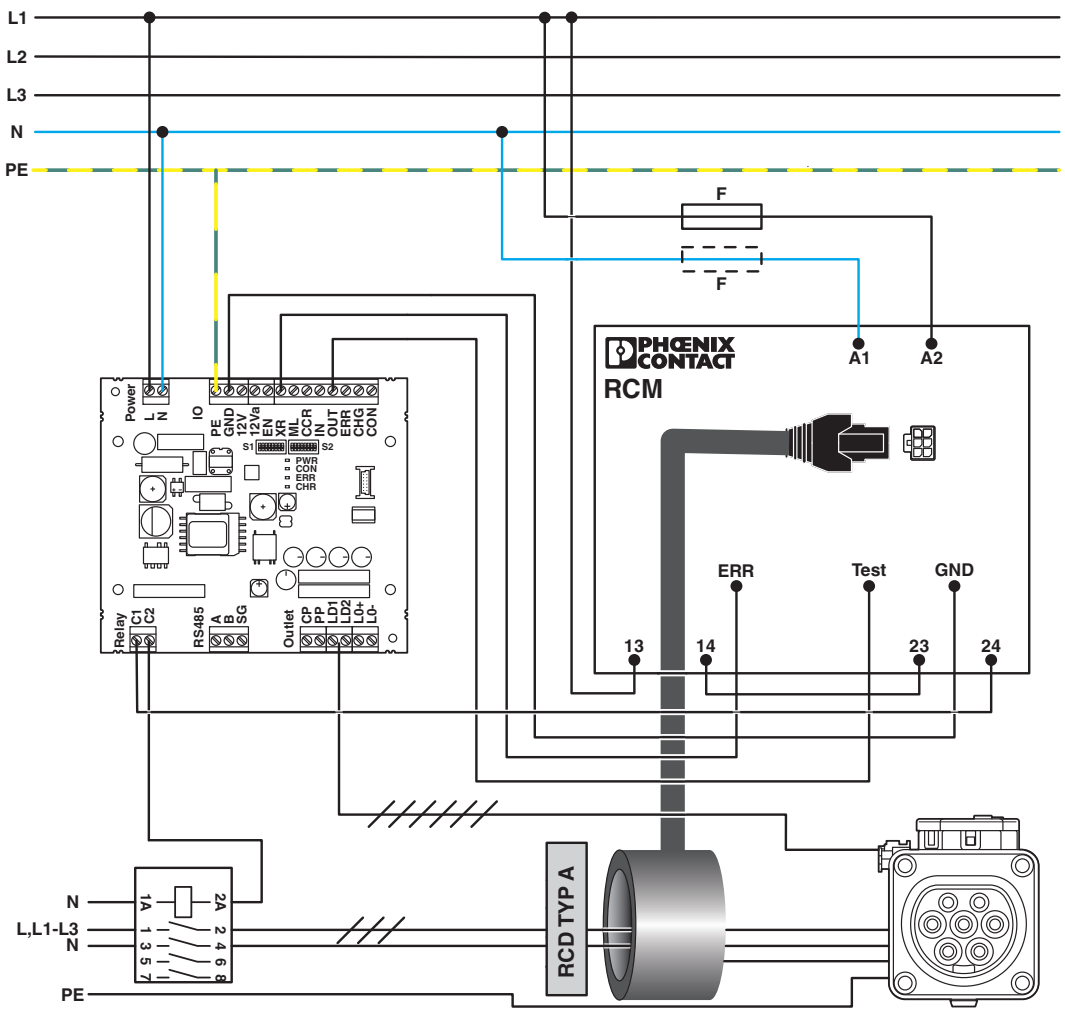

Figure 7-9 Connection example 8 (with EV-RCM-C1-AC30-DC6, 1622450)

Table 7-3 Function activation for connecting the EV-RCM residual current monitoring device at input XR

Address	Value	Function	Automatic resetting of error messages	Automatic EV-RCM device test
4011	0	Deactivated	–	–
	1	Activated	Active	Active
	2	Activated	Inactive	Active
	3	Activated	Active	Inactive*
	4	Activated	Inactive	Inactive*

* The device test can also be carried out manually or from a higher-level controller.

Table 7-4 Device configuration example for connecting the EV-RCM residual current monitoring device

Address	Value	Unit	Explanation
5500	38	–	Triggering of EV-RCM device test activated at output OUT

8 Flow charts for the charging process

The examples are based on the default configurations of the digital inputs and outputs.

8.1 Charging sequence 1

Charging sequence according to **connection example 7.1, “Charging enabled with local release”**

S1/DIP 1 = OFF

S1/DIP 5 = OFF
S1/DIP 6 = ON (20 A)

S1/DIP 5 = ON
S1/DIP 6 = OFF (32 A)

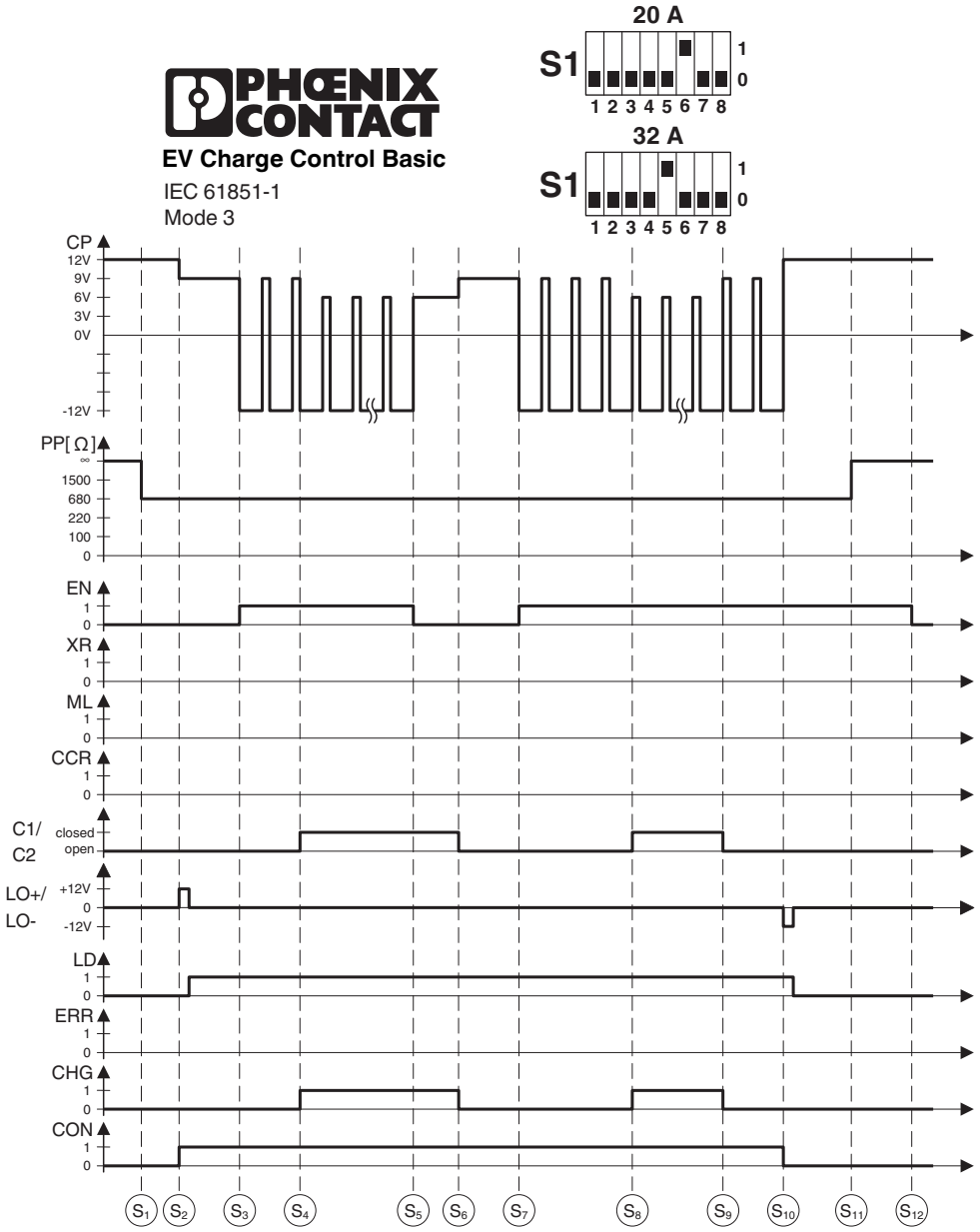

Figure 8-1 Charging sequence 1

8.2 Charging sequence 2

Charging sequence according to **connection example 7.2, “Charging enabled with local release and status indication via external LEDs”**

S1/DIP 1 = ON

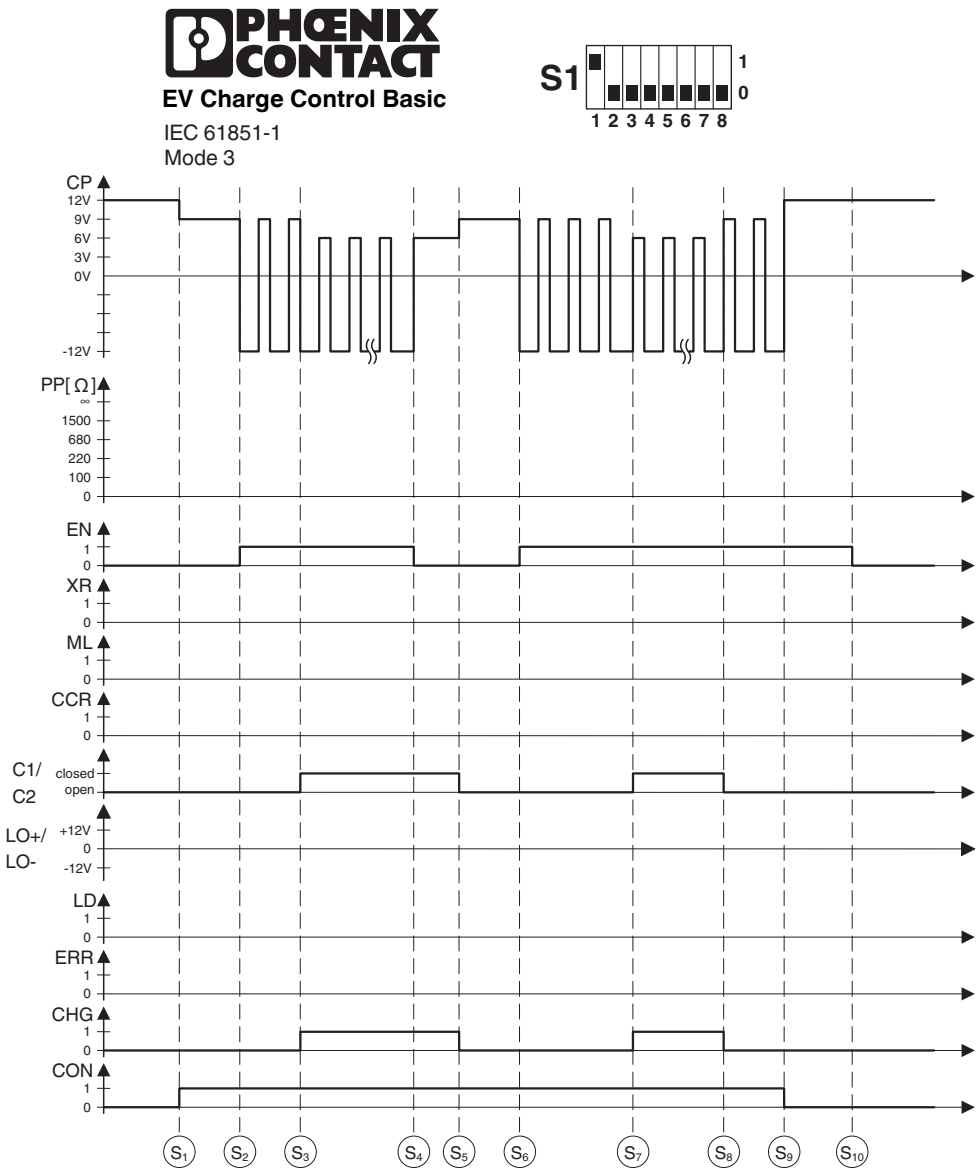

Figure 8-2 Charging sequence 2

8.3 Charging sequence 3

Charging sequence according to **connection example 7.3, "Charging enabled with local release and charging current reduction"**

S1/DIP 1 = OFF

S1/DIP 5 = ON
S1/DIP 6 = OFF (32 A)

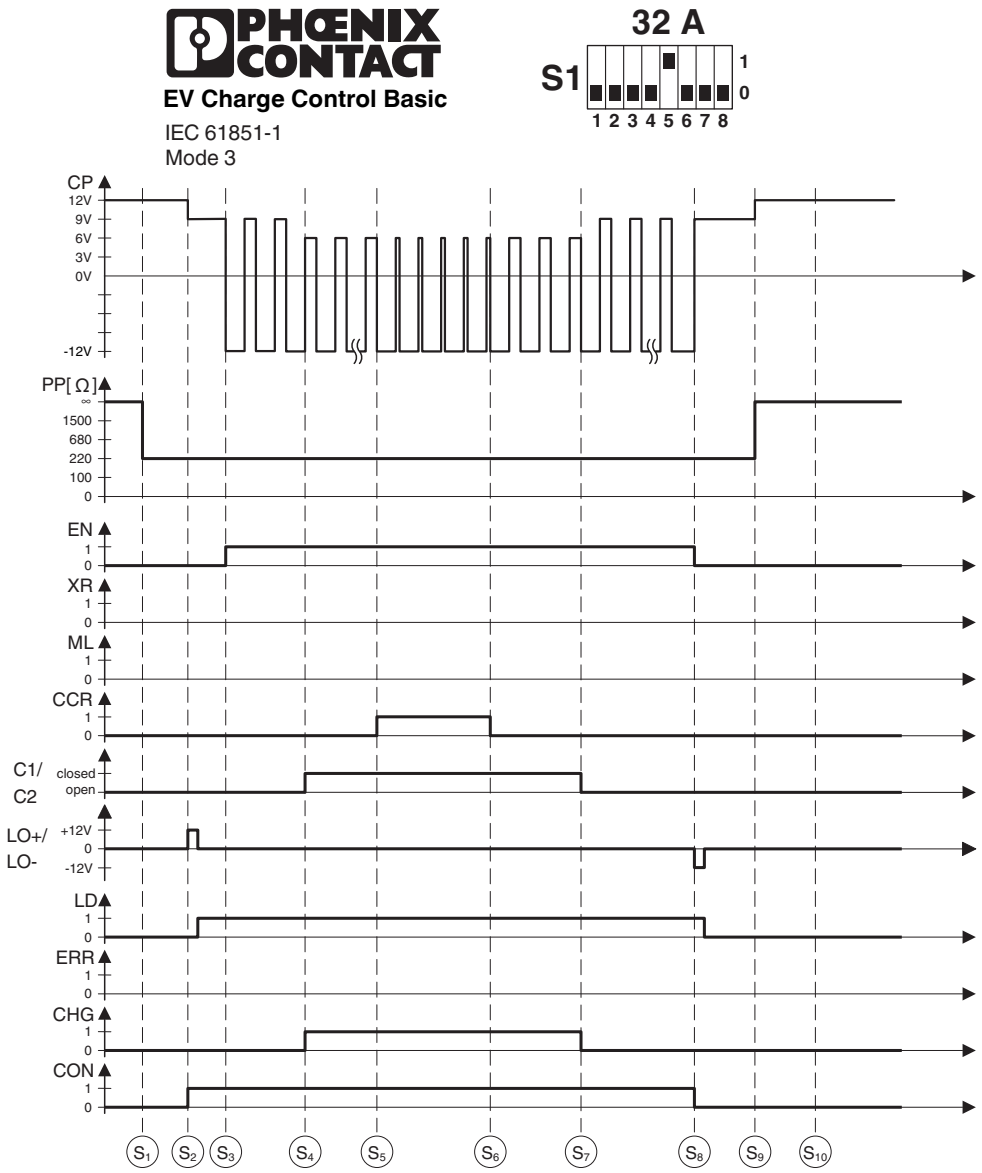

Figure 8-3 Charging sequence 3

8.4 Charging sequence 4

Charging sequence according to **connection example 7.4, “Charging enabled with local release and locking”**

S1/DIP 1 = OFF

S1/DIP 3 = ON

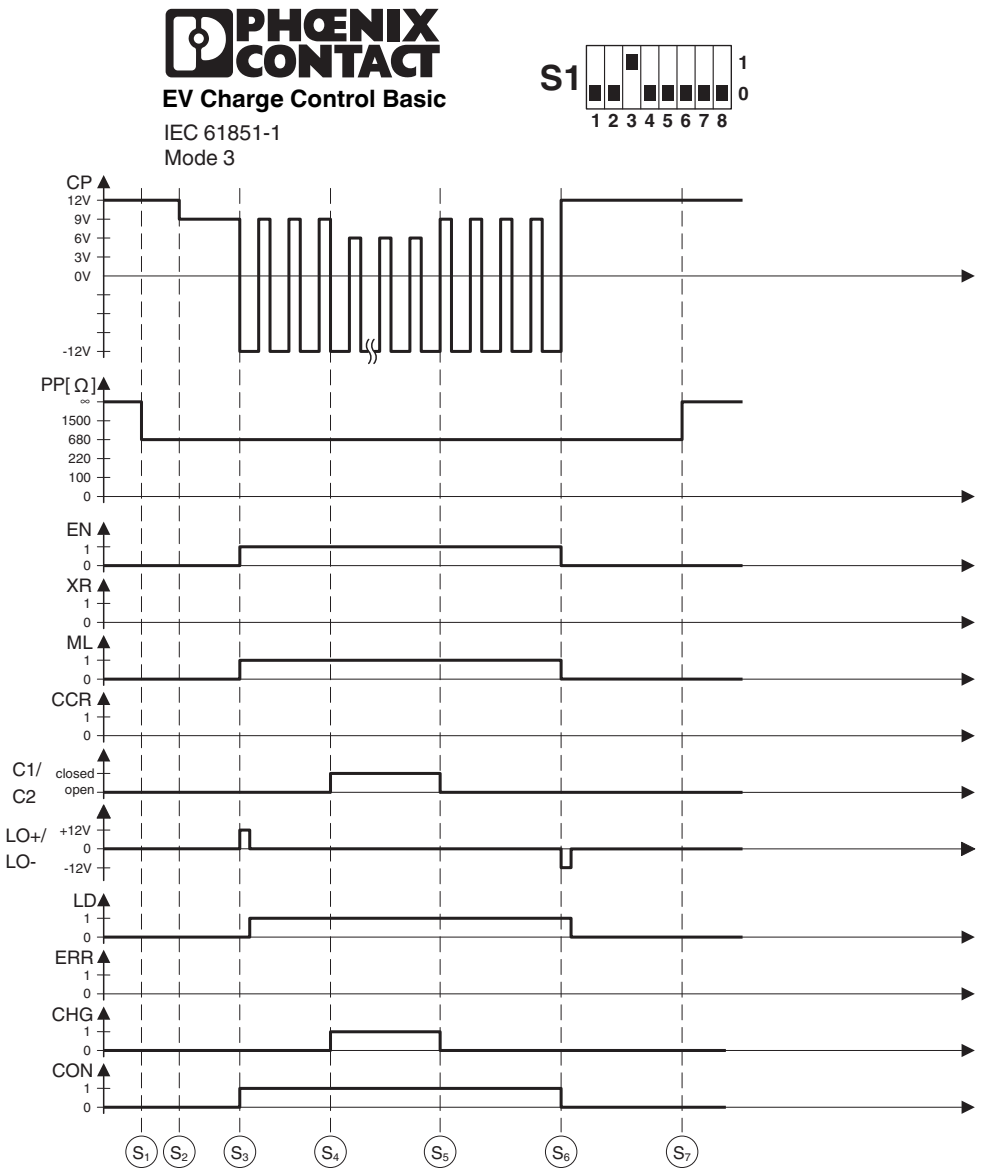

Figure 8-4 Charging sequence 4

8.5 Charging sequence 5

The charging sequence shows an availability test via the XR input and the charging enabled status via the EN input.

S1/DIP 1 = OFF

S1/DIP 2 = ON

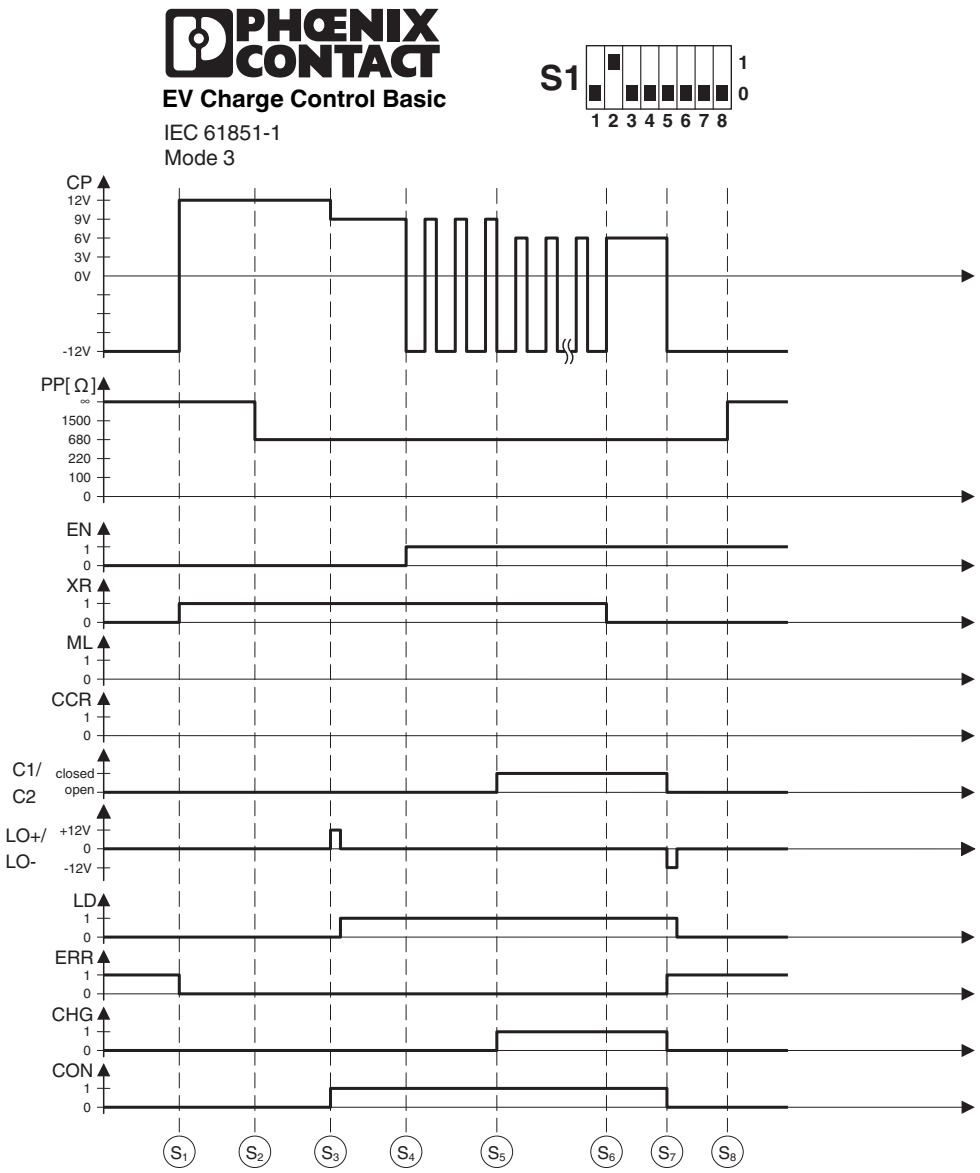

Figure 8-5 Charging sequence 5

8.6 Charging sequence 6

Charging sequence according to **connection example 7.6, “Charging current control via analog CCR signal”.**

S1/DIP 1 = OFF

S1/DIP 5 = ON
S1/DIP 6 = OFF (32 A)

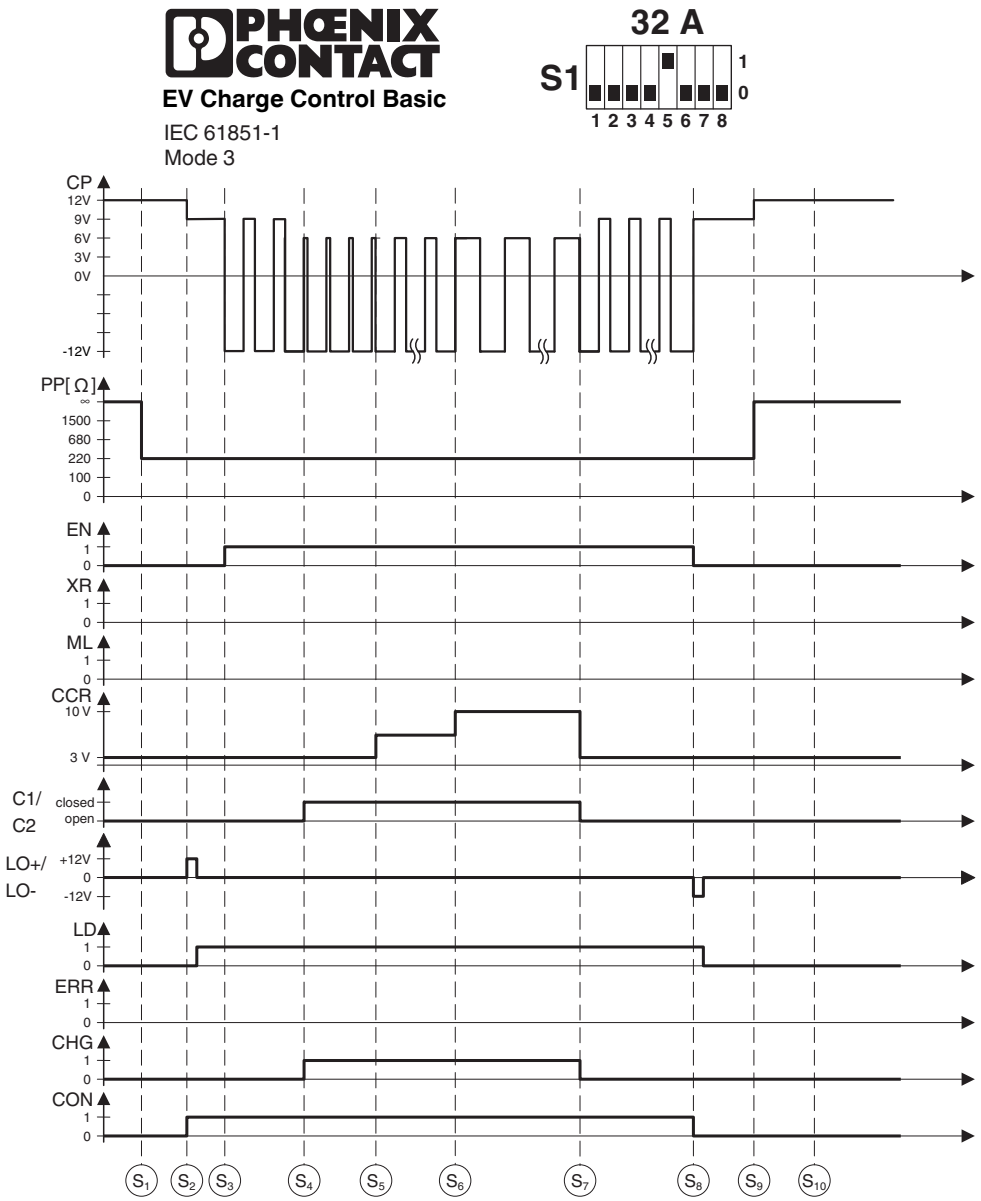

Figure 8-6 Charging sequence 6

9 Modbus description

You can access the device registers via Modbus/RTU. Modbus/RTU can be used to additionally configure the device, request status information, and access and control the charging process. The device operates as a Modbus slave. The slave address is set via S2/DIP 2 – 6. The baud rate (9600 or 19200) for communication is set via S2/DIP 1. See Table “Configuration switches S1 + S2” on page 15.

9.1 Modbus register types

Modbus/RTU supports three register types which are used as follows.

Table 9-1 Modbus registers

Modbus register type	Value	Access
Input	16 bits	Read
Holding	16 bits	Read/write
Coils	1 bit	Read/write

9.2 Register assignment

The following table shows how the device registers are assigned to addresses that can be accessed via Modbus/RTU.

Unless otherwise specified, the numerical values are decimal values.

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Input	1000-1015	16 bits	Read	Retentive	Order designation	ASCII (32 characters)
	1016-1020	16 bits	Read	Retentive	Order number	ASCII (10 characters)
	1021-1026	16 bits	Read	Retentive	Serial number	ASCII (12 characters)
		16 bits		Retentive		
	1027	16 bits	Read	Retentive	Year of manufacture	YYYY (4 x 4 bits BCD)
	1028	16 bits	Read	Retentive	Manufacturing date	MM.DD (4 x 4 bits BCD)
	1029	16 bits	Read	Retentive	Hardware identification	ASCII (MSB) + integer (LSB)
	1030	16 bits	Read	Retentive	Hardware version	Integer
	1031	16 bits	Read	Retentive	Firmware: identification letter and major version number	ASCII (MSB) + integer (LSB)
	1032	16 bits	Read	Retentive	Firmware: version number	Integer
	1033	16 bits	Read	Retentive	Firmware: minor version number	Integer

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	2000	16 bits	Read	–	Configuration switch S1	Binary, 1 bit per DIP switch
	2001	16 bits	Read	–	Configuration switch S2	Binary, 1 bit per DIP switch
	4000	16 bits	Read/write	Retentive	Configuring the enable charging process function via input EN or Modbus registers Switching on the PWM signal if all other conditions required are met.	Integer 0: Charging always enabled 1: Charging enabled if input EN = ON (default) 2: Charging enabled in the event of a pulsed signal at input EN, reset upon next pulse 3: Charging enabled if value 1 is written to register 20000. Charging not enabled (PWM OFF) if value 0 is written to register 20000.
	4001	16 bits	Read/write	Retentive	Configuring external release via input XR or Modbus registers Setting status F (according to IEC 61851-1) if charging station is not available	Integer If S1/DIP 2 = OFF: 0: Always available (Default, if S1/DIP 2 = OFF, other values have no effect) If S1/DIP 2 = ON: 1: Available if XR = ON, status F if XR = OFF (Default, if S1/DIP 2 = ON) 2: Available if value 1 is written to register 20001. Status F if value 0 is written to register 20001.

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	4002	16 bits	Read/write	Retentive	Activating the locking function Charging connector in the Infrastructure Socket Outlet	Integer If S1/DIP 3 = OFF: 0: Locking is performed automatically when the vehicle is connected (status B), unlocking is performed if the vehicle is not detected (status A). (Default, if S1/DIP 3 = OFF, other values have no effect) If S1/DIP 3 = ON: 1: Locking upon ON signal at input ML, unlocking if signal at input ML = OFF (Default, if S1/DIP 3 = ON) 2: Locking in the event of a pulsed signal at input ML, unlocking upon next pulse 3: Locking if value 1 is written to register 20002. Unlocking if value 0 is written.
	4006	16 bits	Read/write	Retentive	Function activation for charging contactor monitoring. For charging contactor monitoring via input CCR, charging current adaptation via input CCR must be deactivated (register 4012 = 0)	Integer 0: Charging contactor monitoring deactivated (default) 1: Charging contactor monitoring by evaluating a force-guided N/C contact at input CCR
	4007	16 bits	Read/write	Retentive	Delay time between switching off the charging contactor and executing charging contactor monitoring	Integer in ms Default = 200 ms
	4008	16 bits	Read	–	Rejecting invalid charging cable Relevant for EV-CC-AC1-M3-CBC-... only	Integer If S1/DIP 4 = OFF 0: All charging cables permitted If S1/DIP 4 = ON 1: 13 A charging cable is rejected

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	4009	16 bits	Read	–	Configuring connection of case B or C Relevant for EV-CC-AC1-M3-CBC-... only	Integer If S1/DIP 5 = OFF: 0: Connection of case B, Infrastructure Socket Outlet If S1/DIP 5 = ON: 1: Connection of case C, Vehicle Connector
	4010	16 bits	Read/write	Retentive	Permitting vehicles with charging status D (ventilation required)	Integer 0: Do not permit charging in status D (default) 1: Permit charging in status D
	4011	16 bits	Read/write	Retentive	Function activation for connecting the EV-RCM residual current monitoring device at input XR S1/DIP 2 must be set to “OFF”. EV-RCM = – EV-RCM-C1-AC30-DC6, 1622450 – EV-RCM-C2-AC30-DC6, 1622451 Optional reset in the event of an error. A function test (device test) is performed upon device start and following every charging process.	Integer 0: Deactivated 1: EV-RCM connection activated; automatic reset active; automatic device test active 2: EV-RCM connection activated; automatic reset inactive; automatic device test active 3: EV-RCM connection activated; automatic reset active; automatic device test inactive 4: EV-RCM connection activated; automatic reset inactive; automatic device test inactive
	4012	16 bits	Read/write	Retentive	Function activation for charging current adaptation via input CCR. Charging contactor monitoring must be deactivated (register 4006 = 0)	Integer 0: Deactivated 1: Digital evaluation (see Table 2-3) (default) 2: Evaluation as analog signal (to use a charging current controller)
	4013	16 bits	Read/write	Retentive	Threshold value for switching off (0 A) or switching on (6 A) the charging process, with analog evaluation of input CCR	Integer in mV Default = 0 mV

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	4014	16 bits	Read/write	Retentive	Threshold value for maximum charging current (S1/DIP switches 5 + 6), with analog evaluation of input CCR	Integer in mV Default = 10,000 mV
	4015	16 bits	Read/write	Retentive	Update time for adapting the charging current, with analog evaluation of input CCR	Integer in s Default = 10 s
	5004	16 bits	Read/write	Retentive	Configuring input IN	Integer 0: Without internal pull-up resistor 1: Internal pull-up resistor connected
	5500	16 bits	Read/write	Retentive	Function assignment for digital output OUT	Integer, according to Table 9-3 Default = mapping to register 23003
	5501	16 bits	Read/write	Retentive	Function assignment for digital output ERR	Integer, according to Table 9-3 Default = status E or F
	5502	16 bits	Read/write	Retentive	Function assignment for digital output CHG	Integer, according to Table 9-3 Default = vehicle is loading, charging contactor is closed
	5503	16 bits	Read/write	Retentive	Function assignment for digital output CON	Integer, according to Table 9-3 Default = vehicle connected in status B, C, or D
	5600	16 bits	Read/write	Retentive	Behavior of digital output OUT in status ON Only takes effect if register 5500 ≠ 0	Integer 1: On 2: Flashing (1 Hz)
	5601	16 bits	Read/write	Retentive	Behavior of digital output ERR in status ON Only takes effect if register 5501 ≠ 0	Integer 1: On 2: Flashing (1 Hz)
	5602	16 bits	Read/write	Retentive	Behavior of digital output CHG in status ON Only takes effect if register 5502 ≠ 0	Integer 1: On 2: Flashing (1 Hz)
	5603	16 bits	Read/write	Retentive	Behavior of digital output CON in status ON Only takes effect if register 5503 ≠ 0	Integer 1: On 2: Flashing (1 Hz)

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	7001	16 bits	Read/write	Retentive	Configuring the operating time of the charging connector locking during opening and closing Relevant for EV-CC-AC1-M3-CBC-... only	Integer, in ms Default = 600 ms
	7002	16 bits	Read/write	Retentive	Maximum number of locking cycles without cooling phase Repetitions in the event of unsuccessful locking attempts	Integer Default = 5
	7003	16 bits	Read/write	Retentive	Break between two locking sequences	Integer, in ms Default = 1000 ms
	7004	16 bits	Read/write	Retentive	Maximum permissible operating time of the locking actuator in continuous mode	Integer, in ‰ Default = 50‰
	7010	16 bits	Read/write	Retentive	Evaluating the locking feedback Setpoint resistance between LD1 and LD2 in the “charging connector not locked” status	Integer, in ohms Default = 65535 (floating switch as confirmation contact open)
	7011	16 bits	Read/write	Retentive	Evaluating the locking feedback Setpoint resistance between LD1 and LD2 in the “charging connector locked” status	Integer, in ohms Default = 0 (floating switch as confirmation contact closed)
	7500	16 bits	Read/write	Retentive	Dimming the on-board LED PWR	Integer, 1 x 16 bits Percentage, pulse duty factor 0% … 100%
	7501	16 bits	Read/write	Retentive	Dimming the on-board LED CON	Integer, 1 x 16 bits Percentage, pulse duty factor 0% … 100%
	7502	16 bits	Read/write	Retentive	Dimming the on-board LED ERR	Integer, 1 x 16 bits Percentage, pulse duty factor 0% … 100%
	7503	16 bits	Read/write	Retentive	Dimming the on-board LED CHR	Integer, 1 x 16 bits Percentage, pulse duty factor 0% … 100%

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Coils	20000	1 bit	Read/write	Volatile	Enabling the charging process Switching on the PWM signal if all other conditions required are met. Only takes effect if register 4000 is configured for this function.	1 bit 0 = charging process not enabled 1 = charging process enabled
	20001	1 bit	Read/write	Volatile	Setting the system state F (according to IEC 61851-1) if the charging station is not available. Only takes effect if register 4001 is configured via Modbus/RTU.	1 bit 0 = charging station not available, status F 1 = charging station available
	20002	1 bit	Read/write	Volatile	Controlling the locking actuator Only takes effect if register 4002 is configured for this function.	1 bit 0 = charging connector is unlocked 1 = charging connector is locked
	20003	1 bit	Read/write	Volatile	EV-RCM function test	1 = EV-RCM function test following the next charging process (status A1 or B1). After the function test, the register is set to 0.
	21000	1 bit	Read/write	Volatile	Restarting the charging controller	1 bit Restart if value 1 is written.
Holding	21100	16 bits	Read/write	Volatile	Resetting to default settings	Integer Reset if value 17281 is written.
	22000	16 bits	Read/write	Volatile	Setting the maximum permissible charging current	Integer Maximum permissible charging current 6 A … 63 A
	23000	16 bits	Read/write	Volatile	Setting the digital output register for output OUT Only takes effect if the digital output OUT is configured with value 0 via register 5500 (see Table 9-3).	Integer 0: Output = OFF 1: Output = ON 2: Output = flashing (1 Hz)

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	23001	16 bits	Read/write	Volatile	Setting the digital output register for output ERR Only takes effect if the digital output ERR is configured with value 0 via register 5501 (see Table 9-3).	Integer 0: Output = OFF 1: Output = ON 2: Output = flashing (1 Hz)
	23002	16 bits	Read/write	Volatile	Setting the digital output register for output CHG Only takes effect if the digital output CHG is configured with value 0 via register 5502 (see Table 9-3).	Integer 0: Output = OFF 1: Output = ON 2: Output = flashing (1 Hz)
	23003	16 bits	Read/write	Volatile	Setting the digital output register for output CON Only takes effect if the digital output CON is configured with value 0 via register 5503 (see Table 9-3).	Integer 0: Output = OFF 1: Output = ON 2: Output = flashing (1 Hz)
	24000	16 bits	Read	Volatile	System status according to IEC 61851-1	2 x ASCII A1, A2, B1, … , D2, E(0), F(0)
	24001	16 bits	Read	Volatile	If S1/DIP 7 = OFF: Proximity evaluation according to IEC 61851-1 and assignment of the current carrying capacity of the charging connector according to Table 5-1. If S1/DIP 7 = ON: Connector detection according to GB/T 18487.1	Iff S1/DIP 7 = OFF – 13 A, 20 A, 32 A, 63 A – 0: PP open – FFFF: 0 ohms between PP and PE (error) If S1/DIP 7 = ON – 63 A: 0 ohms – 0: PP open
	24002	16 bits	Read	Volatile	Charging current specification via signal CP in % (pulse duty cycle of the PWM signal according to IEC 61851-1)	Integer 10% … 90%
	24003	16 bits	Read	Volatile	Charging current specification via signal CP in A	Integer 6 A … 63 A
	24004	16 bits	Read	Volatile	Status of digital inputs	16 bits Bit 0 – bit 4: EN, XR, ML, CCR, IN
	24005	16 bits	Read	Volatile	Status of digital outputs	16 bits Bit 0 – bit 3: OUT, ERR, CHG, CON

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	24017	16 bits	Read	Volatile	Minutes counter and seconds counter in status C and D, reset condition via status A	Integer, 2 x 8 bits mm:ss
	24018	16 bits	Read	Volatile	Hours counter in status C and D, reset condition via status A	Integer, 1 x 16 bits hhhh
	24019	16 bits	Read	Volatile	Minutes counter and seconds counter in status B, C and D, reset condition via status A	Integer, 2 x 8 bits mm:ss
	24020	16 bits	Read	Volatile	Hours counter in status B, C and D, reset condition via status A	Integer, 1 x 16 bits hhhh
	24025	16 bits	Read	Volatile	Error status	Bit = error assignment Bit 2 = rejection of 13 A cable Bit 3 = invalid PP value Bit 4 = invalid CP value Bit 5 = status F due to no charging station availability Bit 6 = locking Bit 7 = unlocking Bit 8 = LD unavailable during locking Bit 11 = status D, vehicle rejected Bit 12 = charging contactor error Bit 13 = no diode in the Control Pilot circuit in the vehicle Bit 15 = EV-RCM residual current detection triggered Bit 16 = EV-RCM selftest error
	24027	16 bits	Read	–	Presetting the maximum current setting via S1/DIP 5 + 6	Integer, 1 x 16 bits
	26000	16 bits	Read	Volatile	Evaluating input EN as analog input	Integer, 1 x 16 bits Standardized to mV
	26001	16 bits	Read	Volatile	Evaluating input XR as analog input	Integer, 1 x 16 bits Standardized to mV

Table 9-2 Register assignment

Type	Address	Value	Access	Memory	Function	Coding
Holding	26002	16 bits	Read	Volatile	Evaluating input ML as analog input	Integer, 1 x 16 bits Standardized to mV
	26003	16 bits	Read	Volatile	Evaluating input CCR as analog input	Integer, 1 x 16 bits Standardized to mV
	26004	16 bits	Read	Volatile	Evaluating input IN as analog input	Integer, 1 x 16 bits Standardized to mV

9.3 Function assignment of output registers

The digital inputs can be assigned different functions by entering values according to Table 9-3 to registers 5500 – 5503.

Table 9-3 Function assignment of output registers for the digital outputs

Value	Function
0	Control from the assigned output register (23000 – 23003)
1	Charging controller in status A
2	Charging controller in status B
3	Charging controller in status B and PWM ON
4	Charging controller in status B and PWM OFF
5	Charging controller in status C
6	Charging controller in status D
7	Charging controller in status E
8	Charging controller in status F
9	Charging controller in status A or B
10	Charging controller in status A or B and PWM ON
11	Charging controller in status A or B and PWM OFF
12	Charging controller in status A - C
13	Charging controller in status A - B or D
14	Charging controller in status A - D
15	Charging controller in status E - F
16	Charging controller in status C or D
17	PWM ON
18	Charging controller has detected a valid PP value
19	Charging controller has detected an invalid PP value
20	Charging controller has detected a 13 A connector at PP
21	Charging controller has detected a 20 A connector at PP
22	Charging controller has detected a 32 A connector at PP
23	Charging controller has detected a 63 A connector at PP
24	Charging controller has detected a 13 A or 20 A connector at PP

Table 9-3 Function assignment of output registers for the digital outputs

Value	Function
25	Charging controller has detected a 13 A or 20 A connector at PP
26	Insufficient current carrying capacity of the charging cable
27	Charging controller switches the charging contactor ON
28	Cannot be used for this device
29	Locking active
30	Cannot be used for this device
31	Cannot be used for this device
32	Cannot be used for this device
33	Cannot be used for this device
34	Cannot be used for this device
35	Charging contactor monitoring triggered
36	Status D, vehicle rejected
37	Vehicle connected in status B or C or D
38	EV-RCM: Test and reset function
39	EV-RCM: Error (system error or residual current detected)
≥ 39	Not permitted

A Appendixes

A 1 List of figures

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Section 4

Section 5

Section 6

Section 7

Section 8