CONFIGURATION DOCUMENTATION

Terra AC – Solar Charging Mode Configuration

Contents

1. Purpose and Basic Description

This document provides instructions on how to configure the Solar Charging Mode feature available in Charger Firmware v1.8.2, ChargerSync 3.0.0 and TerraConfig 2.1.0 Apps and greater.

2. Safety

During the electrical installation and configuration of the equipment the following precautions should be considered. Please note this list is a general guide and a formal site-specific risk assessment should be undertaken along with any other relevant local regulations.

	**DANGER:** ☒ Hazardous voltage may be present within Distribution Boards and at termination points within the Charger ☒ Make sure that the main switch of the power supply for the charger is set to the OFF position. Do a voltage check to make sure that the electrical supply is disconnected from the system. Secure against re-energization.
	**WARNING:** ☒ The electrical installation must be completed according to the local safety and electrical regulations and laws.
	**WARNING:** ☒ First read the supplied instructions of the Energy meter and current transformer (if applicable) before starting the installation work. ☒ The Energy Meter must always be protected by fuses on the incoming side. See for more information the installation manuals of the Energy Meter

3. Solar Charging Modes

3.1. General

As the world moves towards sustainable energy solutions, it is important to adopt and use clean and renewable energy sources for powering electric vehicles. With this in mind, we have developed a concept for a unique and innovative solution that enables to charge an electric vehicle using locally produced solar power.

Our solution should offer three different modes of solar charging, tailored to the specific needs and preferences of our users:

- ☒ Solar only
- ☒ Eco Mix
- ☒ Max speed

3.2. Solar only

3.2.1. Overview

This mode enables users to charge their vehicle solely with excess solar power which would have ordinarily been exported to the grid. The Terra AC power output will be varied to match an export value of energy from the home. This solution provides the user with a highly sustainable solution for powering an EV.

3.2.2. Operating Functionality

Solar only mode will only charge the EV with excessive solar power produced and should not draw additional power from the grid. If there is not enough excessive solar power available to start a charging session or keep the charging session ongoing, the charging session will be paused. This will be visible in the ChargerSync app.

For **Single Phase Chargers**, if the excess solar power as measured by the Energy Meter exceeds the threshold (>=1.4 kW / 6 Amps) charging will commence or resume. The charger will ramp up or down to match as much excessive solar power as possible within the limits of the charger, vehicle, or user settings.

If the above threshold is not met (excessive solar power per phase used <1.4 kW or < 6A) the charging session will pause. The session resumes/starts once there is enough excessive solar power available.

For **Three Phase Chargers** if the excess solar power as measured by the Energy Meter exceeds the threshold (>= 1.4 kW / 6 Amps per phase) charging will commence or resume. The charger will ramp up or down to match as much excessive solar power possible within the limits of the charger, vehicle, or user settings.

If the above threshold is not met (excessive solar power available <1.4 kW or < 6A per phasethe charging session will pause. The session resumes/starts once there is enough excessive solar power available.

3.3. Eco Mix

3.3.1. Overview

Eco Mix mode utilizes a mix of both excess solar power and grid power to charge an EV. The goal of this mode is to optimize the share of renewable energy within a charging session whilst maintaining the minimum charge rate requirements of the vehicle. This mode supports the following situations:

- ☒ Reduces any excessive switching of the charger on and off during times of intermittent solar excess due to shading or cloud cover.
- ☒ Enables smaller sized Solar Systems which may have limited excess power to export to meet the minimum starting current for a charging session.

Charging start is controlled by the ChargerSync app or other authorization method (i.e. RFID if implemented).

3.3.2. Operating Functionality

Eco Mix mode will enable the charge session to commence and maintain a minimum charging power. The EV will then be supplemented with any additional excess solar available above the minimum charging power. This mode has similarities to Solar only but in this instance a minimum charging power of 1.4kW (6 Amps) for Single Phase Chargers and 1.4kW per Phase (6 Amps per Phase) for Three Phase Chargers is maintained to optimize the share of renewable energy within a charging session. The overview of this will be visible in the ChargerSync app.

Charging will continue until the user stops the charging session via the vehicle, ChargerSync App, or other authorization method (i.e. RFID if implemented)

For **Single Phase Chargers** charging will automatically commence with a minimum charging power of 1.4kW / 6 Amps. If the excess solar at this time is not sufficient the balance will be drawn from the grid. As excess solar power, measured by the Energy Meter, increases then the grid drawn will reduce. The charger will ramp up or down to match the excess solar power available >1.4kW (6 Amps). The 6 Amps minimum charging current from the grid is that this method will optimize the share of renewable energy within a charging session.

For **Three Phase Chargers** charging will automatically commence with a minimum charging power of 4.2kW / 6 Amps per Phase. If the excess solar at this time is not sufficient the balance will be drawn from the grid. As excess solar power, measured by the Energy Meter, increases then the grid drawn will reduce. The charger will ramp up or down to match the excess solar power available >1.4kW per Phase (6 Amps per Phase). The 6 Amps minimum charging current from the grid is that this method will optimize the share of renewable energy within a charging session.

3.4. Max Speed

3.4.1. Overview

This mode allows the user to charge their vehicle battery as fast as possible. The charge session will operate at the maximum power rate and the supply is shared between excess solar and the balance from the grid or completely from the grid in the absence of solar.

3.4.2. Operating Functionality

Max Speed mode will enable the charge session to commence a maintain a maximum charging power. The power delivered will be a mixture of grid and solar based on the generation excess available.

For **Single Phase or Three Phase Chargers** charging will automatically commence with a This mode shall charge at any point in time with the maximal power available.

Note: The maximum charging current will be limited by any applied charging schedule or load management settings applied to the charger through the ChargerSync or TerraConfig app based on the home requirements.

3.5. Example of Charger Currents during modes

Example of a 7.4kW Single Phase Terra AC with 32 A rated current.

Excessive Solar Current (A) / 1P	Solar Only Power (kW) / Current (A)	Eco Mix Power (kW) / Current (A)	Max Speed Power (kW) / Current (A)
3.150	0	1.4kW / 6A	7.4kW / 32
5.829	0	1.4kW / 6A	7.4kW / 32
6.493	1.4kW / 6A (if excessive solar current for all phases is >6A)	1.6kW / 7A	7.4kW / 32
7.937	1.7kW / 7A	1.8kW / 8A	7.4kW / 32
10.521	2.3kW / 10A	2.5kW / 11A	7.4kW / 32

Assumptions:

- ☒ Excessive Solar Current is the export value through the Energy Meter (negative value)
- ☒ No additional load management is in place on the site.
- ☒ Electric Vehicle with onboard 7.4kW AC to DC Converter

4. Connection Overview

The Solar Charging mode relies on the use of an Energy Meter in your Main Switchboard to measure the net import or export of energy from your home. This meter is connected directly to your Terra AC Charger and communicated using Modbus RS485 (RTU).

Single Phase ABB Direct Energy Meter

Three Phase ABB Direct Energy Meter

5. Preparation Requirements

To use the Solar Charging Mode the following preparation is required:

- ☒ Terra AC charger – CE or MID Variant Product Code and Firmware version >1.8.2
- ☒ PIN Code shown on the Quick Guide Leaflet delivered with the charger.
- ☒ TerraConfig App (v2.1.0) for installers
- ☒ ChargerSync App (v3.0.0) for home users
- ☒ Solar System with export capability to the grid
- ☒ Compatible Energy Meter – installed and configured by a licensed electrical contractor.

5.1. Modbus Cable Requirements

The Energy Meter will be connected to the Terra AC Charger via a Modbus (RS485) cable.

The table below provides general specifications for the cable needed. Use these tables to select the cable, taking into consideration local installation conditions, cable length, cable temperature/insulation rating and local regulations.

RS485 cable specifications

Functional description	Specification
Number of cores	2 + common shield
Number of (twisted) pairs	1
Cross section range	0.5 – 2.5 mm²
Min – Max external diameter to fit through gland	3.5 – 7 mm
Shielding	Yes
Conductor	Fine strand copper wire
Conductor type	Category 5 (Cat 5)
Insulation	PVC or other material that can be used outdoor and are UV-protected
Characteristic impedance	120 Ω
Minimum Test Voltage [AC]	1.5 kV
Ambient Temperature range	-30°C to 70°C
Core identification	Numbering or color

5.2. Energy Meter Requirements

The following energy meters are compatible with the Solar Charging Mode Feature.

Please note these meters have been tested by ABB to confirm Modbus registers and communication compatibility. Meters not mentioned on this cannot be guaranteed to function with the TerraAC.

The key feature requirement of Solar Integration Compatible Energy Meters is the ability to measure and transmit data on import **and export** values. TCP/IP Support is only required for MID Variant Chargers.

Energy meter	Solar compatible versions			
ABB A-Series	A41 312-100	A42 312-100	A43 212-100	A44 211-100
	A41 313-100	A42 552-100	A43 213-100	A44 212-100
	A41 412-100	A42 552-120	A43 312-100	A44 213-100
		A42 553-120	A43 313-100	A44 311-100
			A43 512-100	A44 352-100
			A43 513-100	A44 353-100
				A44 452-100
				A44 552-100
				A44 553-100
ABB B-Series	B21 311-100	B23 212-100	B24 212-100	
	B21 312-100	B23 311-100	B24 352-100	
	B21 313-100	B23 312-100	B24 353-100	
		B23 313-100		
ABB EV-Series	EV3			
Siemens	PAC3100			
Schneider	iEM3000	PM5300		
ABB D Series	D11 15 40 Modbus	D13 15-M 65 Modbus		
	D11 15-M 40 Modbus			

6. Terra AC Hardware Setup

To set up the Solar Charging Mode feature please perform the following checks with respect to the Terra AC charger.

6.1. Complete Charger Commissioning

The charger should be installed and commissioned as detailed in:

- ☒ Terra AC Installation manual BCM.V3Y01.0-EN_002

Setup of the Charger can be completed using either:

- ☒ Terra Config App (preferred)

This includes setup of the following items:

- ☒ Charger Maximum Current (confirmed by your electrical installer)
- ☒ Charger Internet Connection – Wi-Fi/LAN/4G (Optional)
- ☒ Carry out confirmation test charge sessions with an Electric Vehicle

6.2. Confirm Charger Configuration

6.2.1. Internet Configuration

Ensure each Terra AC charger is connected to the internet and has a stable signal. This can be via a Wi-Fi (2.4GHz), LAN ethernet or 4G SIM (model specific option) connection.

This can be configured during installation and commissioning time by your installer using the TerraConfig App.

When the charger has an internet connection, you will see the Internet Connection LED indicator on the Terra AC be illuminated and solid.

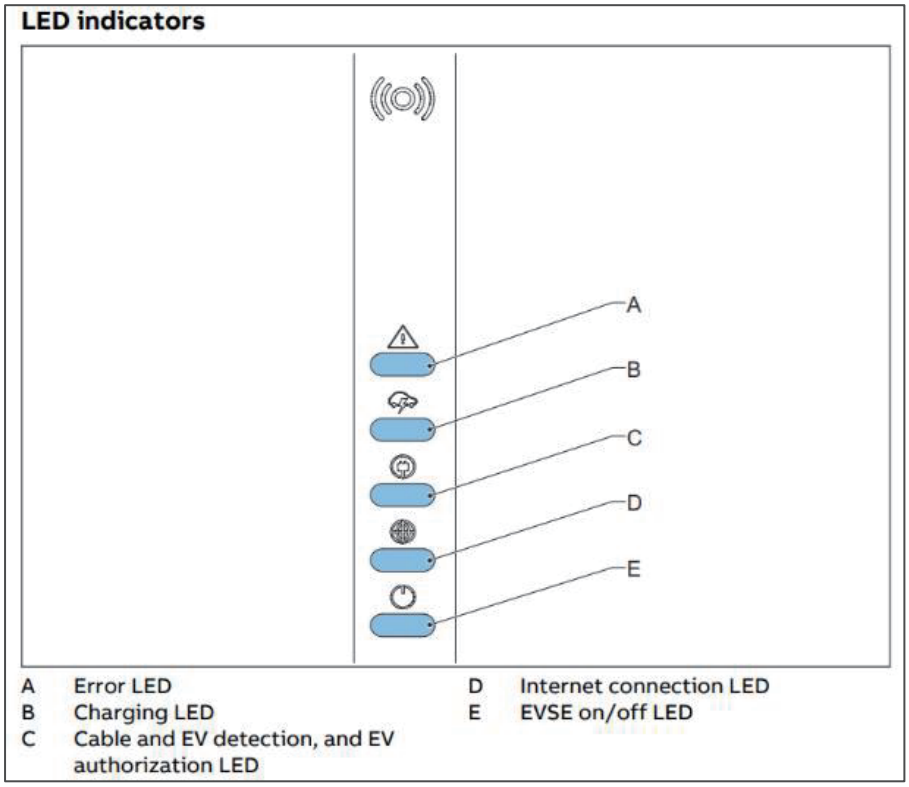
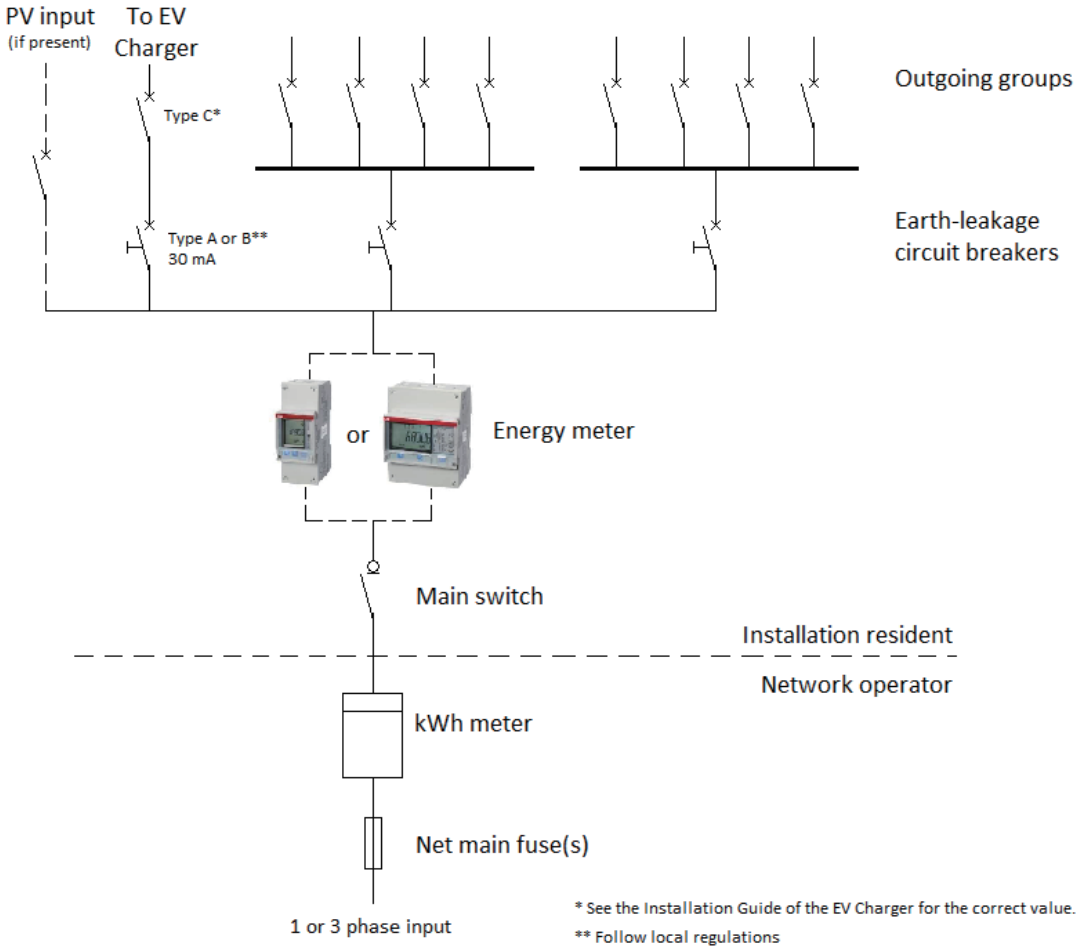


Figure 1 - LED Indicators

7. Energy Meter Installation & Setup

Carry out the installation of the Energy Meter downstream of the Main Switch in the Main Switch Board of the home. The location of the meter needs to be able to capture the generation from the Solar System and the demand from the home and the EV Charger. The figure below is an example of a typical residential switchboard connection.



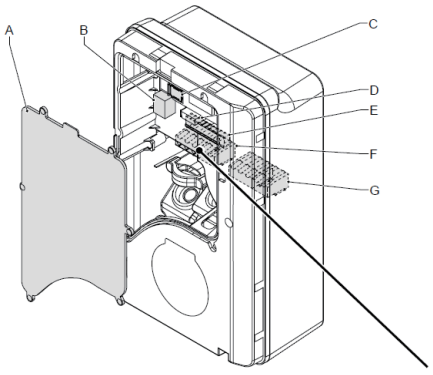
7.1. ABB Energy Meter Installation

	**DANGER:** ☒ Hazardous voltage may be present within Distribution Boards and at termination points within the Charger. ☒ Make sure that the main switch of the power supply for the charger is set to the OFF position. Do a voltage check to make sure that the electrical supply is disconnected from the system. Secure against re-energization.
	**WARNING:** ☒ The electrical installation must be completed according to the local safety and electrical regulations and laws. ☒ The Energy meter must always be protected by fuses on the incoming side. See for more information the installation manuals of the Energy meter.
	**WARNING:** ☒ First read the supplied instructions of the Energy meter and current transformer (if applicable) before starting the installation work.

The Energy meter must be installed in the customer's switchboard (Consumer Unit). If there is no more room in the switchboard to place the Energy meter, a separate suitable electrical box with DIN rail mounting must be used, which must be placed next to the existing switchboard.

Install the Energy meter after the main switch and before the group distribution protection devices (in most cases the earth leakage circuit breaker(s)).

7.2. Modbus RTU Communication Wiring Overview



RS-485 connection for Modbus RTU

A – Maintenance Cover

B – Primary Ethernet Connection

C – Socket for Nano-M2M SIM Card

D – Smart Meter Connection

E – Terminal block for dry contacts input and output

F – Terminal block for the AC input

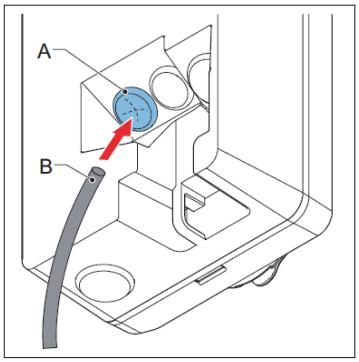
G – Terminal block for the EV charge cable or socket

A terminal block is present (D) to facilitate the RS-485 – Modbus RTU connection.

7.2.1. Insert the cable for the Energy meter communication

Preconditions:

☒ Parts: Cable for RS485, 3x ferrules.
☒ Tools: wire cutter, wire stripper pliers, crimp pliers.

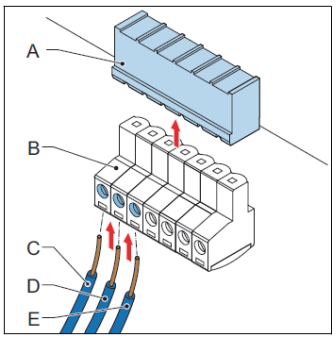


1. Remove the grommet (A) from the Terra AC Charger.
2. Make a hole in the center of the grommet.
3. Install the grommet back on the Terra AC Charger.
4. Cut the cable to the correct length to reach the connector.
5. Push the wires through the grommet.
6. Strip 5 mmof the insulation from the ends of the wires.
7. Crimp a ferrule onto the end of each wire.
8. Put the cable (B) through the inlet hole.

7.2.2. Connect the wires for the Energy meter communication

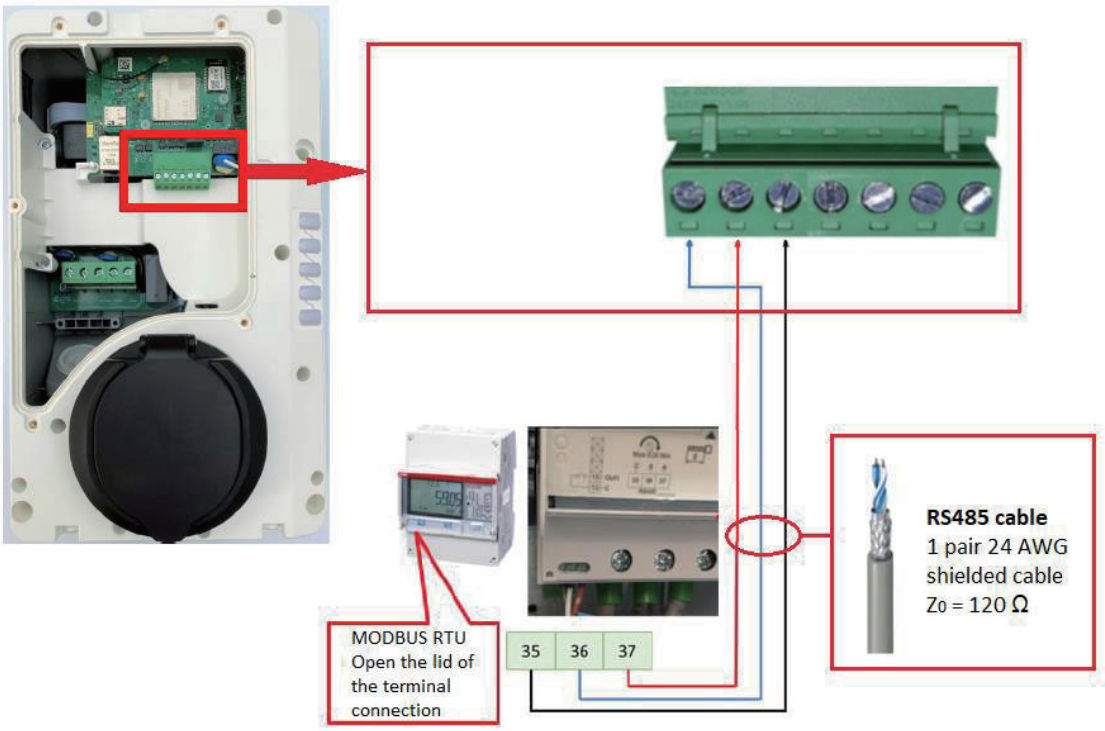
Preconditions:

☒ Tools: Small flat blade screwdriver.



Terra AC – Energy Meter Communication Cable Connection

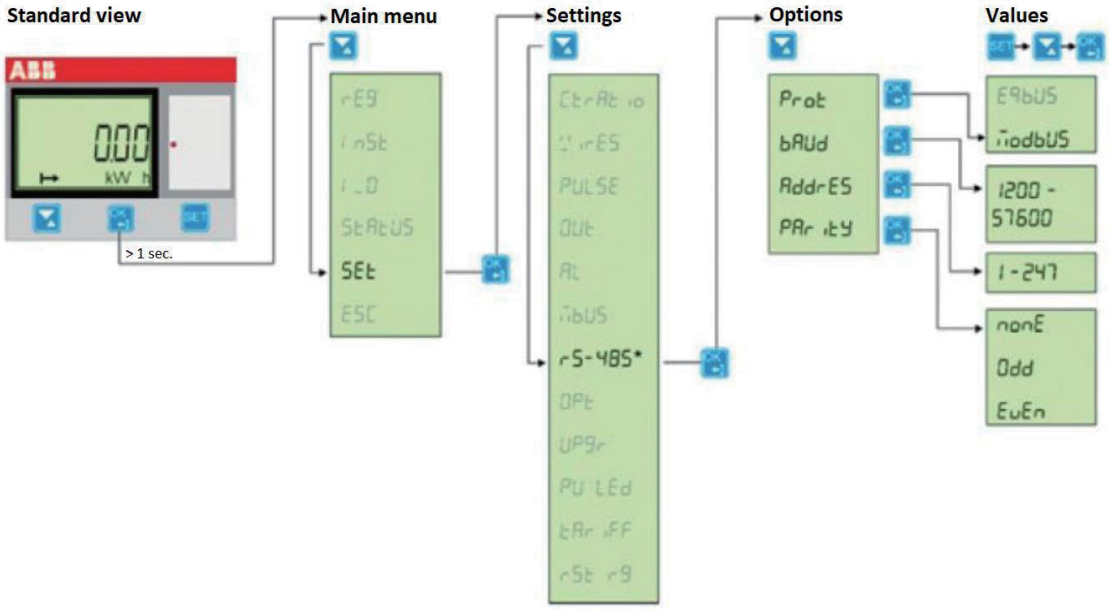
1. Remove the plug (A) of the terminal block (B) from the terminal block (B) of the Energy meter connection.
2. Connect the wires:
   a. Connect the positive wire (C) – RS485 Positive/A/DO.
   b. Connect the negative wire (D) – RS485 Negative/B/DI.
   c. If the Energy meter has a common isolated ground for shielded wire, connect the wire (E).
3. Tighten the connector screws of terminal block (B) with a tightening torque of 0.5 Nm.
4. Install the plug on the terminal block.



7.3. ABB Energy Meter Configuration

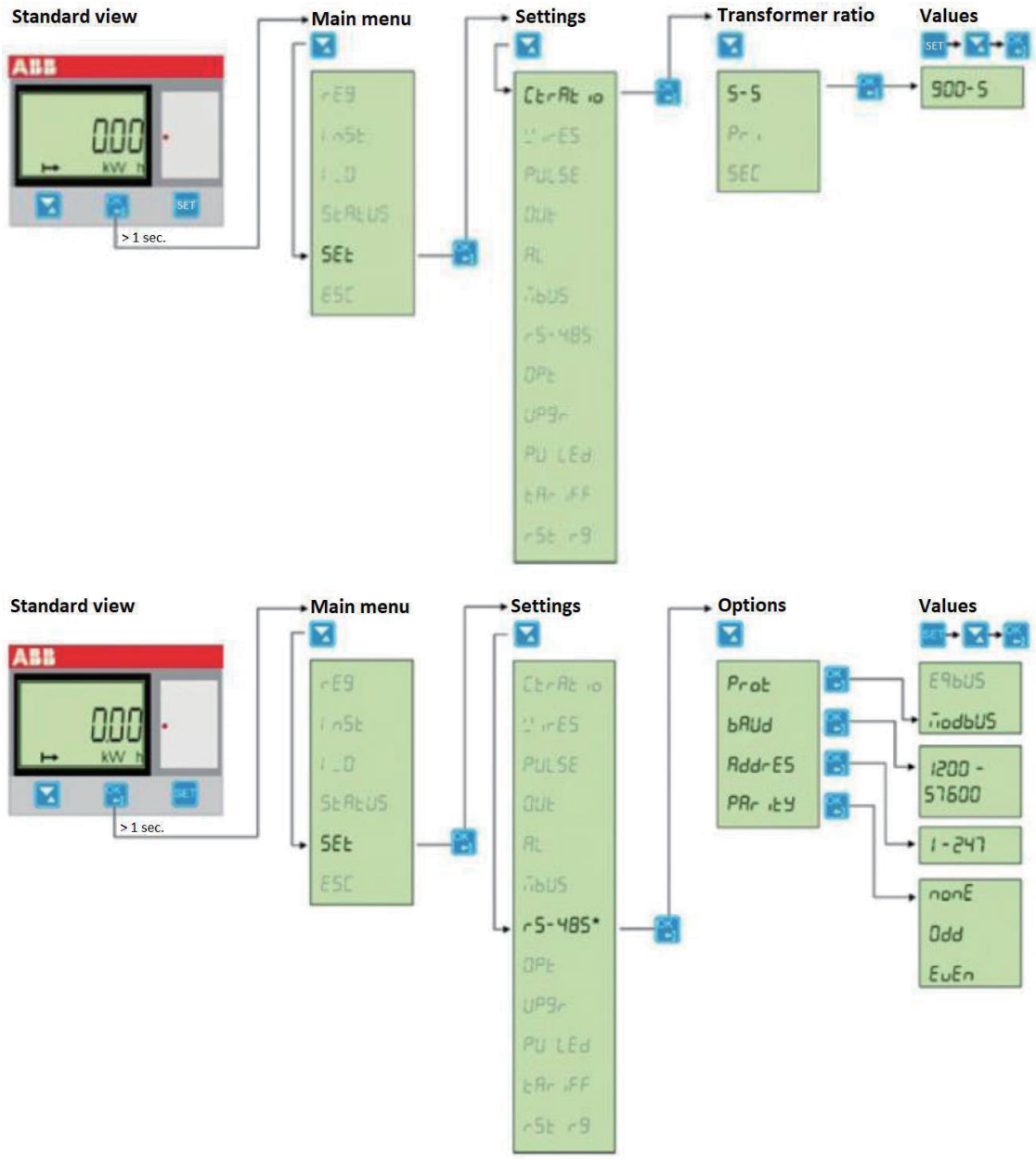
Figures below shows the default factory settings of the Energy meter. The correct settings for solar integration are detailed Section 7.4.

7.3.1. Menu Overview for Direct Connected Type of Energy Meter



7.3.2. Menu Overview for Indirect Connected Type of Energy Meter

Configuration of the current transformer only for the indirect meters.



7.4. Modbus Communication Settings

The following communication settings are required to be set at the **Energy Meter via its display and the TerraAC via TerraConfig App**.

Baud Rate	19200
Parity	Even
Stop Bit	1
Data Bit	8

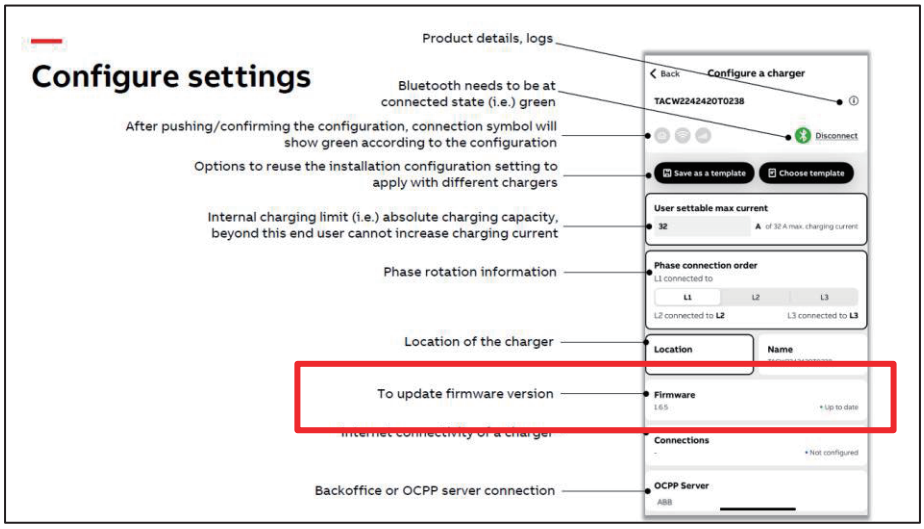
8. Terra AC Software Setup

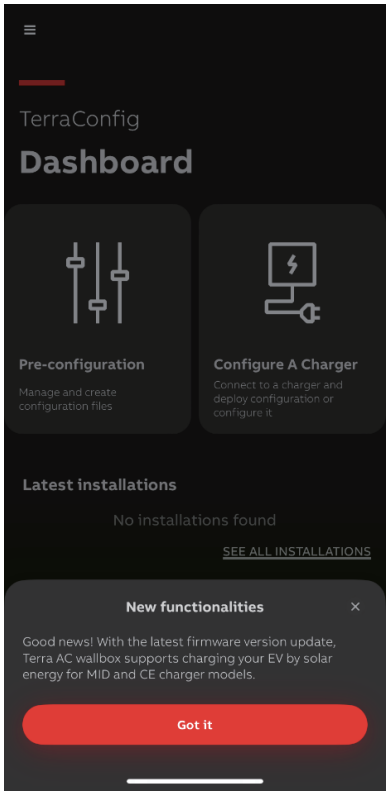
The setup requires the use of ABB's TerraConfig App (Installer) and ChargerSync App (Home User). References for the download and usage are defined in Section 12 of this manual.

8.1. Firmware Update of Terra AC via TerraConfig app

NOTE: This step shall be carried out by your Installer / Electrical Contractor

The Terra AC Charger is required to be updated to minimum of Firmware 1.8.2 to enable Solar Charging.





After updating to Firmware >1.8.2 the user will see the New Functionality screen.

8.2. Energy Meter & Charger Configuration via the Terra Config app

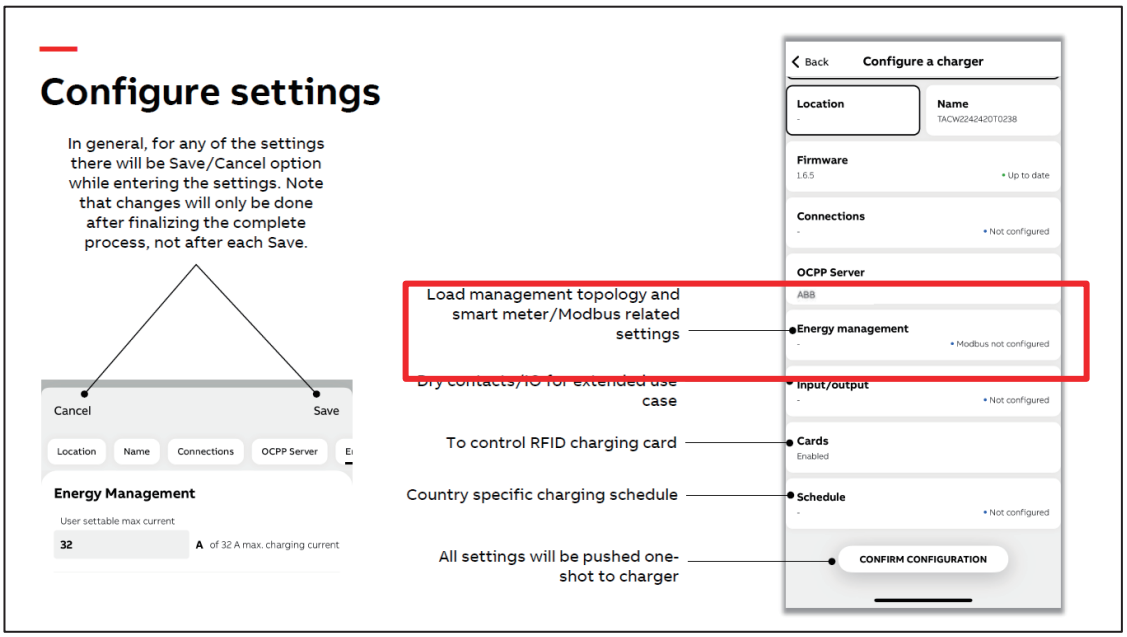
NOTE: During this step the communication between the Charger and Energy Meter will be established. All communication cabling must be completed prior.

These steps shall be carried out by your Installer / Electrical Contractor. This step involves accessing the Main Switchboard, setting of electrical equipment, isolation of the home Solar System and simulating loads on the home.

The following tasks are undertaken using the TerraConfig app which is selected from the main menu.

Steps for setup of communication between Terra AC and Energy Meter

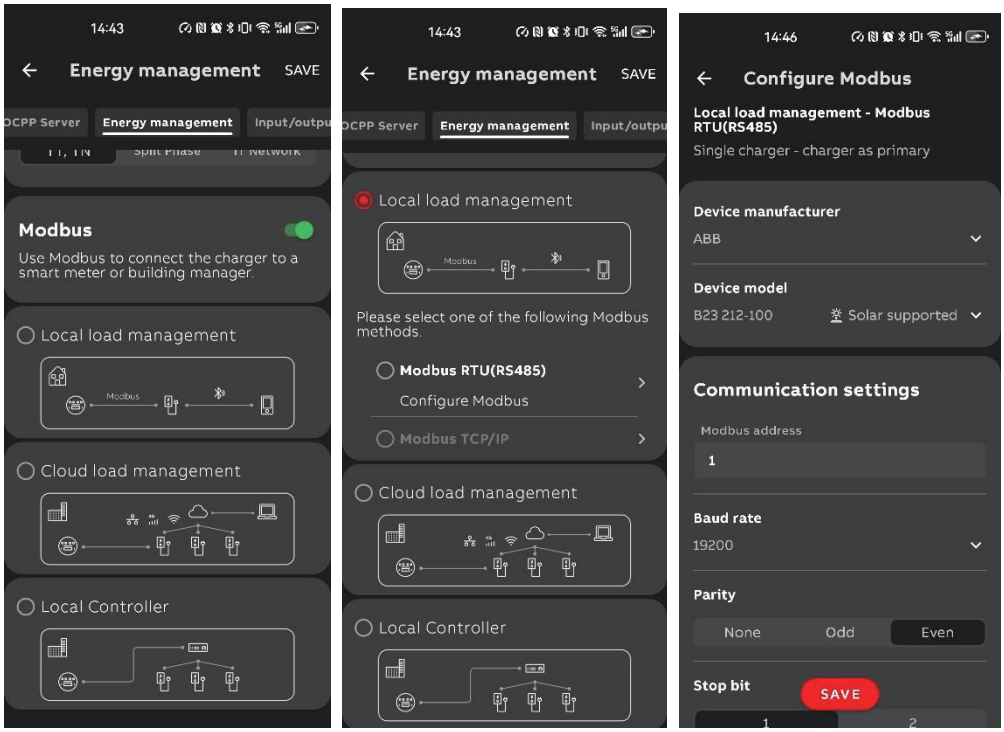
Step 1 – Select the **Energy Management** section from Terra Config App Main Screen



Step 2 – Select **Local Load Management – Modbus RTU (RS485)**

Step 3 – Select **Smart Meter Manufacturer** from the drop-down menu

Step 4 – Select **Device Model** from the drop-down menu (compatible meters are labelled “Solar-Supported”)



Step 5 – Set **Communication Settings – Modbus Address = 1**

Step 6 – Set **Baud Rate = 19200** from the drop-down menu

Step 7 – Set **Parity = EVEN**

Step 8 – Set **Stop Bit = 1**

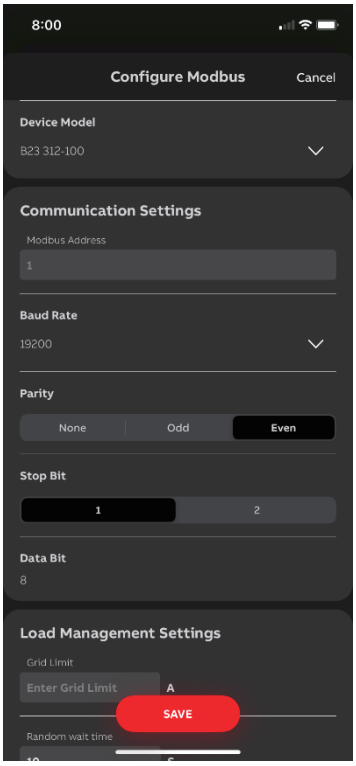
Step 9 – Date Bit = 1 – Set automatically

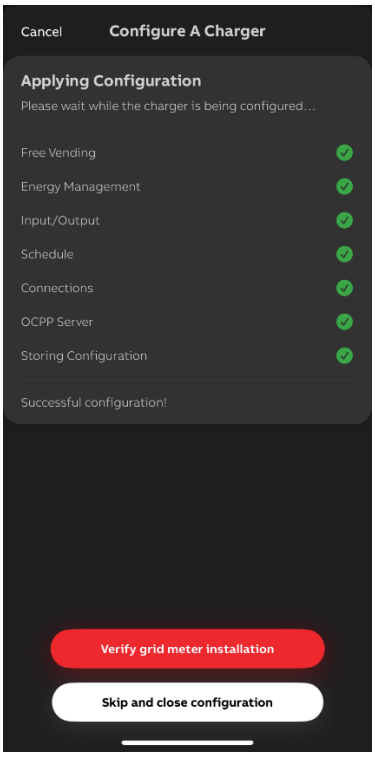
Step 10 – Click **SAVE**

Step 11 – Return to Terra Config Main Screen – Scroll to Bottom and Click **Confirm Configuration**

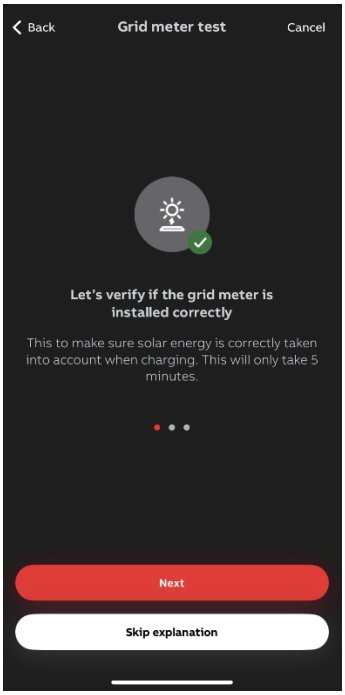
Step 12 – Applying Configuration Screen will show and status of setting updates to the charger will be shown. **Green Tick = Applied. Red Circle = Error in Applying – please check settings and reattempt**

Note: To proceed a **Successful Configuration** message is required.

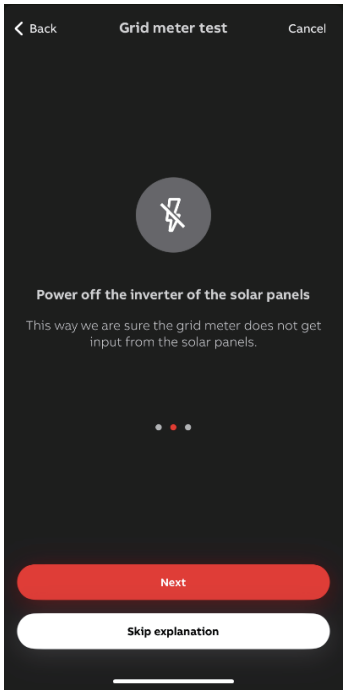




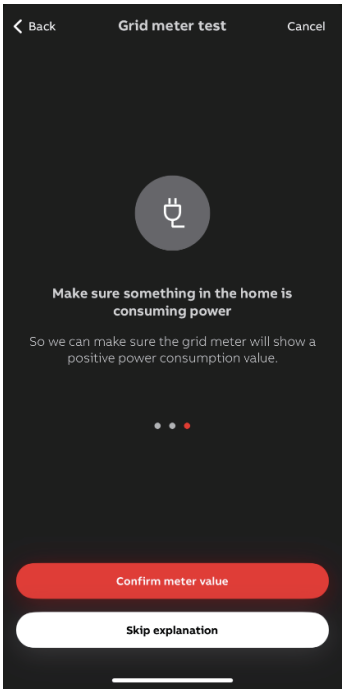
Step 13 – Click on **Verify grid meter installation**



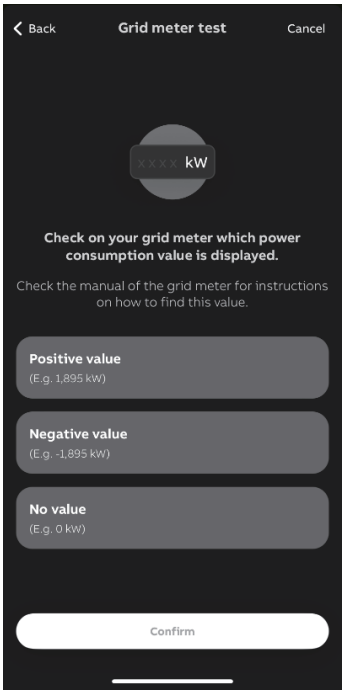
Step 14 – **Access the home Main Switchboard and power down the Solar System** (this may be either at the relevant circuit breaker or involve additional steps based on the Solar System – consult the system manufacturer documentation) – when complete Click **Next**



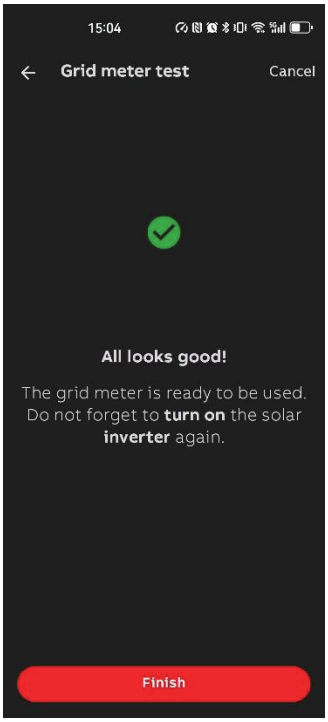
Step 15 – With the Solar System powered down switch on loads within the home to ensure that it is consuming power (importing from the grid). This can be viewed on the instantaneous display on the Energy Meter in the home Main Switchboard. Click **Confirm meter values** when ready to do so.

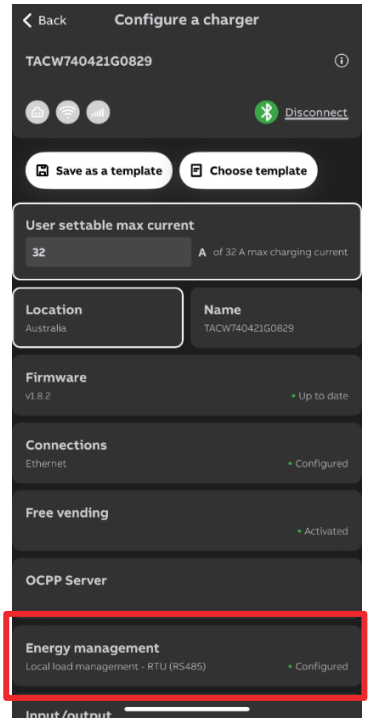


Step 16 – With the home consuming power check the Energy Meter **instantaneous power** consumption value. For grid import this should be a **POSITIVE Value**. If the value is Negative (exporting) or Zero please consult the installation instructions for the Energy Meter manufacture to confirm it is correctly connected. Click on the **relevant box** and then **Confirm**



Step 17 – If correctly configured the Main Screen will be displayed and the Energy Management section will display **Configured**

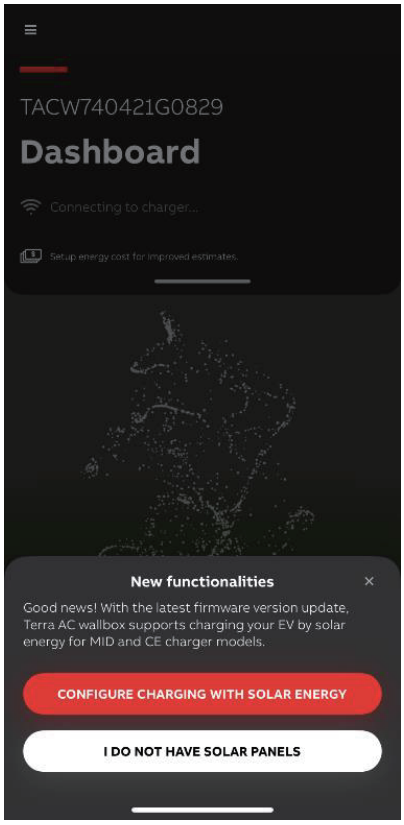


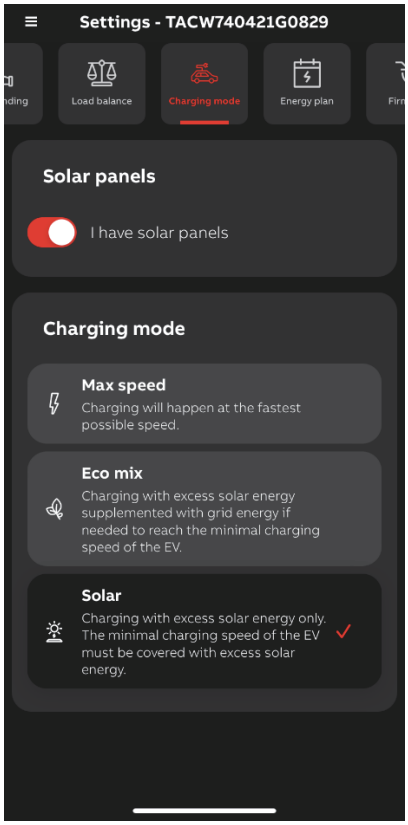


The Installer / Electrical contractor via TerraConfig steps is complete. Final configuration is now carried out using the Home Users ChargerSync App account.

8.3. Configuration of Solar Charging via the ChargerSync App by Home User

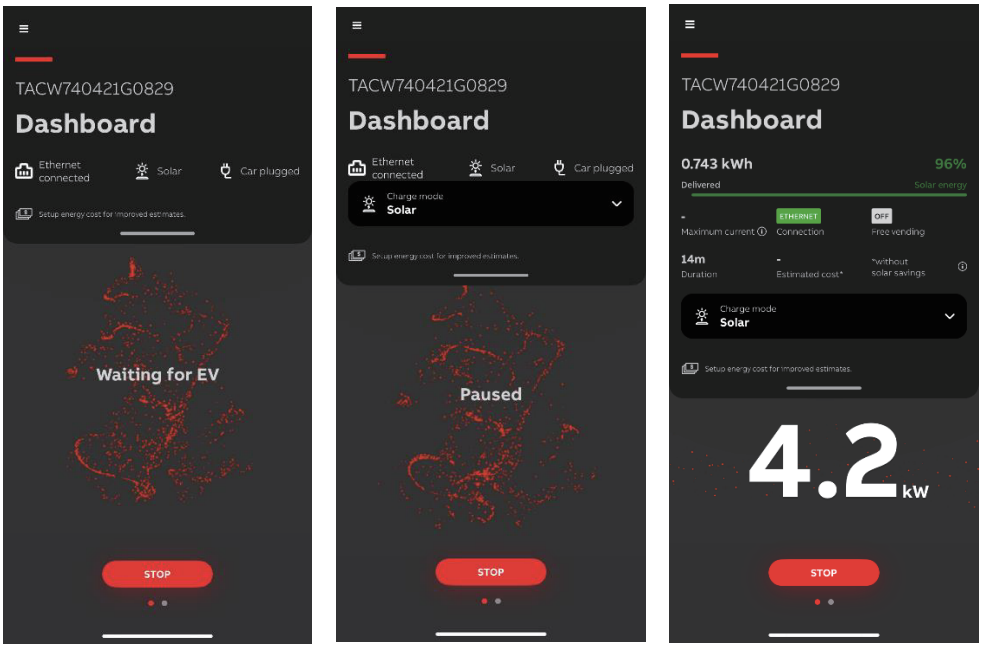
When ChargerSync v3.0.0 is started for the first time the *New Functionalities* message is visible. The user is required to confirm whether their home is fitted with a Solar System and confirm the Charging mode.



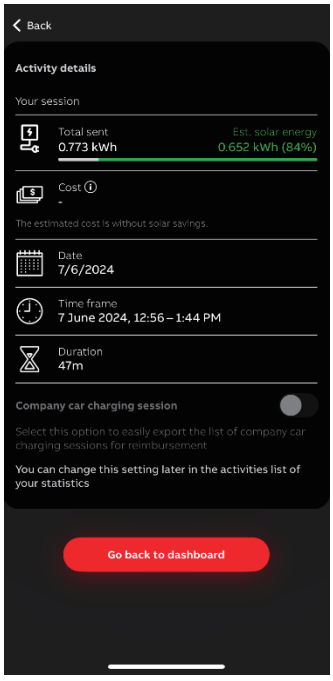


9. Charging Control

The Home User can control charging using the ChargerSync App. Connection of the EV is the same as grid-based charging. The status of charging sequence is displayed below.



At the end of the charging session a summary is provided including the total of renewable versus grid energy consumed.



10. Application information

10.1. Existing Load Management via Direct or Cloud

10.1.1. ChargerSync App – Direct

Load Management via Direct connection can operate in parallel with Solar Charging functions. With the Energy Meter configured it is possible to set import-based load management functions. Please see ABB's Load Management Guideline listed in the references.

10.1.2. ChargerSync Web Portal - Cloud

It is not possible to continue to load manage the charger via ChargerSync Web Portal and utilize the Solar Charging Mode. Solar Charging mode is developed for individual chargers at a single residence only.

10.2. Minimum Charging Current of Electric Vehicles

Electric Vehicles are fitted with various on-board AC to DC converters. Your TerraAC charger should be selected by your installer based on this and your home power requirements. For vehicles with either 1 Phase (7.4kW) or 3 Phase (11kW or 22kW) charging capability a typical minimum charging current of 6 Amps per Phase (1P = 1.4kW or 3P = 4.2kW) is required. The Solar Modes take this into account.

10.3. Home Battery Storage Systems

The Terra AC using Solar Charging mode is based on measuring the net export of power from your home. The Terra AC using Eco Mix or Max Speed Mode will enable charging of your Electric Vehicle with energy from your Home Battery Storage Systems as charging is treated like any other load. Please consult the specific capabilities of your Battery Storage System as to the peak/continuous power delivery when delivering energy and charging priorities when the system is below upper State of Charge replenishment points.

10.4. 3rd Party Billing or Management Platforms

The Terra AC can be connected to a 3rd Party Billing or Management platforms via OCPP (Open Charge Point Protocol) in parallel with Solar Charging. Smart Charging Profiles can also be implemented. DataTransfer messages are implemented to communicate the amount of solar energy consumed during the charge session.
Please see ABB's OCPP integration documentation for further details.

11. Contact Information

NOTICE

In case of technical issues
Contact your local ABB service organization or service partner for an initial analysis and troubleshooting.

12. Additional Information

12.1. Listing of related documents

Ref #	Document Kind, Title	Document No.
1	TerraConfig App User Guide	NA
2	ChargerSync App User Guide	NA
3	Charger Sync Quick User Guide (online)	NA
4	TerraConfig Quick User Guide (online)	NA
5	TerraAC Installation Manual	
6	Load Management Documentation Manual	9AKK108466A2151
7	ABB Terra AC Charger OCPP1.6 Implementation Overview v2.0	NA

13. Revisions

Rev.	Page (P) Chapt. (C)	Description	Date Dept./Init.
0	All	Original Revision	24-06-06/PS
1	8	Add D-Series energy meters	25-03-17/JV