User Manual

Smart Charge Controller

SCC

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History of changes

VERSION	DATE	DESCRIPTION
1.0	29/11/2021	Initial version
1.1	17/01/2022	Update
1.2	04/03/2022	Release Candidate
1.3	06/04/2022	Reviewed version
1.4	21/04/2022	Added transmitter output power Added RED statement Added Safety warning
1.5	11/05/2022	Adapt RS485 interface to A(+) B(-)
1.6	04/03/205	SCC not Delta compatible
1.7	12/03/2025	SCC new layout in commissioning
1.8	28/05/2025	New Xemex template

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1. Introduction

1.1. Scope

This manual is applicable to the Smart Charge Controller, an electronic device which is used in conjunction with an EV charging station that supports the Dynamic Load Balancing feature.
It describes the specifications, installation, and operation of the product. Please read this document carefully before installation and operating.

1.2. Target group

The installation and the operation of this device and any maintenance must be carried out by a qualified person in accordance with specific local standards and safety regulations.

1.3. Intended usage

The Smart Charge Controller can only be used as current meter for an EV charging station and shall operate within the specified values only. It is not possible to use the Smart Charge Controller in a three-phase three-wire (Delta) with an EV.

1.4. Technical assistance

For technical assistance, contact Xemex NV:

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Metropoolstraat 11a
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Tel: +32 201 95 95
E-mail: support@xemex.eu

1.5. Used symbols

Following symbols are used in this document and/or are marked on the product:

	Alternating current
	Three-phase alternating current
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION
	Caution, possibility of electric shock
	Caution
	Earth (ground) terminal

1.6. Safety precautions:

DANGER — HAZARDOUS VOLTAGES
WARNING - These installation/servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Always adhere to the following checklist:

1. Only qualified personnel or licensed electricians should install the Xemex Smart Charge Controller. The mains voltages of 120 Vac to 600 Vac can be lethal!
2. Follow all applicable local and national electrical and safety codes.
3. Install the unit in an electrical enclosure (panel or junction box) or in a limited access electrical room.
4. Verify that circuit voltages and currents are within the proper range for the unit model.
5. Use current transformers (CTs) with built-in TVS with a dielectric strength of at least 3.5KV 50Hz 1min and a work voltage of 660V. Do not use current output (ratio) CTs such as 1A or 5A output CTs: they will destroy the Smart Charge Controller.
6. Ensure that the CTs are placed behind fuses or circuit breakers.
7. Equipment must be disconnected from the HAZARDOUS LIVE voltages before access.
8. Before applying power, check that all the wires are securely installed by tugging on each wire.
9. Do not install the Smart Charge Controller where it may be exposed to temperatures below –10°C or above 55°C, excessive moisture, dust, salt spray, or other contamination. The meter requires an environment no worse than pollution degree 2 (normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation must be expected).
10. Do not drill mounting holes in the device. Click the module on a DIN Rail instead.
11. If the Smart Charge Controller is installed incorrectly, the safety protections may be impaired.

1.7. RED statement

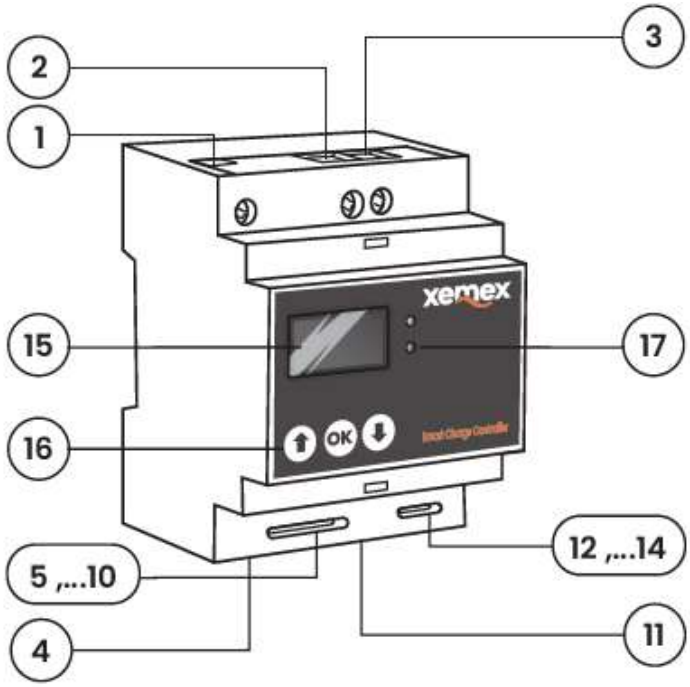
Hereby Xemex N.V. declares that the radio equipment type SCC10-UA is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: www.xemex.eu

1.8. RF Exposure warning

Only install the SCC10-UA in a place where a separation distance of min 20 cm between the SCC10-UA and the human body is respected.

2. Technical description

2.1. Product Overview



1.	Ground connection
2.	230AC, N connection
3.	230AC, L1 connection
4.	P1 input connection
5,...10	current transformer connection
11.	Modbus TCP/IP connection
12,...14	Modbus RJ485/RTU connection
15.	OLED screen
16.	Controll buttons
17.	LED indicators

The Xemex Smart Charge Controller is an electronic device, which is used in conjunction with an EV charging station.

It can control any EV charging station that supports Dynamic Load Balancing based on a Modbus RTU or Modbus TCP/IP current meter.

Maximum 3 current transformers can be connected to the Smart Charge Controller to measure the grid current. Or as a device option, the P1 output of a connected grid Smart Meter can be used for grid measurements.

Wi-Fi is available to commission the unit and to enable FW updates when connected to the internet via the home router.

The unit is powered by the mains voltage.

The user selects the charging mode via the user interface, which consists of an OLED display and 3 buttons.

Towards the charging station it acts as a current meter with Modbus interface which is supported by the EV charging station for its Dynamic Load Balancing functionality, i.e. the charging station, which is the Modbus master, interrogates the Smart Charge Controller, which is the Modbus slave, in the same way as its supported Modbus current meter for Dynamic Load Balancing purposes.

However, instead of measuring the grid current and making the actual measured values available by Modbus like a standard Modbus meter does, the Smart Charge Controller measures the grid current, processes this current based on a selected mode and grid parameter settings and makes this processed/re-calculated current available by its Modbus interface.

The goal of the Smart Charge Controller is to externally control the actual charging current used by the EV charging point based on:

- The EV charging station's Dynamic Load Balancing feature
- The selected operation mode of the Smart Charge Controller
- Grid parameter settings
- The processed/re-calculated current by the Smart Charge Controller

And this for purposes of energy management in the context of:

- Optimization of self-consumption
- Capacity tariff

2.2. Constraints

The well-functioning of the energy management function of the Smart Charge Controller depends on the EV charging station's Dynamic Load Balancing functionality.

It is assumed that this Dynamic Load Balancing functionality works as follows:

- When dynamic load balancing is enabled, the charging point works as a Modbus master and the connected grid meter works as a Modbus slave.
- The goal of dynamic load balancing is to charge the car as quickly as possible, so the charging point requests the meter how much current is currently used by the grid connection and the remaining current capacity of the grid connection point is used to charge the car.
- So the charging point charges the car with a maximum current of "Max current of the grid connection point – the current grid consumption by the household"

3. Technical specifications

3.1. Physical Characteristics

Housing	DIN rail formfactor, 4U
Weight	142 gr
Dimensions	90 x 72 x 65 mm

3.2. Environmental conditions

Protection class	II
Ambient Temperature	-10 °C - +55 °C
Storage temperature	-20 °C - +80 °C
Operating humidity	10%-95%RH (Non-Condensing)
Storage Humidity	5%-95%RH (Non-Condensing)
Pollution Degree	2
Altitude	< 2000m
Application area	Residential, Indoors in suitable meter cabinet

3.3. Power Interface

Connector	Screw terminal connector for N, L1 and functional ground
Voltage range:	230 VAC, +/-10%
Frequency:	50 Hz
Power rating:	5 W
Overvoltage category:	II
External fuse:	16 A

3.4. Modbus RTU Interface

Connector	Screw terminal connector for A (+), B (-) and Shield
Bus termination	120 Ohm
Protocol	Modbus RTU over RS485
Max cable length:	100 meter
Cable location:	Indoor + outdoor
Cable type:	Preferably armoured twisted pair with drain wire. Section 0,20 ... 0,50 mm^2. Example of cable type: Belden 3107A

3.5. Modbus TCP/IP Interface

Connector	RJ45
Protocol	Modbus TCP/IP over Ethernet
Max cable length:	100 meter
Cable location:	Indoor + outdoor
Cable type:	UTP CAT-5

3.6. Metering Interface

Use current transformers (CTs) with built-in TVS with a dielectric strength of at least 3.5KV 50Hz 1min and a work voltage of 660V. Do not use current output (ratio) CTs such as 1A or 5A output CT's: they will destroy the meter.

Ensure that the CT's are placed behind fuses or circuit breakers.

Connector	Screw terminal connectors for max 3 Current Transformers
Measuring principle	Current measurement by Current transformer
Current range	1A ... 80A (if CT ratio = 2000)
CT ratio	2000 (default)
Input impedance	20 Ohm
Accuracy	Typically <5 % at 23 °C
Max Cable length	1 meter

3.7. P1 interface

Connector	RJ11
Protocol	DSMR4 / DSMR5
Max cable length:	3 meter
Cable location:	Indoor

3.8. Wi-Fi

Wi-Fi Protocol	WEP64/128, AES, WPA, WPA2, WAP
Base Band	2.4 GHZ
Data Rate	150 Mbits/s
Channel Bandwidth	20/40 MHz
Operation mode	AP, STA, AP&STA mode
Encryption Mode	Encryption modes IEEE 802.11 b/g/n
Output power	max 20 dBm

3.9. User Interface

LCD	OLED display 128 x 64
Buttons	3 push buttons
LEDs	1 green LED, 1 red LED

3.10. Standards and certifications RED (2014/53/EU)

Health & Safety	EN 62311, EN 61010-1: 2010 + A1: 2019
EMC	EN 301 489
Radio	EN 300 328 - Wi-Fi 2.4 GHz

4. Installation instructions

4.1. Guidelines for safety and installation

This installation guide must be consulted in all cases when manipulating parts which are marked with the Caution symbol.
The installation and the operation of this device and any maintenance must be carried out by a qualified person in accordance with specific local standards and safety regulations.

Caution: never open the secondary circuit of a Current Transformer while current is flowing through the primary circuit!
If the secondary circuit is opened when primary current is flowing, then the voltage will go to a very high value, possibly causing electrical arcing and/or electrical shock to service personnel. Therefore CT's with internal TVS must be used.

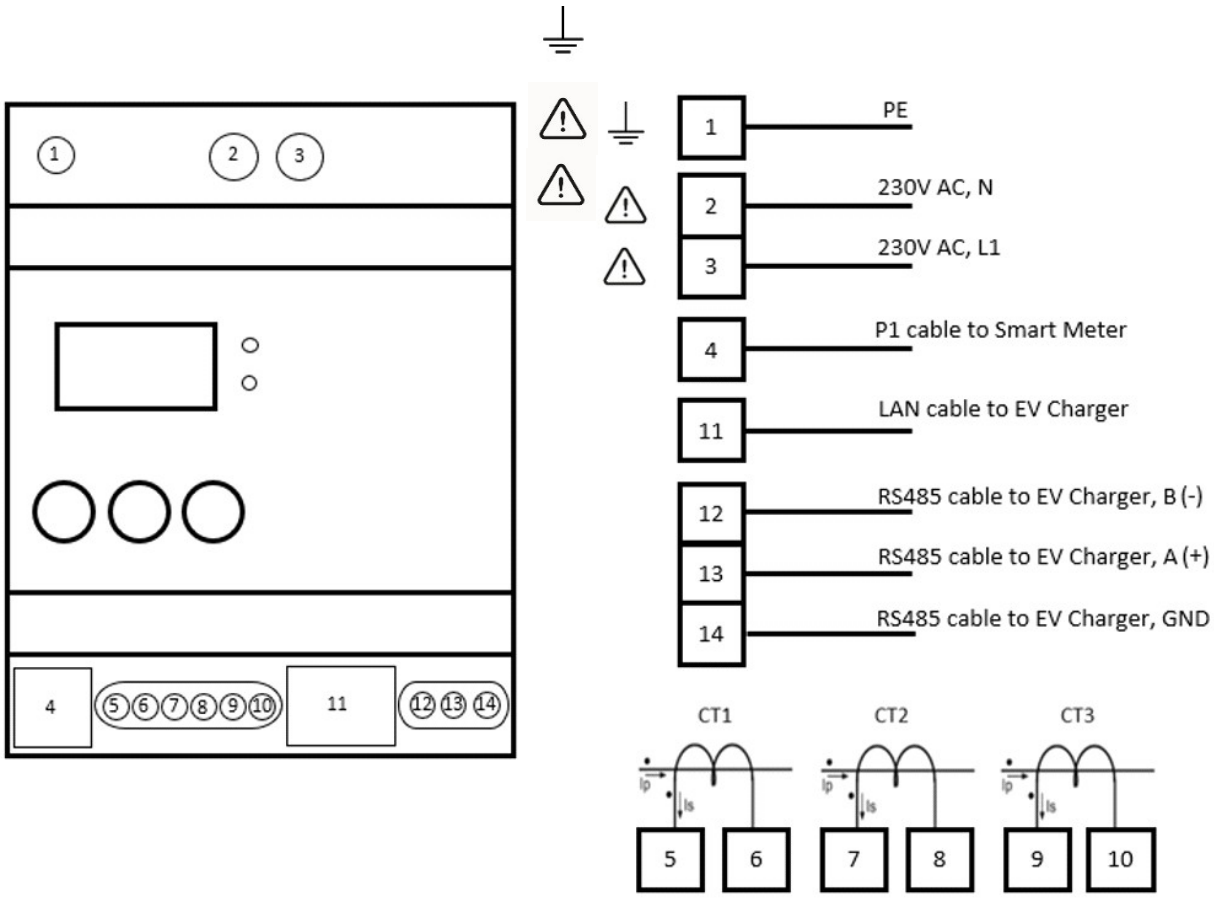
Failing to obey the "Guidelines for safety and installation", the guarantee no longer applies.

4.2. Mounting

Mount the device in a DIN rail cabinet.

4.3. Electrical wiring

4.3.1. Terminals location and description



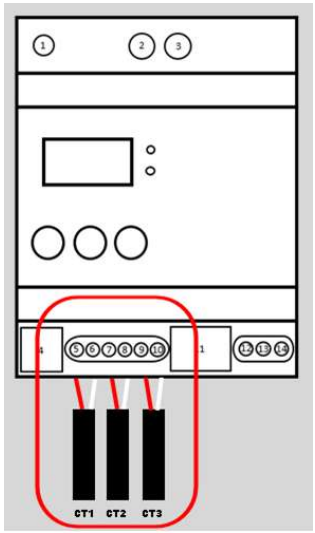
4.3.2. Important Wiring Notes

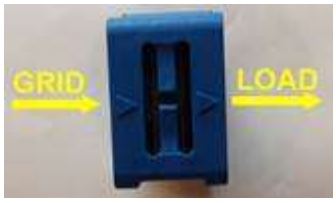
4.3.2.1. AC connections

Do not exchange N (terminal 2) with L (terminal 3). The power direction (import versus export) is derived from the AC connection. When the AC connection is reversed the device will not measure the grid currents/power correctly.

4.3.2.2. CT connections

CT transformers must be installed as follows:

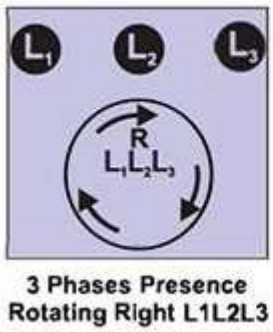




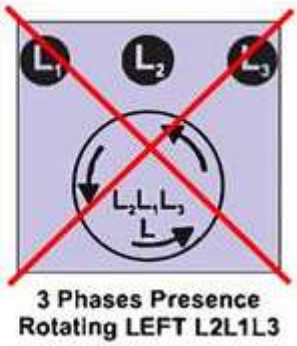
Correctly install the CT clamps on the grid connection. When CT clamps are reversed the device will not measure the

Do not exchange the polarity of the CT wires. When CT connections are reversed the device will not measure the grid currents/power correctly.

The CT connection order is shown for a Right Rotating grid. In case of a Left rotating grid, CT2 and CT3 must be switched. Make sure the phase order corresponds with the



3 Phases Presence Rotating Right L1L2L3



3 Phases Presence Rotating LEFT L2L1L3

4.3.2.3. Modbus

The Modbus Shield must only be connected at the Smart Charge Controller side and not at the Modbus master side. The Modbus GND (terminal 1) connection is also connected to the protected earth of the building.

4.3.3. Circuit-breaker / overcurrent protection

An external circuit breaker / overcurrent protection must be used in the installation. This circuit breaker / overcurrent protection must be suitably located and easily reached. Furthermore, it must be marked as the disconnection device for the Smart Charge Controller.

The overcurrent protection should have following ratings:

- 230/400 VAC
- 16 A

4.3.4. Wiring requirements

For AC connections, use stranded or solid wires with a section of 2.5 mm^2.

4.3.5. Ventilation requirements

There are no specific ventilation requirements.

5. Operating instructions

⚠ Warning: Only use the Smart Charge Controller as described below. If the Smart Charge Controller is not used as specified in this manual, the protection provided by the Smart Charge Controller may be impaired.

The device can be operated by the LCD and the keyboard.

Standard, the LCD shows the current operation mode (=home screen), e.g.:

The user can scroll through the menu structure using the forward and backward button.

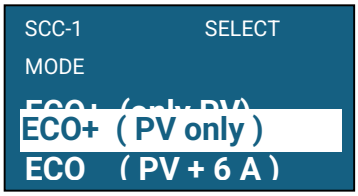
Top level screens are:

- Charge mode
- Current measurements
- Software versions
- Show settings
- Commissioning mode
- Firmware update
- Factory reset

Whenever no button is pressed for 1 minute (except for commissioning mode) , the device quits its current menu (sub)item and shows its home screen.

5.1. Menu screen Charge Mode

This screen is entered after pressing “CHANCE” in the home screen. A list of available modes is shown, the currently selected mode is shown inverse:

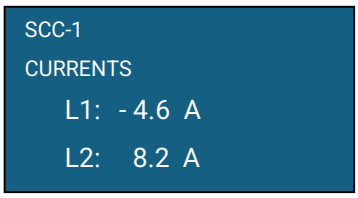


- ECO+ (PV only)
- ECO (PV + 6 A)
- CAPACITY 4 kW
- CAPACITY 5 kW
- CAPACITY 6 kW
- CAPACITY 7 kW

CAPACITY can be selected from 4 kW to 22 kW, however the maximum power shown in the menu depends on the max capacity of the charging point, which is a device setting (see [6]).
Pressing OK selects the currently selected mode and returns to the home screen.

5.2. Screen Current Measurements

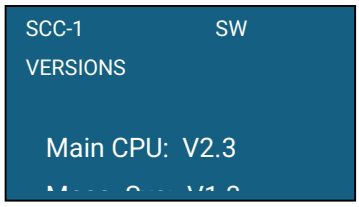
This screen is entered after pressing > in the home screen. The measured currents are shown in real time (update each second):



Pressing OK returns to the home screen.
Pressing < or > navigates to the previous / next screen.

5.3. Screen Software Versions

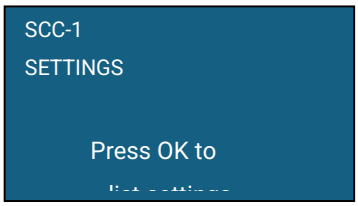
This screen is entered after pressing > in the screen Current Measurements. The software versions are shown, e.g.:



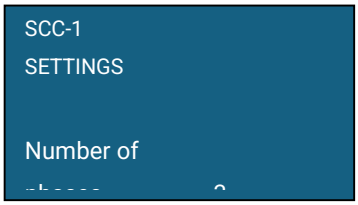
Pressing OK returns to the home screen.
Pressing < or > navigates to the previous / next screen.

5.4. Screen Settings

This screen is entered after pressing > in the screen Software Versions, a list of settings is shown, e.g.:



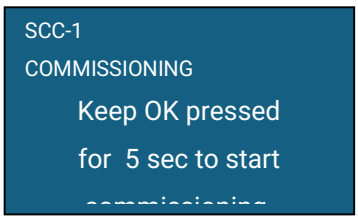
Pressing OK returns lists the settings:



Pressing OK returns to the home screen.
Pressing ∨ or ∧ scrolls trough the settings.

5.5. Screen Commission Mode

This screen is entered after pressing > in the screen Setting



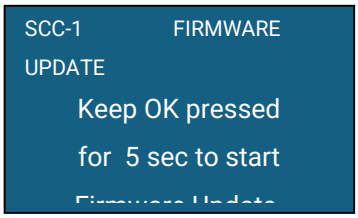
Pressing OK for less than 5 seconds returns to the home screen.

Pressing < or > navigates to the previous / next top level screen.

When the OK button is pressed for > 5 seconds, the device start commission mode, see [6] for details.

5.6. Screen Firmware Update

This screen is entered after pressing > in the screen Commissioning



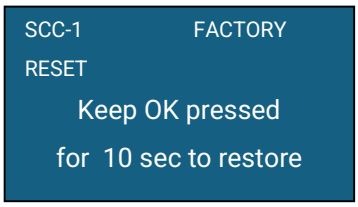
Pressing OK for less than 5 seconds returns to the home screen.

Pressing < or > navigates to the previous / next top level screen.

When the OK button is pressed for > 5 seconds, the device starts a firmware update.

5.7. Screen Factory Reset

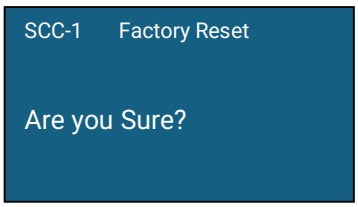
This screen is entered after pressing > in the screen Commissioning.



Pressing OK for less than 10 seconds returns to the home screen.

Pressing < or > navigates to the previous / next top level screen.

When the OK button is pressed for > 10 seconds, confirmation to reset is asked:



Pressing OK for less than 10 seconds returns to the home screen.

Pressing < or > navigates to the previous / next top level screen.

When the OK button is pressed for > 10 seconds, a factory reset is executed.

6. Commissioning

Via the buttons and the LCD menu, the device can be set in commission mode. In commissioning mode, the device acts as a Wi-Fi Access Point. The Access Point name and password are shown on the LCD:

The Wi-Fi SSID is the string “SCC-“ followed by the last 8 digits of the device’s LDN.
The Wi-Fi Code is a 6 digit random number generated when the device commissioning function was started.
If no Wi-Fi station connects within 5 minutes, the device returns to its home screen. The access point is then disabled.
Once a Wi-Fi station is connected the URL of the Commissioning website is shown on the LCD screen:

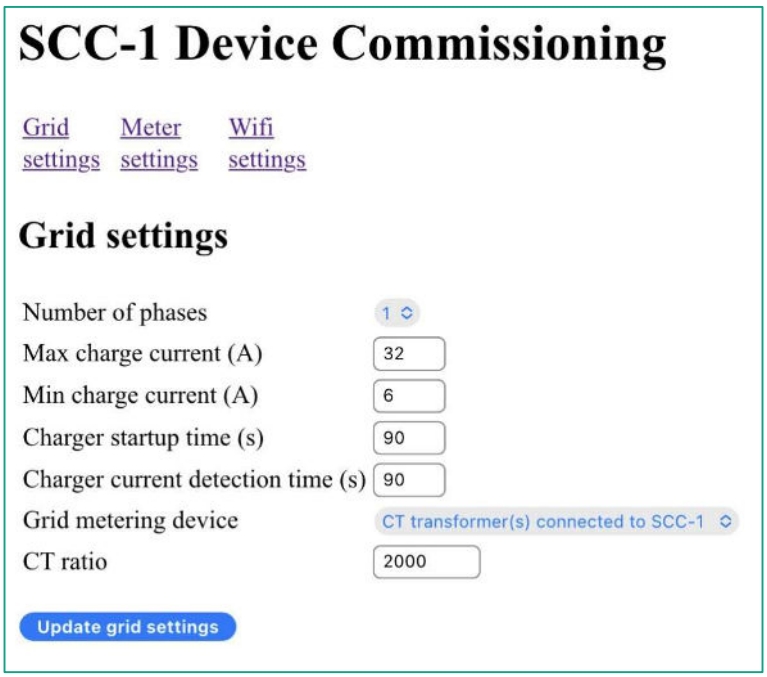
Only one Wi-Fi station can connect at the time. It will receive the fixed ip address 192.168.11.2
The connected Wi-Fi station, e.g. a smartphone, can now access the device’s local website that contains a number of forms to commission the device.
After the settings are done, commissioning mode can be ended by the keyboard and the device will return to operational mode.

6.1. Commissioning web pages

6.1.1. Grid Settings

The grid settings page contains following parameters:

- Number of phases (1 / 3)
- Maximum charge current (must be same as setting in EV charger)
- The method used to measure the grid current (Current transformers / P1)
- CT ratio

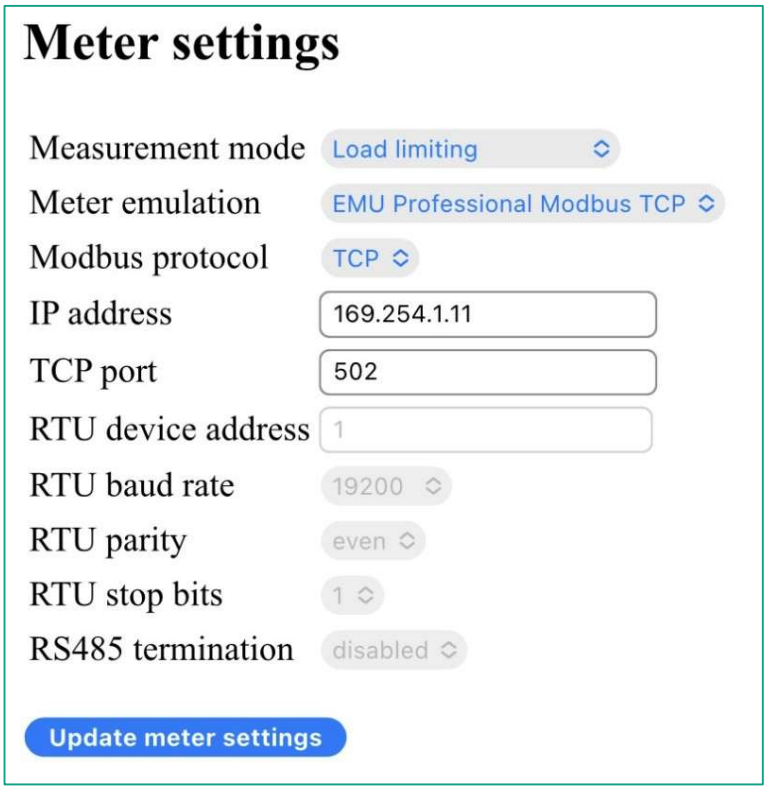


6.1.2. Meter Settings

The Meter settings page contains following parameters:

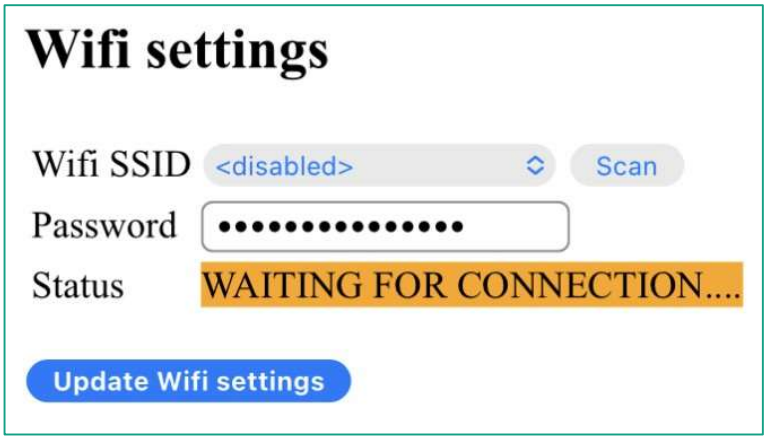
- Meter to emulate: drop down with supported meter type (currently only 1 known type)
  - EMU Professional Modbus TCP
  - An input form that contains the parameters for the selected meter, in case of the EMU Professional Modbus TCP:

    - IP address
    - Modbus port



6.1.3. Wi-Fi settings

Wi-Fi settings page is used to connect the Smart Charge Controller to the home router. This is used for SW updates and remote control.



7. Cleaning

Clean the unit with a slightly damp cloth and mild detergent.

8. Appendix A - EMU Professional Modbus TCP emulation

When the Smart Charge Controller emulates the EMU Professional Modbus TCP meter, following Modbus registers are present:

Register address	Contents	Register length	Unit
4521	N.A.	16	-
4537	instantaneous_apparent_power_l1	2	VA
4539	instantaneous_apparent_power_l2	2	VA
4541	instantaneous_apparent_power_l3	2	VA
4543	total_apparent_power	2	VA
4545	N.A.	22	-
4567	instantaneous_voltage_l1	1	0.1V
4568	instantaneous_voltage_l2	1	0.1V
4569	instantaneous_voltage_l3	1	0.1V
4570	N.A.		-
4591	instantaneous_current_l1	2	mA
4593	instantaneous_current_l2	2	mA
4595	instantaneous_current_l3	2	mA
4597	total_instantaneous_current	2	mA