
USER MANUAL

Terra AC wallbox

Load management



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1. Implementations

1.1. Static mode



Load management can be static or dynamic. For static load management (SLM) the charging power is a fixed value, set as a calculation of grid capacity and other sources of power consumption. In this set-up the fixed charging power is distributed between all connected vehicles. The risk of installation tripping is eliminated as consumption is capped at a maximum load value.

Static Load Management is recommended when only chargers have to be managed.

Static Load Management ensures an even distribution of energy and maximizes grid capacity with no additional cost added as energy management system.

1.2. Dynamic mode



Dynamic Load Management (DLM) optimizes the charging infrastructure as it allows for dynamic change of available power by immediate reaction to capacity changes. DLM means gives the possibility to balance the power distribution to all EVs and taking full volume whenever the capacity is available.

Dynamic Load Management is recommended when the available power is impacted by other devices of the local grid.

Using DLM brings the full potential in a charging infrastructure, by protecting the local grid from overload when full usage and giving best power share allocation depending on specific application needs.

2. Local vs Cloud

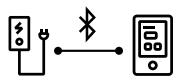
2.1 Local load management

Local load management can be implemented as either static or dynamic, for single charger use or multiple charger installs.

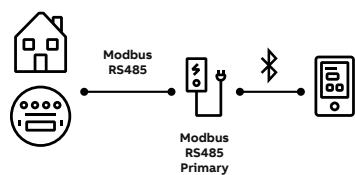
In single charger set-up the charger is the controller, so in this case the commissioning and LM setting can be done via the Terra Config and Charger Sync app.

In multiple charger set-ups the local controller is primary and controls load management.

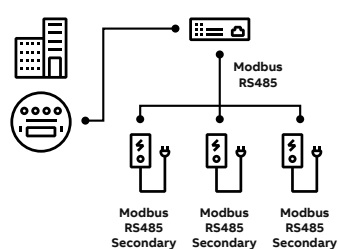
Static w/ single charger



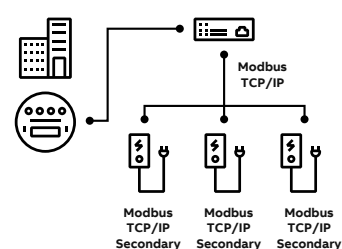
Dynamic w/ single charger



Dynamic w/ multiple chargers via local controller



Dynamic w/ multiple chargers via local controller

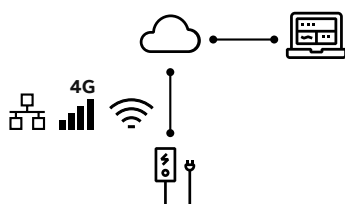


2.2. Load management via cloud

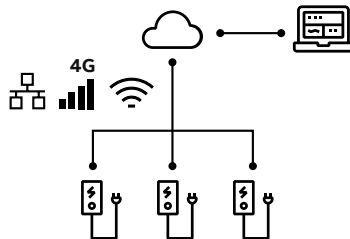
Load management via cloud is recommended for big installations, multiple chargers scenario. Can be implemented as either static, hybrid or dynamic, however best results can be obtained with a dynamic implementation.

The Cloud is the controller in this case and the set-up is done via the Charger Sync portal. The commissioning of the chargers as well as connection to a smart meter / controller is done via the TerraConfig app.

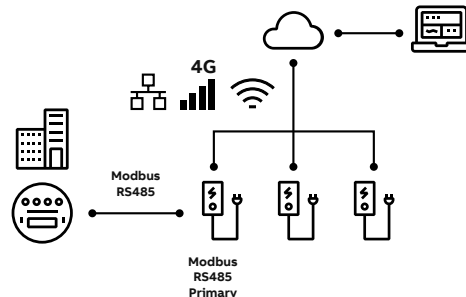
Static w/ single charger



Hybrid w/ multiple chargers



Dynamic w/ multiple chargers



3. Installation

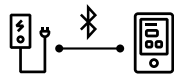
3.1. Static Load Management

—
Topologies
available for
Static Load
Management

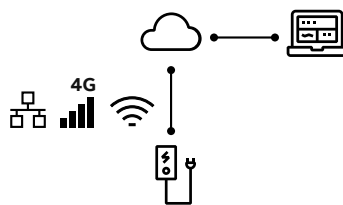
For static load management no external device is required. The installation of the TACWB (Terra AC Wallbox) suffices.

The settings can be done via the TerraConfig app, ChargerSync app and Charger-Sync portal.

Static w/ single charger



Static w/ single charger



3.2. Hybrid and Dynamic Load Management

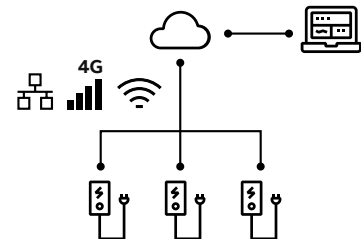
—
Topologies
available for
Hybrid and
Dynamic Load
Management

Dynamic charging with Terra AC can be done with:

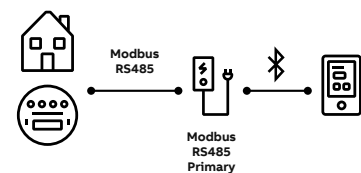
- **Hybrid load management:**
no connection to a smart meter. The set-up of the chargers change based on internal meter readings. Load management changes are configured from the ChargerSync portal.

- **Dynamic load management:**
a connection to a smart meter exists to inform on the consumption of the building and/or other charging stations.
For Dynamic Load Management, the connection to a smart meter can be done either via RS-485 for Modbus RTU (option available across the TACWB portfolio) or to a controller via an ethernet connection for Modbus TCP / IP (option available for TACWB display and UL variants) .

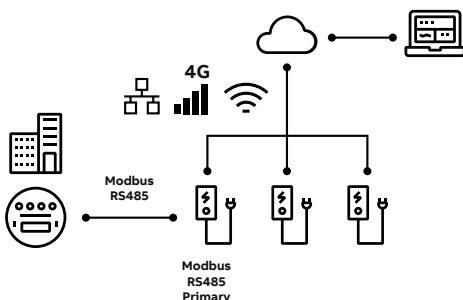
Hybrid w/ multiple chargers



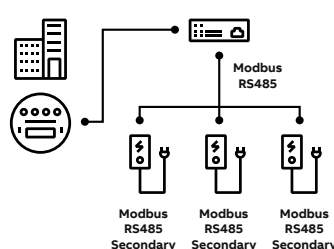
Dynamic w/ single charger



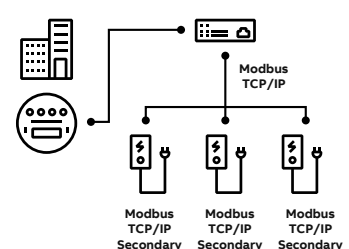
Dynamic w/ multiple chargers



Dynamic w/ multiple chargers via local controller

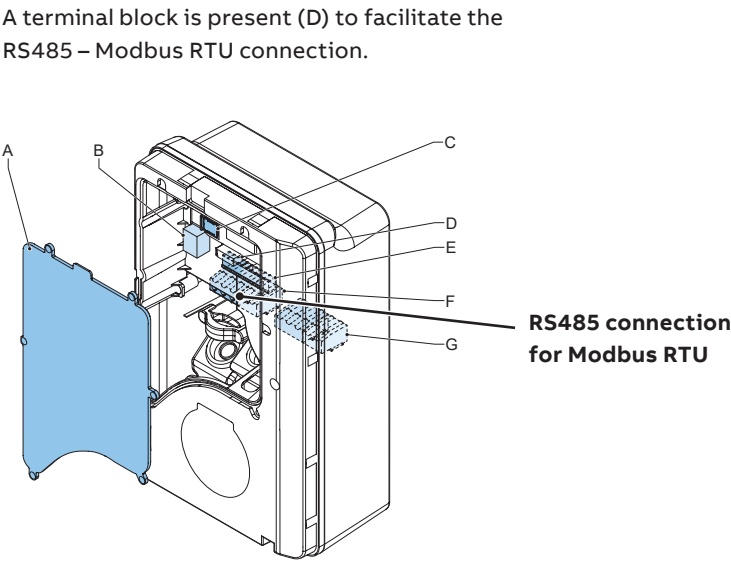


Dynamic w/ multiple chargers via local controller



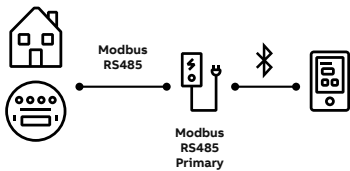
3.2.1. RS485 connection for Modbus RTU

- A. Maintenance cover
- B. Primary Ethernet connection
- C. Socket for a 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 the socket

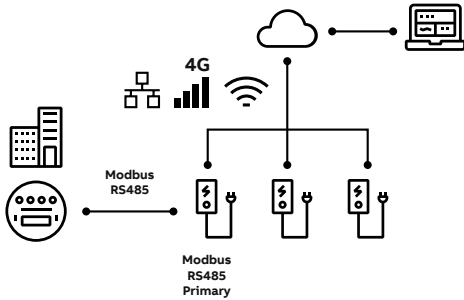


Modbus RTU-RS485 topology available

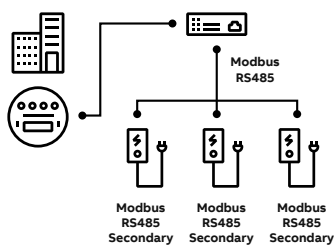
Dynamic w/ single charger



Dynamic w/ multiple chargers



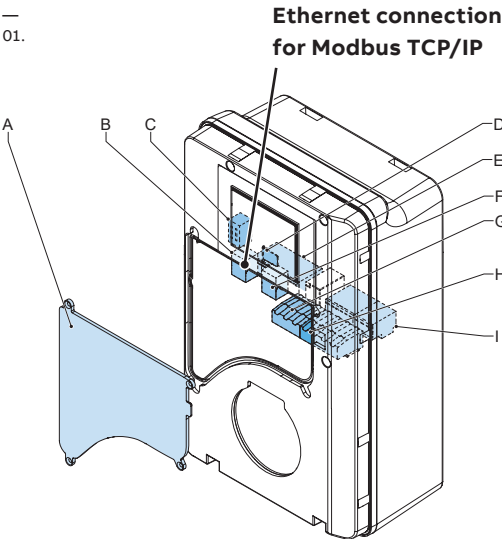
Dynamic w/ multiple chargers via local controller



3.2.2. Ethernet connection for Modbus TCP/IP

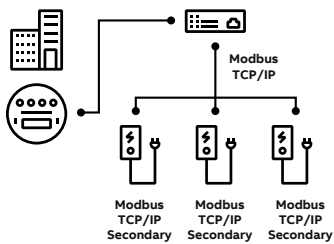
- A. Maintenance cover
- B. Primary Ethernet connection
- C. Electrical pulse connector
- D. Socket for a Nano-M2M SIM card
- E. Terminal block for the AC input
- F. Secondary Ethernet connection for Ethernet daisy-chain
- G. Smart meter connection
- H. Terminal block for dry contacts input
- I. Terminal block for the EV charge cable or the socket

Ethernet connection (B) is present to facilitate the Modbus TCP/IP connection.
This option is available for display and UL variants of the TACWB family.



Modbus TCP/IP topology available

Dynamic w/ multiple chargers via local controller



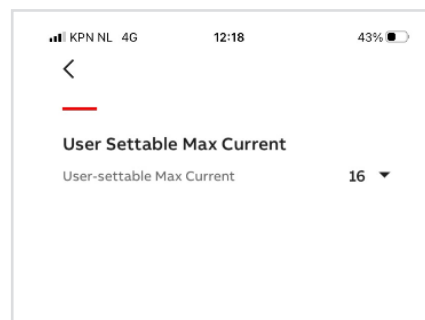
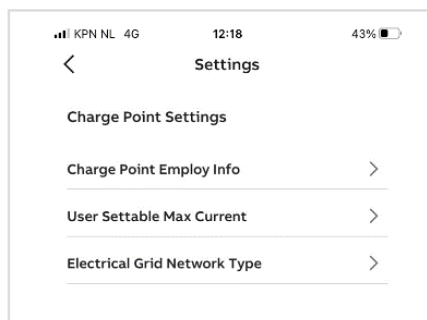
4. Configuration

4.1. Static Load Management

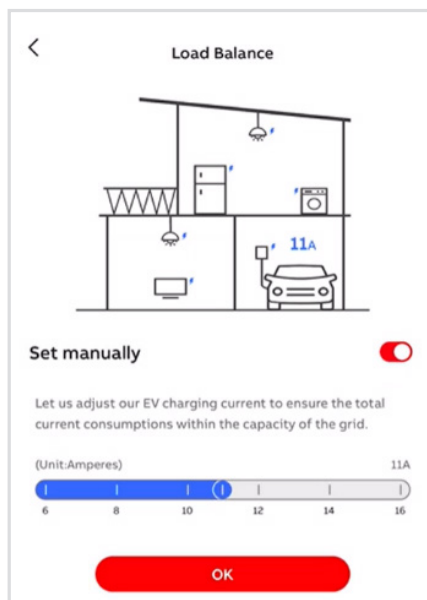
To configure the Static load management the apps and portals can be used.

4.1.1. Configuration via the TerraConfig App

The internal charging limit (i.e. the absolute charging capacity of the TACWB. This limit is to be set by the installer/commissioner and cannot be modified by the end user) can be set at install and commissioning via the TerraConfig app within Settings – User Settable Max Current. The max current can be set at in increments of 1A within the range of 6A-32A.



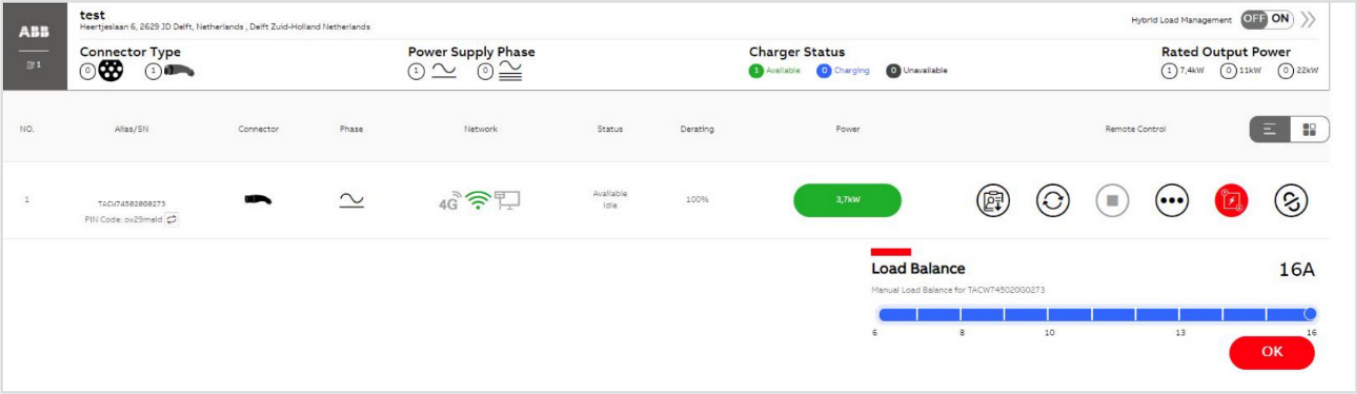
4.1.2. Configuration via the ChargerSync App



The charging limit can be set manually in increments of 1A. This allows the end user to adjust the charging behavior depending on preferences/needs (e.g. energy rate, speed of charge).

4.1.3. Configuration via the ChargerSync Portal

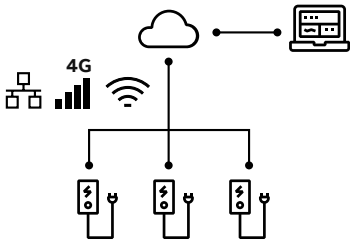
Similar to the ChargerSync App, with the ChargerSync Portal a limitation can be set in 1A increments for any selected charger.



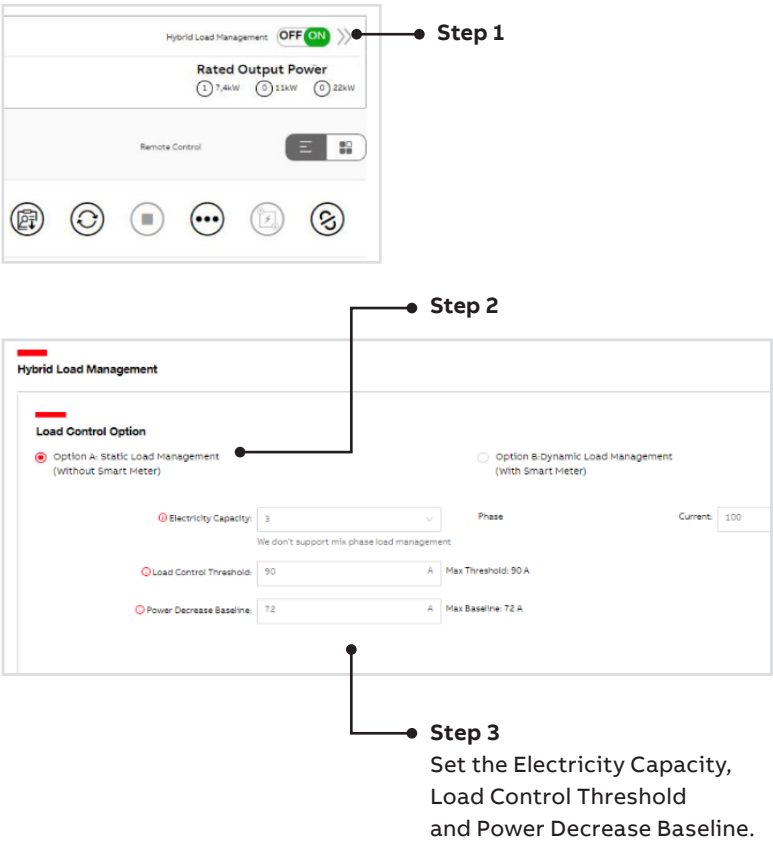
4.2. Hybrid Load management

Hybrid Load Management brings a level of flexibility in absence of a smart meter. Hybrid Load Management is recommended for multiple charger installations.

Hybrid w/ multiple chargers



4.2.1. Configuration via the ChargerSync Portal



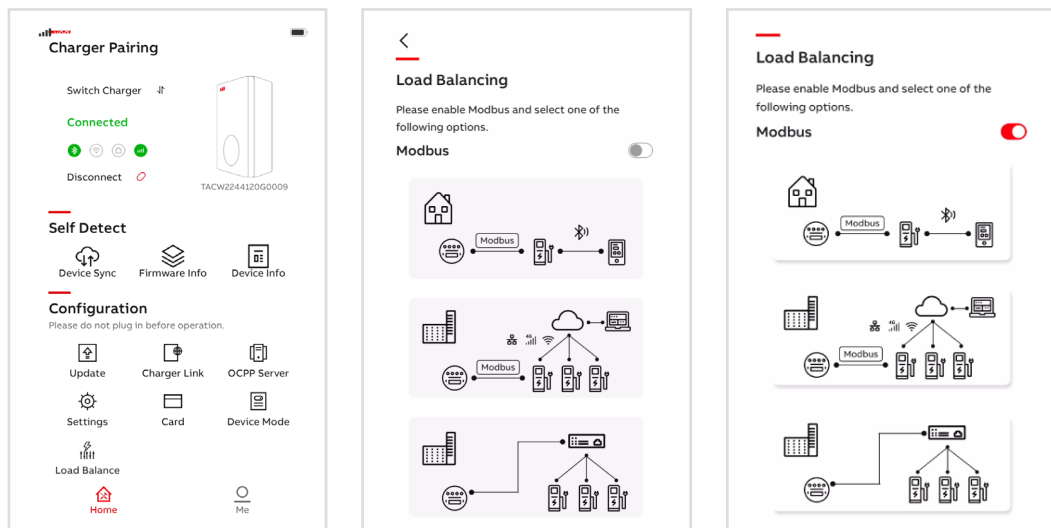
Set the Electricity Capacity, Load Control Threshold and Power Decrease Baseline.

4.3. Dynamic Load Management

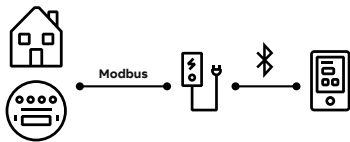
Dynamic load management gives an additional level of flexibility by informing on the overall consumption (chargers and external consumers). This enables maximum usage of the grid capacity by ensuring an immediate reaction to changes within the consumption level.

4.3.1. Configuration via the TerraConfig App

To configure the Modbus smart meter the TerraConfig app needs to be used (v 1.6.1 or higher). The path is: [Main page] –> [Load Balance] –> enable Modbus –> select scenario –> configure meter as per the following options.



• Single charger (Charger as Primary) Available for Modbus RTU – RS485 only



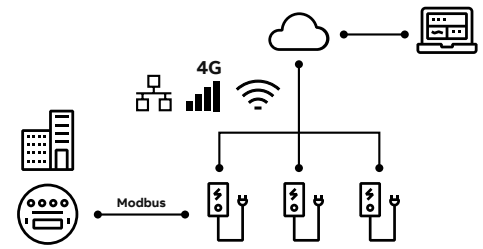
In this scenario the charger is Modbus Primary. Generally recommended for home installation: one charger-one meter.

In this scenario the load management decision comes from the embedded charger algorithm.

• Multiple chargers (Charger as Primary)

Available for Modbus RTU – RS485 only

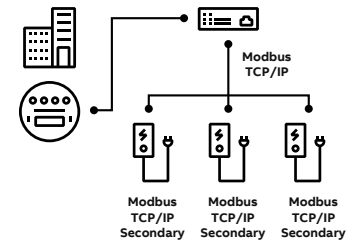
In this scenario one charger of the multiple-charger installation is Modbus Primary and acts as interface to inform the cloud on the smart meter information. Load management strategy is executed from the cloud.



• Multiple chargers (Charger as Secondary)

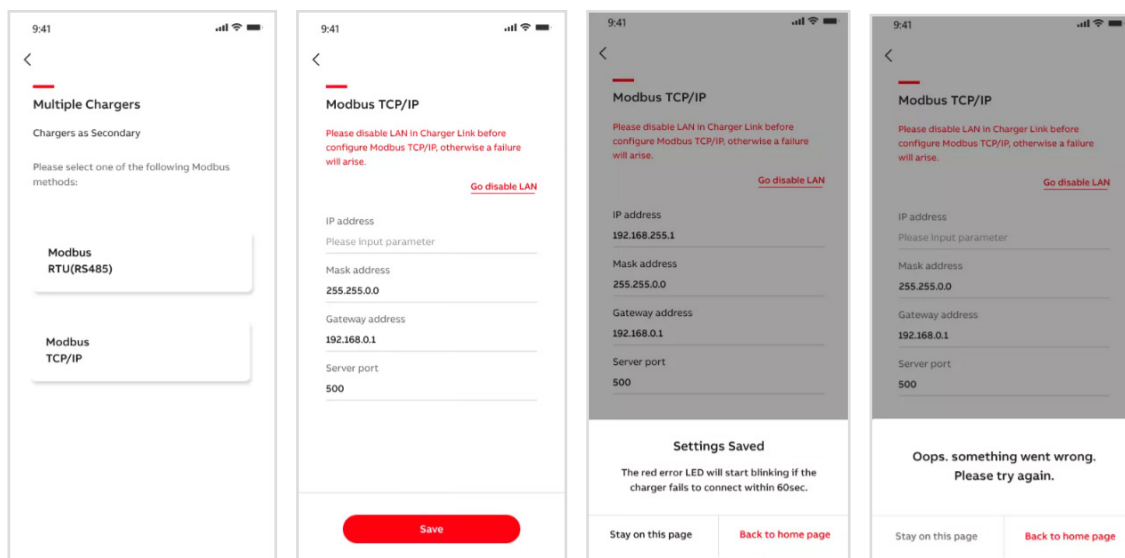
Available for Modbus RTU – RS485 and Modbus TCP/IP.

In this scenario all chargers are Modbus Secondary. Load management strategy is executed from the local controller.



- Multiple chargers (Chargers as Secondary) via Modbus RTU – RS485

- Multiple chargers (Chargers as Secondary) via Modbus TCP/IP

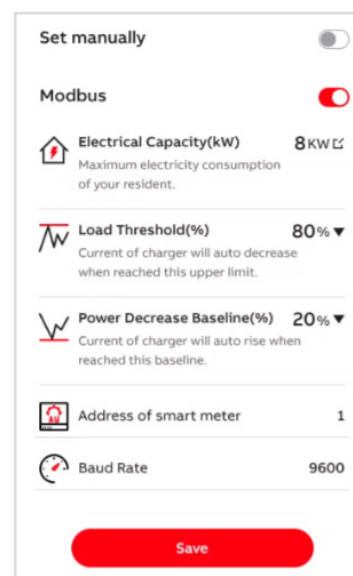


4.3.2. Configuration via the ChargerSync App

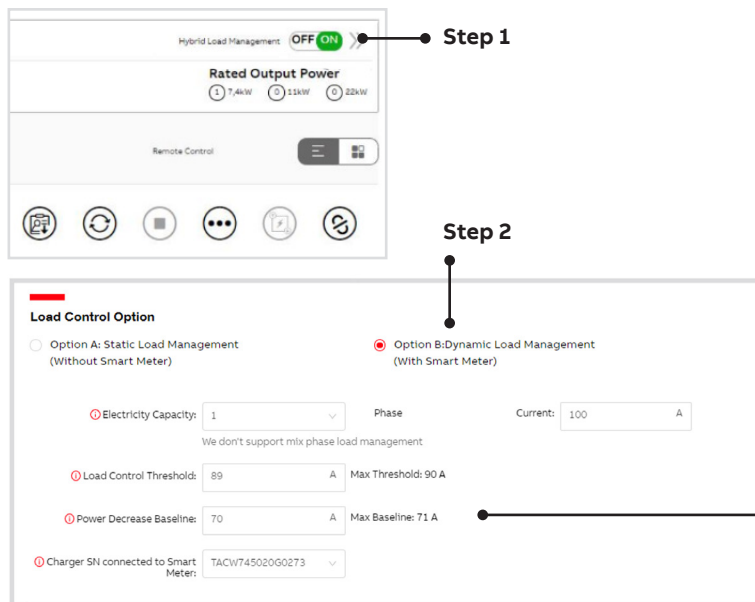
To change the set-up and settings for residential /single – home use case, one – charger – one meter, also the Charger Sync app can be used. This enables the end user / home owner to conduct the configuration without the help of a professional installer.

For this scenario ABB recommends a thorough read of the TACWB installation and user manuals.

The path is: [Main page] – > [Load Balance] – > enable Modbus – > set Load Management limits



4.3.3. Configuration via the ChargerSync Portal



Step 3

Set the Electricity Capacity, Load Control Threshold and Power Decrease Baseline. Select charger SN connected to Smart Meter.

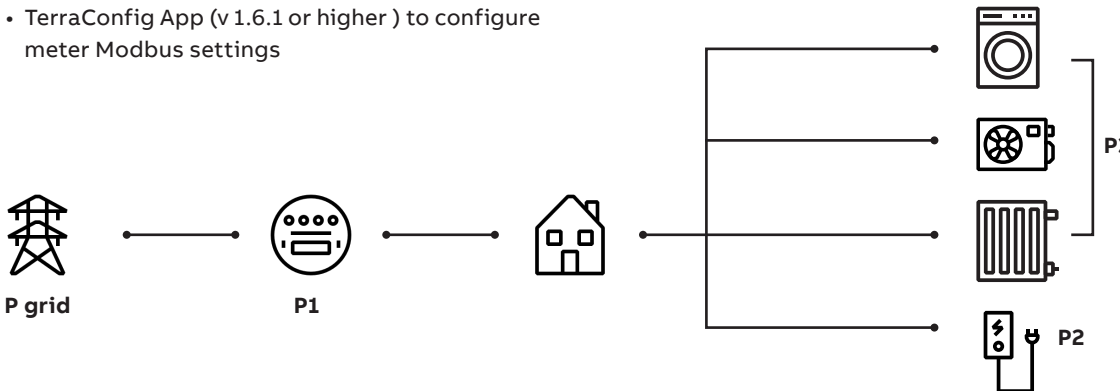
5. Load Management Strategies

5.1. Dynamic load management – single charger



- To enable dynamic load management for a single charger scenario the following set-up is expected:
- one charger, one meter where charger is Modbus Primary and meter Modbus Secondary
 - no connectivity (WiFi, LAN, 4G) required to enable local Dynamic Load Management with single charger
 - TerraConfig App (v 1.6.1 or higher) to configure meter Modbus settings

- charger maximum grid capacity connection setting
- ChargerSync App to make changes by the end user
- set limits: Electrical Capacity (kW), Load Threshold (%) and Power Decrease Baseline



- The essential elements of the load management system:
- 1) The maximum current capacity of the grid or its sub grid system, marked as **P grid**
 - 2) Smart meter with Modbus interface to monitor the real time current of the grid or its subsystems, reporting total consumption, marked as **P1**
 - 3) Controllable load target, in this case, the charging EV, marked as **P2**
 - 4) Other loads, in this case, other operating home electric appliances (AC, induction cooking, etc.) marked as **P3**.
- Assuming a house like the diagram above is a sub grid system (ignore the line loss):

$$P1 = P2 + P3$$

This system can be realized as a minimum system of load management, consider the maximum current capacity is 100 Amps, for safety and margin consideration, the controlled power limit should be controlled under 90 Amps (**Pmax**).

Consider the wallbox can draw as much as 32 Amps, when the **P3** is lower than 90-32 = 58 Amps, EV can be charged at full allocation. In case the **P3** (other loads) is above 58 A, the charger embedded load balancing mechanism will lower the charging capacity and protect the fuse.

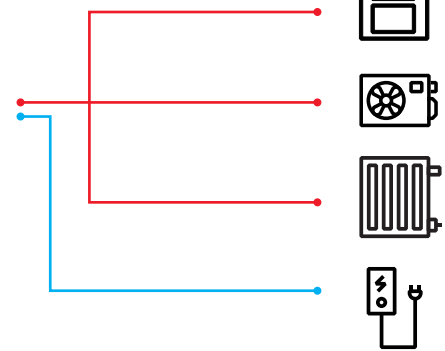
The simplest algorithm can be marked as:

$$P2 = f (Pmax, P1)$$

Pmax can be set via the Terra Config and Charger Sync apps under the field: Load Threshold.

P1 is information obtained from the Smart Meter via the Modbus RTU-RS485 interface.

How does the Terra AC work in 2 steps



1. The energy meter values are transmitted via the Modbus RTU (RS485) connection to the Terra AC.

2. The Terra AC will compare total power consumption with its own integrated energy meter and act according to the configured load balance settings to protect the fuse.

5.1.1. Value and limits

The following fields need to be updated:

Electrical Capacity

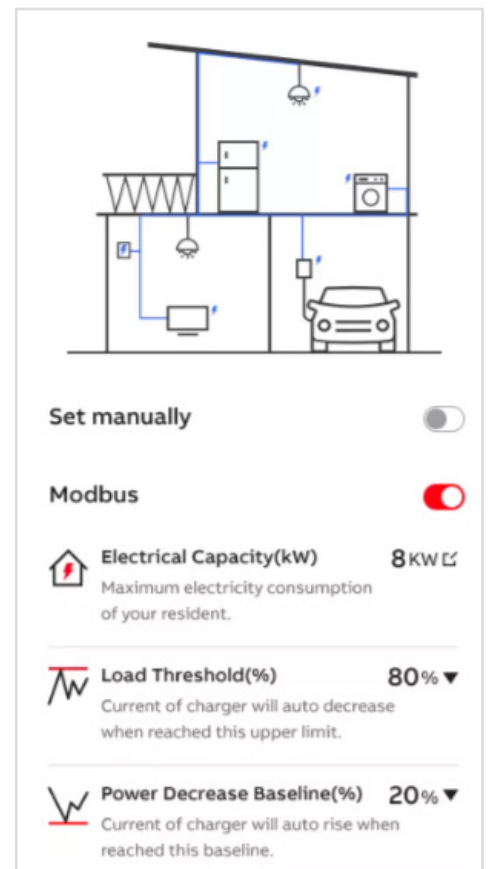
- Is the house grid connection (Pgrid), electricity capacity (in the app example marked as 8kW).

Load Threshold

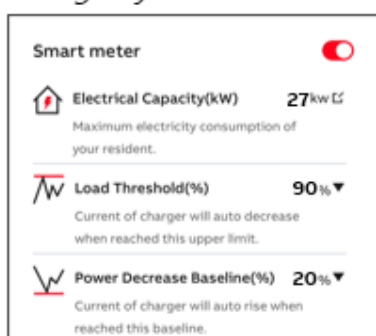
- Calculated as a percentage of the total electrical capacity
- Upper limit: when reached the charger will decrease charging capacity to protect the fuse
- Configurable between 20-90% with 10pp increments

Power Decrease Baseline

- Calculated as a percentage of the total electrical capacity
- Lower limit: when reached it triggers the charger to increase charging capacity
- Configurable between 20-90% with 10pp increments



ChargerSync APP



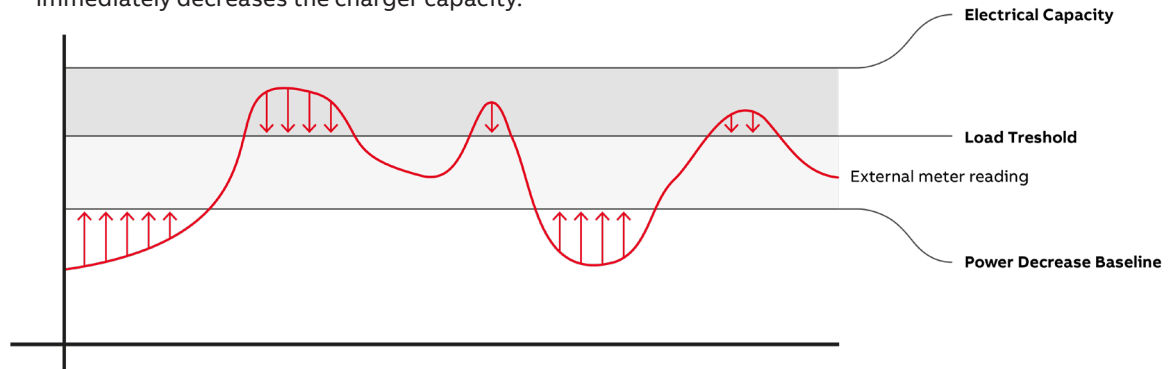
1. Grid limit as **supplied by the utility**

2. Set low enough to allow a **buffer for the one biggest energy consumer in the home** to increase power suddenly. Look at ovens, dryers, air-conditioning, heat pump, induction cooker, but also solar that suddenly may decrease if there's a cloud.

3. Choose a **high** value, after choosing the other 2 values

5.1.2. Behavior for single charger

When the meter value is above the Load threshold the charger immediately decreases the charger capacity.



After the power decrease of the charger:

- if the meter value is higher than the 'Load Threshold', the charger will continue to de-crease until it is below 'Load Threshold'. If the charger is at 6A and the meter value is still above Load Threshold, then the charger stops charging altogether.
- if the meter value is in the area between 'Load Threshold' and 'Power Decrease Baseline', the charger will stop decreasing.
- if the meter value is lower than the 'Power Decrease Baseline', the charger will start to gradually increase until the smart meter value is in the range between 'Power Decrease Baseline' and 'Load Threshold'.

5.2. Hybrid and Dynamic load management – multiple chargers

To facilitate hybrid and dynamic load management for multiple chargers, priority groups can be set to enable different charger behavior. The system allows for three different priority groups: **VIP**, **HIGH** and **MEDIUM**.

5.2.1. Value and limits

Just as the configuration for the single charger install, the three fields (Electrical Capacity, Load Threshold and Power Decrease Baseline) need to be set.

Priority groups and values can be set in the Charger Sync Portal, see below. Option A is for Hybrid Load Management (no meter) and Option B is Dynamic Load Management (with meter).

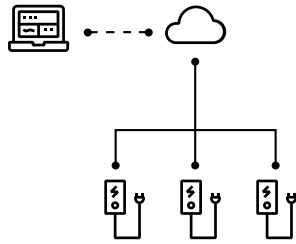
Load Control Option

☐ Option A: Static Load Management (Without Smart Meter)

☒ Option B: Dynamic Load Management (With Smart Meter)

5.2.2. Behavior for multiple chargers

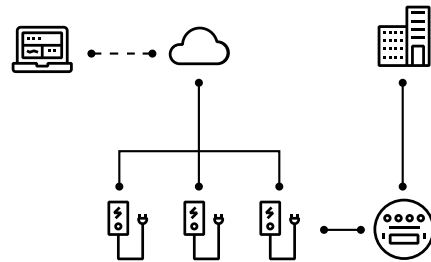
Hybrid Load Management



The only difference between the Hybrid Load Management and the Dynamic Load Management models is the presence of the smart meter.

In **Hybrid Load Management** the installation assumes only the presence of the chargers, with no external user to the grid.

Dynamic Load Management



In **Dynamic Load Management** a smart meter informs on other load and the algorithm adjusts to that input.

VIP always gets maximum capacity and does not decrease capacity once a new charger is activated. The Dynamic Load Management algorithm instructs the charging stations to adapt in real time to changes on load. The profiles optimize usage based on install preferences, with High and Medium groups as the changing variables of the Load Management algorithm.



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