ENERGY MANAGEMENT SYSTEM

TESVOLT ENERGY MANAGER

Installation and Operating Manual

TESVOLT

Free to go green.

CONTENTS

1 IMPORTANT INFORMATION ABOUT THIS MANUAL

1.1 SCOPE

This document applies to the TESVOLT Energy Manager energy management system from version 3.0.3 or higher.

Read this manual thoroughly to ensure error-free installation, initial commissioning and maintenance of the TESVOLT Energy Manager. Installation, initial commissioning and maintenance must be carried out by qualified and authorised specialists. The Installation and Operating Manual should be kept close to the unit and must be accessible at all times to all individuals involved in installation or maintenance.

This Installation and Operating Manual applies to Germany only, without restriction. Ensure that you adhere to the applicable local legal regulations and standards. The standards and legal regulations in other countries may contradict the specifications in this manual. In this case, please contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

1.2 SUPPORTED PRODUCTS

The TESVOLT Energy Manager can be used with the TS-I HV 80 battery storage system. Other compatible devices and systems can be found in our technical document "TESVOLT Energy Manager – Compatible Systems and Devices".

Firmware updates during a component's lifetime may change the communication protocol. If this causes any issues, please contact **service@tesvolt.com** or the **TESVOLT Service Line +49 (0) 3491 87 97 - 200**.

The TESVOLT Energy Manager software is constantly being improved and expanded. Automatic online updates may lead to changes in the design of the configuration menus and their use. Functions may also be added or removed.

1.3 DOCUMENTATION CONTENTS

- TESVOLT Energy Manager installation and operating manual (this document)
- "TESVOLT Energy Manager – Compatible Systems and Devices" technical document

1.4 MEANING OF SYMBOLS

Symbols in the manual

This manual contains the following types of warnings and information:

DANGER! Warning notice indicating that death or serious injury may result if you fail to follow the instruction.

CAUTION! Warning notice indicating that injury may result if you fail to follow the instruction.

WARNING! Warning notice indicating that material damage may result if you fail to follow the instruction.

NOTE: This symbol indicates information relating to the use of the unit.

Symbols on the unit

The following types of warnings and information are used on the unit:

The CE marking indicates that the TESVOLT Energy Manager meets the requirements established by the European Union for attaching this marking.

The UKCA marking indicates that the TESVOLT Energy Manager meets the requirements established by the United Kingdom for attaching this marking.

Old electrical and electronic devices frequently contain valuable materials. Old devices should not therefore be disposed of in general waste. Take this unit to a municipal collection point for electronic waste.

1.5 GENERAL SAFETY INFORMATION

DANGER! Failure to observe the safety information can result in danger to life
Improper use can lead to life-threatening injuries. Any person tasked with working on the system must have read and understood this manual, particularly the section “2 Safety” on page 8. **All safety information must be followed without fail.**

Everyone who works on the TESVOLT Energy Manager must follow the specifications in this manual.

This manual cannot describe every conceivable situation. For this reason, the applicable standards and corresponding occupational health and safety regulations always take priority.

In addition, installation may also involve residual hazards under the following circumstances:

- Installation, commissioning and configuration has not been carried out properly.
- Installation, commissioning and configuration has been carried out by personnel who have not received the relevant training or instruction.
- The warnings and safety information in this manual have not been followed.

1.6 DISCLAIMER

TESVOLT GmbH assumes no liability for personal injury, damage to property, damage to the product and follow-on damage attributable to the following causes:

- Non-compliance with this manual,
- Improper use of the product,
- Repairs, opening the cabinet and other actions performed on or with the product by unauthorised and/or unqualified personnel,
- Use of non-approved spare parts.

Unauthorised modifications or technical changes to the product are forbidden.

1.7 APPROPRIATE USE

TESVOLT Energy Manager is an energy management system comprising a control unit including the relevant measuring equipment and corresponding software. The components were built in accordance with the current state of the art in technology and product-specific standards.

TESVOLT Energy Manager is designed for used with compatible battery storage systems and inverters. Any other use must be agreed with the manufacturer.

The TESVOLT Energy Manager is used for energy management in a commercial enterprise. The unit may only be operated in enclosed spaces. The working ambient temperature range for the

TESVOLT Energy Manager is 0 °C to 50 °C and the maximum relative humidity is 5 to 95 % (non-condensing).
The unit must not be exposed to direct sunlight or placed directly beside sources of heat.

The TESVOLT Energy Manager hardware must not be exposed to corrosive environments.

The hardware and software must not be tampered with.

Adherence to the specifications in this Installation and Operating Manual also forms part of appropriate use.

1.8 GUARANTEE

The current guarantee conditions can be downloaded from the internet by visiting **www.tesvolt.com**.

1.9 REQUIREMENTS FOR INSTALLERS

The locally applicable regulations and standards are to be adhered to for all work.

The TESVOLT Energy Manager may be installed only by qualified electricians with the following qualifications:

- Training in dealing with hazards and risks encountered when installing and operating electrical equipment and systems,
- Training in installing and commissioning electrical equipment,
- Knowledge of and compliance with the technical connection conditions, standards, guidelines, regulations and laws applicable on site,
- Knowledge of and adherence to this document and the associated product documentation, including all safety instructions,
- Successful participation in the **TESVOLT Energy Manager certification training** (information about training courses can be found at **www.tesvolt.com**; alternatively, please email academy@tesvolt.com).

2 SAFETY

2.1 SAFETY INFORMATION

DANGER! Life-threatening voltage results in danger to life and health due to electric shock.

- All work on the electrical devices may only be completed by qualified electricians.
- Do not operate the units when damp.
- Do not take the power supply components out of a cold environment into a warm environment immediately before commissioning.

CAUTION! Danger from working on open current transformer circuits. If current transformers are used in the system, care must be taken to ensure that the secondary circuit of the current transformer is short-circuited before working on the current transformer circuits. The current transformer circuit must never be operated open under any circumstances, as this can lead to personal injury and damage to the device.

Avoiding physical injury

- When working with the unit, note all safety notices attached to the packaging and the unit.
- Check whether there is no damage to the unit, any accessories and the power supply both before commissioning and regularly during continuous operation. If there is any doubt, have a qualified electrician check whether the technology is sound.
- If the unit is damaged or needs to be repaired, always leave this to authorised personnel.
- Make sure the accompanying power supply is used and the unit's mains voltage is identical to the mains voltage in your country.
- The Energy Manager may only be operated with the power supply provided or via the internal 24 V power supply from the TESVOLT PCS. Any damage caused by using a different power supply is not covered by the manufacturer/supplier guarantee.
- Do not open either the Energy Manager or the power supply! Removing or damaging the casing can expose live components and compromise the functioning of the unit.

Avoiding damage to the TESVOLT Energy Manager

- The Energy Manager has a protection class of IP20 and may only be installed indoors in dry, dust-free environments. Protect the unit from dust, moisture, aggressive substances and vapours.
- The ambient temperature must be between 0 °C and +50 °C.
- Do not touch any electronic components or connections on the unit as this may damage or destroy them. Ground yourself before working on the unit.
- If the unit or power supply is damaged or destroyed, it must be decommissioned immediately by a specialist.
- Only operate the unit if it is in a technically perfect condition.
- If there are error messages on the unit, always contact service@tesvolt.com or the TESVOLT Service Line +49 (0) 3491 87 97 - 200 directly.

2.2 DATA SECURITY

In order to be able to make full use of all the functions of the TESVOLT Energy Manager, it must be connected to the local network and the internet. Although the communication path between the Energy Manager and internet services is secured in accordance with the latest technology, there are security risks involved in connecting to a network or the internet: Third parties could access your network and misuse your energy data. Please take the same care with passwords that allow access to your network as you do when protecting data on your computer.

You should therefore operate the TESVOLT Energy Manager in a separate area on your network (subnet or VLAN) or on a completely separated network, e.g. using an LTE router. In any case, the network should be protected by a firewall. Remote access should only be possible via an encrypted VPN connection.

Protecting your personal energy data is extremely important to us. The myTESWORLD platform is therefore permanently kept up to date with the latest security technology in order to ensure that energy data can be retrieved only by the owner and participants who are entitled to do so.

NOTE: The data collected by the Energy Manager may deviate from the electricity meter data, depending on how the data is captured. If we read existing power measurement meters, the meter readings we use correspond to those of the meters. However, data from the Energy Manager are not to be used for billing purposes.

3 PREPARATION

3.1 REQUIRED TOOLS AND RESOURCES

TOOL/RESOURCE	USE
0.4 x 2.5 screwdriver	Connection to the terminal blocks
Laptop	Configuration of the TESVOLT Energy Manager
Wireless router if necessary	If there is no communications infrastructure available, an easy way to carry out initial configuration is with a wireless router.
Patch cable	Connection of laptop and TESVOLT Energy Manager and to router/LAN.
At least 3x IP addresses for LAN 1 network	You need at least 3 IP addresses to configure and commission the TESVOLT Energy Manager. If dynamic addresses are not assigned using DHCP, you must have static addresses set up.

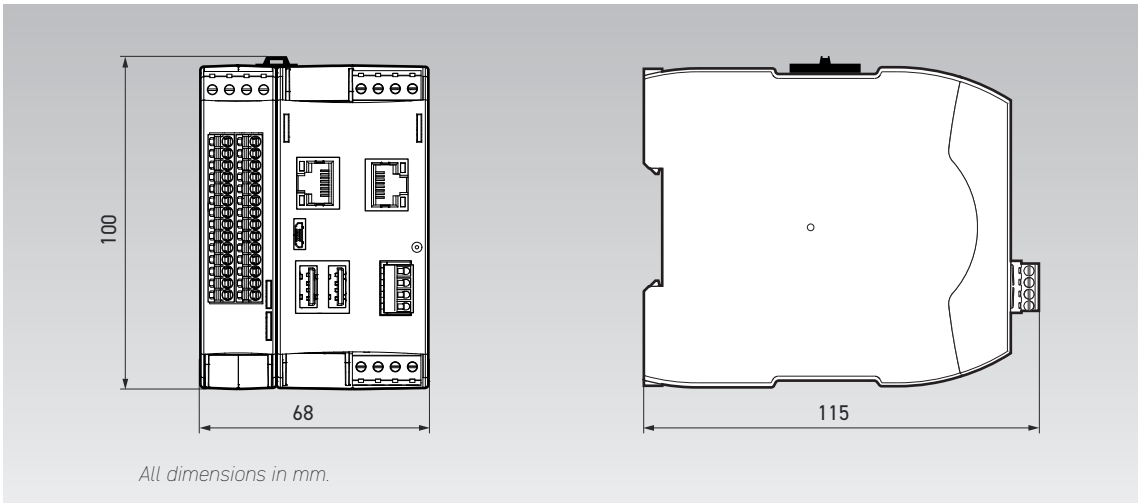
3.2 PREPARATORY WORK

For all installed components:

- Update firmware to the most recent version,
- Activate Modbus TCP (e.g. SMA),
- Activate external control (e.g. Fronius).

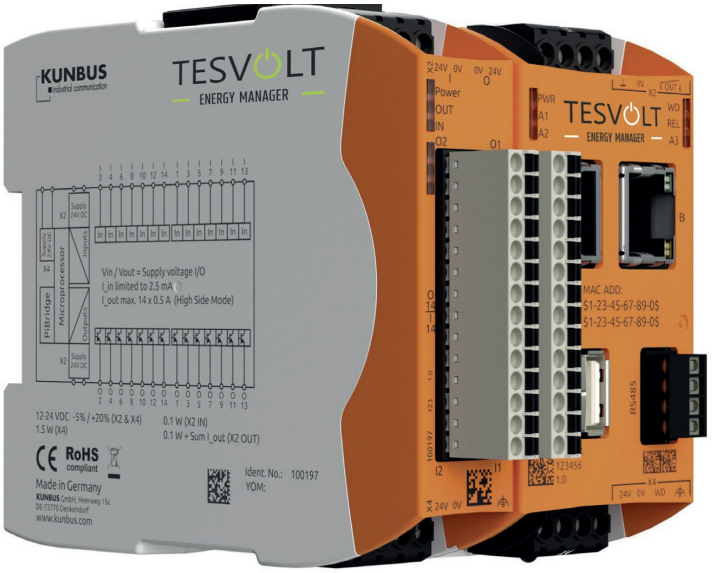
3.3 PREPARATION FOR INSTALLATION

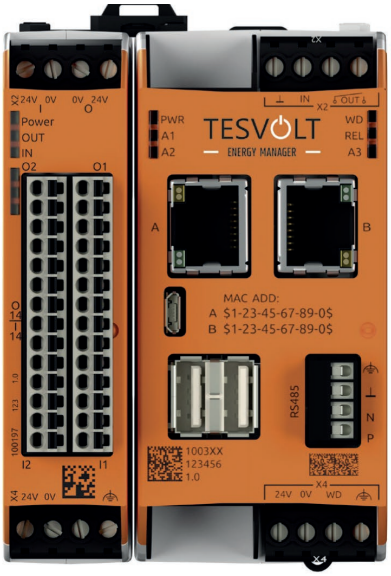
The TESVOLT Energy Manager is installed in control cabinets or in small installation distributors on a 35 mm mounting rail as per DIN 43880. It can be installed in any position.



All dimensions in mm.

4 TECHNICAL DATA





TECHNICAL DATA FOR THE TESVOLT ENERGY MANAGER	
Electrical connection	
Voltage	12–24 V_{DC} (-15%/+20%), protected against reverse polarity
Current (at U = 24 V_{DC})	max. 210 mA
Power	max. 20 W (incl. max. 1 A USB power supply)
Interfaces	
2 x RJ 45 10/100 Ethernet (with independent MAC addresses)	2 x Ethernet 10/100 Mbit/s, RJ45
Micro USB jack (exclusively for image transfer to eMMC)	1 x micro USB (exclusively for image transfer to eMMC)
RS-485	1 x RS-485, terminal connections
USB	2 x USB 2.0 type A (total power draw from both jacks max. 1 A)
Micro HDMI	HDMI 2.0a (4K)
Other:	1 x PiBridge system bus, 1x ConBridge system bus
Terminal blocks/connections	
Wire cross-section	0.5–1.5 mm^2, 28–16 AWG
Stripping length of the cable	7 mm
Ambient conditions	
Operating temperature	-25 to +55°C
Max. (air) humidity at 40°C	max. 93% (non-condensing)
Storage/transport temperature	-25 to +85°C
Protection class	IP 20
Miscellaneous	
Casing dimensions (H x W x D)	96 x 45 x 110.5 mm
Weight	197 g (224 g incl. plug)
Place of installation	Indoors
Type of installation	35 mm mounting rail
Standards	EN 61326-1:2013, EN 55011 group 1 class A, EN 55011 group 1 class B

5 TESVOLT ENERGY MANAGER

5.1 SCOPE OF DELIVERY

1

TESVOLT Energy Manager KC4S

2

TESVOLT Energy Manager DIO Modul

3

Terminal block
14-pin plug

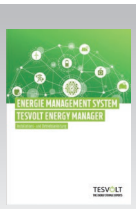
4

Pi-Bridge plug

5

Serial number sticker

6

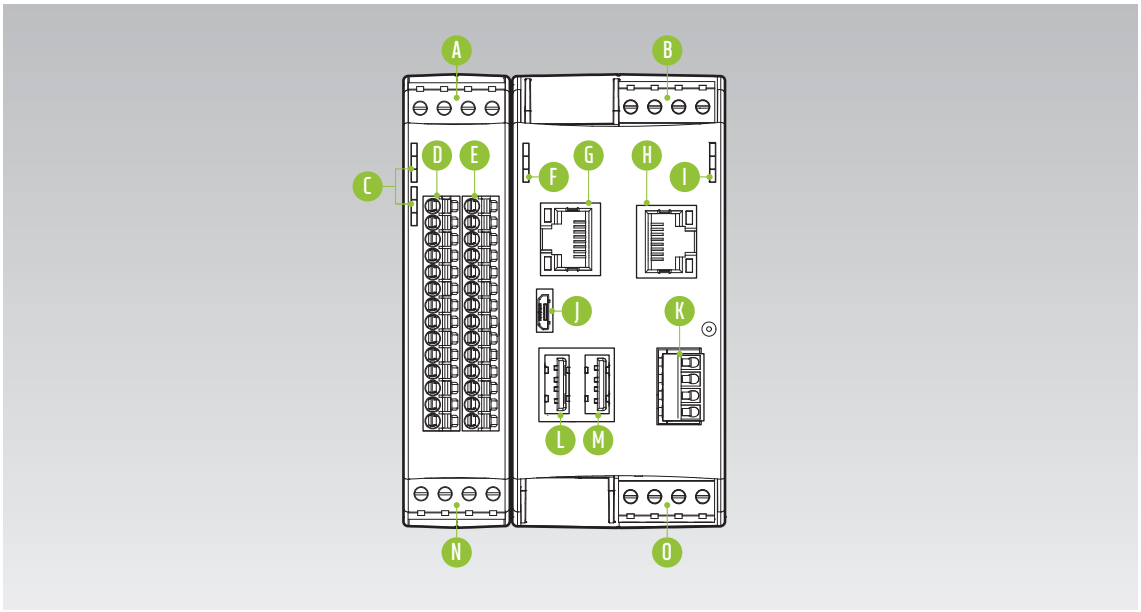


Installation and Operating Manual Energy Manager

ITEM	QUANTITY	DESCRIPTION
1	1	**TESVOLT Energy Manager KC4S**
2	1	**TESVOLT Energy Manager DIO module** (with terminal block)
3	2	**Terminal block 14-pin plug**
4	1	**Pi bridge plug**
5	3	**Serial number sticker**
6	1	**Installation and Operating Manual for the TESVOLT Energy Manager**

NOTE: Keep serial number safe
Keep the serial number of your unit in a safe, accessible place in case of potential support enquiries. It is advisable, for example, to stick the sticker with the serial number in the control cabinet or in the manual.

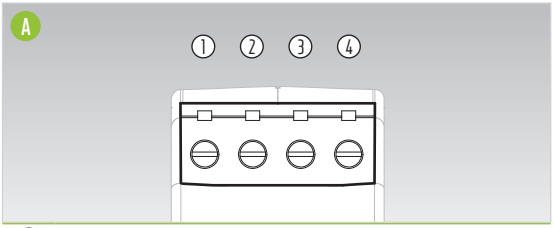
5.2 CONNECTIONS AND SETUP OF THE TESVOLT ENERGY MANAGER



POS.	DESIGNATION	DESCRIPTION
A	X2 DIO	X2 DIO terminals
B	X2 KC4S	X2 KC4S terminals
C	LED DIO	DIO LED indicators
D	O2/I2	Digital outputs/digital inputs
E	O1/I1	Digital outputs/digital inputs
F	LED KC4S 1	KC4S – 1 LED indicators
G	LAN A	LAN 1 port
H	LAN B	LAN 2 port
I	LED KC4S 2	KC4S – 2 LED indicators
J	Micro-USB	
K	RS485	
L	USB	USB A port
M	USB	USB A port
N	X4 DIO	24 V power supply
O	X4 KC4S	24 V power supply

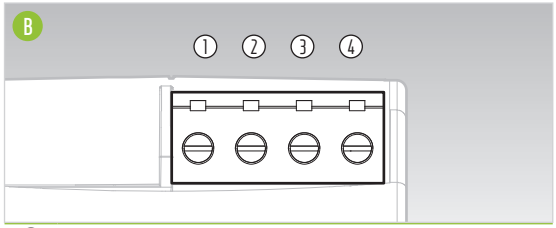
Description of the connections

X2 DIO



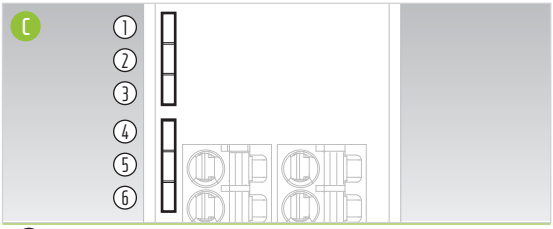
1	24 V I
2	0 V I
3	0 V O
4	24 V O

X2 KC4S



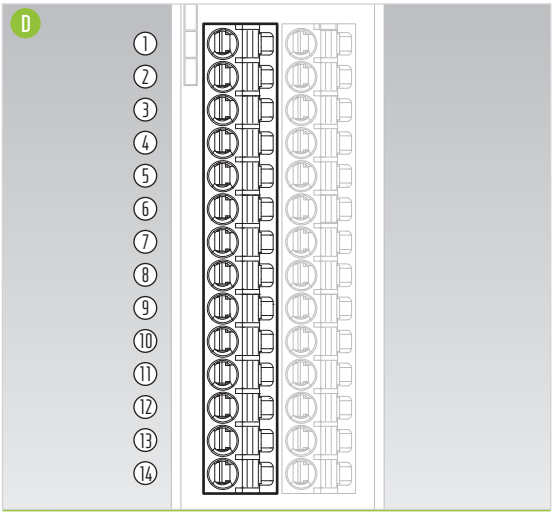
1	Digital input for UPS status signal
2	Digital input for UPS status signal
3	Relay contact (max. 30 V /2 A)
4	Relay contact

LED-Indicator DIO

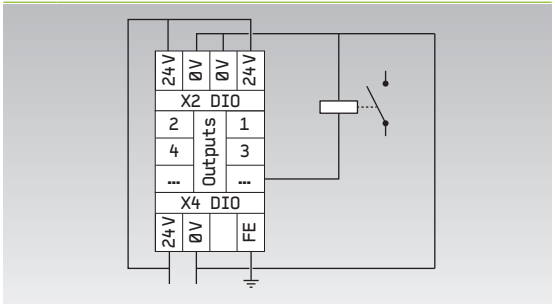


1	Power
2	OUT
3	IN
4	
5	
6	

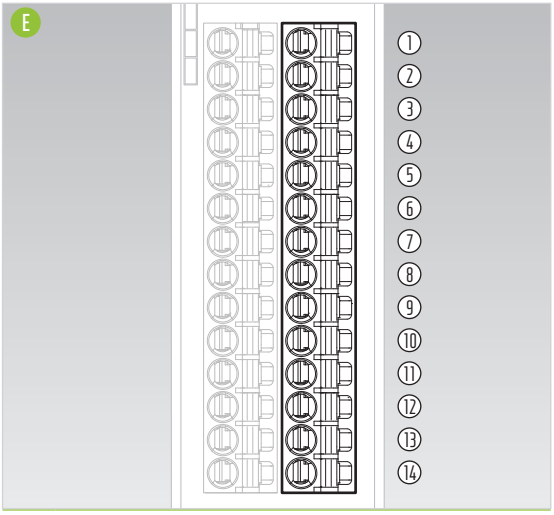
O2/I2



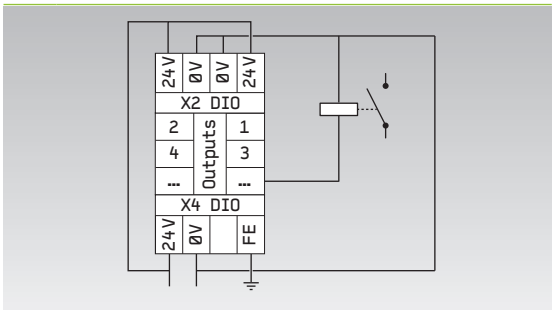
1	Output 2
2	Output 4
3	Output 6
4	Output 8
5	Output 10
6	Output 12
7	Output 14
8	Input 14
9	Input 12
10	Input 10
11	Input 8
12	Input 6
13	Input 4
14	Input 2



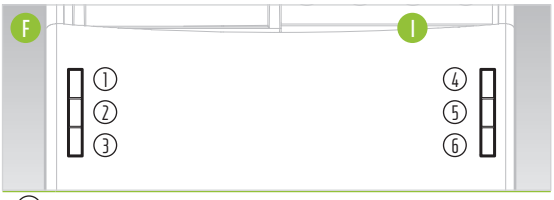
O1/I1



1	Output 1
2	Output 3
3	Output 5
4	Output 7
5	Output 9
6	Output 11
7	Output 13
8	Input 13
9	Input 11
10	Input 9
11	Input 7
12	Input 5
13	Input 3
14	Input 1

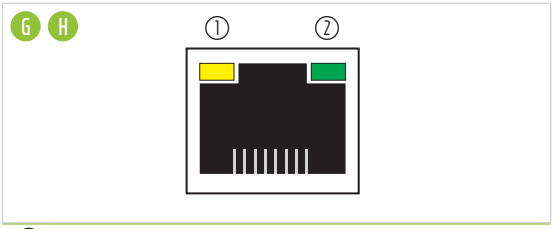


LED-Indicator KC4S



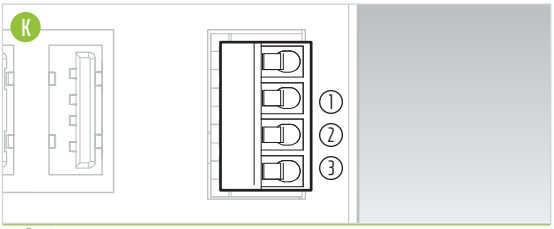
1	PWR power (green = ready for operation/red = error)
2	A1 no function
3	A2 no function
4	WD no function
5	REL relay (OFF = contact open/green = contact closed)
6	A3 no function

LAN



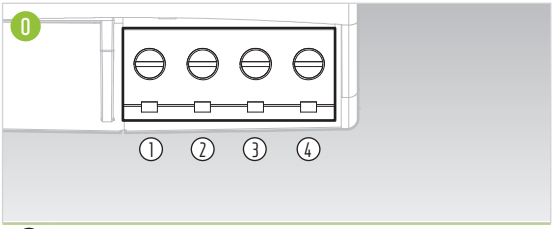
1	Activity LED – indicates network connection activity.
2	Link LED – indicates network connection status.

RS485



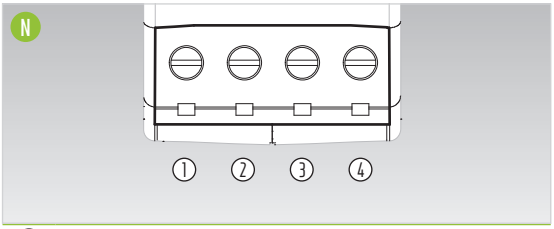
1	GND
2	Data B
3	Data A

X4 DIO



1	24 V
2	0 V
3	WD (not used, preinstalled bridge to 2)
4	Functional ground

X4 KC4S

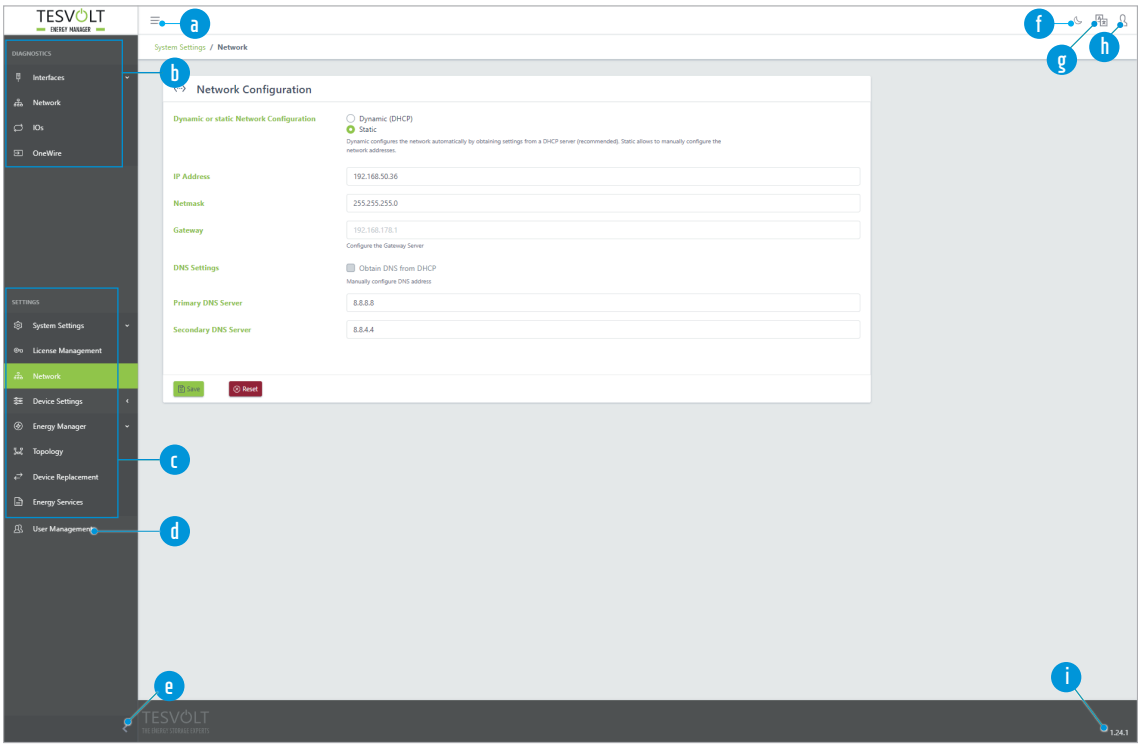


1	24 V
2	0 V
3	WD (not used, preinstalled bridge to 2)
4	Functional ground

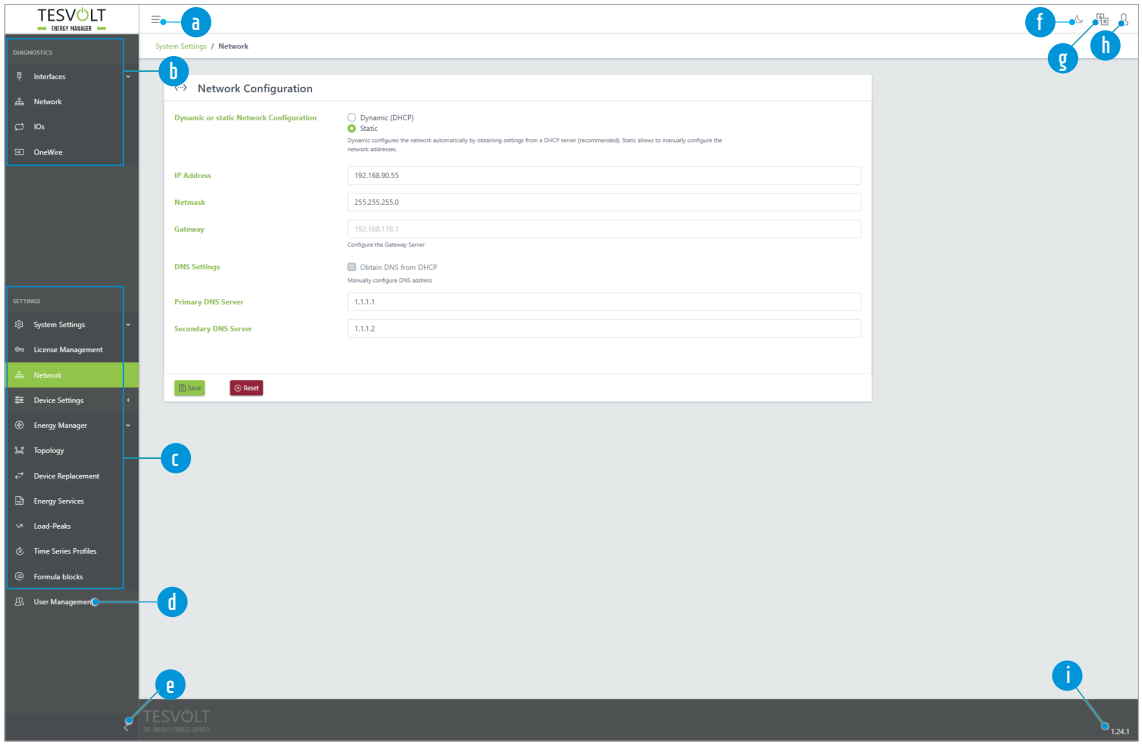
5.3 TESVOLT ENERGY MANAGER USER INTERFACE

The TESVOLT Energy Manager is operated via a graphic user interface. The display is viewed in a browser. The unit can be configured from the user interface and live values and other data can be read from here. The PRO and BASIC licence user interfaces differ in terms of the number of functions available in the Settings section c.

BASIC-Licence



PRO-Licence



a	**Expanding and collapsing the menu**	Show or hide the menu
b	**Analysis**	Information on the status of the networks, the inputs and outputs, and the 1-Wire input
c	**Settings**	Configuration of the Energy Manager and logical devices
d	**User settings**	Info on the cache, user settings and logout of current users
e	**Menu display**	Reduced menu display with symbols or full display including text
f	**Bright/dark display**	Switch between bright or dark user interface
g	**Sprache**	Sprachumstellung Deutsch/Englisch
h	**User settings**	Info on the cache, user settings and logout of current users
i	**Firmware version**	Shows the version of the firmware of the TESVOLT Energy Manager

6 INSTALLING THE UNIT

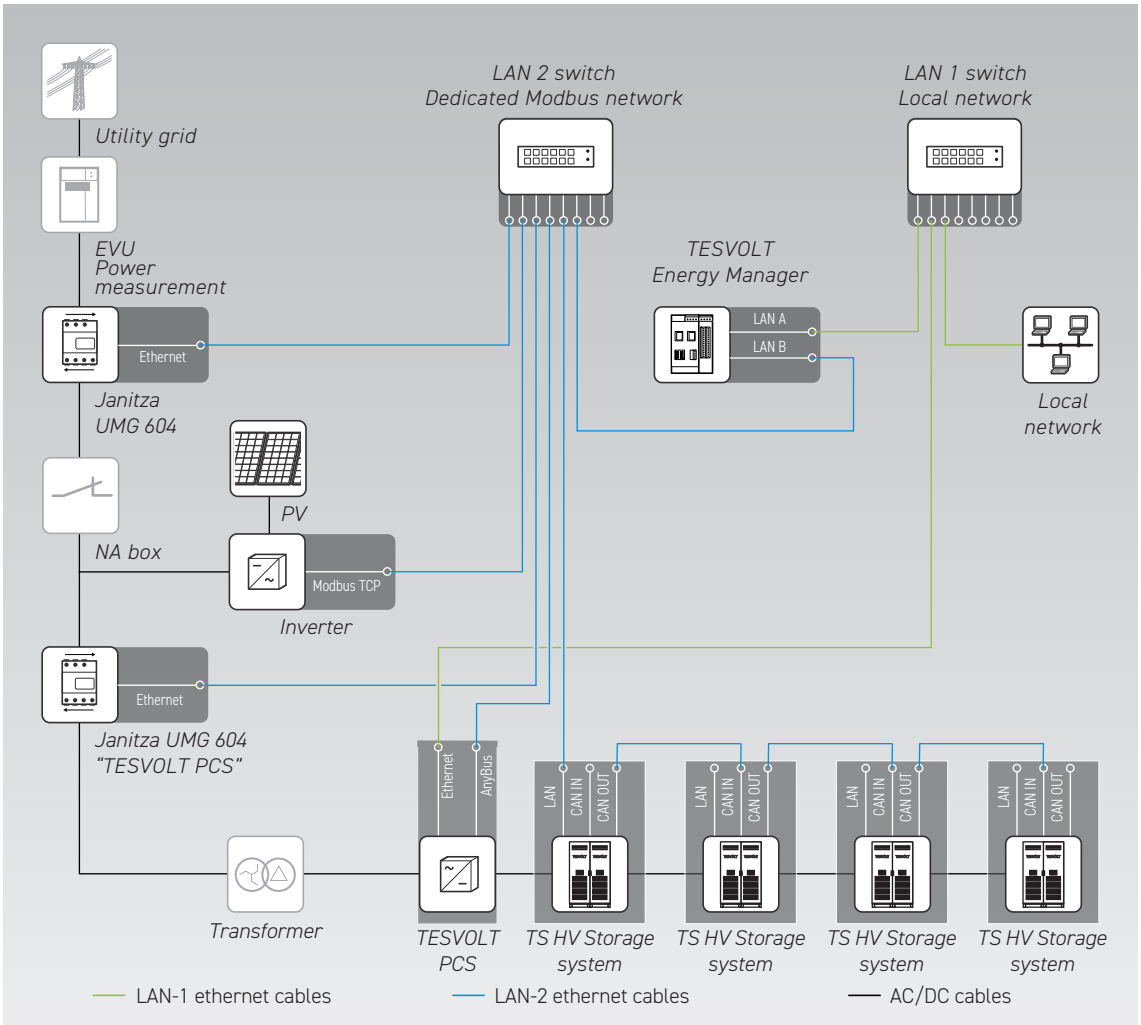
NOTE: When connecting new units, the Energy Manager must be taken out of operation and be voltage-free.

6.1 NETWORK STRUCTURE

Note that in particular the LAN 1 network is separated from the internal network, as with a guest network. A firewall or VLAN can also be used here. An alternative option is separate internet access, e.g. via an LTE router.

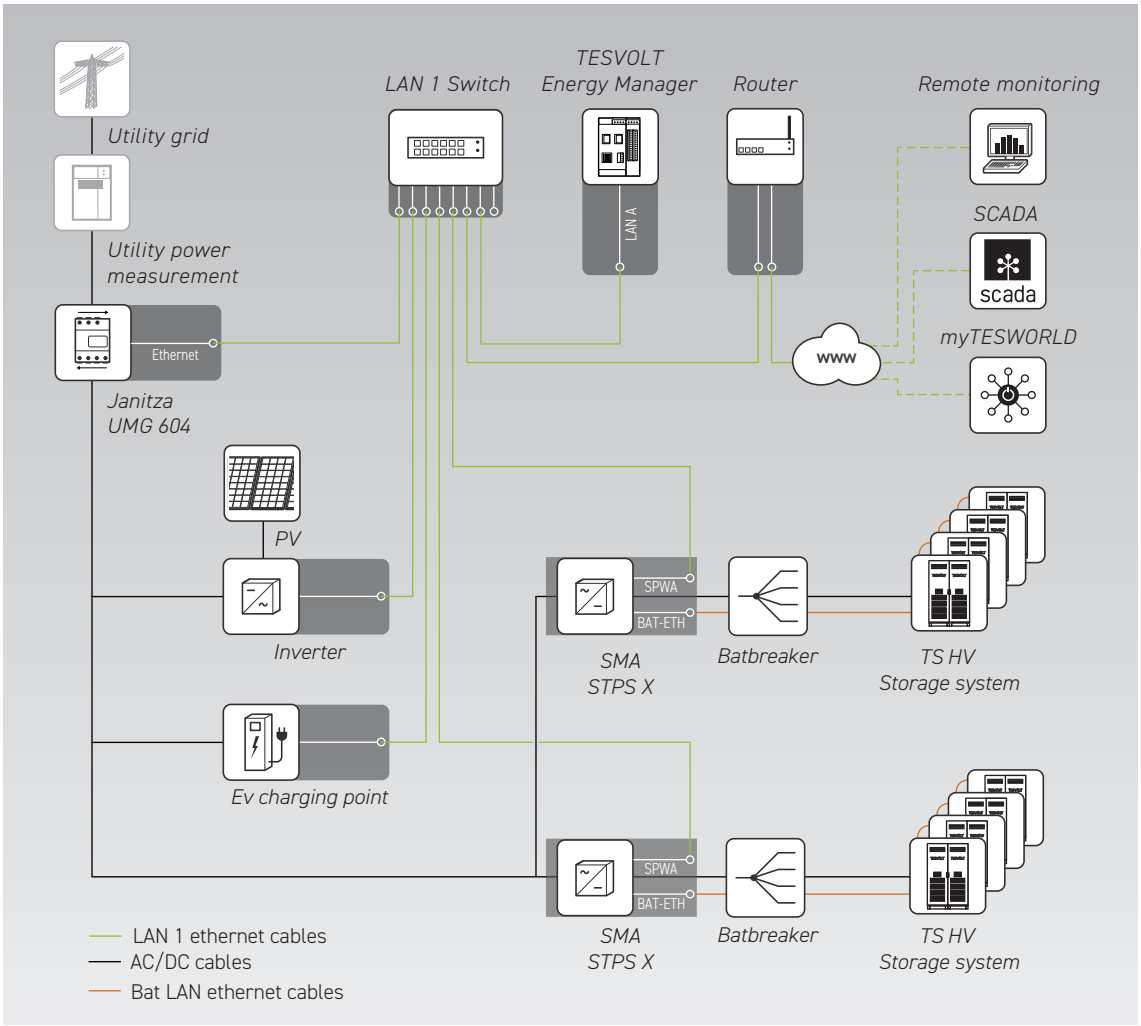
TS-I HV 80

The illustration shows a typical communications architecture setup with a TS-I HV 80.



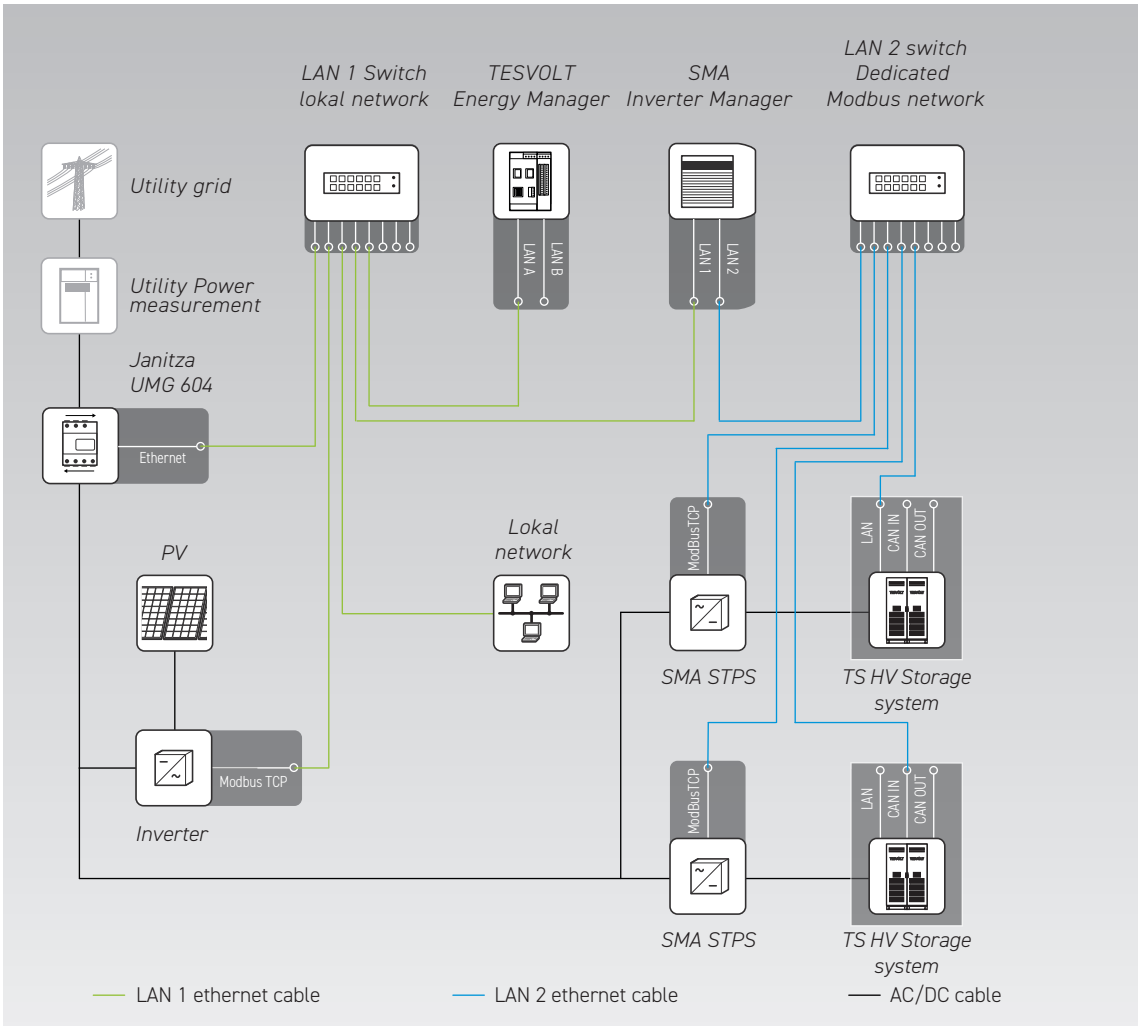
SMA STPS X

The illustration shows a typical communications architecture setup using an SMA STPS X inverter together with a TESVOLT TS HV 30-80 E storage system.



SMA Inverter Manager

The illustration shows a typical communications architecture setup with an SMA Inverter Manager. This allows an SMA STPS 60 to be used with a TESVOLT HV storage system, for example.



6.2 MAXIMUM CABLE LENGTHS FOR TESVOLT ENERGY MANAGER INPUTS AND OUTPUTS

NOTE: Disruption to data transfer due to insufficient shielding of energy cables
Insufficient shielding of energy cables produces an electromagnetic field during operation which can disrupt data transfer through network cables. When laying network cables without separators, a minimum distance of 200 mm must therefore be maintained from unshielded energy cables. When laying network cables with separators, the following minimum distances apply depending on the separator material: aluminium 100 mm, steel 50 mm.

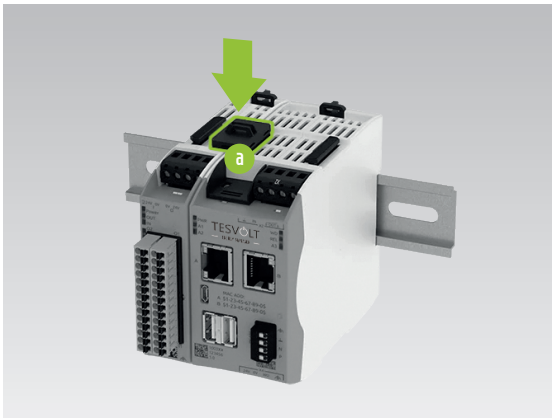
INPUT/OUTPUT	MAXIMUM CABLE LENGTH
Power supply	3 m
Digital inputs/outputs	10 m
Ethernet 10/100Mbit	30 m
RS-485	30 m

6.3 TOP HAT MOUNTING RAIL INSTALLATION

Install the TESVOLT Energy Manager in a control cabinet or small installation distributor on a 35 mm mounting rail as per DIN 43880. It can be installed in any position. Note the installation dimensions shown in the illustration in section “3.3 Preparation for installation” on page 10 as well as the maximum cable lengths in the previous section.

6.4 CONNECTION OF KC4S AND DIO-MODUL

WARNING! The DIO module must only be connected on the left side using the black PiBridge plug. If a module is connected on the right side (the connect port), the units may be damaged or destroyed.



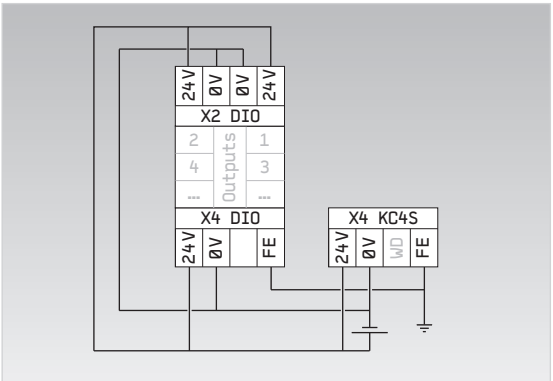
Connect the PiBridge to the PiBridge connections on the KC4S and DIO module as shown.

6.5 24 V POWER SUPPLY

WARNING! Do not connect the KC4S to the power supply until all other units and connectors have been connected. If the KC4S is already connected to the voltage source and a unit is connected later, it is possible that the KC4S and/or connected units may be damaged or destroyed.

WARNING! Make sure that the wiring is correct, otherwise the KC4S and/or connected units may be damaged or destroyed.

Connect the 24 V power supply of the KC4S and the DIO module. If possible, consolidate the connections for the functional ground and connect them to an appropriate grounding point. Please note that the supply line must be switchable. The fuse protection should be 3 A.



Operating voltage	24 V
Power	max. 20 W
Wire cross-section	0.5–2.5 mm², 28–16 AWG
Cable length	max. 3 m
Stripping length of the cable	7 mm

6.6 NETWORK

Connect the LAN A connection of the Energy Manager G for the internet connection to the LAN 1 switch, and then connect the LAN B connection H to the LAN 2 switch (dedicated Modbus network). If units cannot be connected to the dedicated network (LAN 2), they can also be connected to the LAN 1 network. When configuring the DHCP server, make sure that an infinite lease time is set for the IP of the connected units of the topology. Otherwise, a connection failure of a ModBus unit may result in it receiving a new IP from the DHCP server and it will no longer be possible to control the units with the Energy Manager. If you do not use a DHCP server as recommended, a fixed IP address must also be assigned to all units manually.

Transmission speed	10/100 Mbit
Cable length	max. 30 m

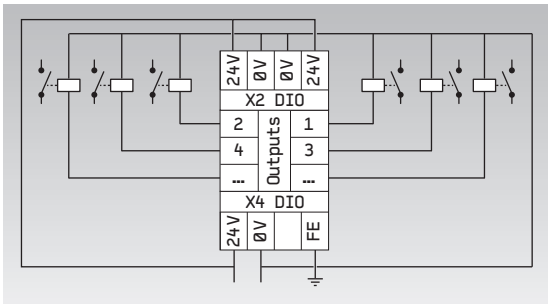
6.7 RS-485

The integrated RS-485 interface K ① ② ③ can be used, for example, to connect Modbus RTU units. Terminal assignment can be found in the section “Description of the connections” on page 13 et seq. Please note the technical specifications for the connection.

Wire cross-section	0.5–1.5 mm², 28–16 AWG
Cable length	max. 30 m
Stripping length of the cable	7 mm
Terminal tightening torque	0.2 Nm

6.8 DIGITAL OUTPUTS

The digital outputs D ① ... ⑦ and E ① ... ⑦ can be used, for example, to connect relays (e.g. for heat pumps that are smart grid ready) or NA box signals. Terminal assignment can be found in the section "Description of the connections" on page 13 et seq. Please note the technical specifications for the connection.



No. of channels	14
Max. current	500 mA in total
Max. voltage	24 V_{DC}
Wire cross-section	0.5–1.5 mm^2, 28–16 AWG
Cable length	max. 10 m
Stripping length of the cable	7 mm

6.9 CONNECTION OF THE ENERGY MANAGER

DANGER! Life-threatening voltage

- Connect the Energy Manager when it is voltage-free.
- Make sure the unit cannot be switched back on.
- Do not supply the 24 V power supply unit with 230 V mains voltage until the final step.

1 Connect the 24 V power supply in accordance with section "6.5 24 V power supply" on page 22.

2 Now, connect the grid connections of the TESVOLT Energy Manager and all units connected in the network to the switches according to sections "6.1 Network structure" on page 18 and "6.6 Network" on page 22. Check all cables beforehand with a network tester. For use with a TS-I HV 80, please refer to the "Establishing communication links" section in the Installation and Operating Manual for the model.

7 UNIT SETUP

In systems with TESVOLT battery inverters, please follow the commissioning instructions provided in the relevant installation and operating manual.

7.1 SWITCH ON THE TESVOLT ENERGY MANAGER

Follow the steps below to switch on the TESVOLT Energy Manager:

- Connect the 24 V power supply.

  > The LED of the POWER button flashes during start-up.

  > The LED of the POWER button lights up continuously when the system has successfully started up.

NOTE: Email notification of inactivity
If the unit has been inactive for more than 45 minutes, it will not send a heartbeat to the myTESWORLD portal. In this case, you will receive an email prompting you to take action.
When you receive this email, please check that the unit has started up correctly and is connected to the network.

Check activity and connectivity

Follow the steps below to check whether the TESVOLT Energy Manager has correctly started up and is connected to the network:

1 Check that the power LED on the unit is lit up.

The power LED is not lit up:

- Check the voltage supply (see "6.5 24 V power supply" on page 22).
- If necessary, disconnect and restore the power supply (see "6.9 Connection of the Energy Manager" on page 23).
- The unit may be defective. Contact TESVOLT Service.

The power LED is lit up:

- Go to 2 and follow the instructions.

2 Check that the network LEDs on the LED inputs are flashing (see "Description of the connections" on page 13).

The network LEDs are not flashing:

- Check the network cabling on the unit and correct it if necessary (see "6.6 Network" on page 22).
- Restart the unit if necessary.
- The unit may be defective. Contact TESVOLT Service.
- The network LEDs are flashing:
- Go to 3 and follow the instructions.

3 Check the unit connectivity in the user interface (see “Checking network configuration and status” on page 29).

Unit not connected:

- Check network settings such as firewall and IP.
- Check internet availability.
- Contact TESVOLT Service if necessary.

The unit is connected:

- It is operating correctly.

7.2 SCANNING THE NETWORK ENVIRONMENT

1 Scan the network environment using an IP scanner, e.g. the Advanced IP Scanner.

In the IP scanner results list, double-click on the IP address of the TESVOLT Energy Manager (manufacturer: Kunbus GmbH), or copy the IP address and paste it in the browser address bar.

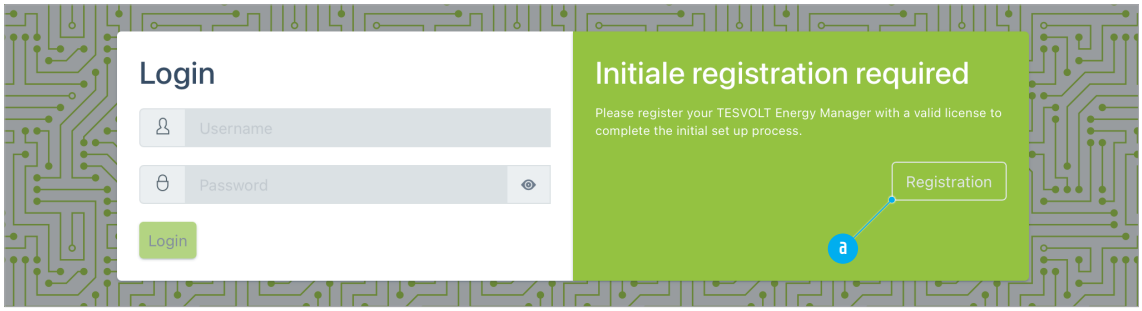
7.3 REGISTRATION AND LICENSING

1 Switch on the 24 V power supply.

2 Connect your laptop to the dedicated Modbus network to access the TESVOLT Energy Manager user interface. In the factory configuration, the unit is pre-configured for the use of a DHCP server.

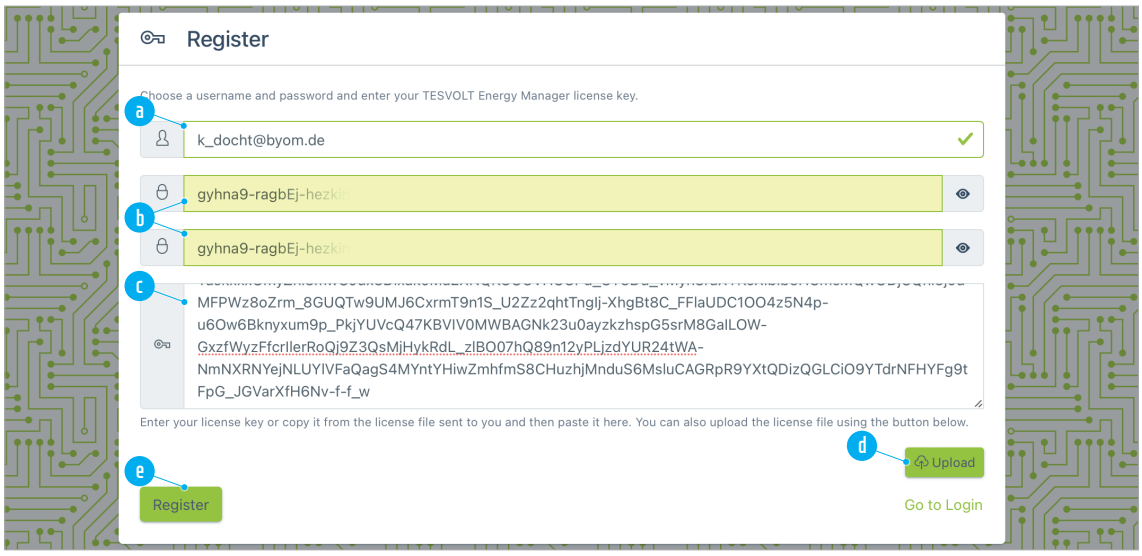
STOP **WARNING!** Please note that the PRO licence is a fee-based subscription. If you do not extend the licence, all PRO functions will cease at the end of the licensed period. In some circumstances this can result in high subsequent costs.

3



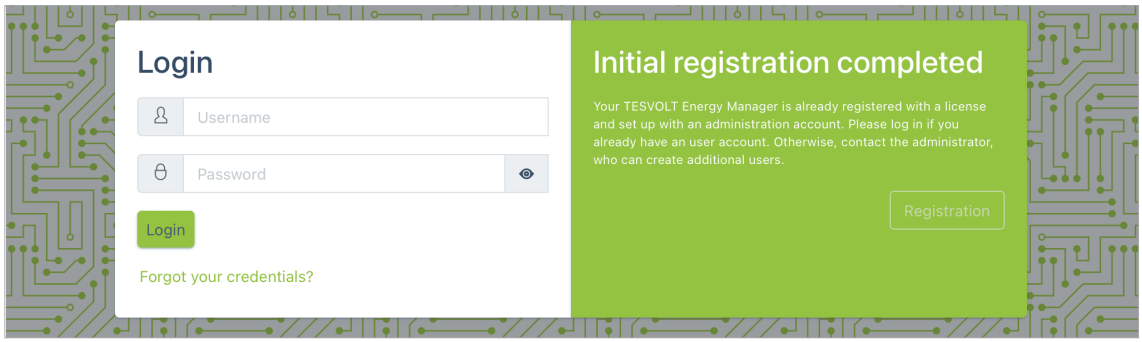
Enter the IP address of the TESVOLT Energy Manager in a browser to access the configuration interface. Before you can commission the Energy Manager, the unit must be registered with a licence. To do this, click on the “Registration” button a.

5



Enter a user name in the input field a and enter the password for the user in the fields b. Then copy the character string of the licence key into the field c. Instead of copying the licence key into the input field, you can also upload it as a TXT file. To do this, click on the "Upload" button d and select the relevant file. Then click on the "Register" button e.

6



On the right, green half of the login window, you will now see the message "Initial registration complete". Log into the unit again with the newly created user details.

NOTE: Serial number displayed

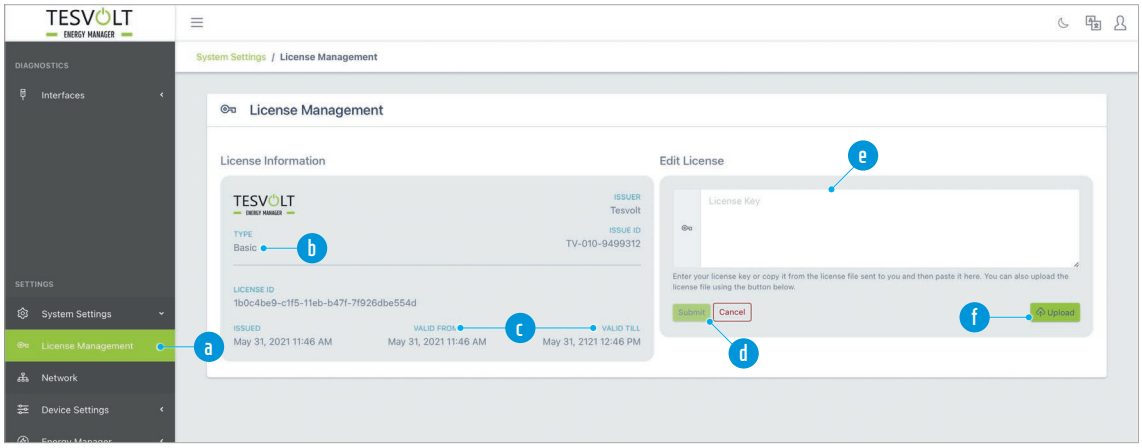
The serial number is displayed in the bottom right-hand corner of the TESVOLT Energy Manager login page. This number is important for potential support enquiries. You can also find it on the stickers included in the delivery (see section "5.1 Scope of delivery" on page 12).

Licence management

NOTE: After a PRO licence has expired, a BASIC licence must be installed for operation
When a TESVOLT Energy Manager has been operated with a PRO licence that has not been extended, a BASIC licence must first be installed in order to continue operating the Energy Manager with the free BASIC functions.

NOTE: Getting a licence reset by Support
To have your licence reset, please contact the Support team by emailing **service@tesvolt.com** or by calling the **TESVOLT Service Line +49 (0)3491 87 97-200**.

1



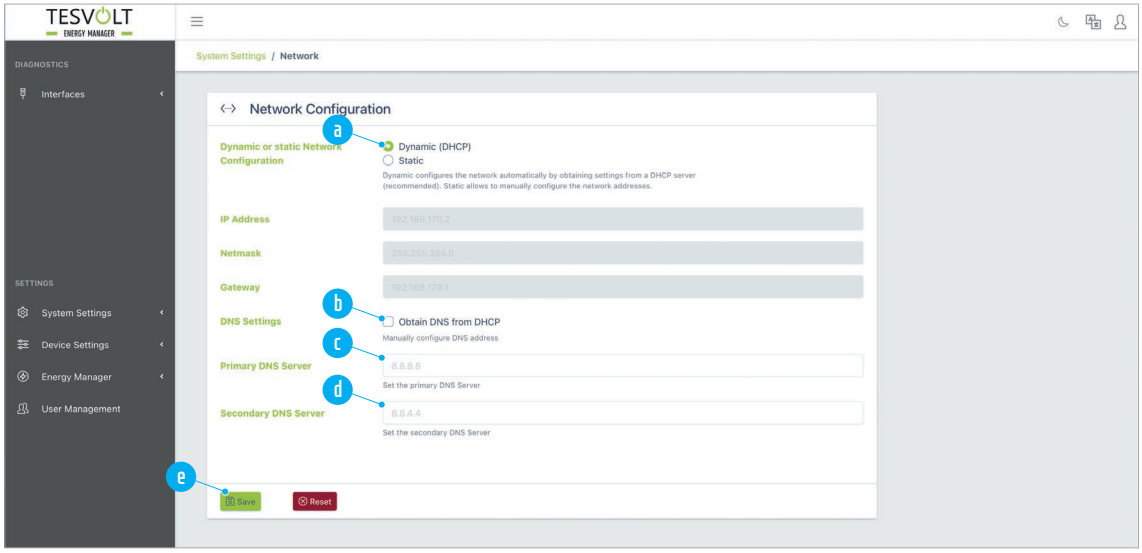
Access the licence management by clicking on “Licence Management” in the side menu (a). In the licence information section you can find details such as your licence type (b) and the period of validity (c). If you would like to enter a new licence (e.g. if you subsequently purchase a PRO licence), you can either copy the licence key into the relevant field (e) or upload a text file with the key by clicking on the “Upload” button (f).
Then click on “Submit” (d).

7.4 NETWORK CONFIGURATION

Setting up the network configuration

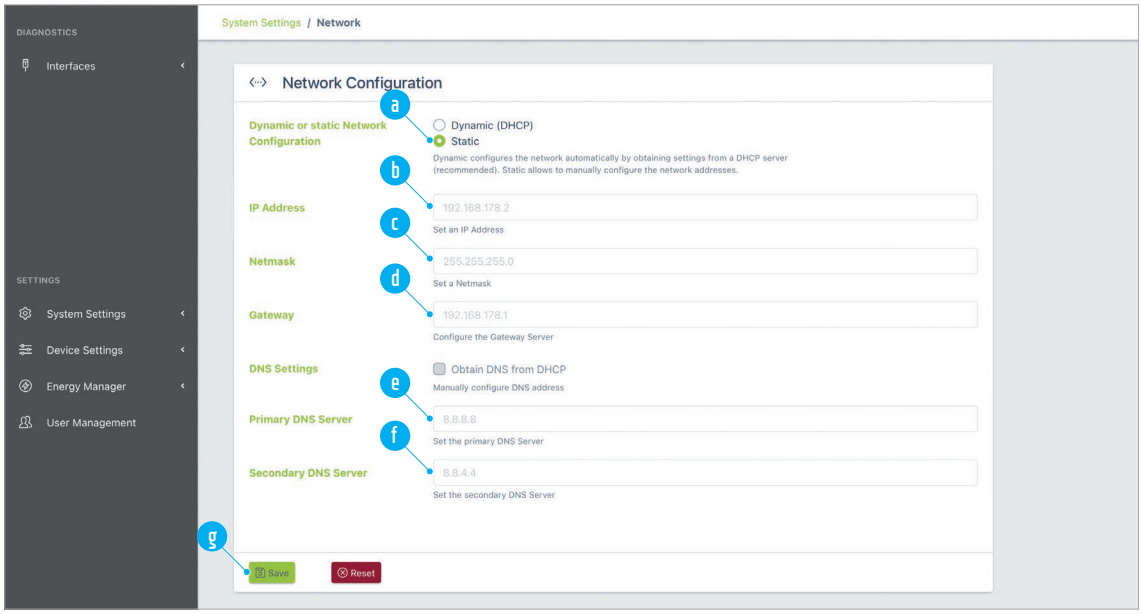
NOTE: In dynamic network configuration (factory setting), the IP address of the TESVOLT Energy Manager is automatically assigned by the DHCP server. Determining the IP numbers of the Energy Manager and the other units can be very time-consuming. This is a significant drawback especially when it comes to error diagnosis. For this reason, the use of static network configuration is recommended. Note the IP addresses used and what they are used for in a separate document.

1



If you would like to use a DHCP server (factory setting), in the "Settings" section of the side menu, click on the "System Settings" menu item and then "Network". For the first item "Dynamic or static Network Configuration", click on the option "Dynamic (DHCP)" (a). This option enables fully automatic network configuration of the unit, meaning the Energy Manager automatically obtains an IP address, netmask and gateway when the DHCP server is started. You can also configure the following settings: (b) automatic DNS configuration yes/no. If automatic DNS configuration is set to "no": (c) primary DNS server, (d) secondary DNS server. To apply the changes, click on "Save" (e).

2

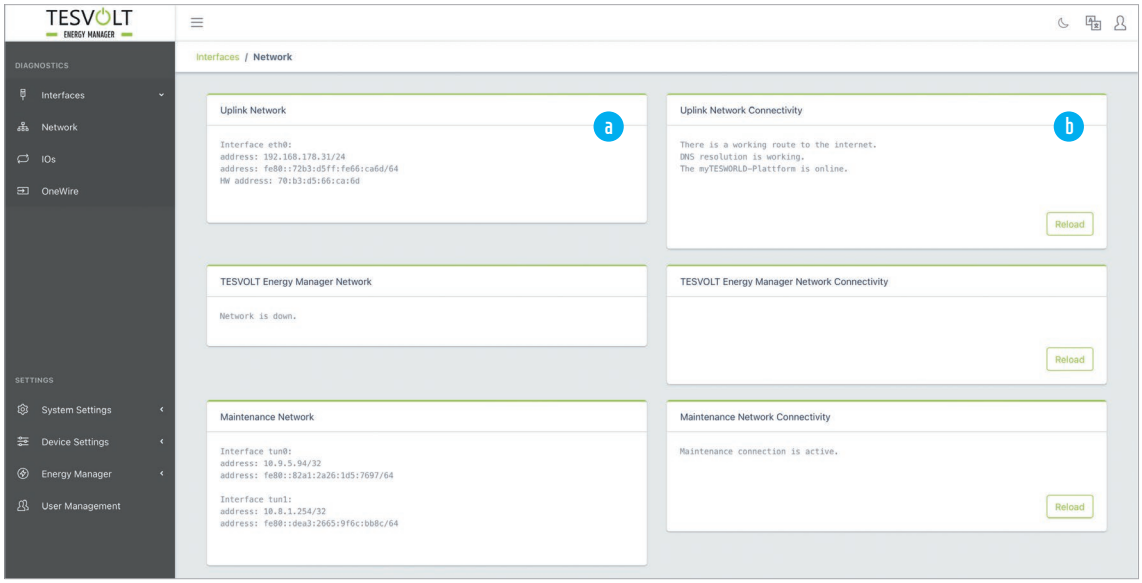


To adjust the static network settings of the ethernet connection, click on the "System Settings" menu item in the side menu and then on "Network". For the first item "Dynamic or static Network Configuration", click on the option "Static" (a). You can now configure the following settings for the static network

configuration: b the future IP address of the Energy Manager, c the netmask of the network, d the IP address of a gateway (usually the router), e primary DNS server, f secondary DNS server. To apply the changes, click on “Save” g.

Checking network configuration and status

1



To check the network settings and the status of the connections and the network, click on “Interfaces” in the side menu and then on the item “Network”. In the “Uplink Network” section a you will find the current IP address (IPv4) of the TESVOLT Energy Manager on the second line. In the “Uplink Network Connectivity” section b you can see if there is a connection to the internet, if a DNS server is available and if there is a connection to the myTESWORLD platform. The other sections are relevant for servicing.

7.5 USER MANAGEMENT

Both the TESVOLT Energy Manager (hardware) and the myTESWORLD portal have their own user management. In order to monitor and control a system using myTESWORLD, you must first create a user on the TESVOLT Energy Manager and then in the myTESWORLD portal.

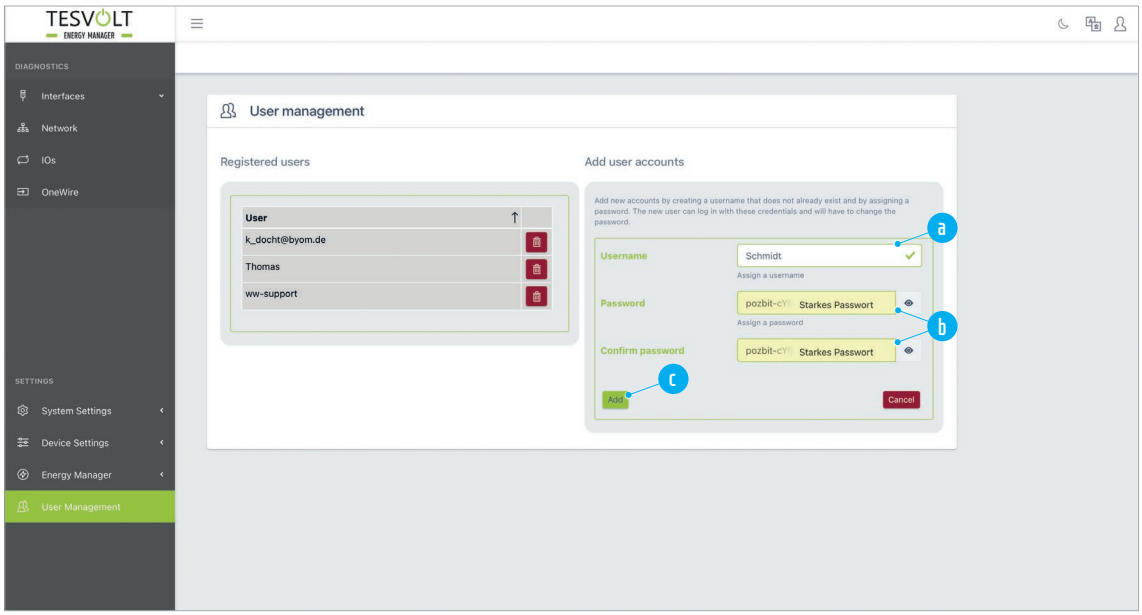
Creating users

NOTE: Protect access to user accounts by using secure passwords (at least 8 characters long including lower case and upper case letters, numbers and special characters). Preferably use different passwords for accessing the TESVOLT Energy Manager and the myTESWORLD platform.

NOTE: In order to remain capable of swift responses during servicing, we recommend always creating a user account for the TESVOLT service team. You can then provide us with the access data when servicing is required.

1 When the TESVOLT Energy Manager has started up again, access the user interface again (http://IP address of the unit).

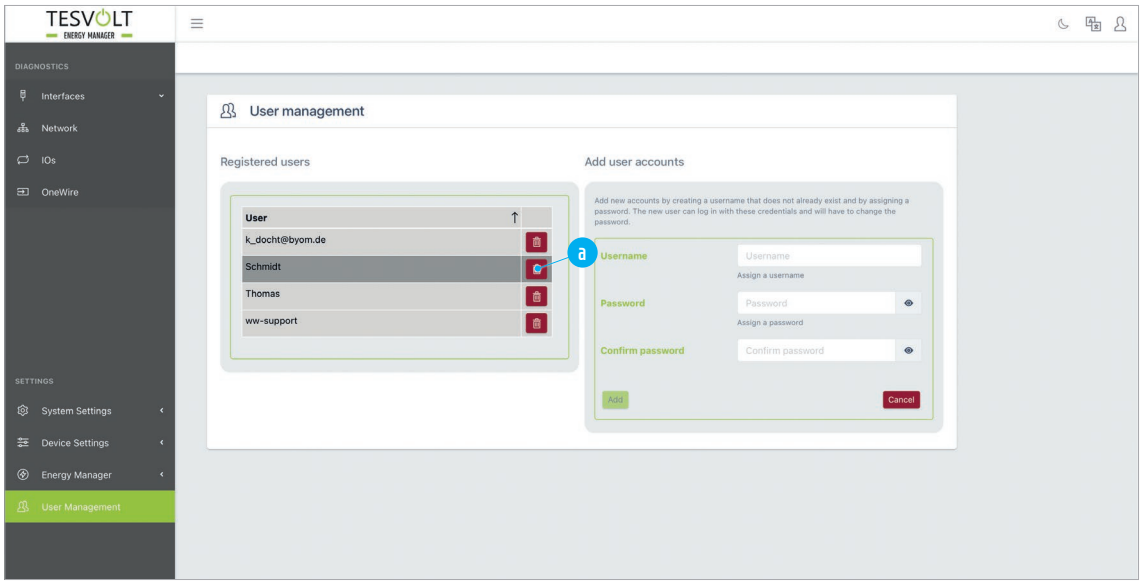
2



To set up an additional user, click on “User Management” in the side menu. In the window this brings up, you can set up additional users using the dialogue box on the right-hand side under “Add user accounts”. Enter the relevant name in the field “Username” a and the corresponding password in the two following fields b. Finally, click on “Add” c to save the details.

Deleting users

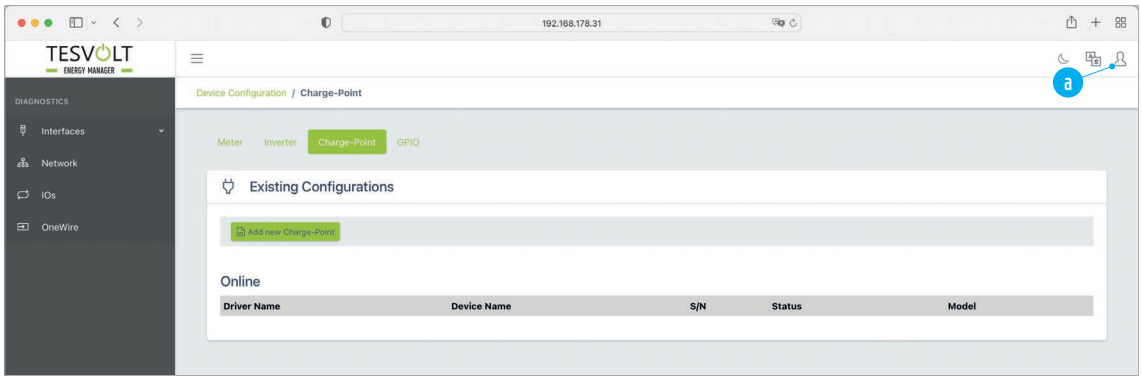
1



Click on “User Management” in the side menu. Then click on the “Delete” button a next to the entry in the user list you wish to delete, and confirm the action in the following dialogue box. The user is now deleted.

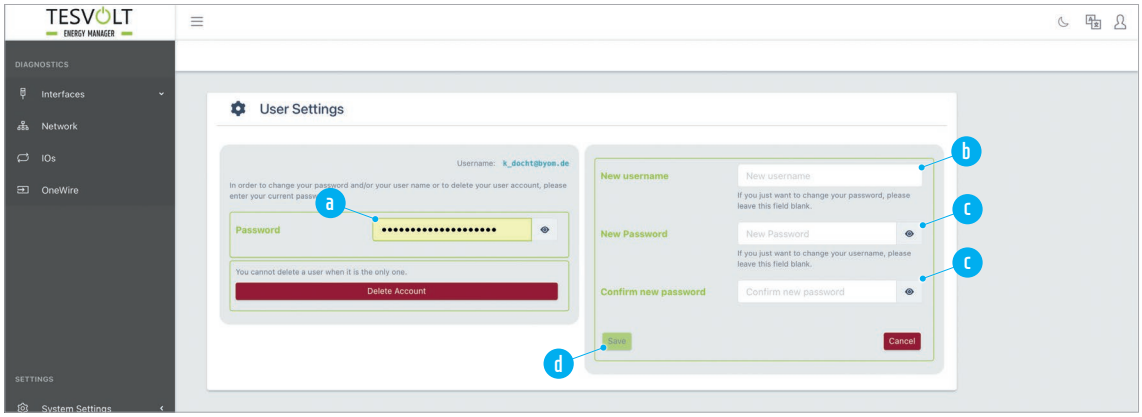
Editing users

1



Click on the user symbol a to access the settings for the active user account.

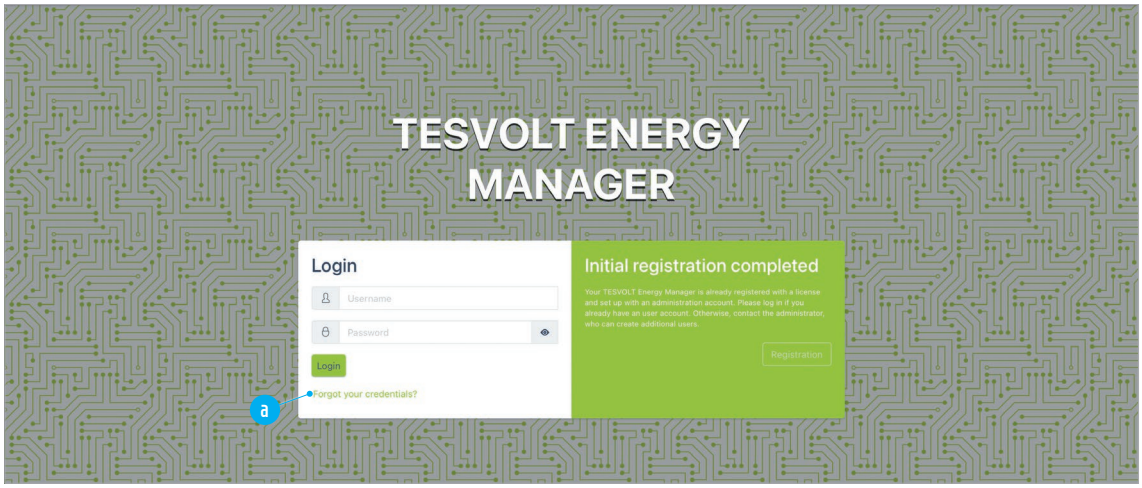
2



To make changes to the name or password of the current user, you must first enter your password a. You can then enter a new user name for the active account in the field b. If you would (also) like to change the password, enter a new password in the fields c. Then click on the “Save” button d to save the changes.

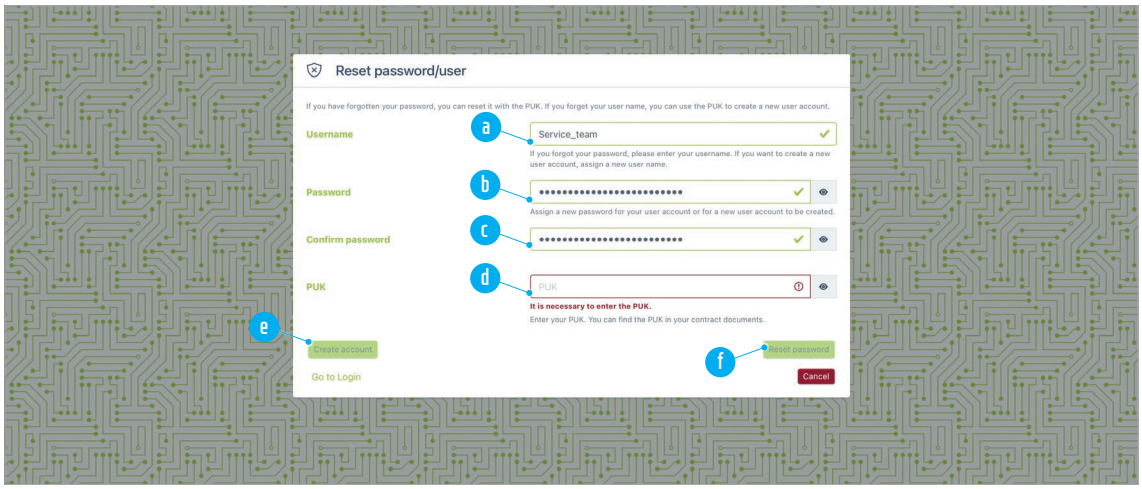
Resetting a password

1



If you have lost your password, user name or both, click on “Forgot your credentials?” a on the login page.

7



In the next dialogue box, enter your user name in the field “Username” a or, if you have forgotten it, a new one. In the two fields “Password” b and “Confirm password” b, you must enter your new password. In the field “PUK” c the PUK must now be entered. If you did not write down the PUK, you can find the PUK on a black sticker on the left side of the KC4S casing (on the side of the DIO). After entering the PUK, click either on “Create account” d if you also want to set up a new user name, or on “Reset password” e if you only need to reset the password.

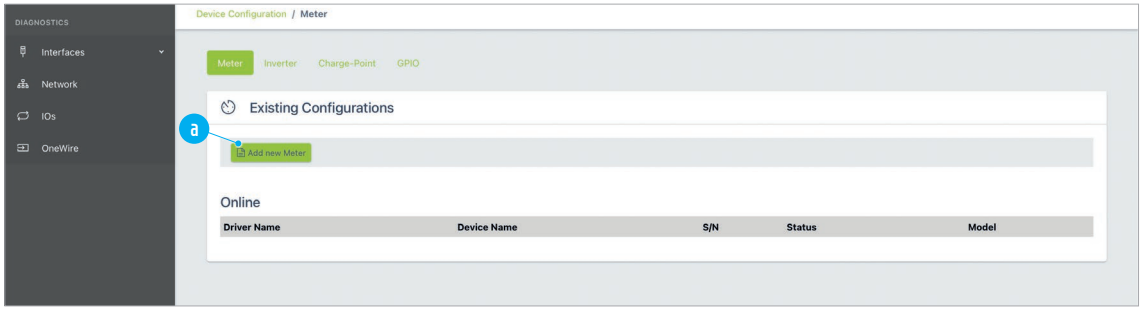
8 TOPOLOGY SETUP

8.1 SETTING UP LOGICAL DEVICES

The devices whose setup is described in this section are referred to as "logical devices". In contrast, all devices that you will go on to set up in the topology (see section "8.2 Setting the topology" on page 51) are described as "physical devices". Later, logical and physical devices will be linked with each other, as described in the section "Procedure – Adding physical devices" on page 52.

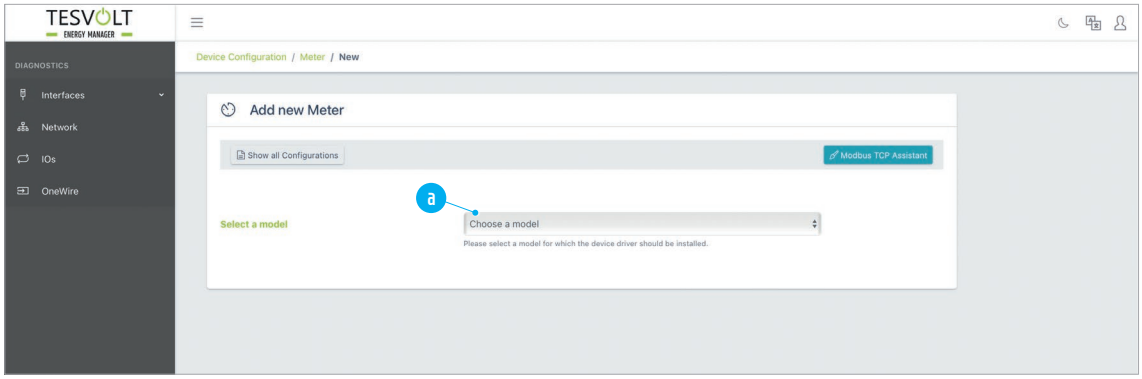
Meter configuration

1



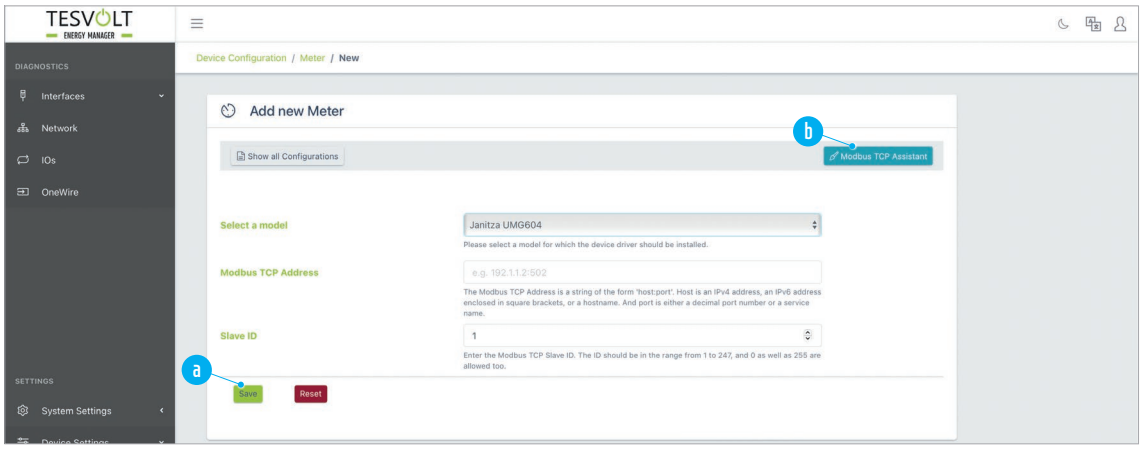
Log into the TESVOLT Energy Manager and access the page "Existing Configurations" (Meter). In the side menu, click on: "Device Settings" → "Meter" and then on the button "Add new Meter" a.

2



On the window that appears, click on "Choose a model" a and select the type of meter used from the drop-down menu (e.g. Janitza UMG 604).

3



Fill in the fields and then click on the "Save" button a. If you know the IP address of the meter and this is already in operation, you can simply copy the address using the Modbus TCP Assistant, rather than entering it. To do this click on the button b and select the IP address of the meter from the drop-down menu. The address is saved to the clipboard and can be pasted in the field "Modbus TCP Address".

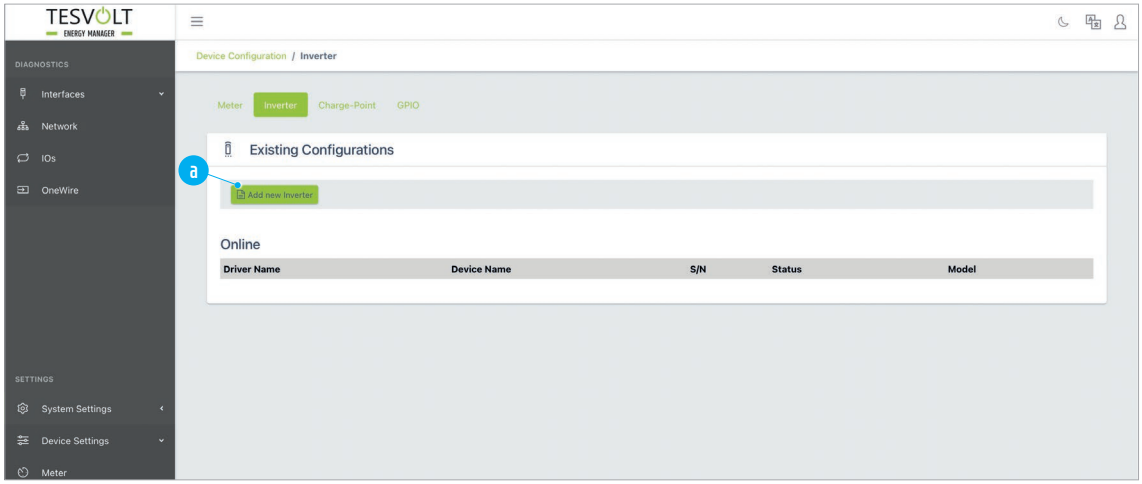
NOTE: If you are using a meter from Janitza or SIEMENS, please note:
- The default value for the port is :502 (e.g. 192.168.29.8:502).
- The default Modbus slave ID is 1. In Janitza meters it can be changed if necessary in the meter configuration.

4 The page "Existing Configurations" is now loaded again. If the added meter is already in operation and online, the new meter will appear in the "Online" list after 20 seconds at the latest. If the meter is not yet online/operational, it is found in the "Offline" list.

5 The second meter and any additional meters can then be added in the same way. The meter installation location (utility grid transmission/inverter) is assigned during the topology assignment (see section "8.2 Setting the topology" on page 51 et seq.) and for TS-I HV systems with backup functionality, additionally in the configuration of the PCS.

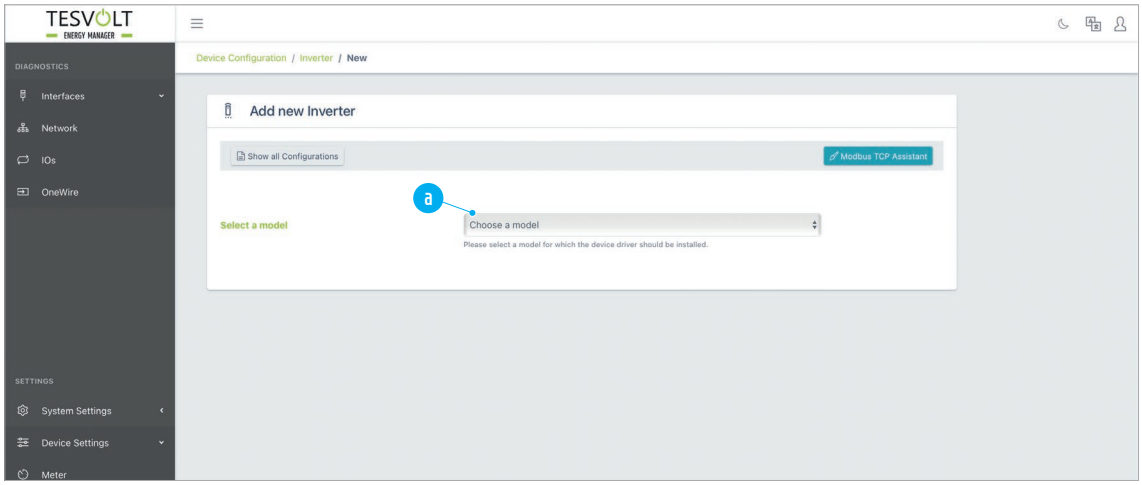
Battery inverter configuration

1



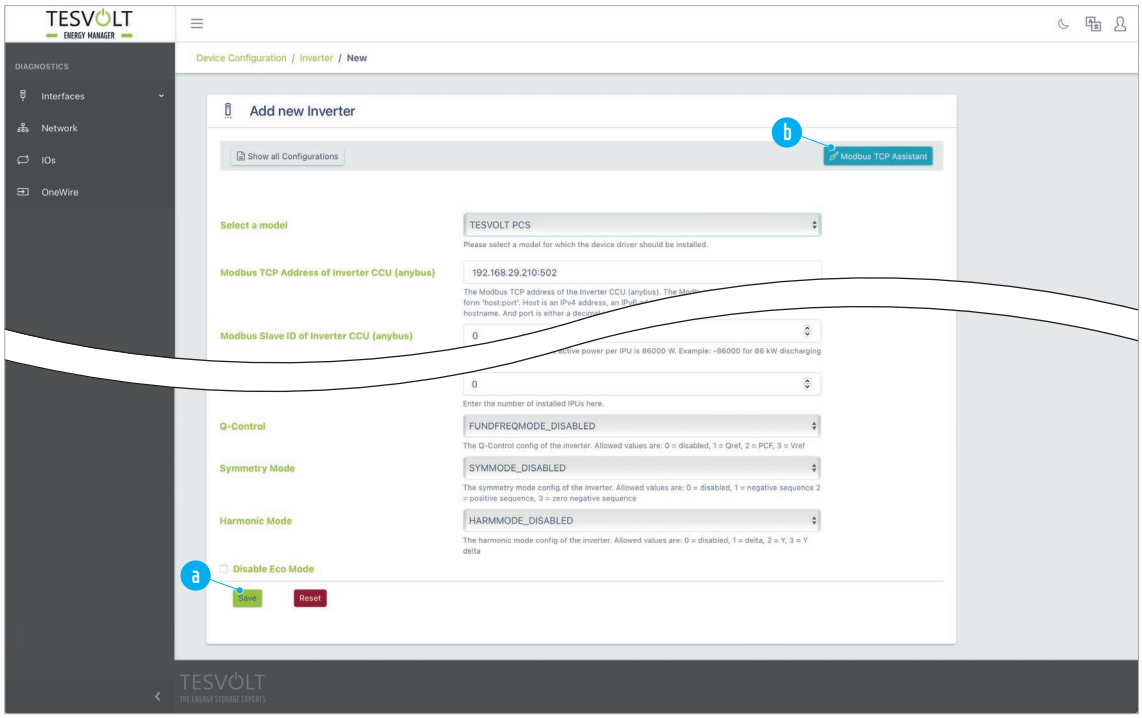
Log into the TESVOLT Energy Manager and access the page "Existing Configurations" (Inverter). In the side menu, click on: "Device Settings" → "Inverter" and then on the button "Add new Inverter" a.

2



On the page that appears, click on "Choose a model" a and select the type of inverter used from the drop-down menu (e.g. TESVOLT PCS).

3



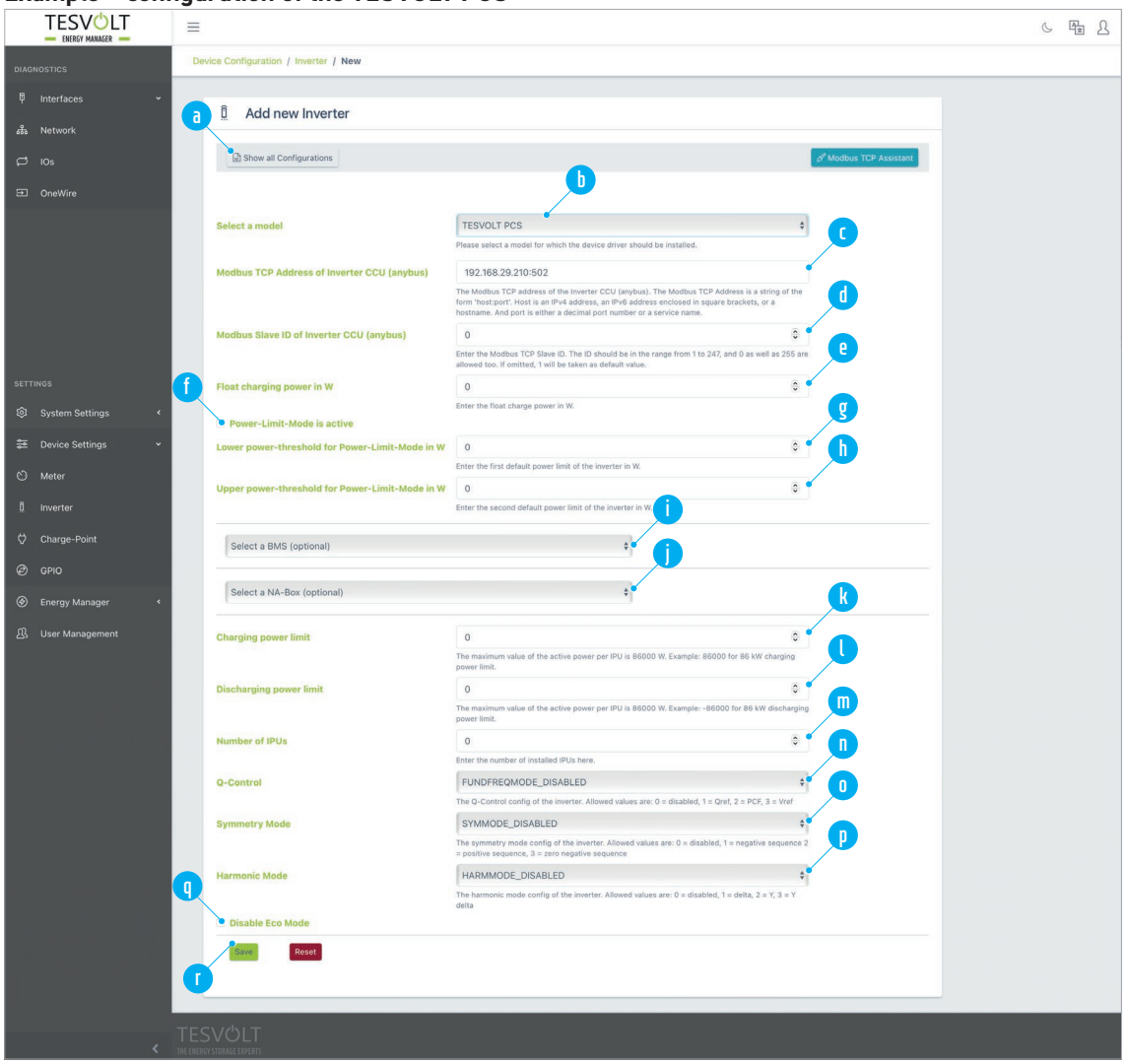
Fill in the fields and then click on the "Save" button a. If you know the IP address of the inverter and this is already in operation, you can simply copy the address using the Modbus TCP Assistant, rather than entering it. To do this click on the button b and select the IP address of the inverter from the drop-down menu. The address is saved to the clipboard and can be pasted in the field "Modbus TCP Address".

NOTE: SMA Data Manager

You can also use the configuration wizard to set up the SMA Data Manager.

Example – configuration of the TESVOLT PCS

1



a **Show all Configurations** > Back to overview of battery inverters

b **Select a model** > Drop-down menu to select the type of battery inverter

c **ModbusTCP Address of Inverter CCU (anybus)** > Enter the Modbus TCP address of the battery inverter here. This is stored on the SD card and is also shown on a sticker on the CCU.

d **Modbus Slave ID of Inverter CCU (anybus)** > Modbus slave ID of the inverter.
The default value is "0".

e **Float charging power in W** > Enter what power should be used for float charging the batteries (e.g. 1,000 W per IPU plus 1,000 W if a transformer is present).

f **Power-Limit-Mode is active** > Using the power limit function, the inverter can limit the power via the MIO (e.g. physical peak shaving with control speed <1 ms). However, a specific system configuration is required for this.
If necessary, please contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

g **Lower power-threshold for Power-Limit-Mode in W** > The default value is "0".

h **Upper power-threshold for Power-Limit-Mode in W** > The default value is "0".

i **Select a BMS (optional)** > Drop-down menu to select a BMS

j **Select a NA-Box (optional)** > Drop-down menu to select the NA-Box used

k **Charging power limit in W** > Limits the charging power to the value set (positive value).

l **Discharging power limit in W** > Limits the discharging power to the value set (negative value).

m **Number of IPUs** > Enter the number of active IPUs.

n **Q-Control** > Configuration of the Q-Control (FUNDFREQMODE_DISABLED, FUNDFREQMODE_QREF, FUNDFREQMODE_PCF, FUNDFREQMODE_VREF)

o **Symmetry Mode** > Configuration of the Symmetry Mode (on/off)

p **Harmonic Mode** > Configuration of the Harmonic Mode (on/off)

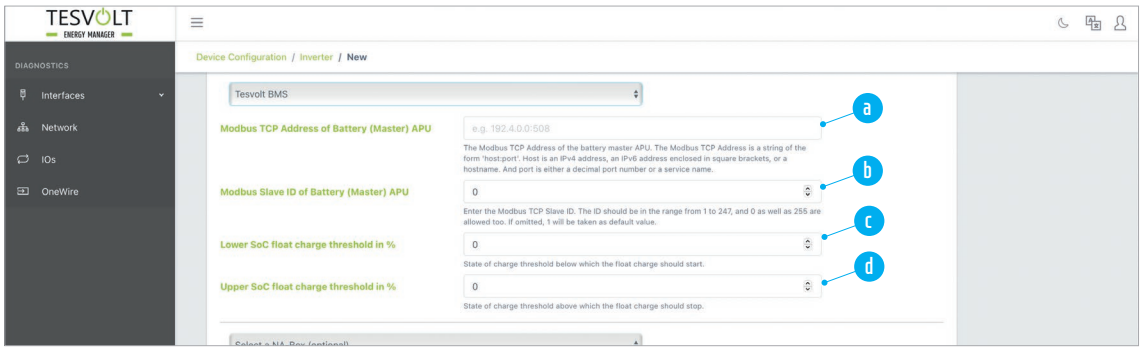
q **Disable ECO Mode** > If the fastest response times in the millisecond range are required, ECO Mode must be disabled.

r **Save**

2 Enter the values in the fields on the screen according to the explanations above.

3 Then click on "Save" r to apply the settings.

4 Where "TESVOLT EMS" is selected in Step 1 i, use the following settings:



a **Modbus TCP Address of Battery (Master) APU** > Enter the Modbus TCP address of the battery (master) APU here. You can display the IP address via the APU display (2nd page). Remember to enter port :502.

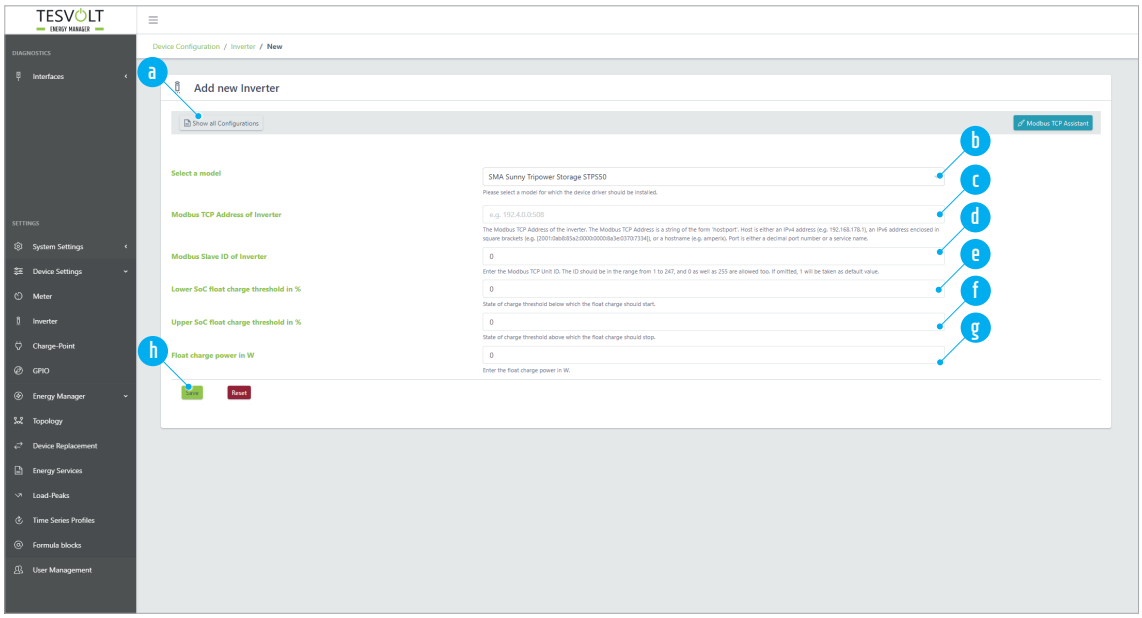
b **Modbus Slave ID of Battery (Master) APU** > Enter the slave ID of the battery (master) APU here. The default value is "0".

c **Lower SoC float charge threshold in %** > The threshold for the float charge defines the lower limit of the depth of discharge protection zone as a percentage of the state of charge. If it goes below this value, the battery system recharges itself back to the upper limit d, at a power level corresponding to the value set for "Float charging" in Step 1 e.

d **Upper SoC float charge threshold in %** > Defines the upper threshold of the depth of discharge protection zone as a percentage of the state of charge. Above this value, the float charging is stopped and the battery system switches to standby mode.

Example – SMA STPS X configuration

1



a **Show all configurations** > Back to the inverter overview

b **Select a model** > Drop-down-menu to select the type of battery inverter (depending on the power rating SMA Sunny Tripower Storage STPS30 or SMA Sunny Tripower Storage STPS50)

c **Modbus TCP address** > ModbusTCP address of the SMA STPS X (default: Port 502, you must enter the port!)

d **Slave ID** > Slave ID of the SMA STPS X (default: 3)

e **Lower SoC trickle charge threshold in %** > The threshold for the trickle charge defines the lower limit of the depth of discharge as a percentage of the state of charge. If it falls below this value, the battery system recharges itself back to the upper limit f, at a power level corresponding to the value set for the trickle charge g. (Default: 1%)

f **Upper SoC trickle charge threshold in %** > Defines the upper threshold of the depth of discharge protection zone as a percentage of the state of charge. Above this value, the trickle charging is stopped and the battery system switches to standby mode. (Default: 3 %)

g **Trickle charge power in W** > Enter the power to be used for trickle charging the batteries (default: 1,000)

h **Save**

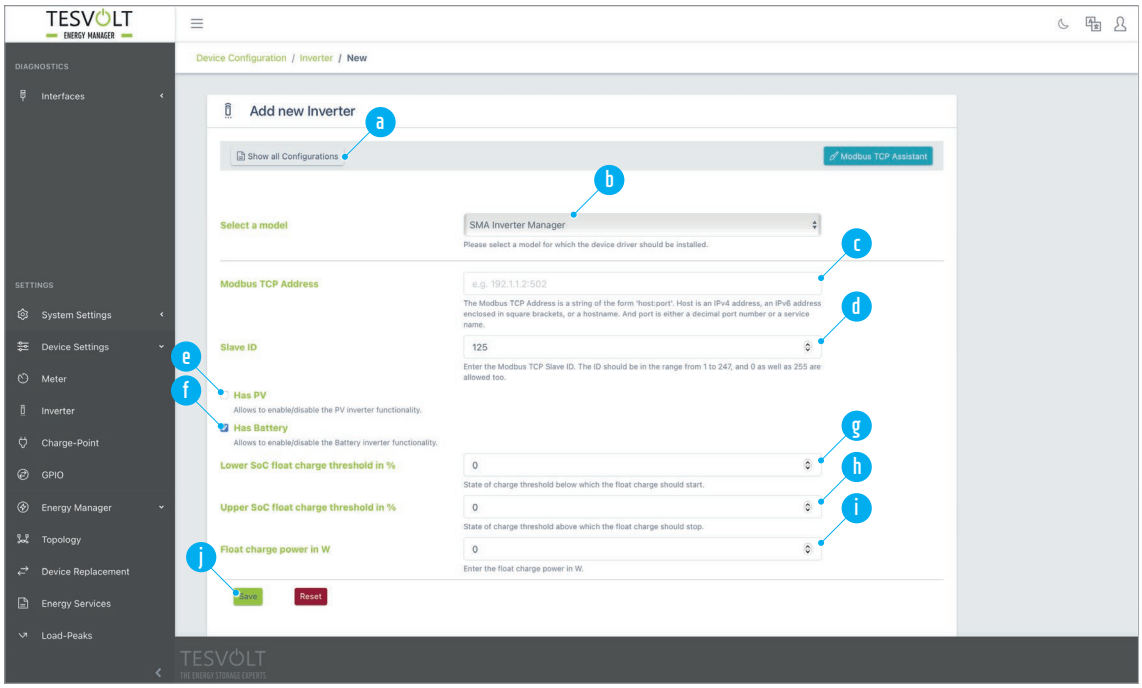
2 Enter the values in the fields on the screen according to the explanations above.

3 Then click on “Save” h to apply the settings.

NOTE: When the upper SoC trickle charge threshold has been reached, trickle charging is stopped — until the upper SoC trickle charge threshold is exceeded again. As a result of the battery inverter’s self-consumption, the battery falls to the lower SoC trickle charge threshold if there is no charging. It recharges itself back to the upper SoC trickle charge threshold at a power level corresponding to the value set for trickle charging.

Example – SMA Inverter Manager configuration

1



- a **Show all configurations** > Back to the inverter overview
- b **Choose a model** > Drop-down menu to select the type of battery inverter
- c **Modbus TCP address** > ModbusTCP address of the SMA Inverter Manager (IMPORTANT: Port 502)
- d **Slave ID** > Slave ID of the SMA Inverter Manager (default: 125)
- e **Has PV** > Must always be set to "Off" (tick box not ticked)
- f **Has battery** > Must always be set to "On" (tick box ticked)
- g **Lower SoC trickle charge threshold in %** > The threshold for the trickle charge defines the lower limit of the depth of discharge protection zone as a percentage of the state of charge. If it falls below this value, the battery system recharges itself back to the upper limit h, at a power level corresponding to the value set for "Trickle charging" i. (Default: 1 %)
- h **Upper SoC trickle charge threshold in %** > Defines the upper threshold of the depth of discharge protection zone as a percentage of the state of charge. Above this value, the trickle charging is stopped and the battery system switches to standby mode. (Default: 3 %)
- i **Trickle charge power in W** > Enter the power to be used for trickle charging the batteries (default: 1,000)
- j **Save**

2 Enter the values in the fields on the screen according to the explanations above.

3 Then click on "Save" j to apply the settings.

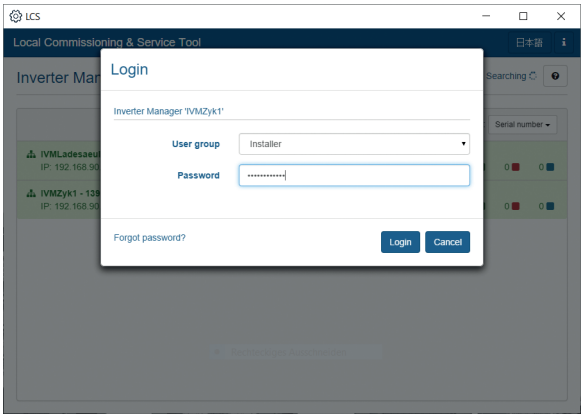
NOTE: When the upper SoC trickle charge threshold has been reached, trickle charging is stopped, until the upper SoC trickle charge threshold is exceeded again. As a result of the battery inverter's self-consumption, the battery falls to the lower SoC trickle charge threshold if there is no charging. It recharges itself back to the upper SoC trickle charge threshold at a power level corresponding to the value set for trickle charging.

Settings in the SMA Inverter Manager

NOTE: The SMA STPS-60 battery inverter must already be commissioned and updated to the latest software version (2.05.007, released 19 September 2024).

NOTE: The software version of the LCS tool must match the firmware installed on the SMA STPS.

1

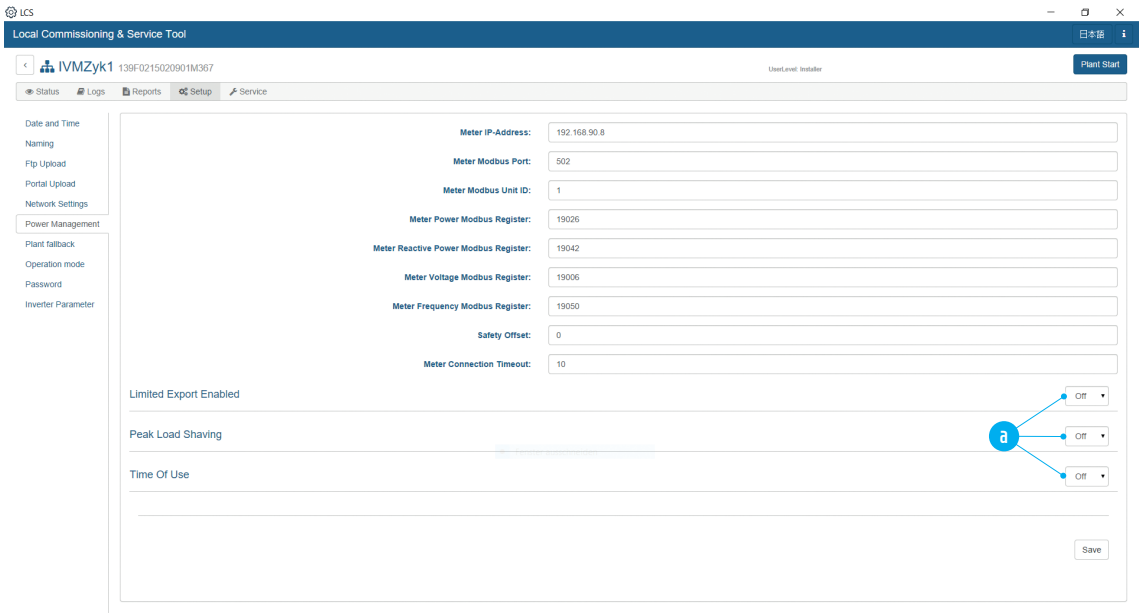


Log in to the LCS tool as "Installer". The password can be found on the device unless it has been changed.

2 Check the firmware version of the inverter. Do this by clicking on the right arrow keys in the inverter display until "communication version" is displayed. The version of the LCS tool can be queried using the "i" symbol in the top right corner of the programme window.

3 If the firmware versions do not match, carry out any necessary updates to make them match.

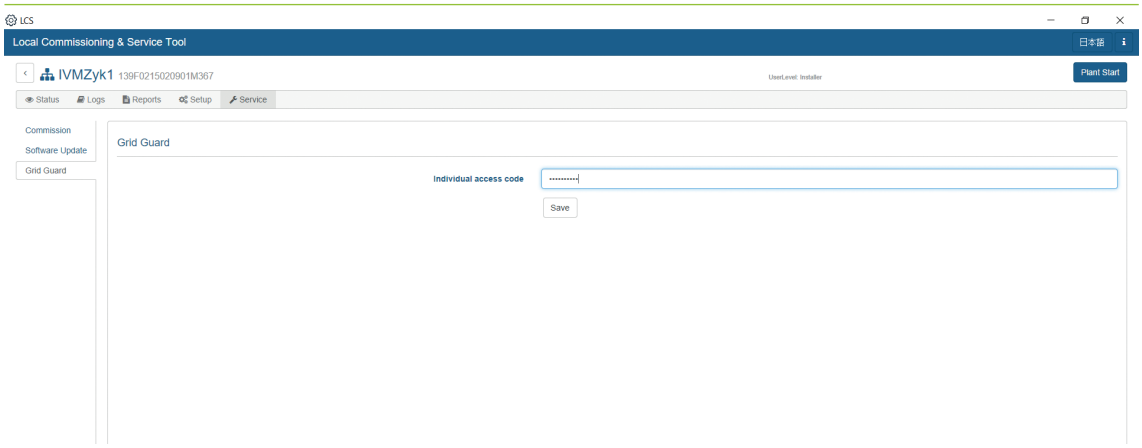
4



Open the "Power Management" page from the "Setup" menu. Do not change the grid meter settings. Please note that with the Janitza 604 the maximum number of reading devices is five.
For control via Modbus, all applications a on this page must be set to "Off". No Modbus commands are executed if time of use or peak load shaving are active. "Limited export enabled" is already deactivated in the normal configuration of the Inverter Manager.

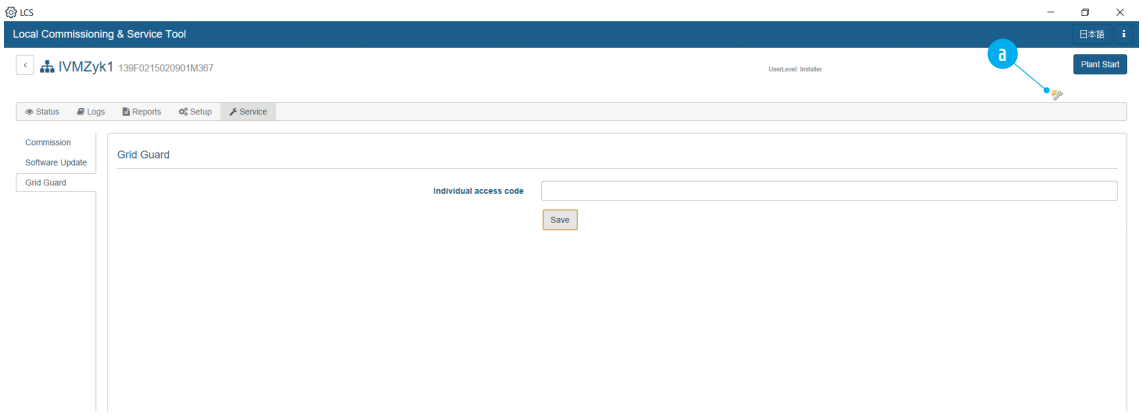
NOTE: A personal Grid Guard code is required for the following configuration steps. You must request this code from SMA.

5



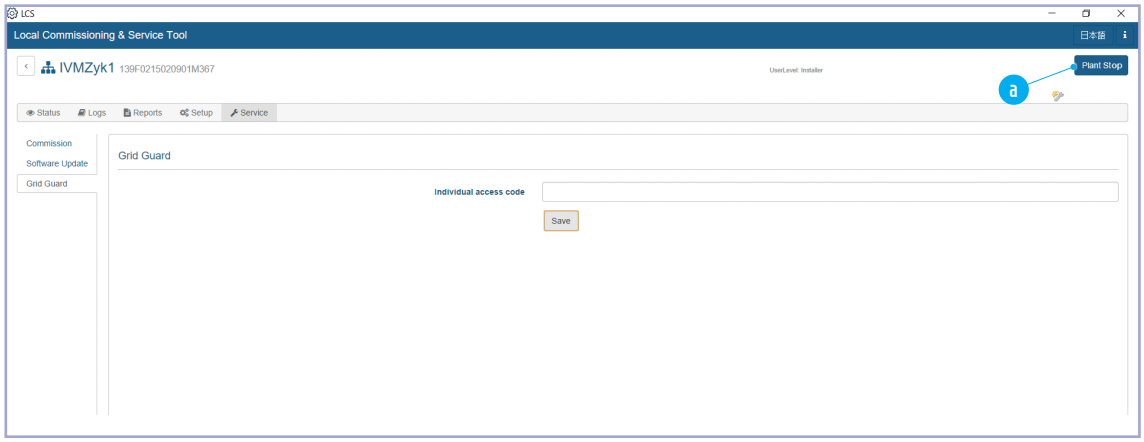
Go to the "Service" menu on the "Grid Guard" page and enter your personal Grid Guard code.

6



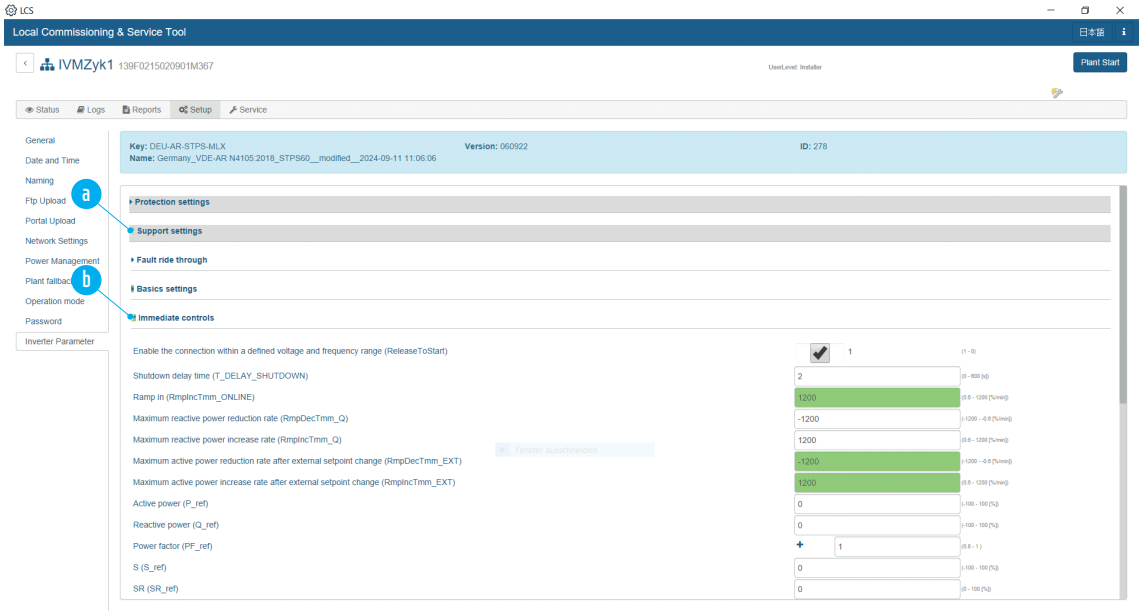
Successful entry is indicated by a message and a symbol a in the top right corner:

7



Before making the next changes, please stop the inverter(s)using the "Plant Stop" button a. If the inverter(s) is/are switched off, the button is labelled "Plant Start".

8



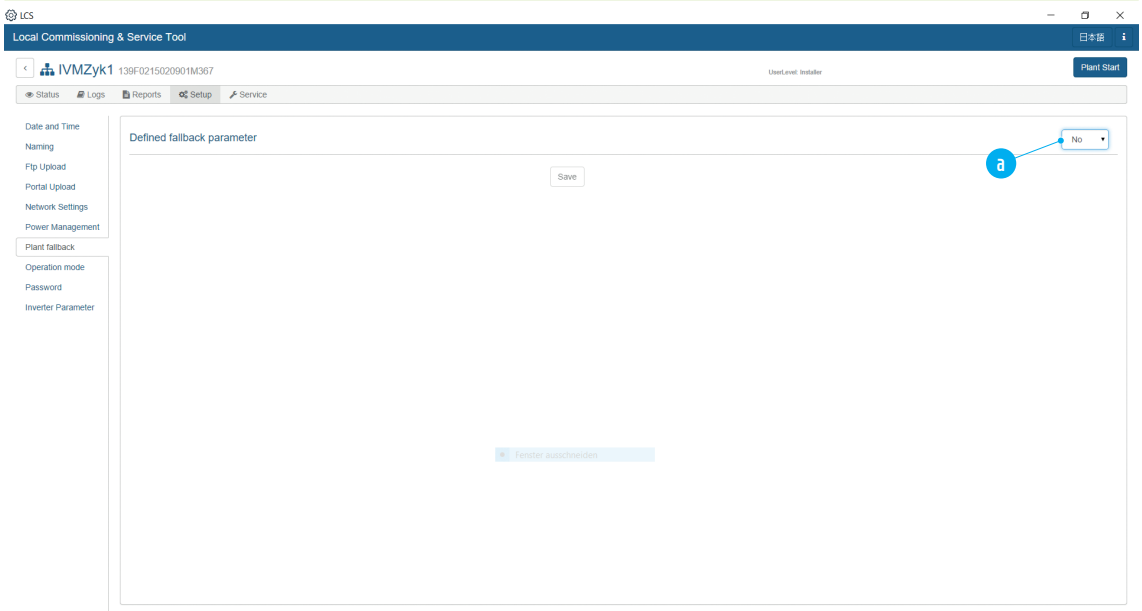
Go to the "Inverter Parameters" page via the menu item "Setup". Loading these parameters may take several minutes. On this page, open the "Support Settings" (a) section and then the "Immediate controls" subsection (b).
Change the following parameters (marked green in the figure):

Parameter	**New value**
Ramp In (RmpIncTmm_ONLINE)	1200%/min
Maximum active power reduction rate after external setpoint change (RmpDecTmm_EXT)	-1200%/min
Maximum active power increase rate after external setpoint change (RmpIncTmm_EXT)	1200%/min

Save the changes by clicking the "Save" button. The inverter will then restart.

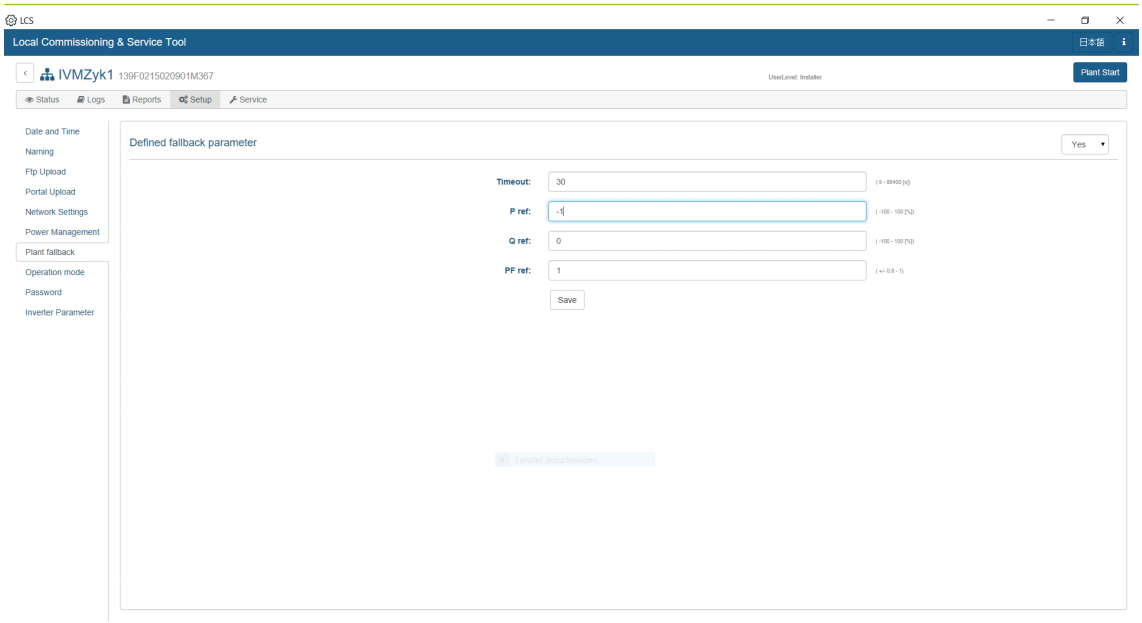
Optional: *Fallback when Modbus communication is interrupted*

1



We recommend using a fallback setting to protect the battery against deep discharge in the event of a prolonged communication interruption between the SMA Inverter Manager and the TESVOLT Energy Manager. To do this, go to "Plant Fallback" in the "Setup" menu and set the switch to "Yes".

10



Once activated, you can define the interruption period “Timeout” after which the inverter should react. We recommend the following settings:

Parameter	**Value**
Timeout	60 s
P ref	-1% (corresponds to charged with 1% of available inverter power)
Q ref	0
PF ref	1 (Power Factor)

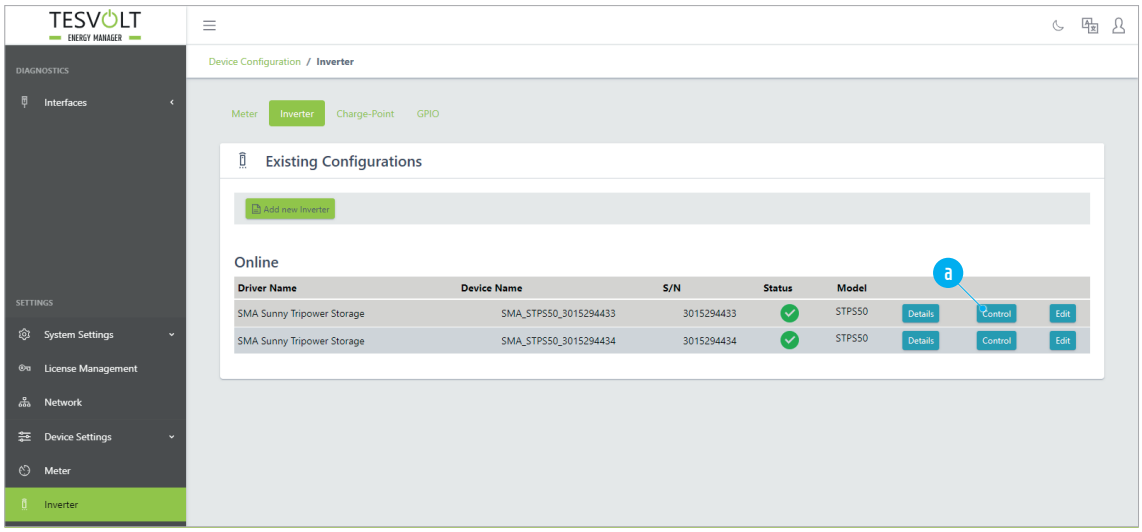
Controlling the inverter

To ensure safe work on the unit, you can control and switch off the selected inverter.

For example, you can activate automatic start/stop mode in the inverter configurations.

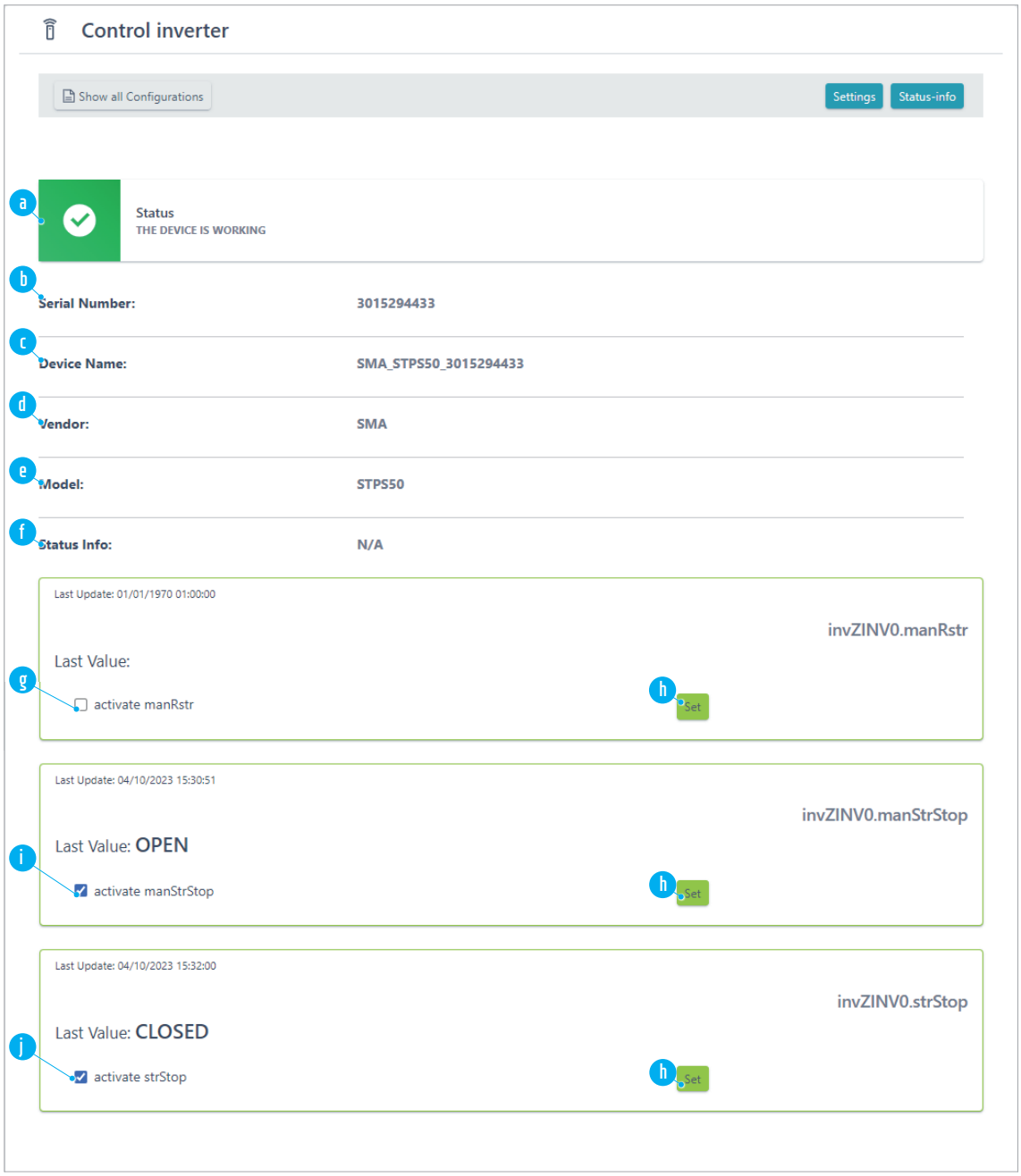
1 Open the unit configurations for the relevant inverter by clicking on “Inverter” in the side menu under “Unit Configurations”.

2



To control the inverter, click the “Control” button a.

3



a Status > Unit status
b Serial number > Display inverter serial number
c Unit Name > Display the inverter unit name
d Manufacturer > Display inverter manufacturer
e Model > Display inverter model number
f Status info > Display status information
g Last value > Activation of manual start
i Last value OPEN > Unit is off – activation of manual start/stop
j Last value CLOSED > Unit is on – activation of start/stop

4 Check the box next to "activate manRstr" g to activate manual start. Then click on "Set" h.

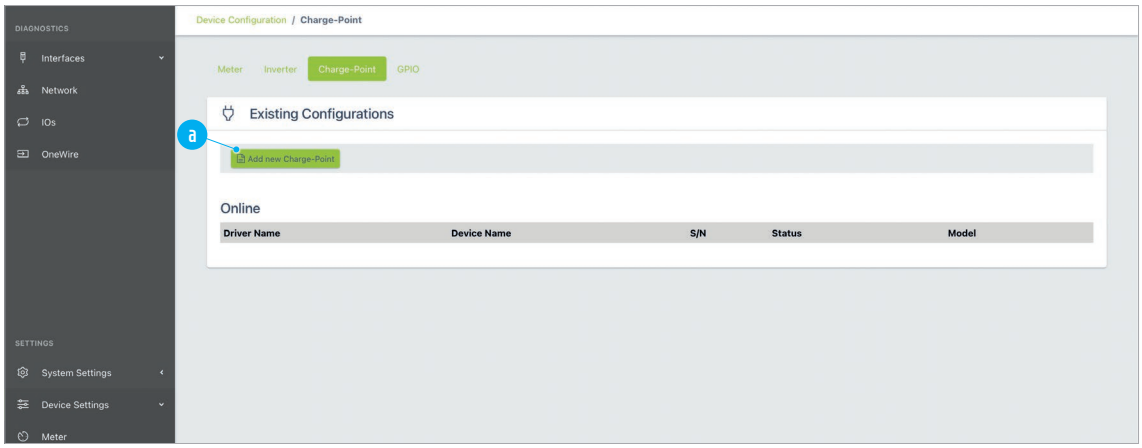
5 Or tick the box next to "activate manStrStop" i to activate the manual start stop. Then click on "Set" h.

6 Or tick the box next to “activate StrStop” j to activate the automatic start/stop mode. Then click on “Set” h.

NOTE: For safety reasons, the settings made here override the settings in the energy services of the switch (see section “Switch/set point” on page 70).

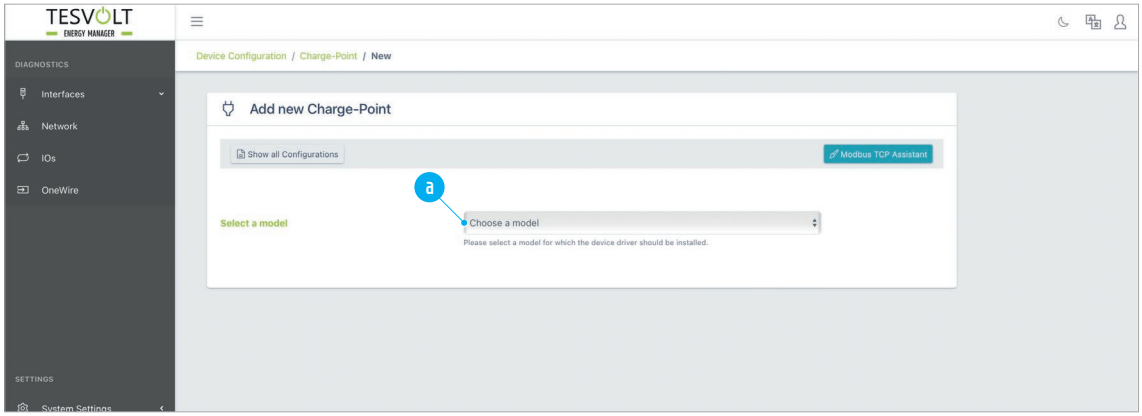
Charge point configuration

1



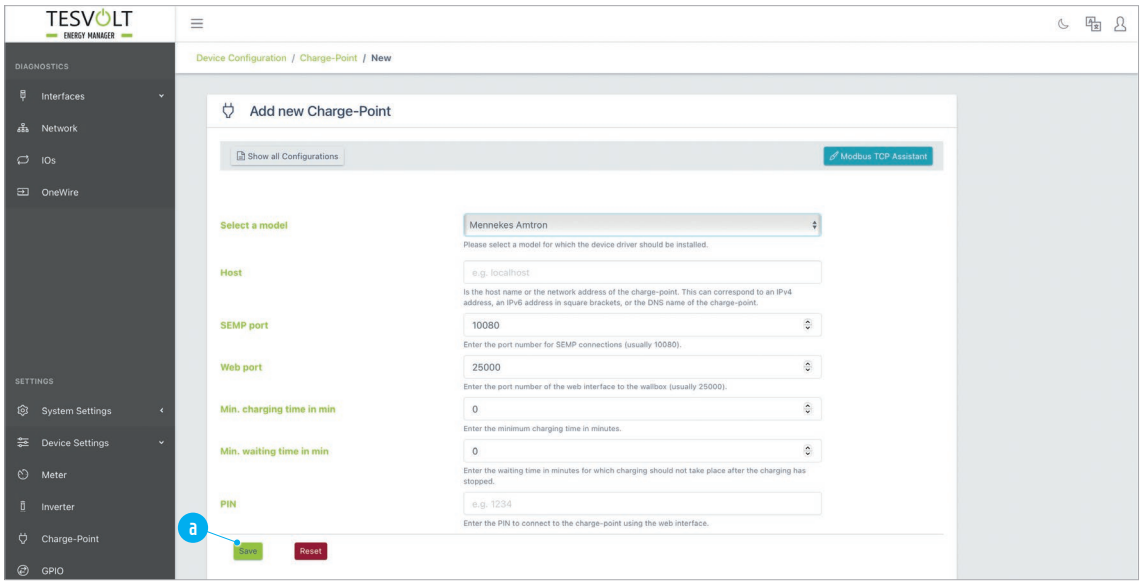
Log into the TESVOLT Energy Manager and access the charge point overview (“Existing Configurations”) via the side menu: “Device Settings → Charge-Point”. Then click on the “Add new Charge-Point” button a.

2



On the page that appears, click on “Choose a model” a and select the type of charge point used from the drop-down menu (e.g. Mennekes Amtron). Then complete the fields.

3

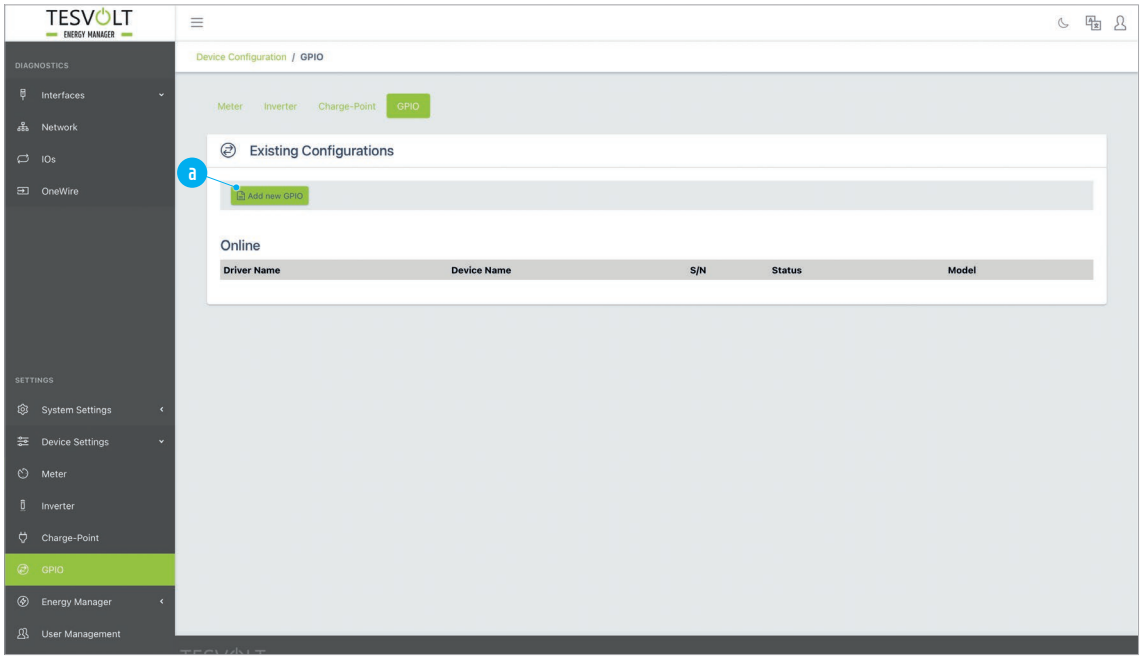


Finally, click on "Save" a, to apply the settings.

Digital outputs (GPIO) configuration

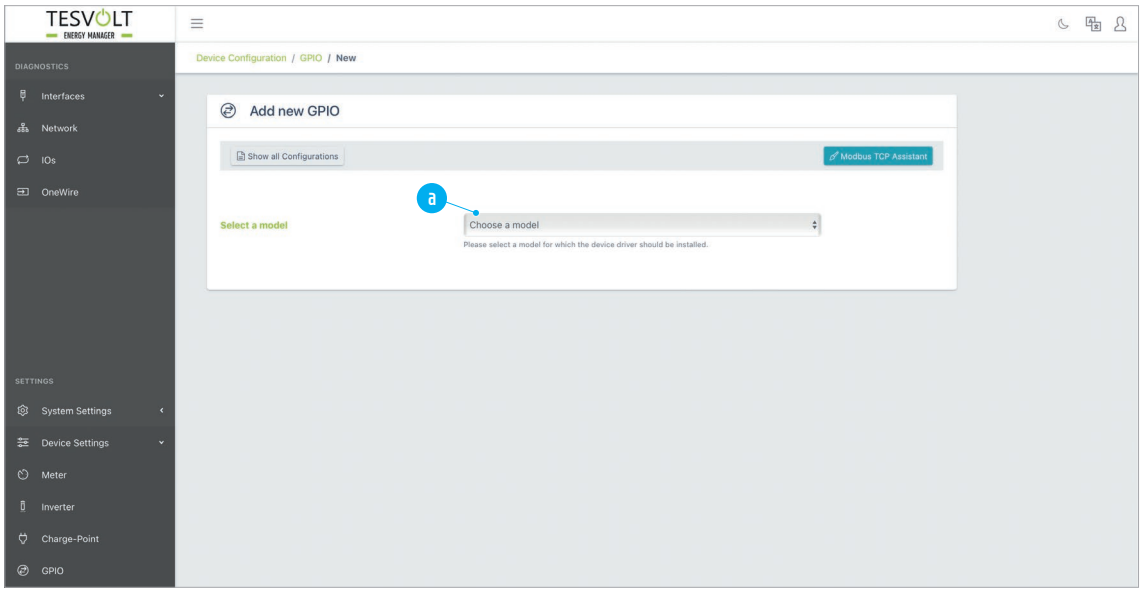
"GPIO" refers to the digital outputs of the TESVOLT Energy Manager (D ①...⑦ and E ①...⑦). The unit has a total of 14 of these outputs, which allow relays for load control or generation control (e.g. for heat pumps that are smart grid ready) to be switched separately. Further information can be found in the section "6.8 DIGITAL OUTPUTS" on page 23.

1



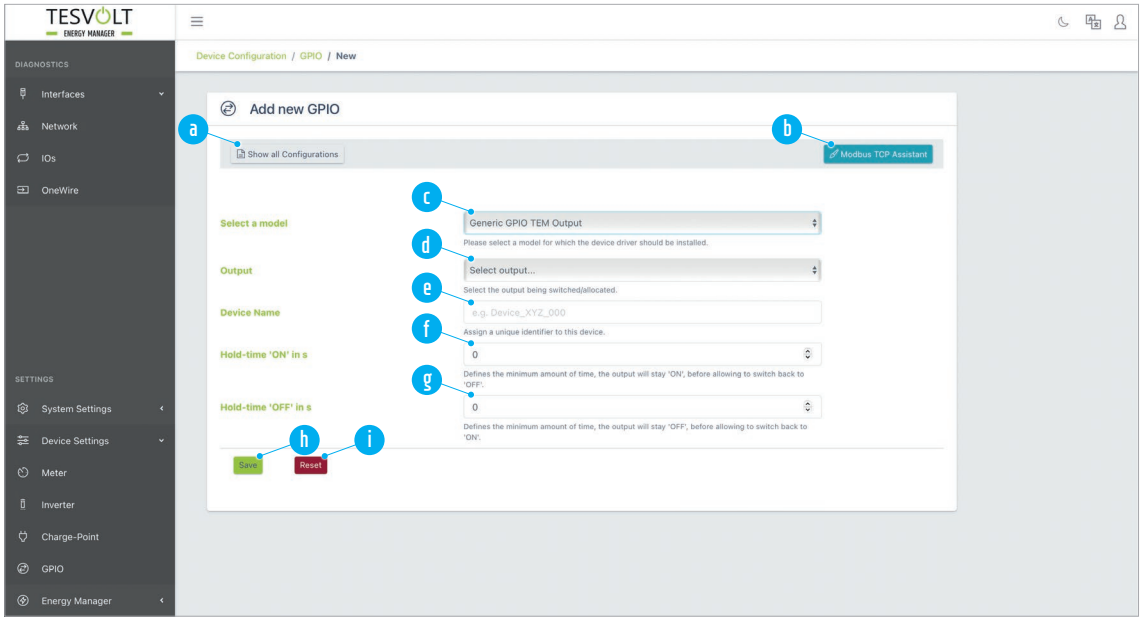
Log into the TESVOLT Energy Manager and access the GPIO overview ("Existing Configurations") via the side menu: "Device Settings → GPIO". Then click on the "Add new GPIO" button a.

2



On the page that appears, click on "Choose a model" (a) and select "Generic GPIO TEM Output" from the drop-down menu.

3



Complete the fields.

- (a) **Show all configurations** > Back to the GPIO overview
- (b) **Modbus TCP assistant**
- (c) **Select a model** > Currently only generic GPIO TEM output
- (d) **Output** > Digital output of the TESVOLT Energy Manager to be used
- (e) **Device name** > Device name can be freely selected for the device to be switched (Warning: the unit cannot be renamed again later.)
- (f) **Hold-time "ON" in s** > Enter the amount of time the output will stay ON before it is possible to switch it OFF again
- (g) **Hold-time "OFF" in s** > Enter the amount of time the output will stay OFF before it is possible to switch it ON again
- (h) **Save**
- (i) **Reset**

4

Then click on "Save" (h) to apply the settings.

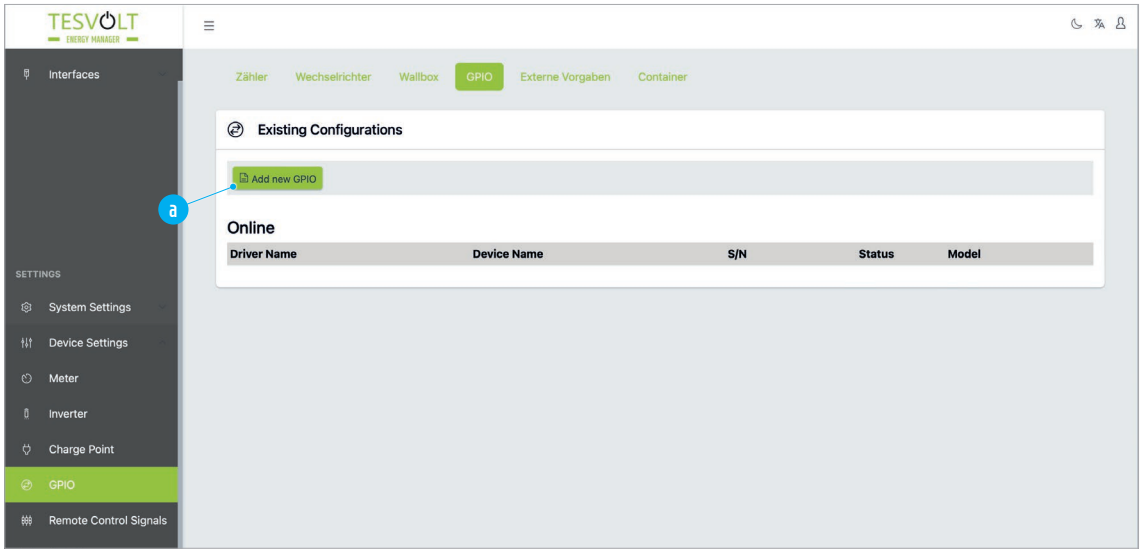
Digital input (GPIO) configurations

The digital and potential-free inputs on a TESVOLT Energy Manager can be used to control the EMS. As soon as there is a signal at a GPIO input, it can be used to determine the outcome of a decision in a decision tree, to control generators/consumers through energy services or for calculations, e.g. in formula blocks. The switching of this input can determine the use of strategies, the power level setting points or other calculations. For this purpose, a specific input is defined which can then be selected in all "Simple Sensors" fields. This enables the targeted use of key switches on wall boxes, control panels in production halls and much more.

For information on connecting the digital inputs of the Energy Manager, see section "5.2 Connections and setup of the TESVOLT Energy Manager" on page 13.

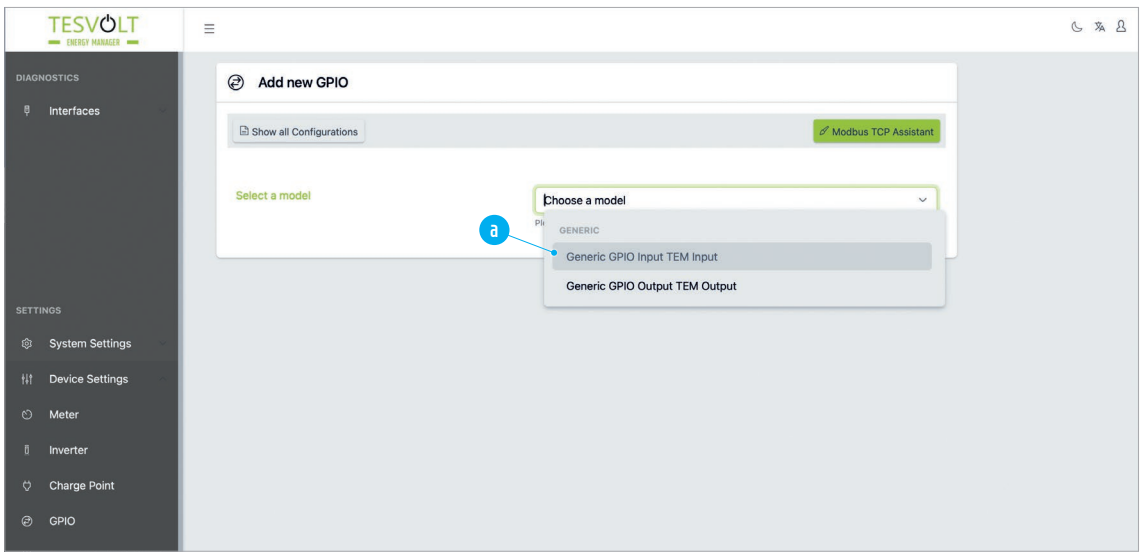
To read and use the GPIO input, proceed as follows:

1



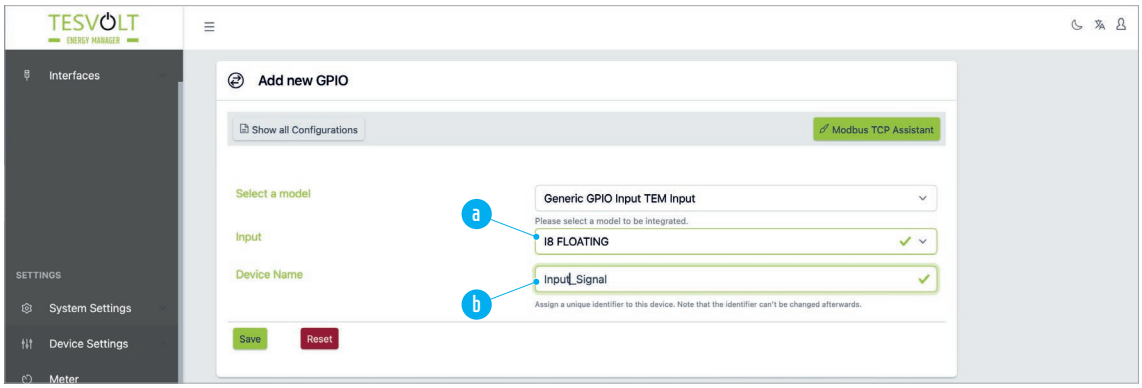
Add a new GPIO by selecting Device Configuration > GPIO from the menu on the side and then clicking on "Add GPIO" a.

2



Select "Generic GPIO Input Amperix Input" under model selection a.

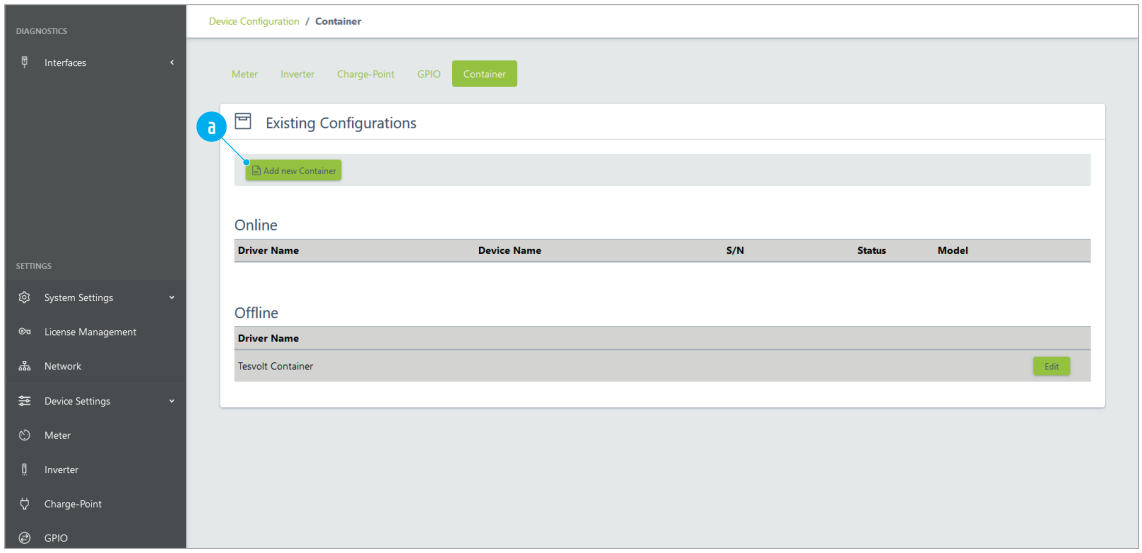
3



Under input a select one of the available inputs. Under device name b enter a name that helps you recognise it. Click "Save" to complete the setup.

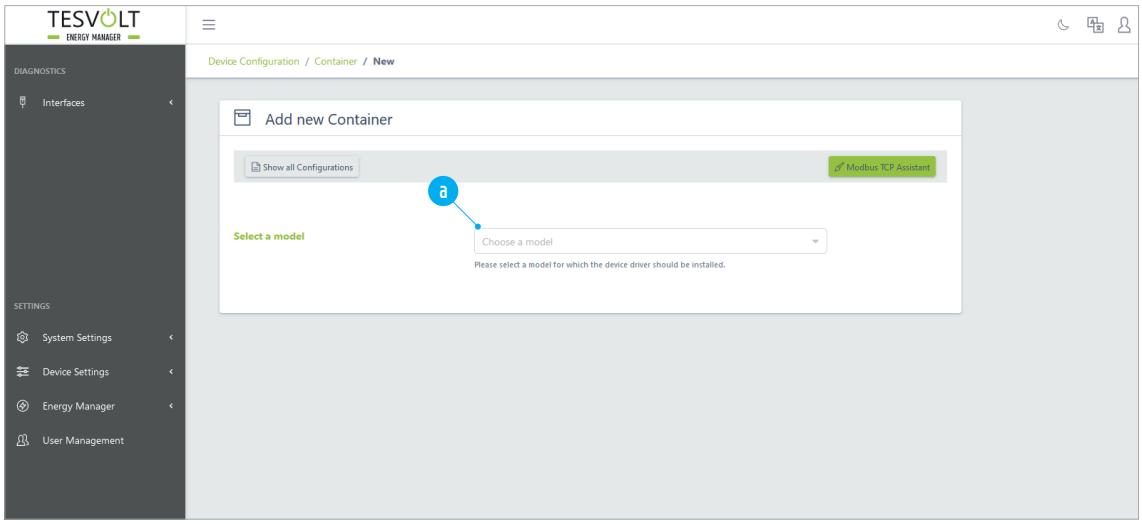
Container configuration

1



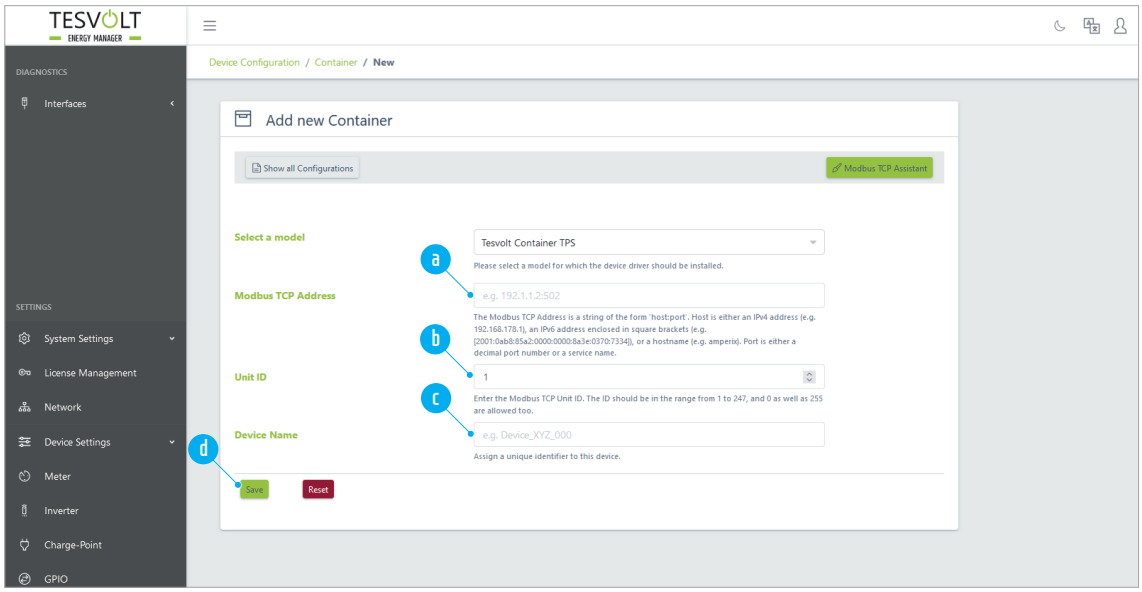
Log into the TESVOLT Energy Manager and access the container overview ("Existing Configurations") via the side menu: "Unit Configuration → Container". Then click on the "Add container" button a.

2



On the page that appears, under "Choose a model", select a "TESVOLT Container TPS" from the drop-down menu.

3



Complete the fields.

a Modbus TCP Address > Here enter the Modbus TCP address and port (:502) of the container.

b Unit ID > Modbus TCP unit ID (default: 1)

c Unit name > Freely selectable name for the unit (warning: the unit cannot be renamed again later.)

4

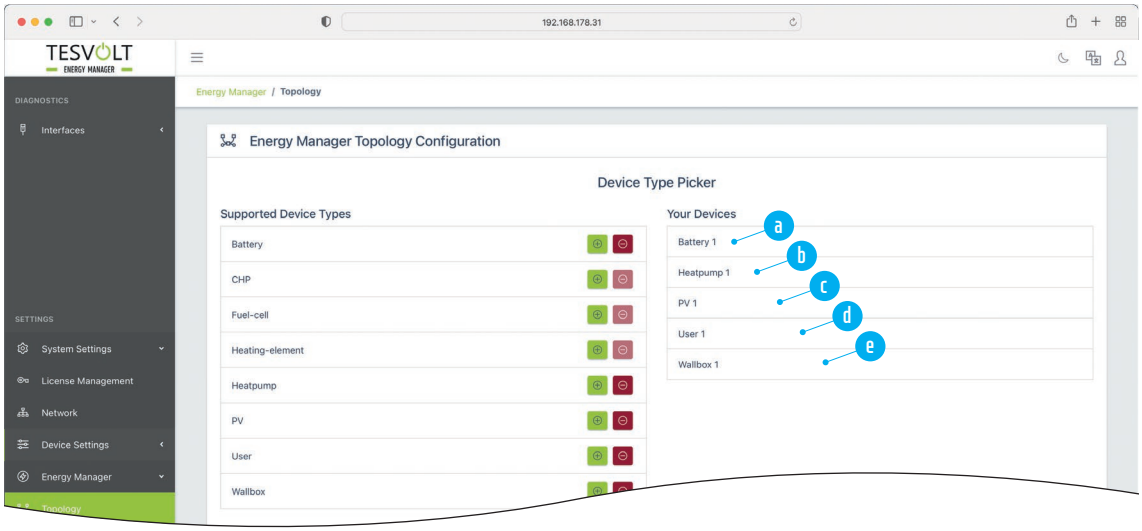
Then click on “Save” d to apply the settings.

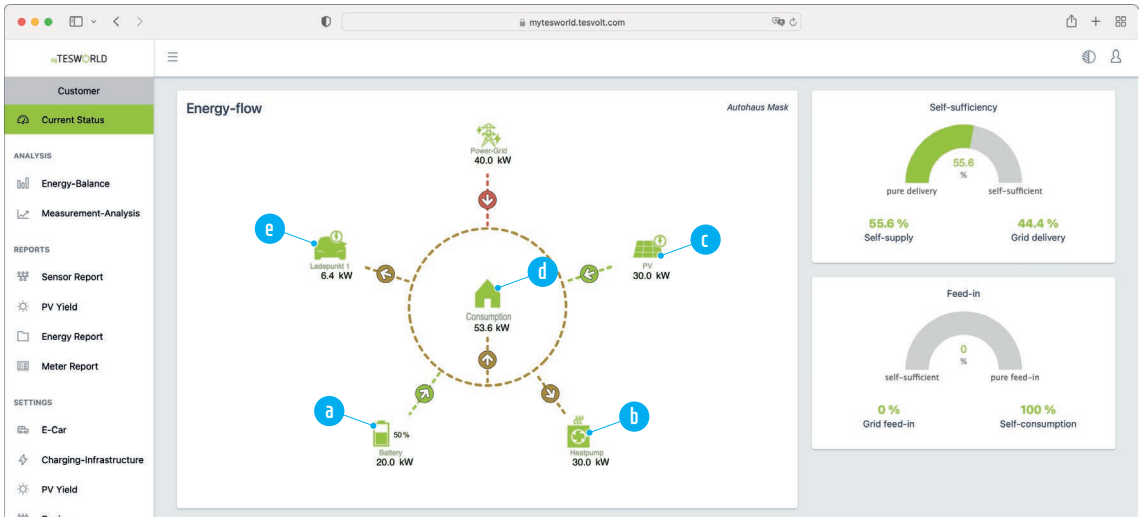
NOTE: Topology settings

Once the unit is configured, the corresponding physical unit in the topology of the TESVOLT Energy Manager must be assigned to the container. For assignment and further procedures for configuring the topology, please refer to section “Procedure – Adding physical devices” on page 52.

8.2 SETTING THE TOPOLOGY

Compatible devices such as meters, battery inverters and charge points have been installed, connected to the TESVOLT Energy Manager and configured in terms of software, as described in the previous section “8.1 Setting up logical devices” on page 33 et seq. This also goes for devices that will be controlled by means of the digital outputs (GPIO), where applicable. Now the TESVOLT Energy Manager must be told how these logical devices stand in relation to each other (e.g. Battery Inverter 1 is connected to Battery 1 and measured by Meter 2). This is one of the purposes served by the topology, but it is also a requirement for accurate visualisation in the myTESWORLD portal and for many energy services.





In order for it to be able to configure and display the relationships between the logical devices, “physical devices” are set up in the Energy Manager topology configuration. These devices are later displayed 1:1 in the myTESWORLD system visualisation. Each physical device must be measured by at least one meter. This does not mean that every physical device requires its own meter, but that its consumption must be able not only to be measured but also clearly identified.

Meter requirements

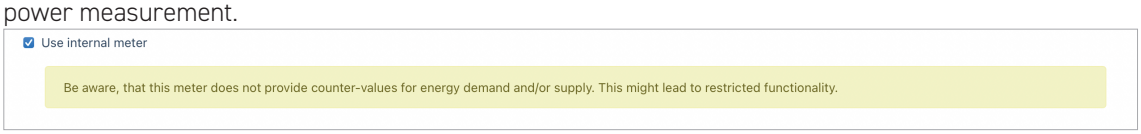
Absolute requirements:

- There are at least as many meters as physical devices.
- All physical devices are measured by at least one meter.
- It must be possible to clearly identify the power of each physical device. For example, it will not work if Battery 1 and Battery 2 are only ever measured together (or not at all) by all meters.

Conditional requirements:

- There must be a utility grid transmission meter, or else the visualisation in myTESWORLD will be limited.

NOTE: Where they exist, internal meters in devices such as inverters can be used, provided that the devices are connected to the TESVOLT Energy Manager by Modbus. However, please be aware of the following important restriction. Not every internal measuring device is suitable for use as a meter for power measurement.



If you want to use the internal meter in this kind of device, it will alert the Energy Manager. In general we advise against the use of these meters within the topology.

Actuator requirements

For implementing energy services, the behaviour of logical devices (which are not meters) is controlled at specific measuring points in accordance with a defined strategy. These logical devices are known as actuators.

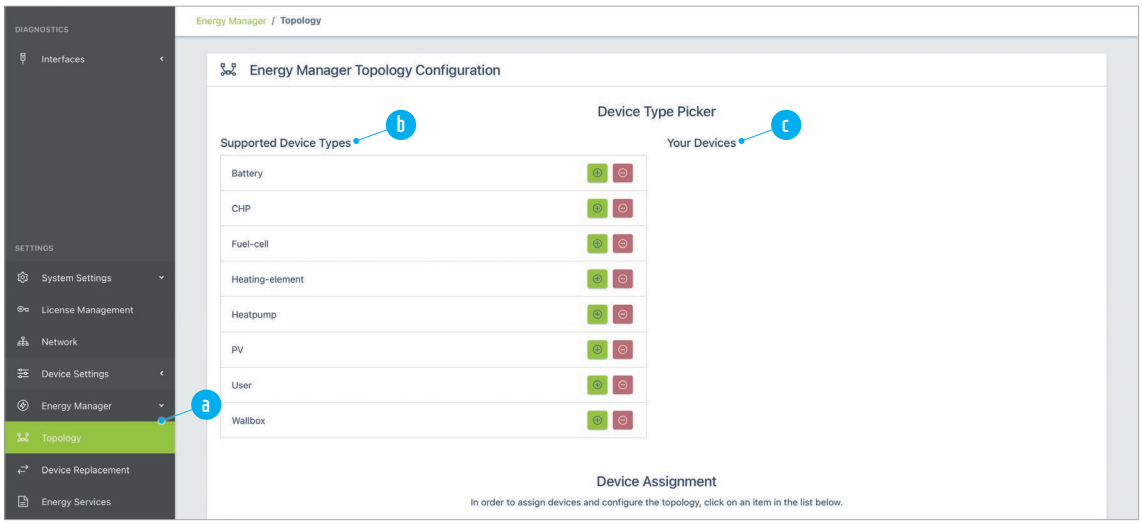
Absolute requirements for actuators:

- Every actuator that is to be used in the energy services must be configured in the topology! The only exception to this is devices controlled via the digital outputs (GPIO). Missing configurations are not recognised by the TESVOLT Energy Manager.
- Two actuators must not affect the same device. The only exception to this is devices controlled via the digital outputs (GPIO).

Procedure – Adding physical devices

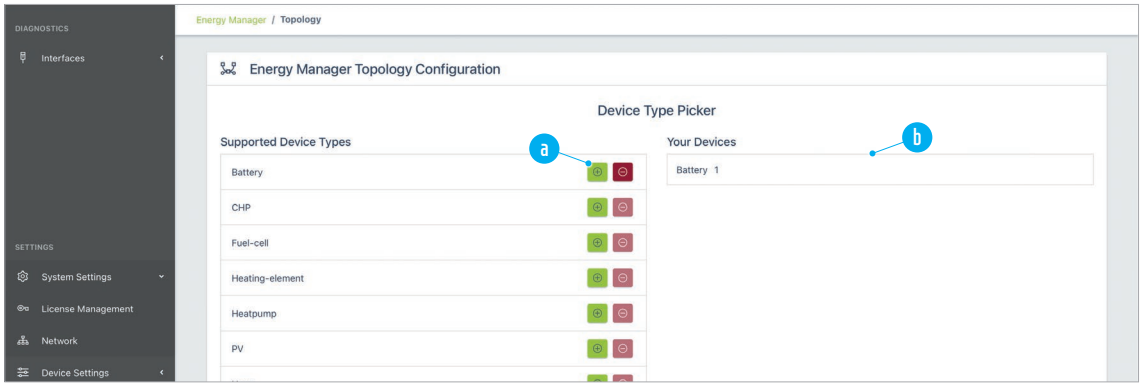
NOTE: We recommend mapping out a circuit diagram of the topology on which all significant system components are represented. As well as the designation for the topology, also note down important parameters such as maximum currents. If you have planned to use SoC-dependent decisions within the framework of a decision tree, it is sensible to create a diagram for this showing the allocation of the capacity of the battery inverter for the various energy services including the respective SoC thresholds.

1



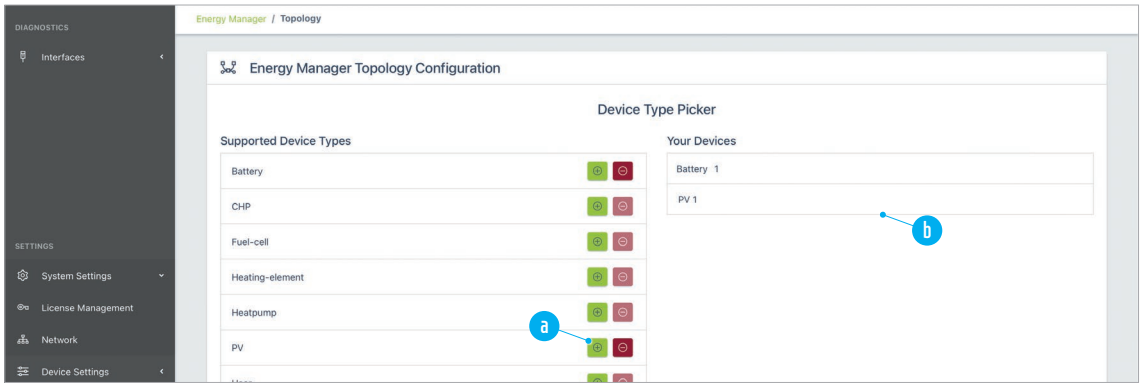
Log into the TESVOLT Energy Manager and in the side menu under “Settings” select “Energy Manager” → “Topology” a. The next steps are first to select the devices in your system in the left-hand column “Supported Device Types” b by clicking on the [+] button, causing them to be added to the right-hand column “Your Devices” c. When adding the physical devices, it is best to proceed in order from top to bottom.

2



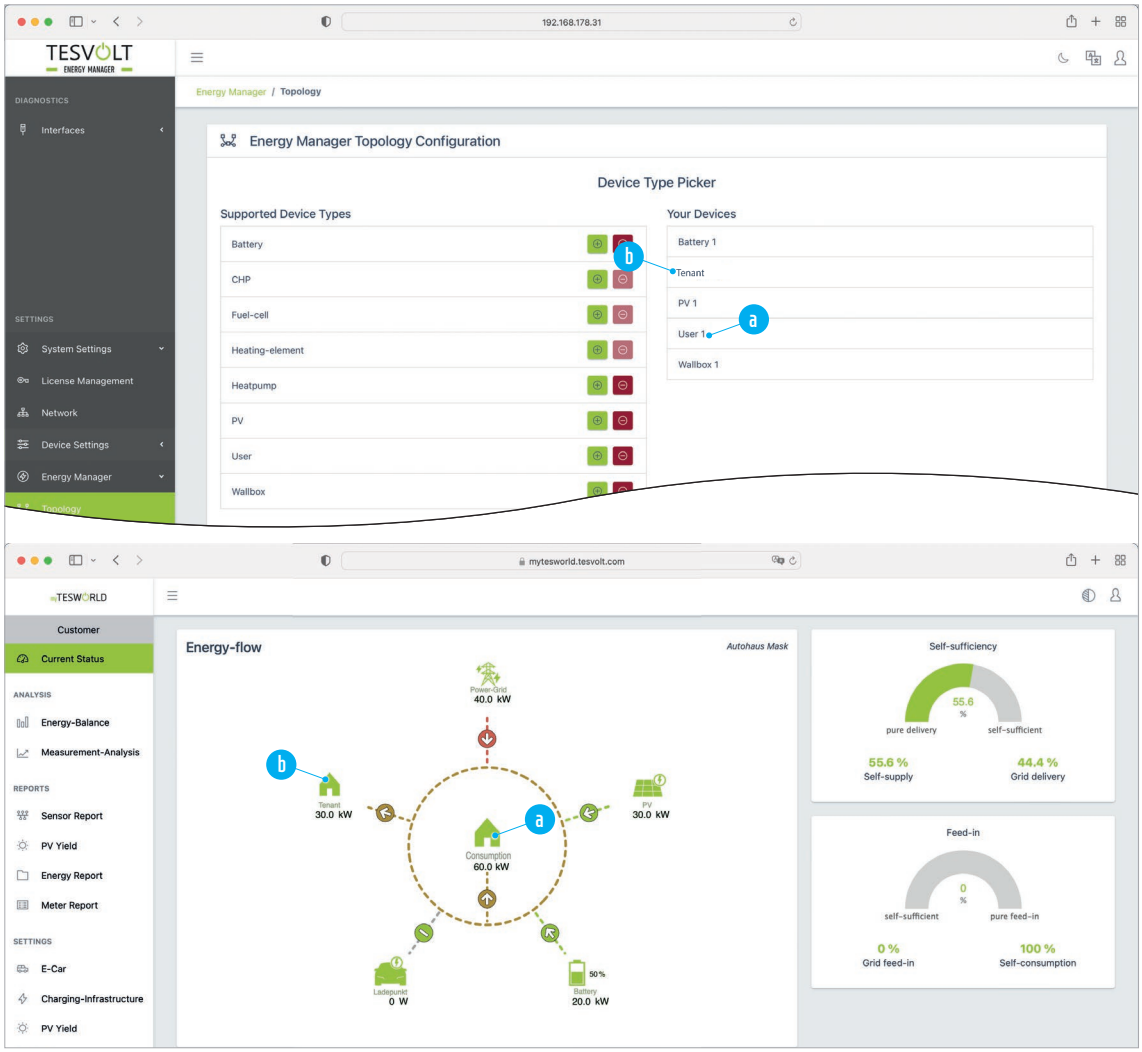
To set up a battery, find the item “Battery” in the “Supported Device Type” list and click on the [+] button at the end of the line a. You will now find the item “Battery 1” b in the “Your Devices” list.

3



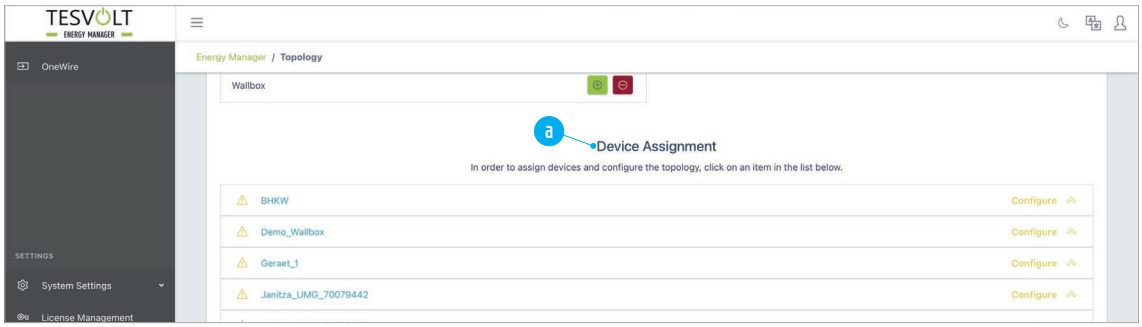
To set up a PV installation, find the item “PV” from the “Supported Device Type” column and click on the [+] button of the item a. “PV 1” will now appear under “Your Devices” b.

NOTE: Power used by unspecified consumers (e.g. household electricity), which is only recorded by the utility grid transmission meter (i.e. the sum of the loads not assigned to a physical device), is automatically assigned to "User 1" by the system. Even though it does not refer to a device in the traditional sense, "User 1" must be set up as a physical device, as this represents unspecified consumption in the middle of the circle of the system visualisation a in the myTESWORLD portal. In accordance with the principle outlined above, users must also be measured by at least one meter and if no specific measurement is taken, calculation is not possible. If more than one user is set up, the additional users b are positioned alongside the other physical devices outside the circle in the visualisation.



4 To set up a user, select the item "User" from the "Supported Device Type" list and click on the [+] button at the end of the line. You will now find the item "User 1" in the "Your Devices" list.

5



In front of each entry in the "Device Assignment" list there is a symbol. The symbols provide information about the logical device type and the colour gives information about the configuration status:

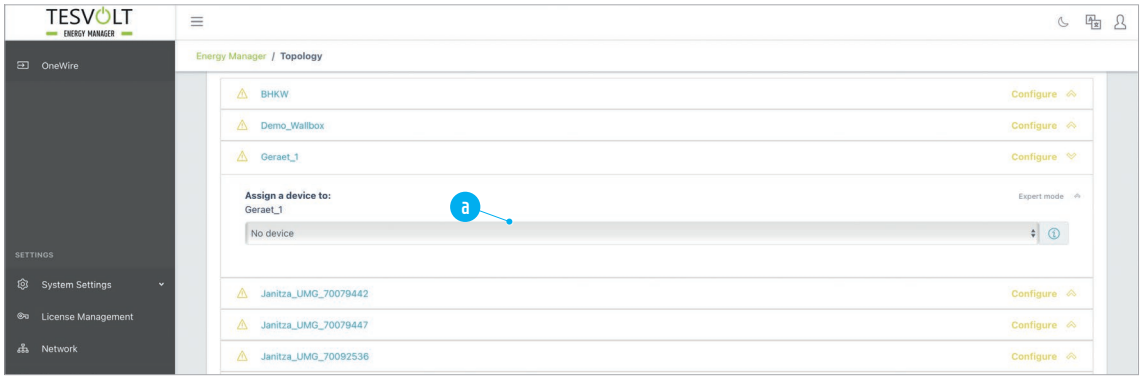
Unconfigured device

Device

Meter

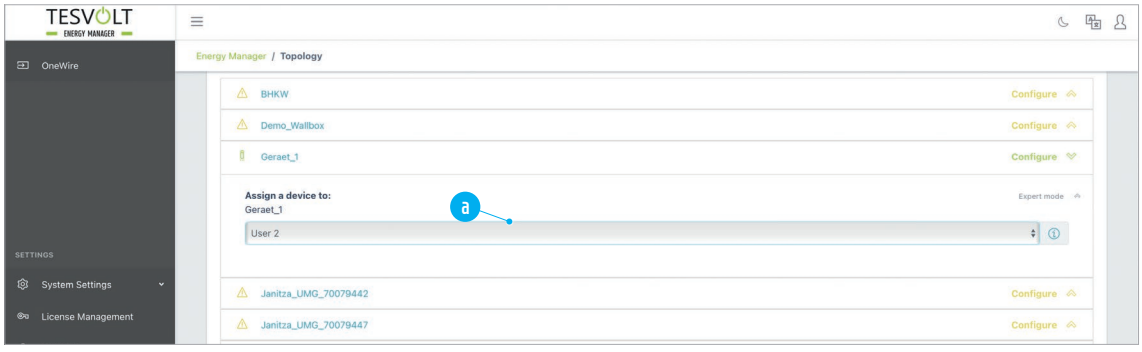
The colour of the entry also provides information about the status of the respective logical device. Yellow entries denote devices that are not yet assigned, while green entries are assigned.

6



Now assign all devices that are not meters. Meters can be recognised by their names, which start with the name of the manufacturer and/or with "mtr" and are followed by a combination of numbers and letters. Click on the first non-meter device to select and assign it. When the entry is expanded, click on the drop-down menu that is now visible a.

7



You will now see a drop-down menu a with the devices you set up previously. Click on one of the devices to select and assign it. The warning icon at the start of the entry changes to a device symbol if the assignment is successful, and the colour changes from yellow to green (as does the colour of the word "Configure" at the end of the line).

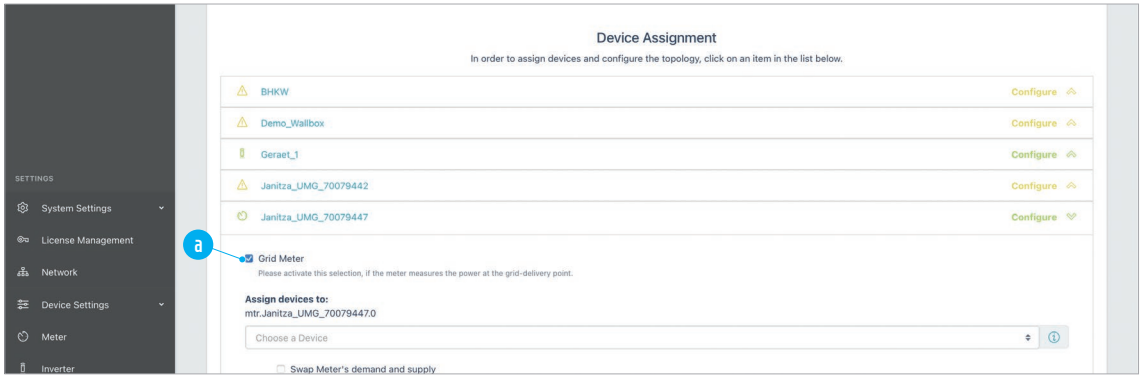
8

Now assign the remaining devices in the same way.

Meter configuration

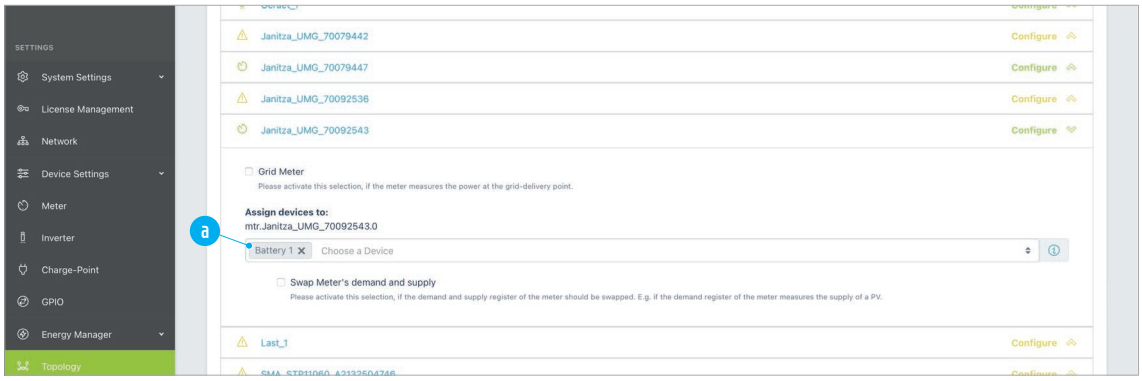
1 Note down the serial numbers of the meters installed in the system. They are needed for further configuration to identify and assign the meters. The serial number of the meter is part of its designation (e.g. the 8-digit number for Janitza meters).

2



First, find the entry for the meter of the utility grid transmission point. Click on the list entry to open it. Tick the square box a next to "Grid Meter" by clicking on it. The grid meter is defined as the sum of the power levels of all physical devices at the grid connection point.

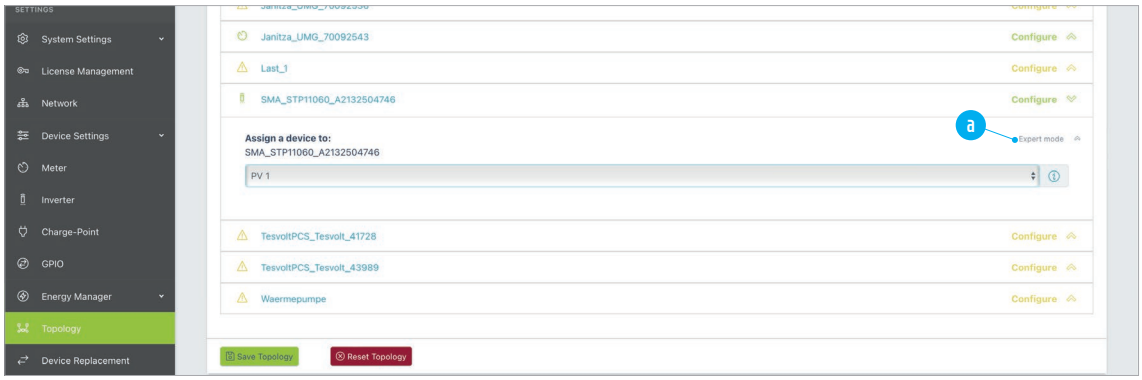
3



Next, select and open the battery storage system meter a from the list. Click on the drop-down menu under the label "Assign devices to:" and select the item "Battery 1" by clicking on it.

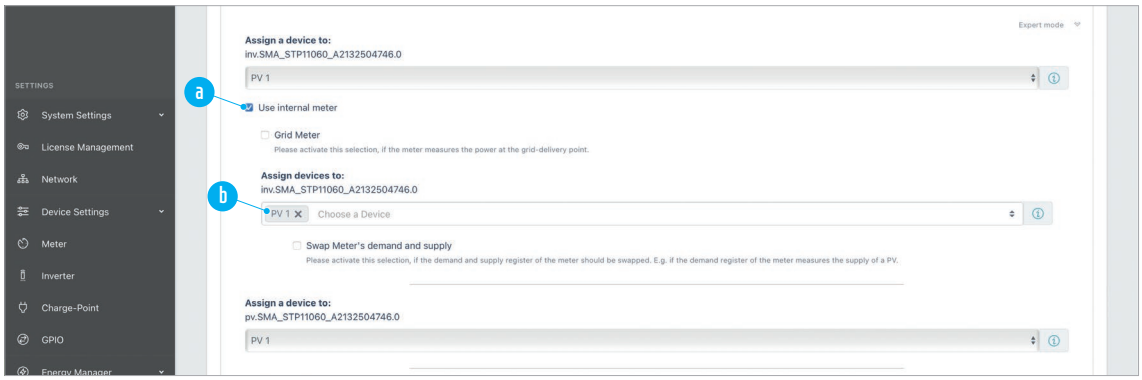
4 Then, one after another, select and open any other meters present in the system. Then click on the field labelled "Choose a Device" and select all devices that, viewed from the grid connection point, come behind the relevant meter and are recorded by it.

5



If you want to use a device's internal meter, click on its entry to expand it. Next, click on "Expert mode" a.

6



In the expert view, additional configuration options are visible. Tick the “Use internal meter” option a. In the “Assign devices to:” section that now appears, select which device is measured by the internal meter b (normally the same physical device that this logical device is assigned to).

7

Finally, assign the appropriate meters and devices to all positions not yet assigned in the topology.

Device replacement

If it is necessary to replace one of the devices in the topology, you can avoid the time-consuming process of reconfiguration by means of the "Device Replacement" feature.

NOTE: Only inactive devices can be replaced.

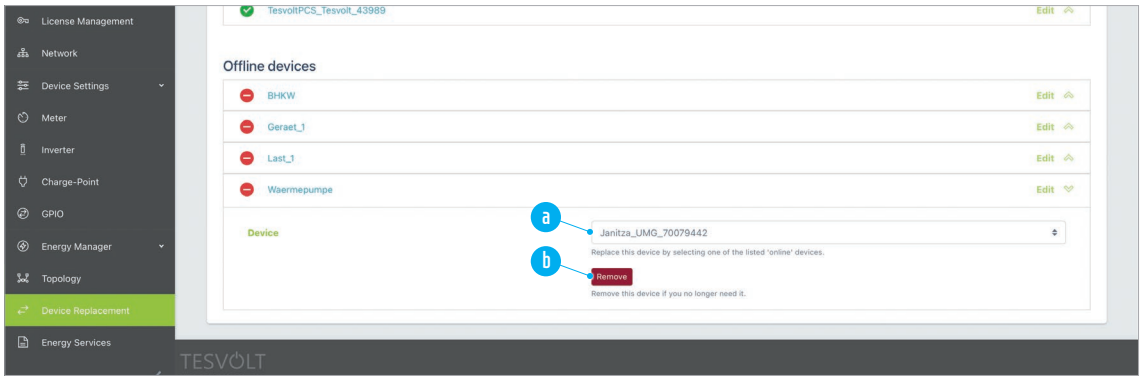
WARNING: If you are replacing a meter, it is essential to ensure that it is installed with the exact same orientation as its predecessor. This applies even in cases where the orientation was/is actually not correct and the generation/consumption registers have been exchanged via the topology configuration of the meter. The register exchange via the topology configuration only corrects the values displayed, leaving the raw data of the meter unchanged. If the new meter is installed with a different orientation from its predecessor, the raw data will have a different sign from this point onwards and all past data becomes unusable.

1 Before replacing a device, you must have applied the necessary settings on the new device, connected it to the Modbus and switched it on. This does not apply to devices connected via the digital outputs (GPIO). These devices can be replaced at any time without the "Device Replacement" feature.

2

To replace a device, click on "Device Replacement" (a) in the side menu. Find the entry of the device to be replaced from the "Offline devices" list (b) and click on "Edit" (c).

3



The entry is now expanded. Click on the drop-down menu "Choose a Device" (a) and select the new device by clicking on it. Confirm the action in the following dialogue box.

If you do not want to replace the device but to permanently delete it, do not select a replacement in the drop-down menu and instead click on the "Remove" button (b).
Warning: This action cannot be undone!

9 SETTING UP STRATEGIES AND ENERGY SERVICES

9.1 PROCEDURE

An energy services strategy is the implementation of a specific application, such as self-consumption optimisation, in a strategy for controlling actuators. The procedure for this is as follows:

1. Definition of actuator groups that will implement the energy service, e.g. a battery that performs self-consumption optimisation at the grid meter, or a PV installation that is not allowed to feed into the public utility grid.
2. Configuration of energy services, e.g. self-consumption optimisation.
3. Assignment of the configured energy services to actuator groups.

Using a decision tree (PRO version), several strategies can also be linked to each other and carried out dependent on conditions. This combination of applications is also known as "multi-use". Very complex scenarios can be implemented in this way. Be aware that each actuator can only ever implement one strategy at a time. The procedure for setting up a decision tree is as follows:

1. Definition of standard strategy
2. Definition of strategy links and decision paths
3. Activation of energy service strategies

9.2 OVERVIEW OF ENERGY SERVICES

NOTE: Only inactive devices can be replaced.

First, strategies must be defined. As part of this, an energy service (e.g. target power self-consumption) is assigned to an actuator group (e.g. Battery 1), which implements the service.

The following energy services are available for selection:

BASIC licence

- Target power
  - Advanced
  - Self-consumption
  - Physical peak shaving
  - PV regulation
- Grid isolation
- Switch/set point
- Switchable loads/generation

PRO licence (fee-based)

- RLM peak shaving
- Forecast-based charging
- Remote control
- Off-grid generator curtailment for target SoC
- Charging station control
- Dynamic electricity tariffs

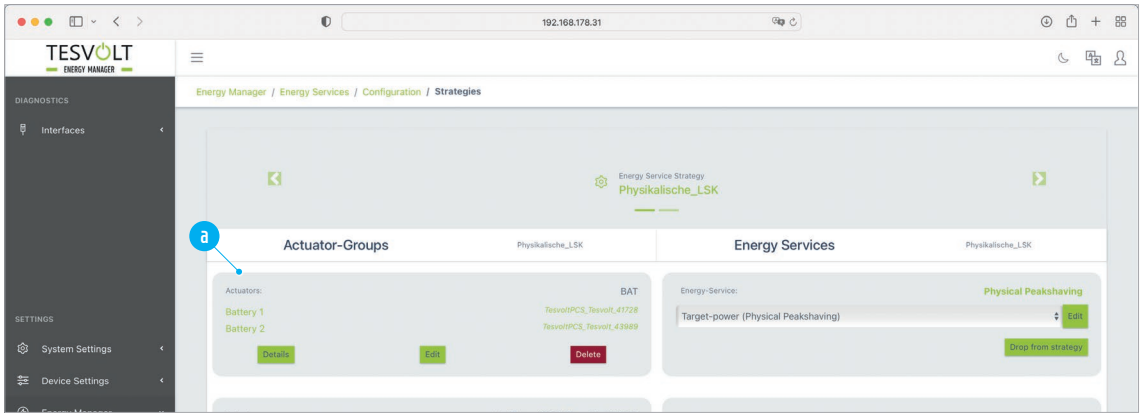
9.3 ACTUATORS AND ACTUATOR GROUPS

Actuators with a similar function (e.g. generators or batteries) can be combined to form actuator groups. There are four different types of groups:

1. "Simple priority" actuator group – Actuator priorities for performing an energy service are determined by the order in the group. This parameterisation is suitable for easy creation of cascade connections.
2. "Extended priority" actuator group – Actuator priorities can be freely defined and differentiated by generator and consumer.
3. Multi-battery actuator group – Used to combine multiple batteries into a virtual battery.
4. "Charging station infrastructure" actuator group – combines different wallboxes.

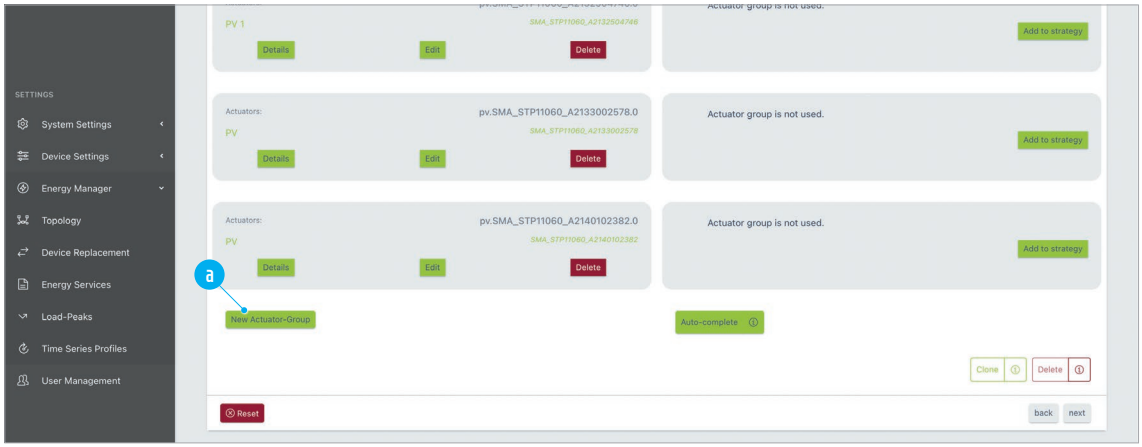
NOTE: The batteries are also listed individually in the actuator groups and can be used individually in strategies.

1



Click on "Energy services" in the side menu to access the "Strategies" page. This page shows all the actuators known to the system.

2



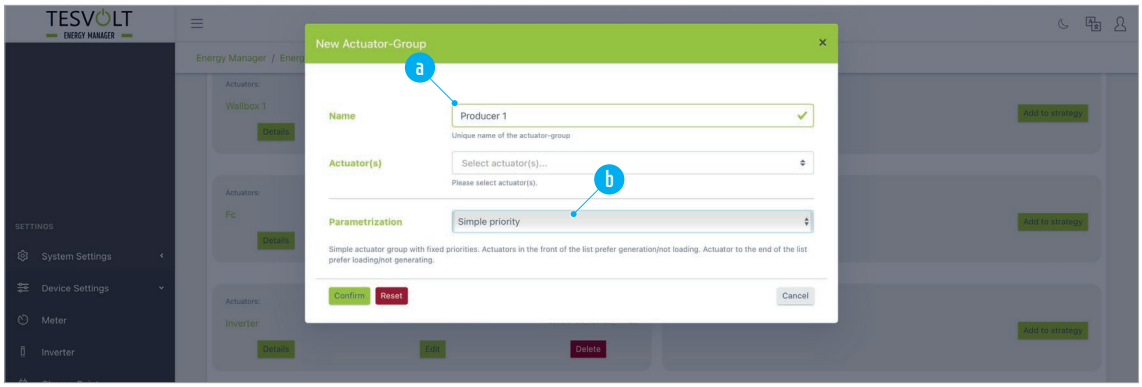
Click on "Energy services" in the side menu to access the "Strategies" page. Scroll all the way to the bottom and click on "New actuator group" a.

"Simple priority" actuator group

NOTE: There should never be more than one battery integrated in an actuator group with "simple priority".

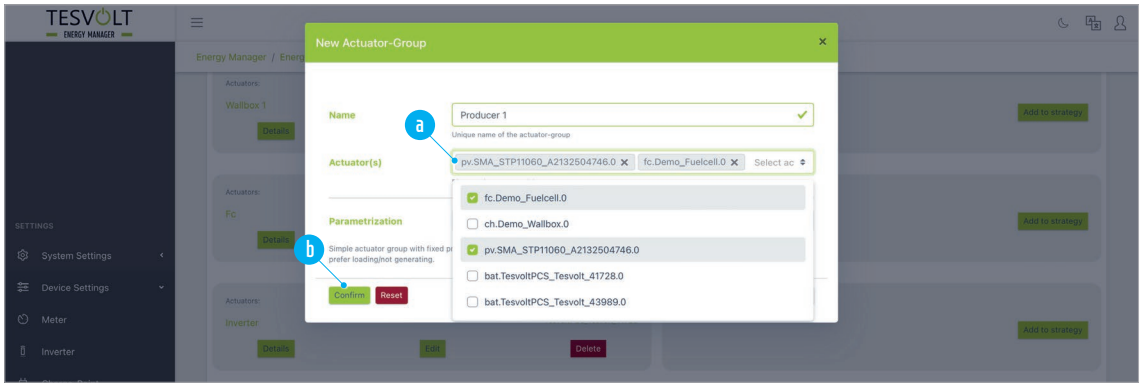
NOTE: If a PV installation and a battery are integrated in an actuator group with "simple priority", this battery will never be charged by the integrated PV installation.

1



Give the new actuator group a name in the “Name” a field . Next, select the “Simple priority” setting in “Parametrization” b.

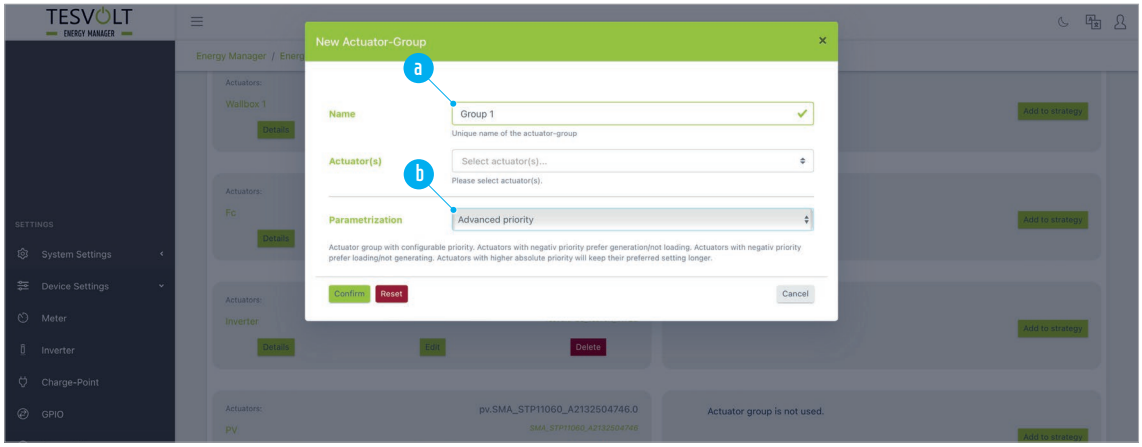
2



Select the actuators a you wish to combine in the group. The sequence indicates the priority when performing the energy service. The first actuator selected has the highest priority during generation. The actuators selected afterwards have the highest priority during consumption and charging. Then click on “Confirm”. b.

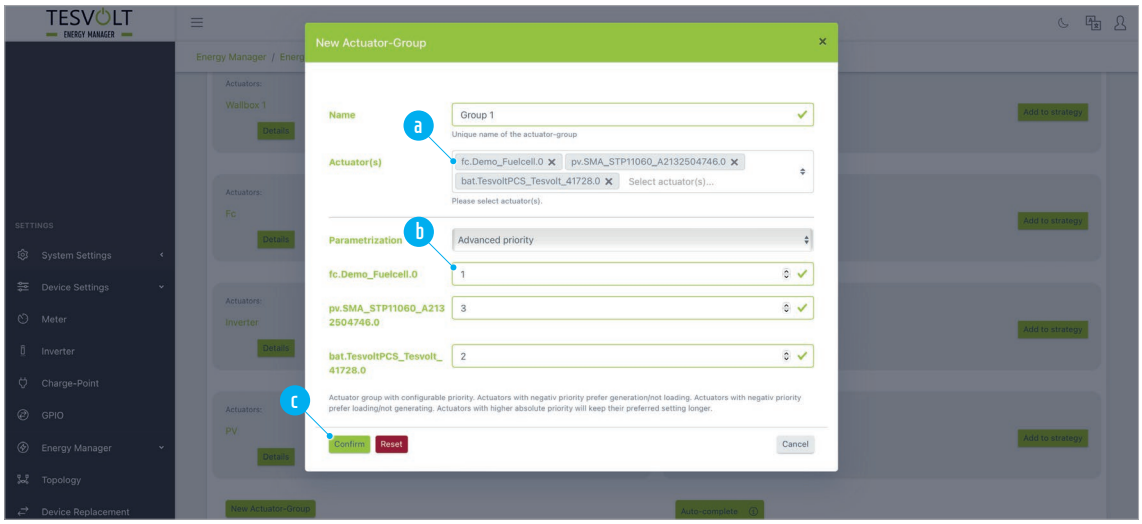
“Extended priority” actuator group

1



Give the new actuator group a name in the “Name” field a. Next, select the “Advanced priority” setting in “Parametrization” b.

2



Next, select the actuators (a) you wish to combine in the group. Any sequence is possible. Next, determine the priority of the actuators (b) when they are used to perform an energy service. Use a sign to indicate whether the actuator prefers to generate (positive sign) or charge (negative sign). The absolute value determines the level of priority compared to the other actuators (higher value = high priority). Finally, click on “Confirm” (c).

“Multi battery” actuator group

If the TESVOLT Energy Manager detects several batteries in a system, they are automatically combined in a group. However, you can also combine just one part of the storage system in a group manually. The batteries that are combined in a group make configuration easier for you, as all batteries combined in the group are controlled collectively and you only have to configure the group, rather than each individual battery.

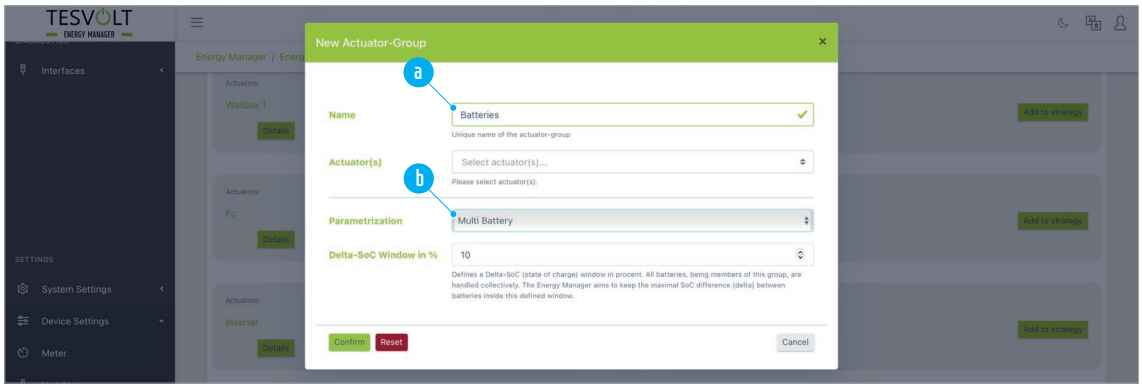
The combined batteries are kept at a uniform state of charge (SoC) in operation. To avoid excessive cycling during charging, the TESVOLT Energy Manager allows the individual storage systems a defined deviation from the specified (joint) SoC. This deviation can be set as the delta SoC window in % (see step 3).

NOTE: The batteries are also listed individually in the actuator groups and can be used individually in strategies.

NOTE: The functions “off-grid use” and “grid replacement operation” are not available when you combine different TESVOLT storage systems into one actuator group.

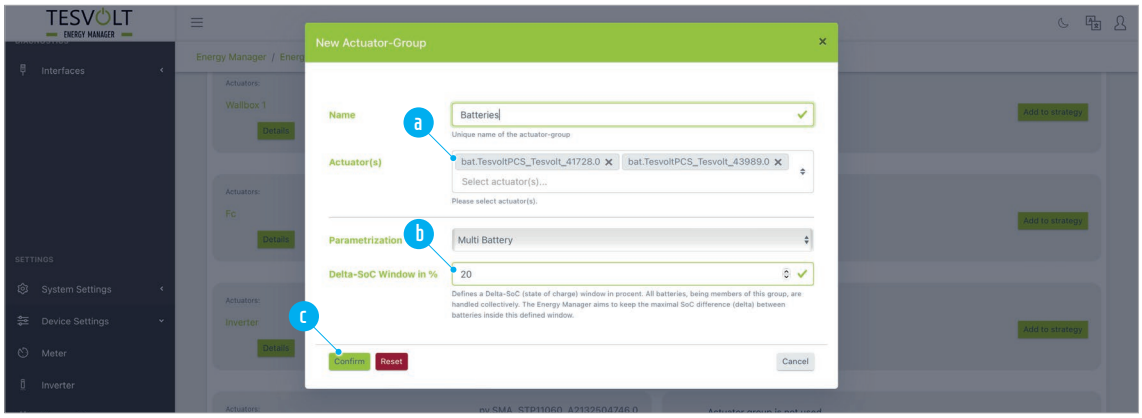
NOTE: If your system features several batteries set up in master/slave systems, these are only ever treated as an individual storage system in the TESVOLT Energy Manager. Master/slave systems can only be controlled collectively.

1



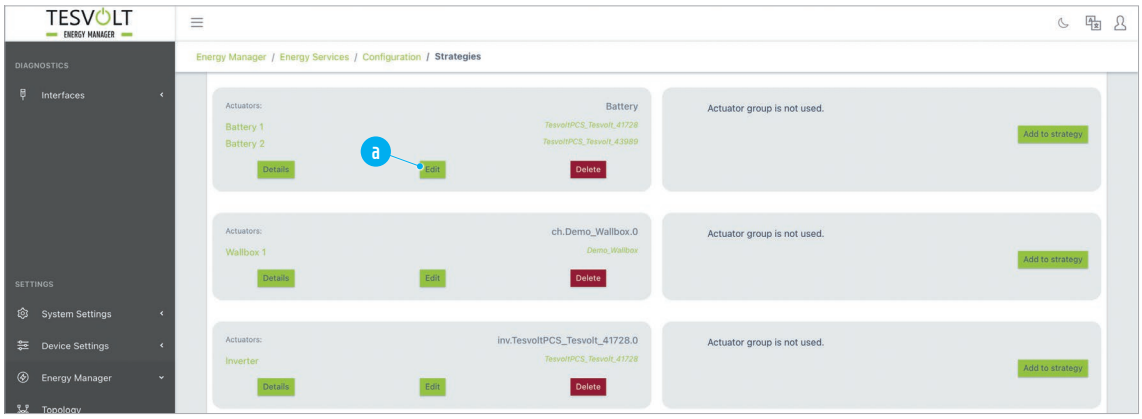
Give the new actuator group a name in the "Name" field a. Next, select the "Multi-battery" setting in "Parameterisation" b.

2



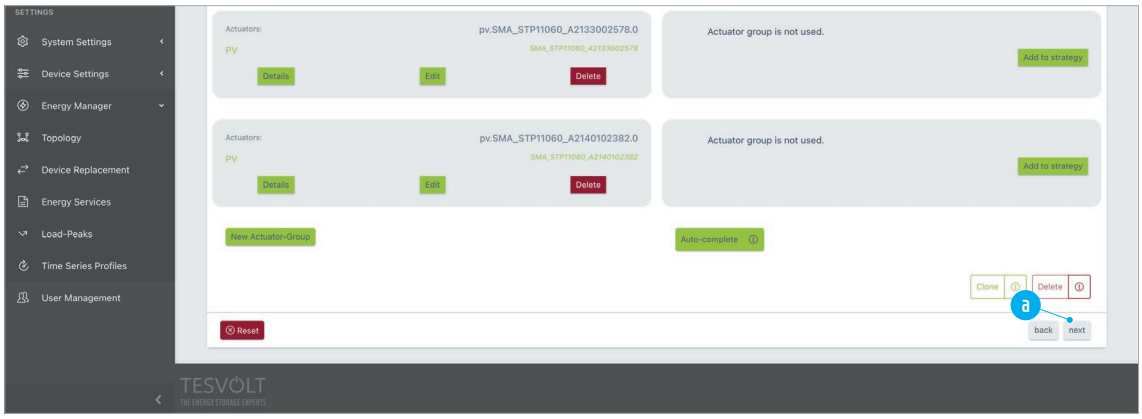
Then click on "Select actuator(s)..." a and select the battery storage system that you would like to group by clicking on the relevant option field. In the "Delta-SoC Window in %" field b, enter the maximum deviation of the state of charge for the storage systems in the group. The tolerated deviation prevents cycling or ON/OFF oscillation during charging. Finally, click on the "Confirm" button c.

3



If you would like to change the delta SoC window or the name of the actuator group, find the actuator group with the combined batteries and click on the "Edit" button a. Now make the desired changes to the delta SoC window or the name and then click on the "Confirm" button.

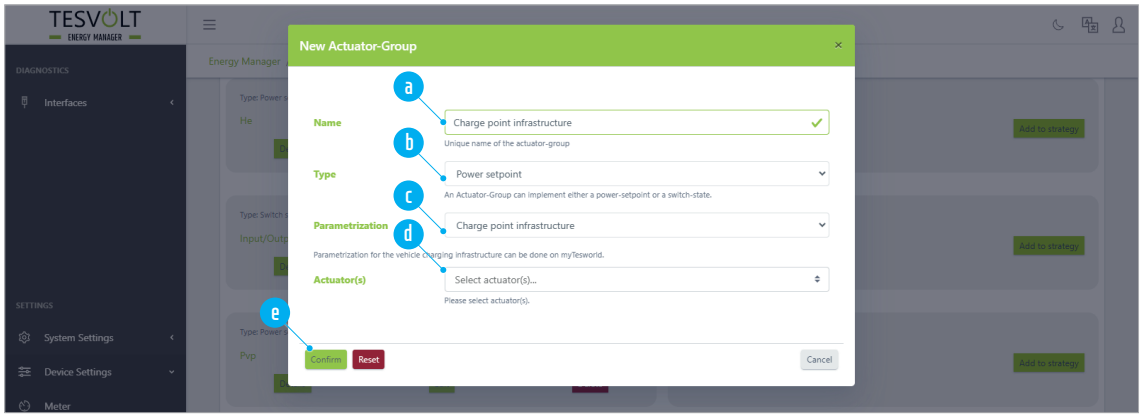
4



Finally, click on “next”. You will now see the page “Energy Services Activation”. Click on “next” again. On the following page, “Energy Services Configurations Summary”, scroll all the way down to the very bottom of the page and click on the “Save” button.

“Charging station infrastructure” actuator group

1



a Name > Give the new actuator group a name in the “Name” field .
b Type > Select the power set point as the type.
c Parametrization > Select charging station infrastructure from the drop-down menu.
d Actuators > Select the required wallboxes from the drop-down menu.
Save your details by clicking on “Confirm” e.

For the charging station infrastructure actuator group, you can, for example, configure the “Physical peak shaving” energy service strategy; see “Example – configuration of the TESVOLT PCS” on page 36.

Information on control via the TESWORLD portal can be found in the section “Charging station control” on page 96.

9.4 BASIC LICENCE APPLICATIONS

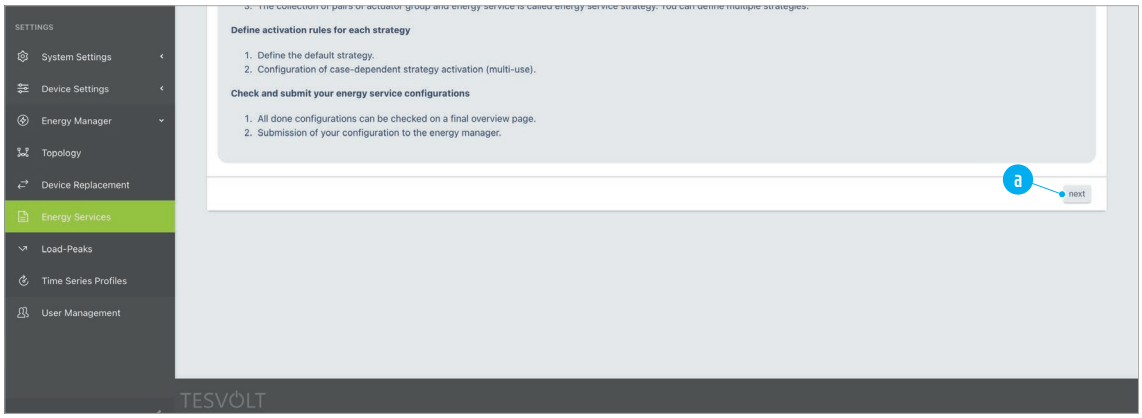
All applications are configured by means of energy services in the form of strategies. In the PRO version, it is also possible to carry out various strategies on a case-dependent basis using a decision tree. A system with the BASIC licence, however, can still carry out several applications at the same time, as long as these use different actuators. For example, you can use a battery for peak shaving or self-consumption optimisation, and at the same time limit the feed-in of a PV installation (active power limitation) and also switch generators or consumers.

NOTE: On the "Strategies" page itself, no changes can be saved. To save permanent changes, click on "next" at the bottom of the page. You will then see the page "Energy Services Activation". Click on "next" again. On the following page, "Energy Services Configurations Summary", scroll all the way down to the very bottom of the page and click on the "Save" button.

Self-consumption optimisation

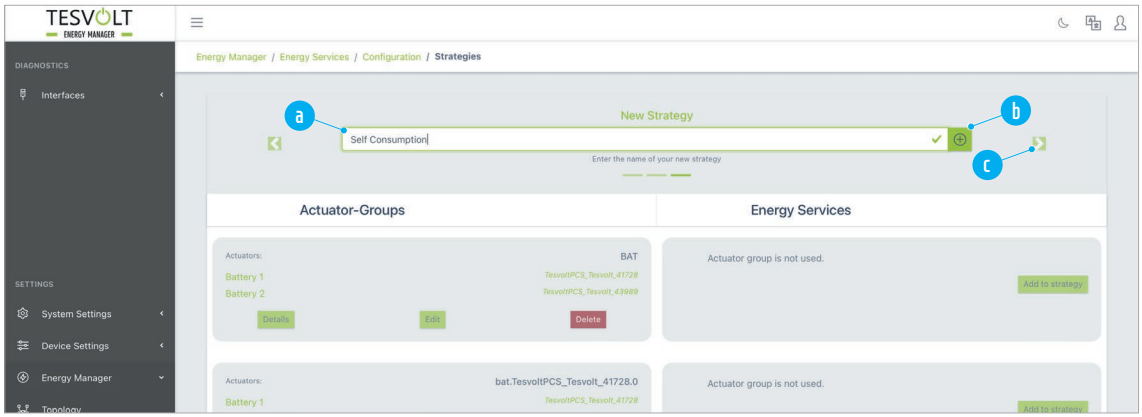
Energy service: "Target power" with "Self-consumption" preselection
Target power: 0 kW
Position in topology: Grid connection point
Actuator group: Battery used.
Description: The battery tries to reduce the amount drawn from the grid to 0 by discharging, and charges in the case of excess power.

1



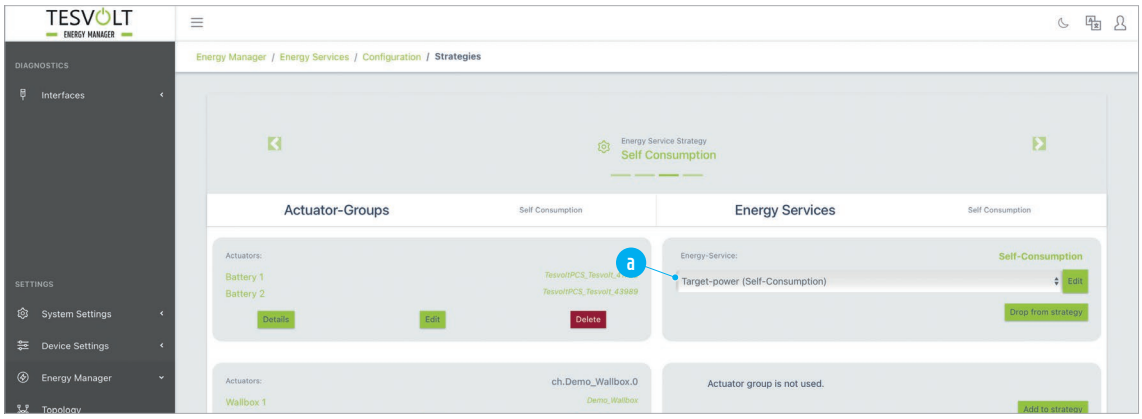
In the side menu, click on "Energy Manager" → "Energy Services" and then on "next" a.

2



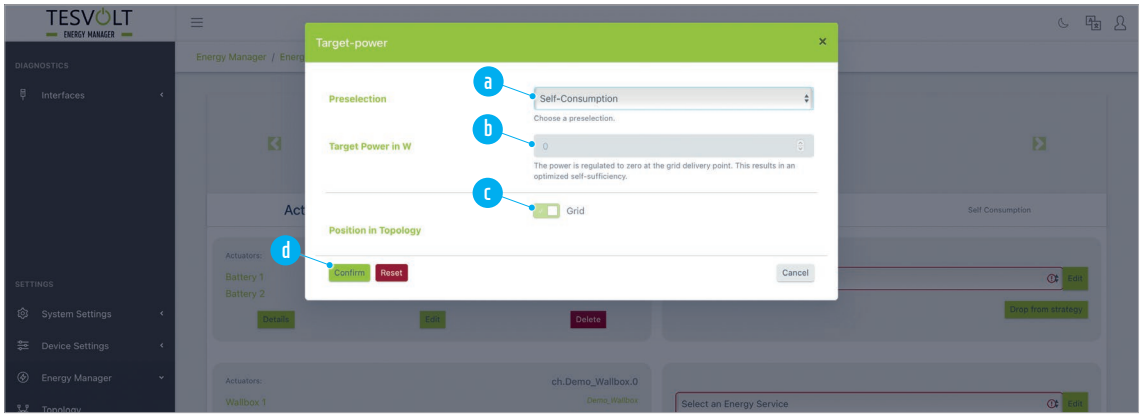
Set up a new strategy. If a strategy has already been set up previously, first click on the right arrow button c and keep clicking on it until the strategy name "New Strategy" can be seen above the input field. Enter a name for the strategy in the input field labelled "Your Strategy Name" (e.g. "Self-consumption") a and then click on the [+] symbol b to the right of the input field.

3



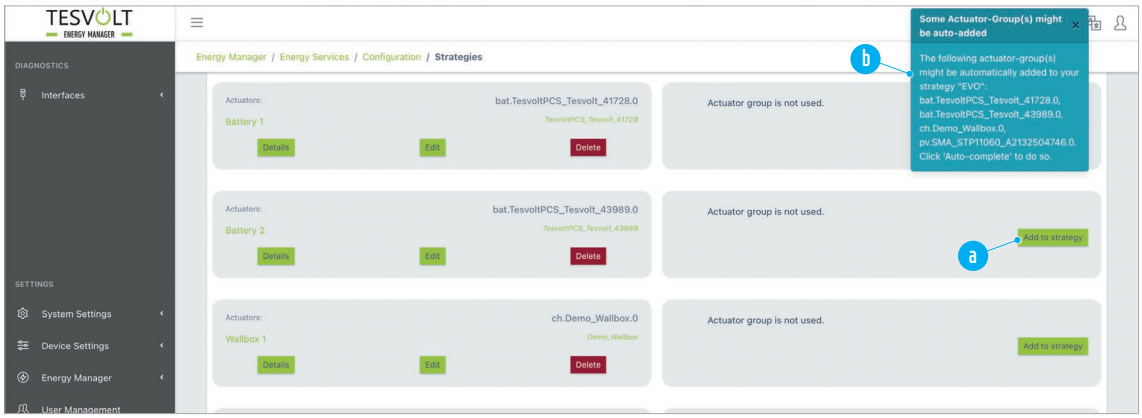
Under “Actuator-Groups” you can see the same number of “Battery” sections as there are logical devices of this type. If you want all batteries to behave the same, then combine them into an actuator group (see “9.3 Actuators and actuator groups” on page 60). Otherwise, find the entry of the battery you want and in the right-hand column next to the entry, click on the drop-down menu “Select an Energy Service” a. Select “Target-power” from the list.

4



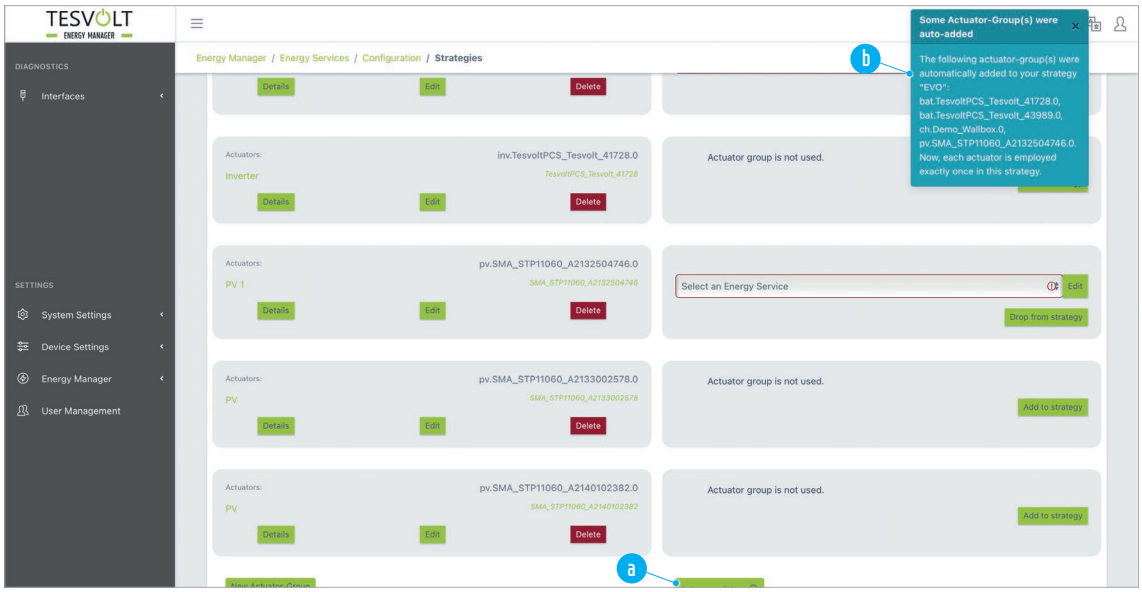
In the “Target power – Self-consumption” dialogue box a, the “Target Power in W” b is preset to “0”. Next to “Position in Topology” you will see a switch icon c. The “Grid” setting is always preset to ON. This means that the values from the grid meter are used for control. Finally, click on “Confirm” d.

5



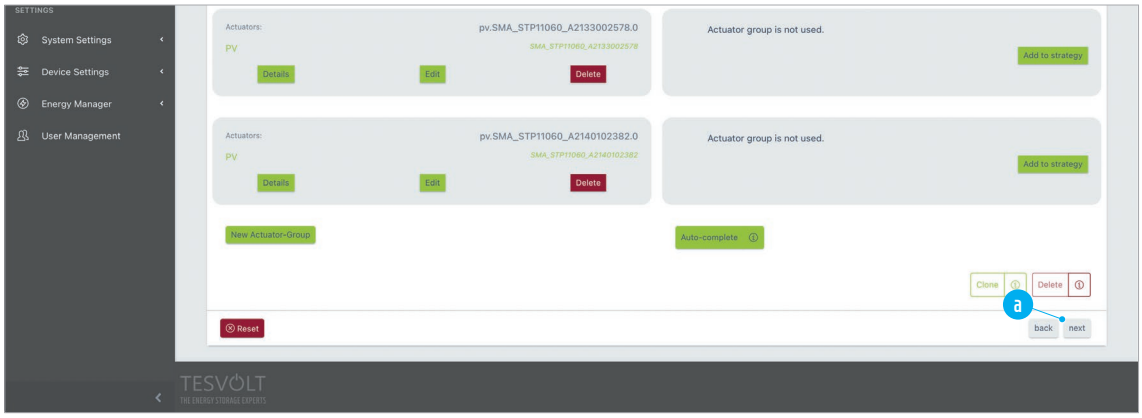
Even though we generally try to use all actuator groups within one strategy, remove all actuators/ actuator groups that are not being used from the strategy. To do this, click on the button “Drop from strategy” in the section of the relevant actuator a. When the group has been removed from the strategy, a message b appears, which you can close.

6



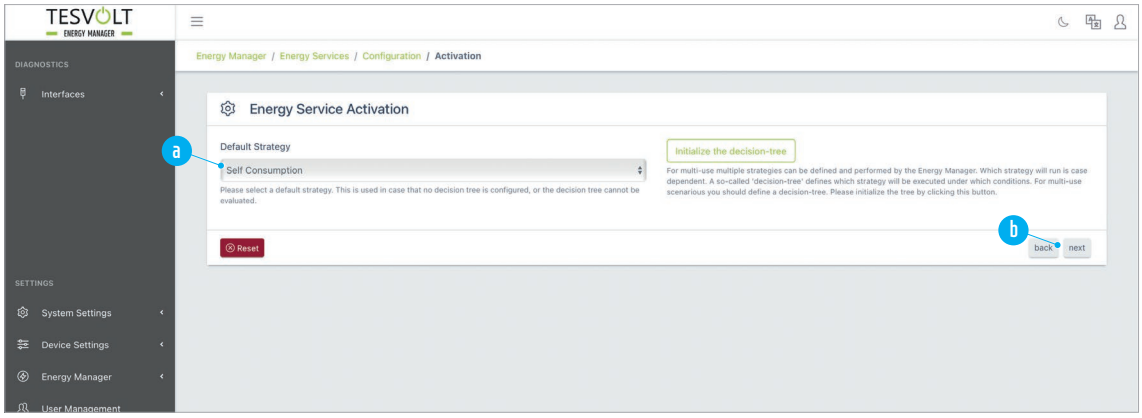
If you have accidentally removed too many actuator groups, you can restore them by clicking on the button "Auto-complete" a. When this function has been executed, a message confirming this is displayed b.

7



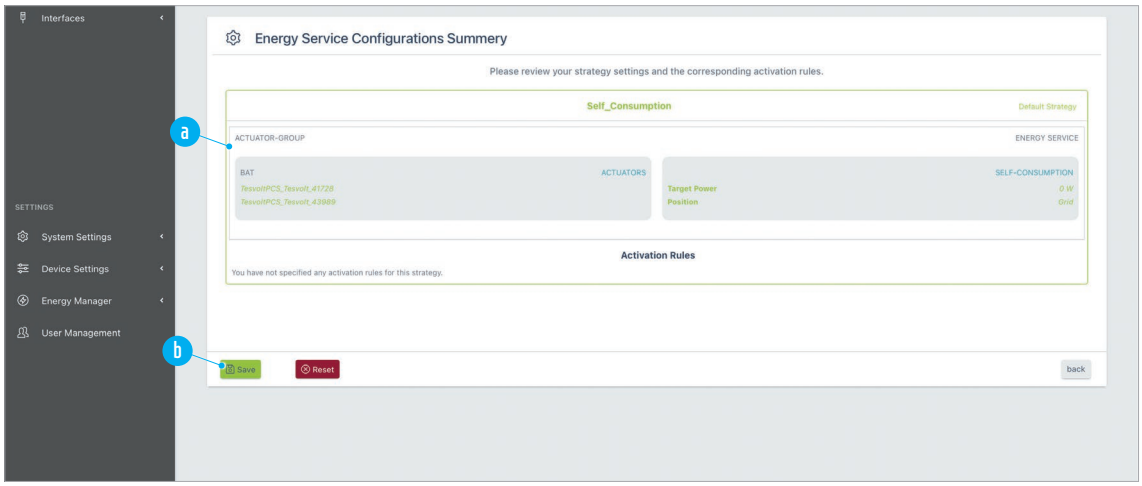
Then, click on "next" a.

8



You now come to the "Energy Service Activation" page. Here, you must specify a default strategy if applicable a. Then click again on "next" b.

9



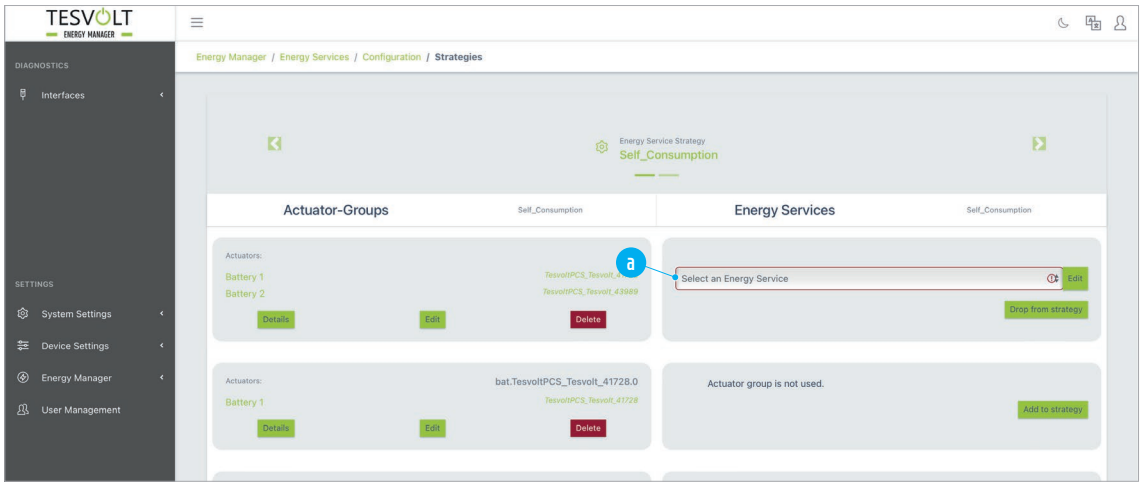
On the next page, “Energy Service Configurations Summary”, you can check the energy service configuration a once more. Finally, click on “Save” b.

Grid isolation – battery discharge protection mode

Energy service: “Grid isolation – battery discharge protection mode”
Actuator group: Battery
Description: To prevent the battery discharging too deeply, the system is switched off after a set time in battery discharge protection mode. The system is switched on at periodic intervals to recharge the uninterruptible power supply (UPS).

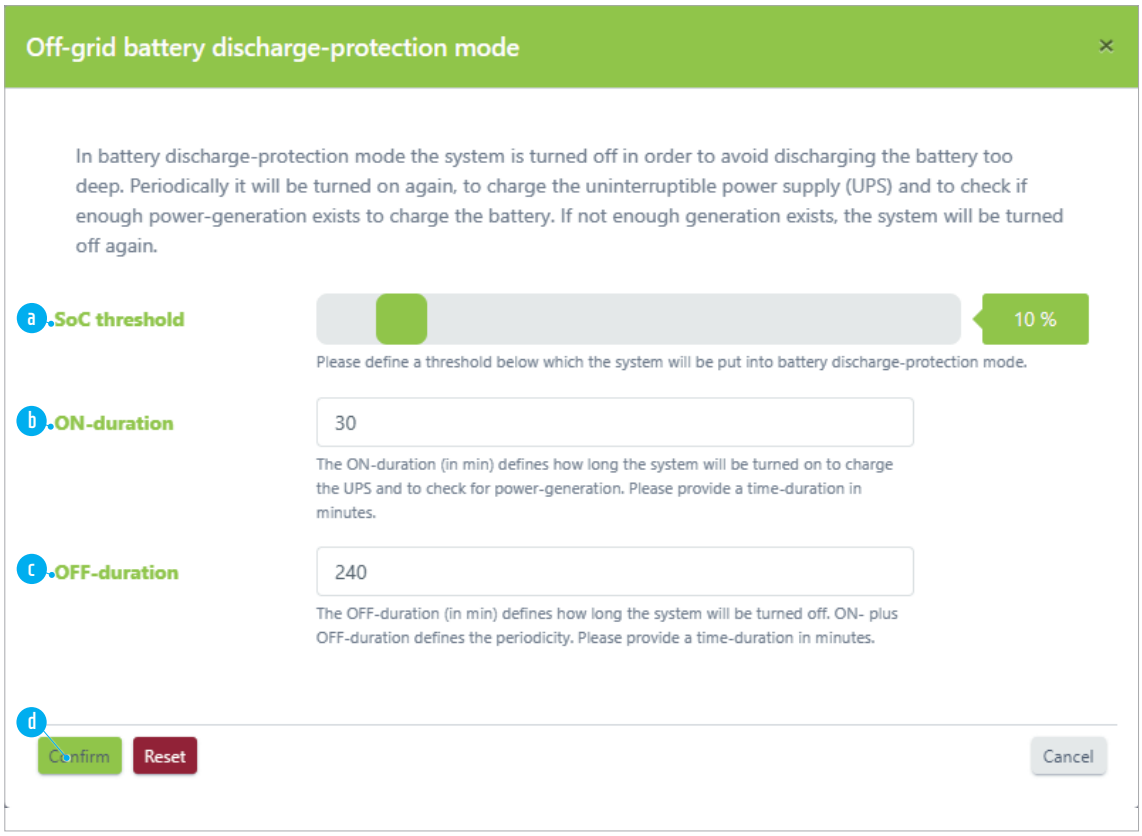
1 Create a new strategy (as described in section “Self-consumption optimisation” on page 65, step 2). Enter a new name for the strategy (e.g. “Grid isolation”) and then confirm your entry by clicking on the “+” symbol.

2



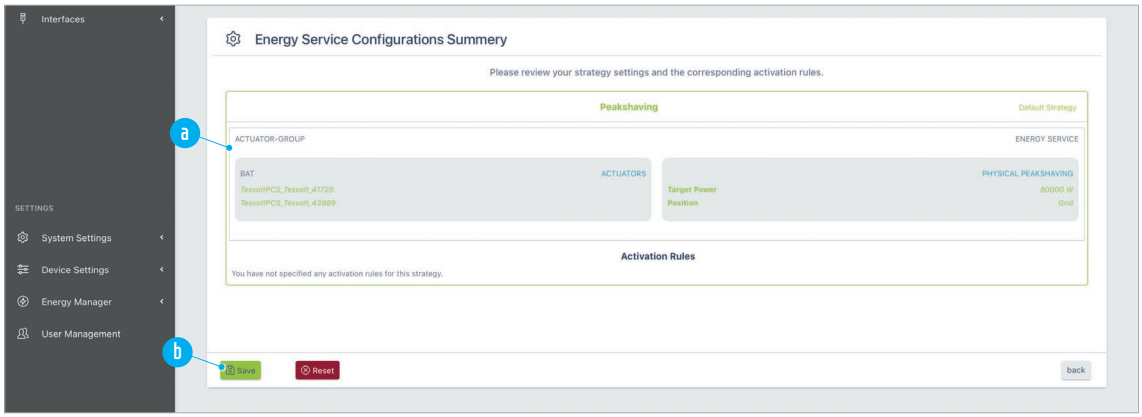
Under “Actuator groups”, you can see the same number of “Battery” sections as there are logical units of this type. If you want all batteries to behave the same way, combine them into an actuator group (see “9.3 Actuators and actuator groups” on page 60). Otherwise, find the entry of the battery you want and in the right-hand column next to the entry, click on the drop-down menu “Select energy service” a. Select “Grid isolation – battery discharge protection mode” from the list.

3



a SoC limit > Define the SoC limit using the slider.
b ON time > Enter the time in minutes (greater than 0) that the system should be switched on for to charge the uninterruptible power supply (UPS).
c OFF time > Enter the time in minutes (greater than 0) that the system remains switched off for.
Confirm your entries by clicking on "Confirm" d.

4



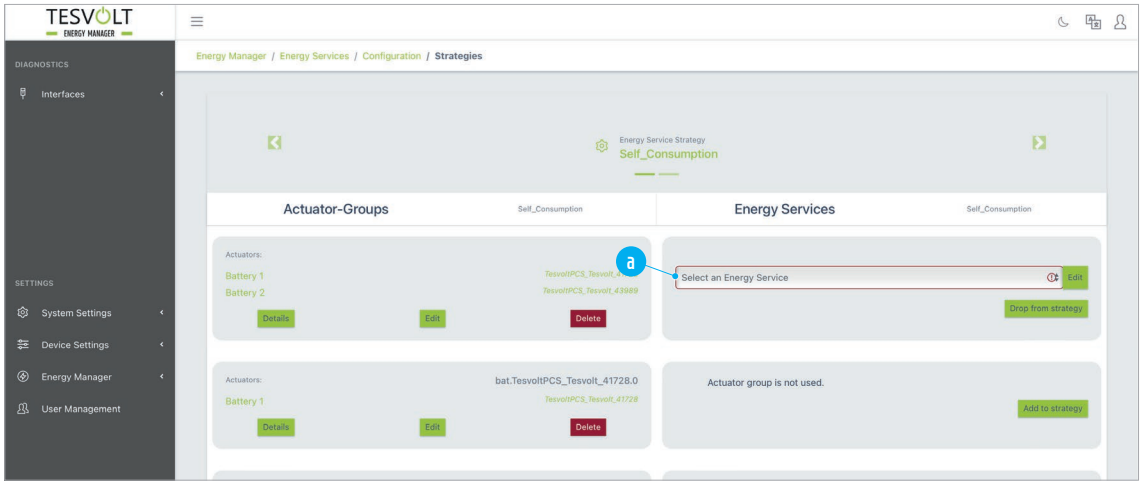
Then click on "Next" (at the bottom). You will now see the page "Energy Services Activation". Click on "Next" again. On the next page, "Energy Service Configurations Summary," click on the "Save" button b at the very bottom to save your entries.

Switch/set point

Energy service: "Switch/set point"
Actuator group: Battery
Description: For switching the on/off switch on the TESVOLT Energy Manager and for defining a set point (expert mode).

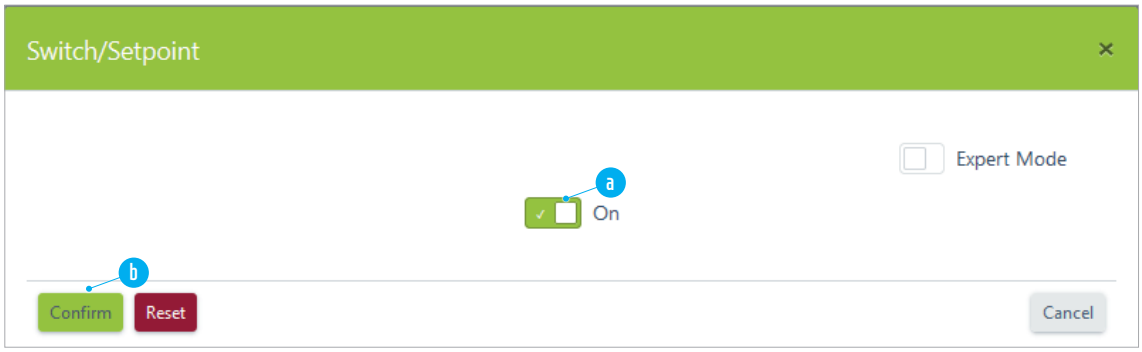
1 Create a new strategy (as described in section "Self-consumption optimisation" on page 65, step 2). Enter a new name for the strategy (e.g. "Set point") and then confirm your entry by clicking on the "+" symbol.

2



Under "Actuator groups", you can see the same number of "Battery" sections as there are logical units of this type. If you want all batteries to behave the same way, combine them into an actuator group (see "9.3 Actuators and actuator groups" on page 60). Otherwise, find the entry of the battery you want and in the right-hand column next to the entry, click on the drop-down menu "Select energy service" a. Select "Switch/set point" from the list.

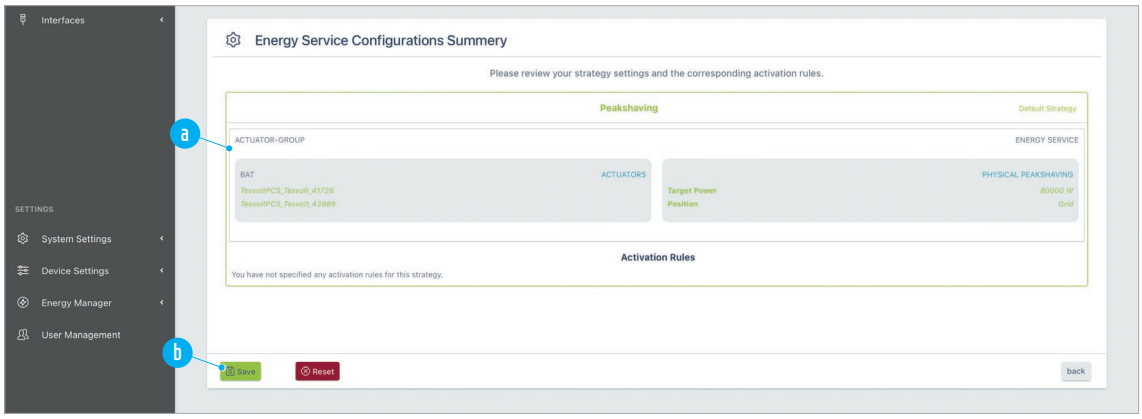
3



a Set the unit's switch by activating the green box by clicking on "On" or by deactivating "Off".
b Confirm your entries.

NOTE: In expert mode, setpoint settings can only be made by administrators.

4



Then click on “Next” (at the bottom). You will now see the page “Energy Services Activation”. Click on “Next” again. On the next page, “Energy Service Configurations Summary,” click on the “Save” button b at the very bottom to save your entries.

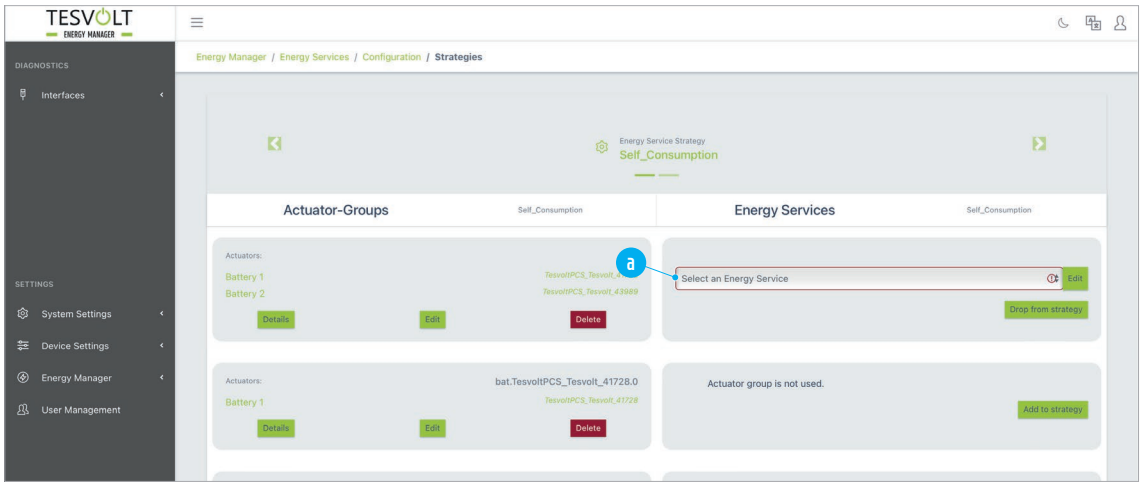
Physical peak shaving

Energy service: “Target power” with “Physical peak shaving” preselection
Target power: Freely selectable output at the grid connection point (positive value)
Actuator group: Battery
Description: The value of the target power must be positive and determines the maximum output drawn from the utility grid. If this value is exceeded, the storage system discharges to cap the load peak. The battery charges up to the specified target power from any available source, which can include from the utility grid.

1

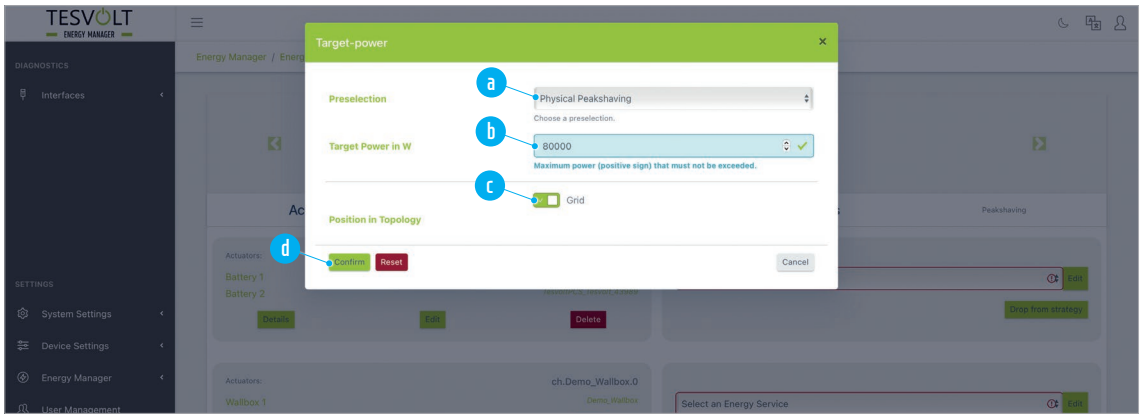
Set up a new strategy (as described in the previous section “Self-consumption optimisation” on page 65, step 2). Enter a new name for the strategy (e.g. “Physical peak shaving”) and then confirm your entry by clicking on the [+] symbol.

2



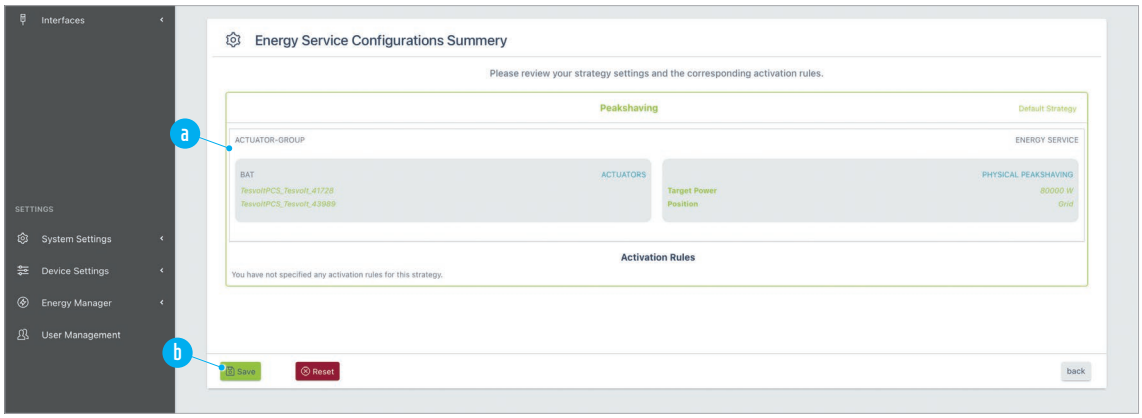
Under “Actuator-Groups” you can see the same number of “Battery” sections as there are logical devices of this type. If you want all batteries to behave the same, then combine them into an actuator group (see “9.3 Actuators and actuator groups” on page 60). Otherwise, find the entry of the battery you want and in the right-hand column next to the entry, click on the drop-down menu “Select an Energy Service” a. Select “Target-power” from the list.

3



In the "Target-power" dialogue box, select the "Physical Peakshaving" preselection (a). Then, for the "Target Power in W" (b), enter the desired value for the power limit, e.g. 80000 for 80 kW. Next to "Position in Topology" you will see a switch icon (c). The "Grid" setting is preset to ON. This means that the values from the grid meter are used for regulation. If you want the peak shaving to take place in a different position in the topology, first click on the "Grid" switch and then select the appropriate meter from the drop-down menu. Then, click on "Confirm" (d) to apply the settings.

4



On the next page, "Energy Service Configurations Summary", you can check the energy service configuration (a) once more. Finally, click on "Save" (b).

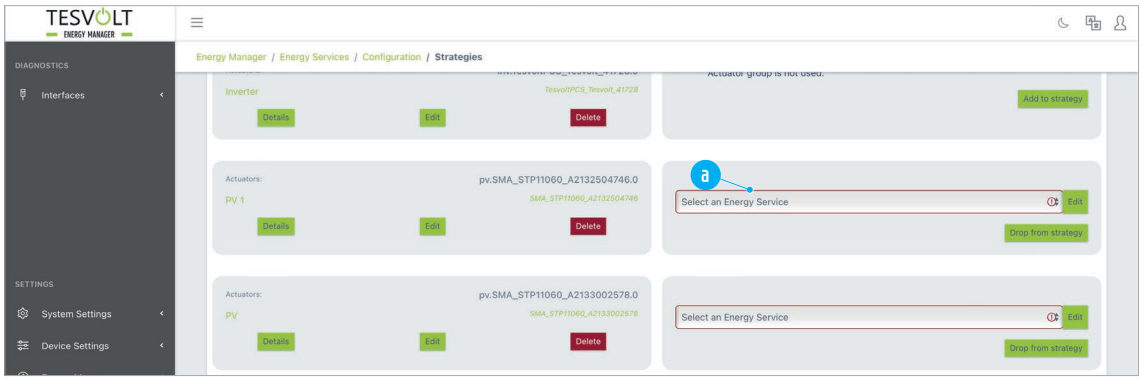
PV installation active power limitation

Energy service: "Target power", "PV curtailment" preselection
Target power: Freely selectable output at the grid connection point (negative value)
Actuator group: PV
Description: The specified target power must be negative and defines the maximum power fed in to the public utility grid. If this value is exceeded, the output of the PV installation is reduced in order to limit the feed-in to the specified value.

1

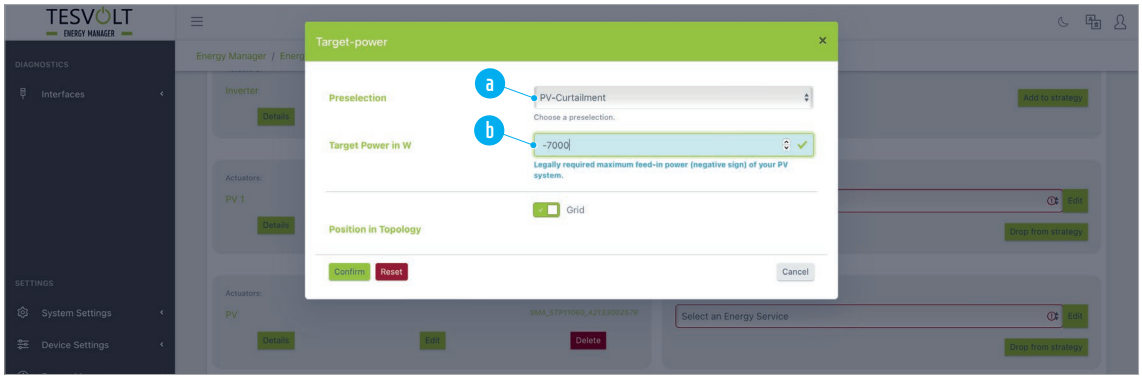
As applicable, set up a new strategy (as described in the previous section "Self-consumption optimisation" on page 65, step 2), or edit an existing strategy. Enter a new name for the strategy (e.g. "Active power limitation_PV") and then confirm your entry by clicking on the [+] symbol.

2



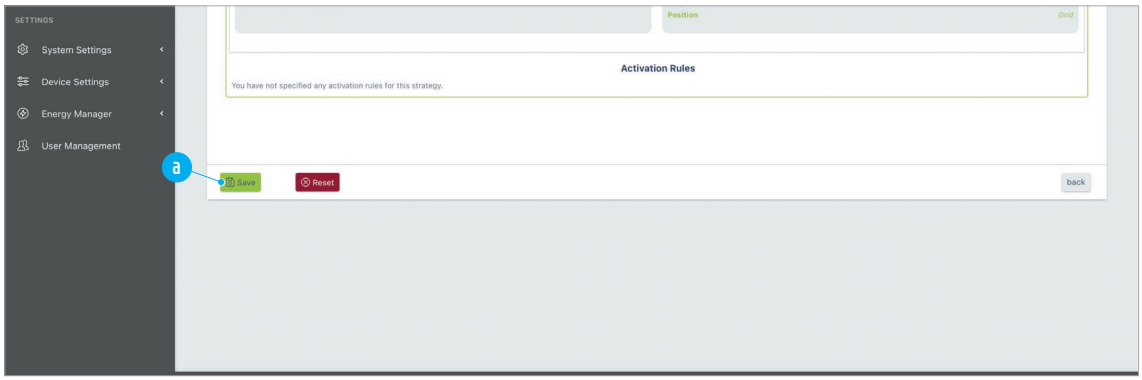
Under “Actuator-Groups”, find the section “PV”. If there is more than one PV installation in the system, these are called “PV 1”, “PV 2”, etc. (PV installations cannot be combined into groups). In the right-hand column under the heading “Energy Service”, click on the drop-down menu “Select an Energy Service” for the actuator group “PV 1” a and select “Target-power”.

3



In the “Target-power” dialogue box, select “PV-Curtailment” from the drop-down menu a, and for the “Target Power in W” b enter, for example, “-7000”, which corresponds to a feed-in of 7 kW (70 % of a 10 kWp PV installation). Next to “Position in Topology” you will see a switch icon. The “Grid” setting is preset to ON. This means that the values from the grid meter are applicable for regulation. Then, click on “Confirm”. If you have several PV inverters to configure in your system, repeat the process from step 2 for each additional PV inverter.

4



Finally, click on “next”. You will now see the page “Energy Services Activation”. Click on “next” again. On the following page, “Energy Services Configurations Summary”, scroll all the way down to the very bottom of the page and click on the “Save” button.

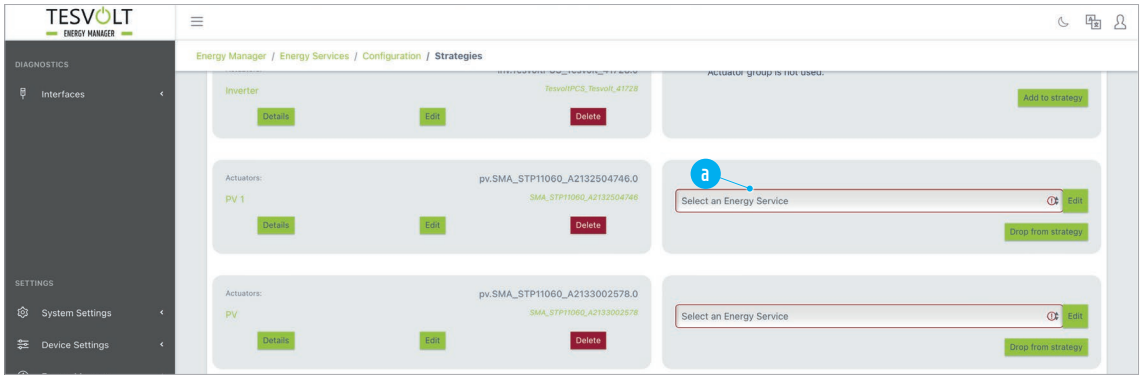
PV installation active power limitation zero feed-in

Energy service: "Target power", "PV curtailment" preselection
Target power: 0
Actuator group: PV
Description: The specified target power must be 0 and prevents the PV installation feeding into the utility grid. If the power falls below this value (which means the PV installation is feeding in), the output of the PV installation is reduced to the point that feed-in stops.

NOTE: In order to meet the normative guidelines for zero feed-in in Germany, you require a PRO licence, as only by means of a decision tree is it possible to limit the SoC of the battery storage system so that it can absorb surplus production at any time, meaning it can reliably prevent feed-in.

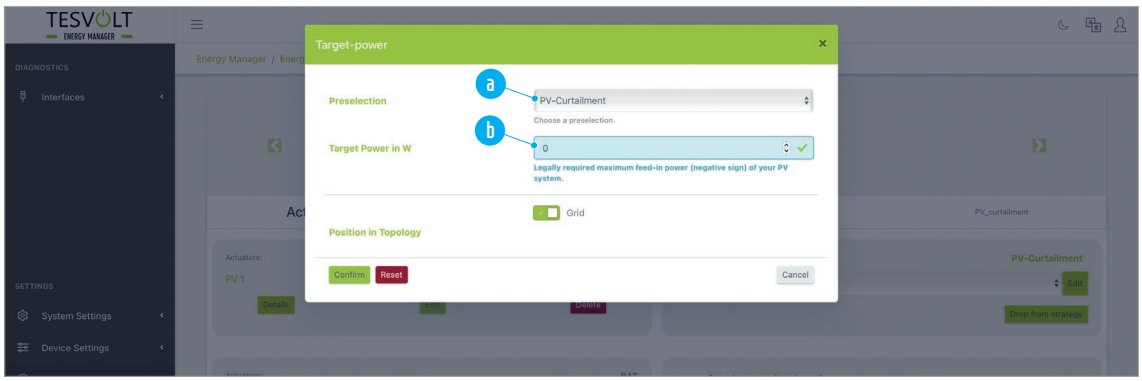
1 As applicable, set up a new strategy (as described in the previous section "Self-consumption optimisation" on page 65, step 2), or edit an existing strategy. Enter a new name for the strategy (e.g. "Zero feed-in_PV") and then confirm your entry by clicking on the [+] symbol.

2



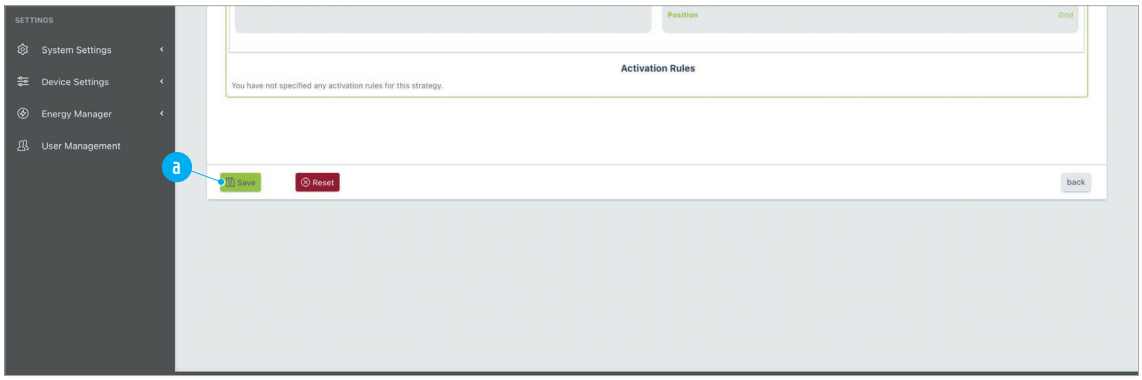
Under "Actuator-Groups", find the section "PV". If there is more than one PV installation in the system, these are called "PV 1", "PV 2", etc. (PV installations cannot be combined into groups). In the right-hand column under the heading "Energy Service", click on the drop-down menu "Select an Energy Service" for the actuator group "PV" a and select "Target-power".

3



In the "Target-power" dialogue box, select "PV-Curtailment" from the drop-down menu a, and for the "Target Power in W" b enter, for example, "0", which corresponds to a feed-in of 0 kW. Next to "Position in Topology" you will see a switch icon. The "Grid" setting is preset to ON. This means that the values from the grid meter are applicable for regulation. Then, click on "Confirm". If you have several PV inverters to configure in your system, repeat the process from step 2 for each additional PV inverter.

4



Finally, click on "next". You will now see the page "Energy Services Activation". Click on "next" again. On the following page, "Energy Services Configurations Summary", scroll all the way down to the very bottom of the page and click on the "Save" button a.

Generation control during utility grid operation

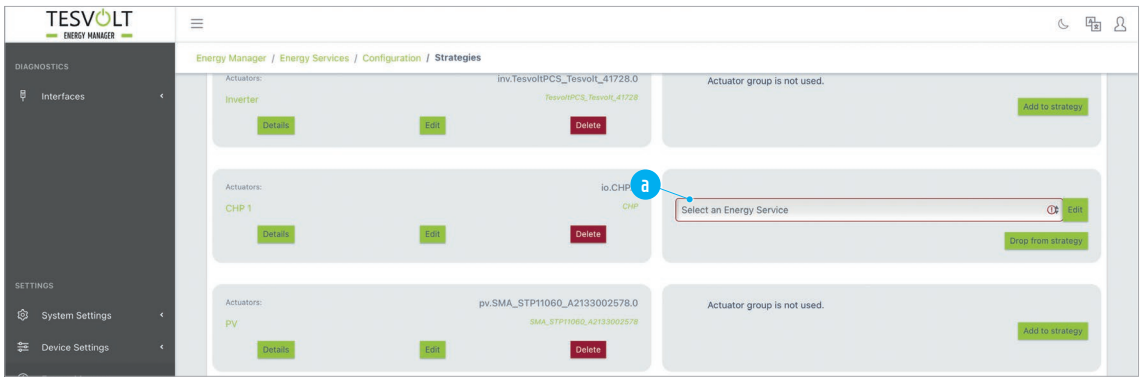
Energy service: "Interruptible loads/yields"
Upper/lower threshold: Freely selectable output at any point (negative/positive value)

Actuator group: Switchable generator

Description: If the power exceeds the upper threshold, a switchable generator is switched on. If the power falls to a value below the lower threshold, the generator is switched off again.

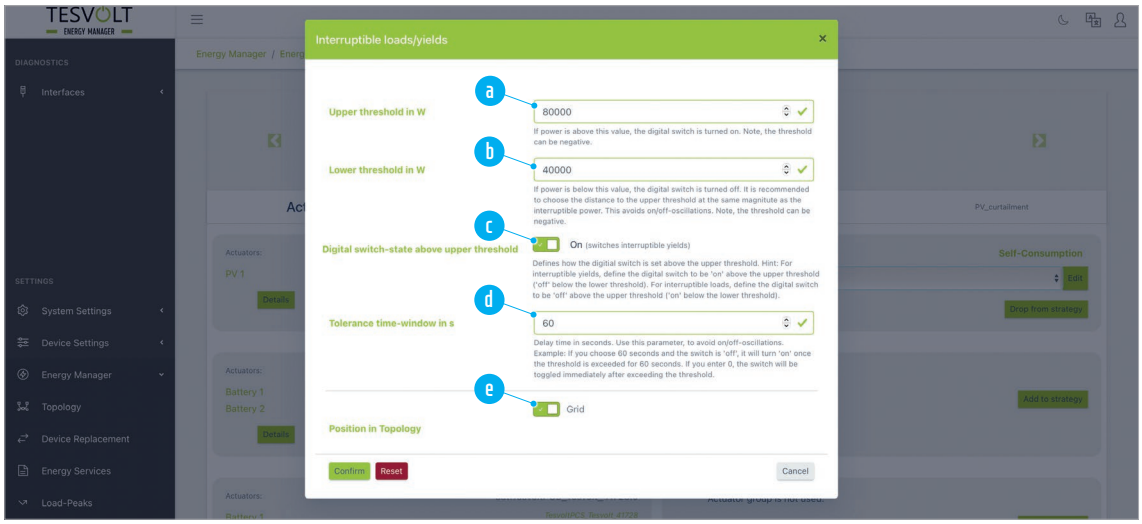
1 As applicable, set up a new strategy (as described in the previous section "Self-consumption optimisation" on page 65, step 2), or edit an existing strategy. Enter a new name for the strategy (e.g. "CHP_peak shaving") and then confirm your entry by clicking on the [+] symbol.

2



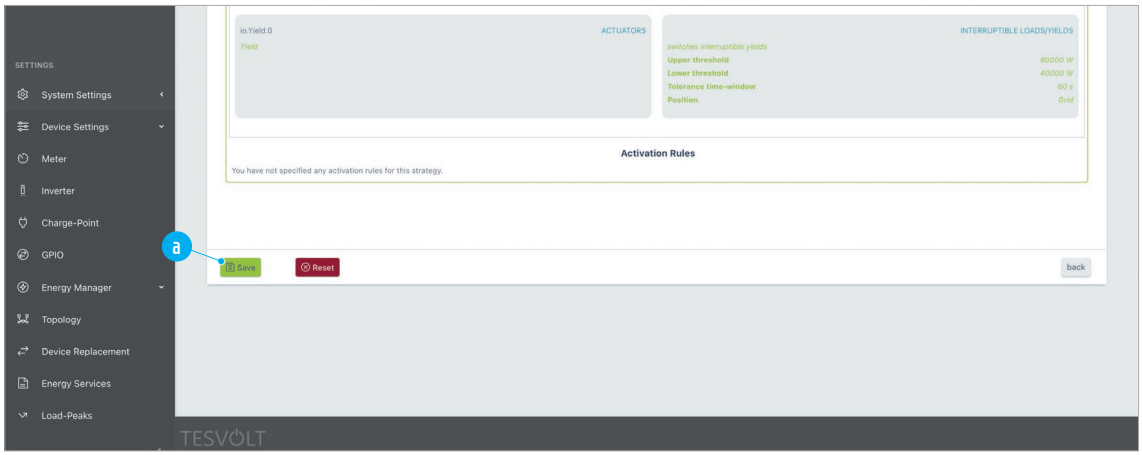
Under "Actuator-Groups", find the section "CHP" (it must be a switchable generator). If the device cannot be controlled via Modbus, then configure one of the digital outputs for it (see also "Digital outputs (GPIO) configuration" on page 46). In the right-hand column under the heading "Energy Service", click on the drop-down menu "Select an Energy Service" for the actuator group "CHP" a and select "Interruptible loads/yields".

3



In the "Upper threshold" field a enter the power value above which the generator should be switched on. In the "Lower threshold" field b enter the power value below which the generator should be switched off again. The difference should equate to at least the output of the generator (ideally make it a bit larger to avoid on-off oscillation). The switch "Digital switch-state above upper threshold" c must be set to "On" for switchable generators (factory setting). As an additional measure against on-off oscillation, you can specify a start-up delay for the generator in the field "Tolerance time-window in s" d. The threshold must then be exceeded for the specified time before the switch-on process is activated. In the "Position in Topology" field, enter where the specified threshold should be measured. If this is not at the grid meter, deactivate the "Grid" switch e by clicking on it and then select the desired measuring point from the drop-down menu. Next, click on "Confirm".

4



Finally, click on "next". You will now see the page "Energy Services Activation". Click on "next" again. On the following page, "Energy Service Configurations Summary", scroll all the way down to the very bottom of the page and click on the "Save" button a.

Load control

Energy service: "Interruptible loads/yields"
Upper/lower threshold: Freely selectable output at any point (negative/positive value)

Actuator group: switchable consumer (via GPIO)

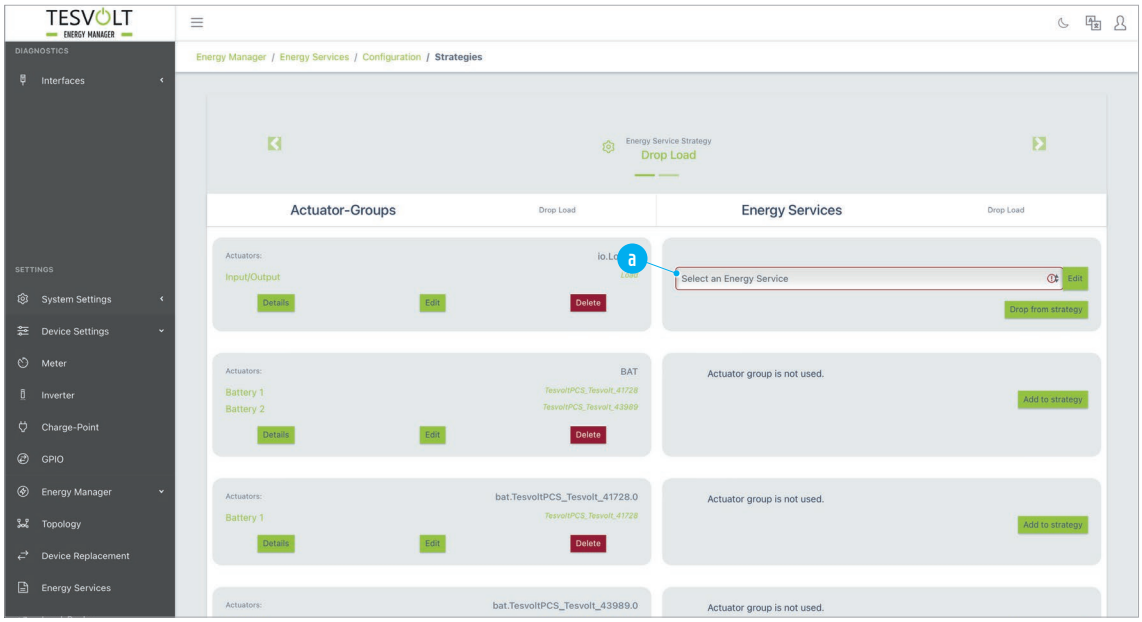
Description: If the power exceeds the upper threshold, a consumer is switched off. If the power falls to a value below the lower threshold, the consumer is switched on again. The difference between the upper and lower threshold should equate to at least the power drawn by the consumer (ideally make it a bit larger) to avoid on-off oscillation. A start-up delay can also be employed.

1 Configure one of the digital outputs for switching the load (see "Digital outputs (GPIO) configuration" on page 46 et seq.) and call this "Load_1".

2 Now access the page "Topology" via the side menu under "Device Settings". Scroll down to the "Device Assignment" section and click on the entry "Load_1". Click on the drop-down menu "No device" and select either a dedicated meter to measure "Load_1" or, if there is no dedicated meter, select "User_1", as long as Load_1 is recorded by the grid meter. Finally, click on "Save Topology".

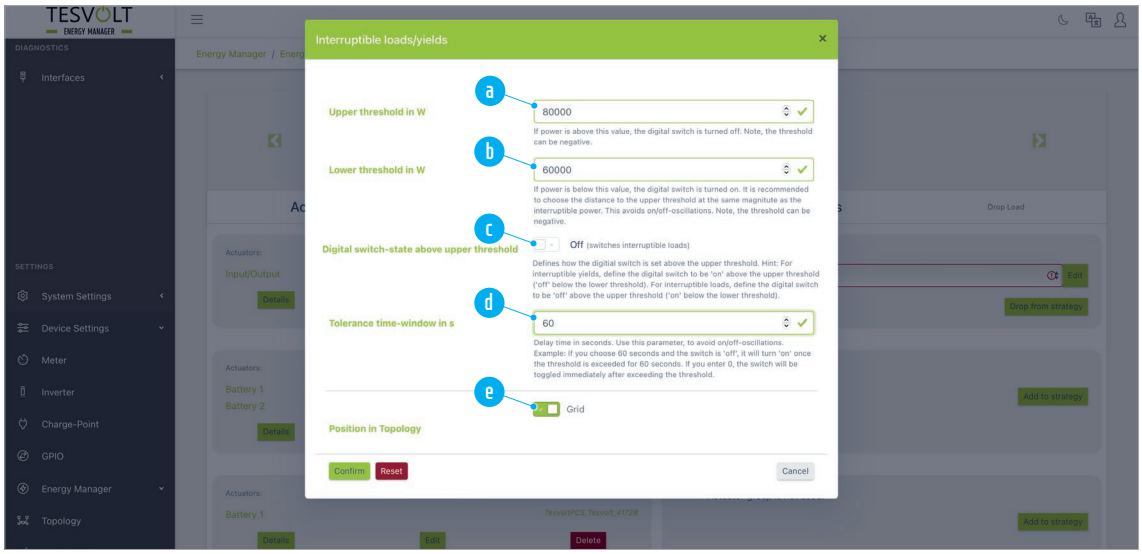
3 As applicable, set up a new strategy (as described in the previous section "Self-consumption optimisation" on page 65, step 2), or edit an existing strategy. Enter a new name for the strategy (e.g. "Drop Load") and then confirm your entry by clicking on the [+] symbol.

4



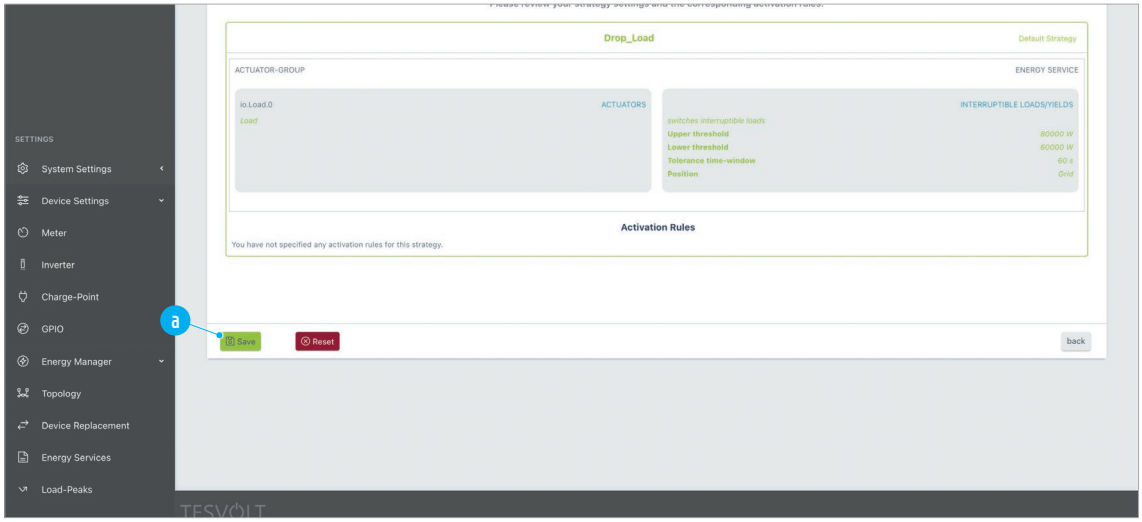
Under "Actuator-Groups", find the section "Input/Output". In the right-hand column under the heading "Energy Service", click on the drop-down menu "Select an Energy Service" for the actuator group "Input/Output" a and select "Interruptible loads/yields".

5



In the "Upper threshold" field a enter the power value above which the consumer should be switched off. In the "Lower threshold" field b enter the power value below which the consumer should be switched on again. The difference should equate to at least the power drawn by the consumer (ideally make it a bit larger to avoid on-off oscillation). The switch "Digital switch-state above upper threshold" c must be set to "Off" for switchable consumers. As an additional measure against on-off oscillation, you can specify a start-up delay for the consumer in the field "Tolerance time-window in s" d. The threshold must then be exceeded for the specified time before the switch-off process is activated. In the "Position in Topology" field, enter where the specified threshold should be measured. If this is not at the grid meter, deactivate the "Grid" switch e by clicking on it and then select the desired measuring point from the drop-down menu. Next, click on "Confirm".

6



Finally, click on "next". You will now see the page "Energy Services Activation". Click on "next" again. On the following page, "Energy Services Configurations Summary", scroll all the way down to the very bottom of the page and click on the "Save" button a.

Back-up power

If the battery inverter used in your system has off-grid capability, you can use also this function when using a TESVOLT Energy Manager with the Basic licence. Since, in the case of grid isolation, a suitable battery inverter takes over grid formation independently, the Energy Manager has no function in this. It can therefore in principle configure any strategy that is carried out in grid operation. However, as no SoC case distinctions can be made with a Basic licence, it is not possible to define a minimum SoC in order to have sufficient energy available for the case of grid isolation. If possible, therefore, you should use a strategy that keeps the storage system at a higher state of charge most of the time, such as peak shaving.

NOTE: Please note that the provision of back-up power is dependent on the use of a battery inverter with off-grid capability, such as the TESVOLT PCS. Warning – the SMA STPS 60 does not have off-grid capability.

Charging station infrastructure

The **charging station infrastructure** (CSI) is a specific actuator group that consists exclusively of charging points. The technician uses their parameters to define how electricity is distributed to the charging points.

Actuator groups for energy services are assigned in "Strategies". You can create multiple CSI actuator groups. However, only one CSI can be active within a strategy, i.e. assigned to an energy service. You can select different distribution parameters using different strategies. The active strategy is defined by the decision tree.

The CSI only controls the current levels of the charging points, not the charging power. The charging power can differ significantly between two charging points with the same assigned current.

Parameters:

- **Name:** You are free to choose an actuator group name, as long as it is not already being used by another actuator group.
  If multiple charging infrastructures are in use, they are distinguished by this name.
- **Type/parametrization:** Select *Power set point* as the type. Then for parametrization, *Charging infrastructure*.
- **Total limits:** In this section, define the limits that the charging infrastructure as a whole must adhere to.
  Please note that there will be a slight delay in charging points/cars implementing new requirements. The EMS only generates new specifications for the charging infrastructure every 20 seconds. If no command has been sent within the last 20 seconds, the last command received will be executed.
- **Maximum current on the utility grid:** Specifies the maximum permissible current at the grid connection point. This means that the charging infrastructure also adapts to the consumption of other units. This value refers to each individual phase, not its sum. If you do not wish to set a limit, e.g. because the charging infrastructure cannot reach the limit, you can set the limit to unlimited.
- **Maximum current for the charging infrastructure:** Specifies the maximum electricity drawn by the charging infrastructure. Unlike the maximum current on the utility grid, this limit does not consider other units.
- **Electricity limits for charging points:** In this section, set the maximum permitted current for each charging point separately.
- **Charging points:** Enter the charging points to be controlled by the charging infrastructure. The sequence also defines the sequence of settings on myTESWORLD.
  You can only select charging points that have been assigned to a unit in the *Topology* section.
  If charging points are not displayed, check the settings in the *Topology* section and adjust as necessary.

Setting up the charging station infrastructure on myTESWORLD

The charging infrastructure actuator group is configured on myTESWORLD under "Settings → Charging infrastructure".

If there is only one charging infrastructure set up for the EMS, this is selected automatically.

If multiple charging infrastructures have been set up for the EMS, first select the one you wish to configure. Here the names defined in the actuator groups are used.

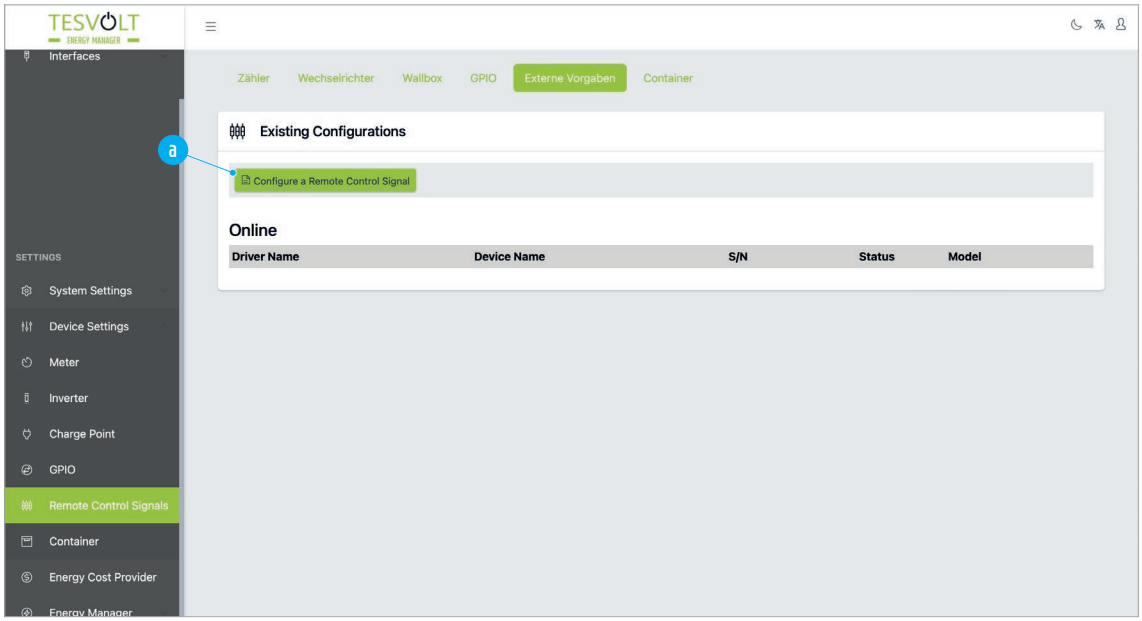
For each charging point, the wallbox assigned to it in the topology and the unit name are displayed.

Ripple control receiver

Network operators can use ripple control receivers to transmit information to their customers such as limits for the grid feed-in of large photovoltaic installations. This is often a requirement for registering large-scale generation plants. The ripple control receivers pick up the radio signals from the utility grid operator. These signals are encoded on four contacts connected to the TESVOLT Energy Manager. The set limits can be entered in the UI of the TESVOLT Energy Manager and then implemented in energy services and strategies.

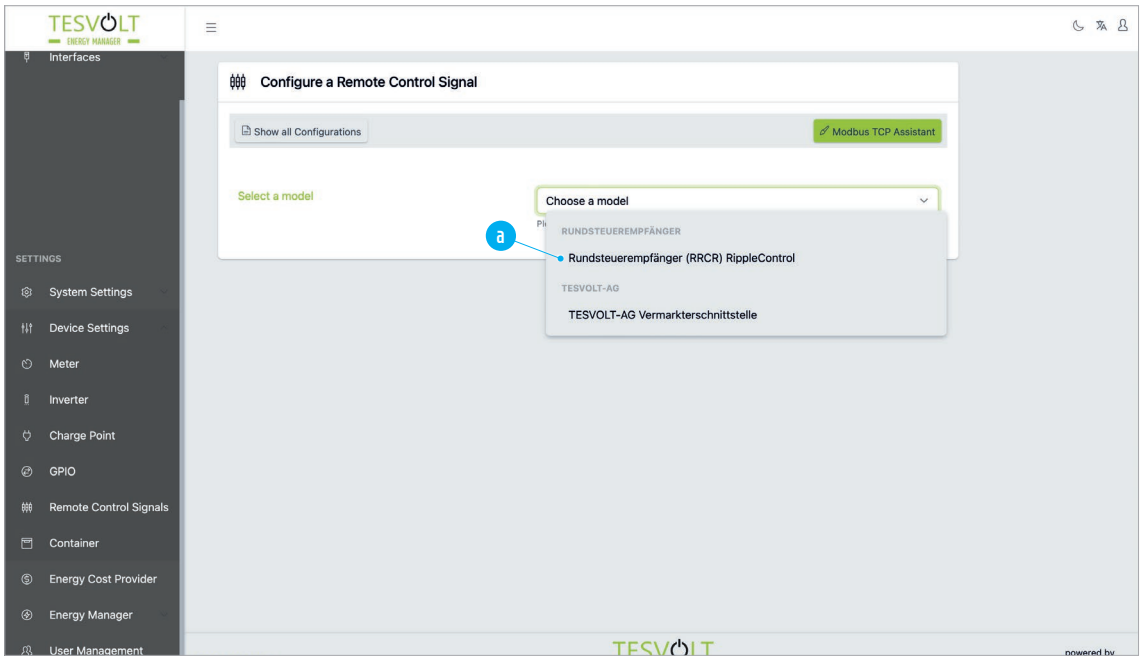
1 The four contacts of the ripple control receiver are connected to four inputs of the TESVOLT Energy Manager.

2



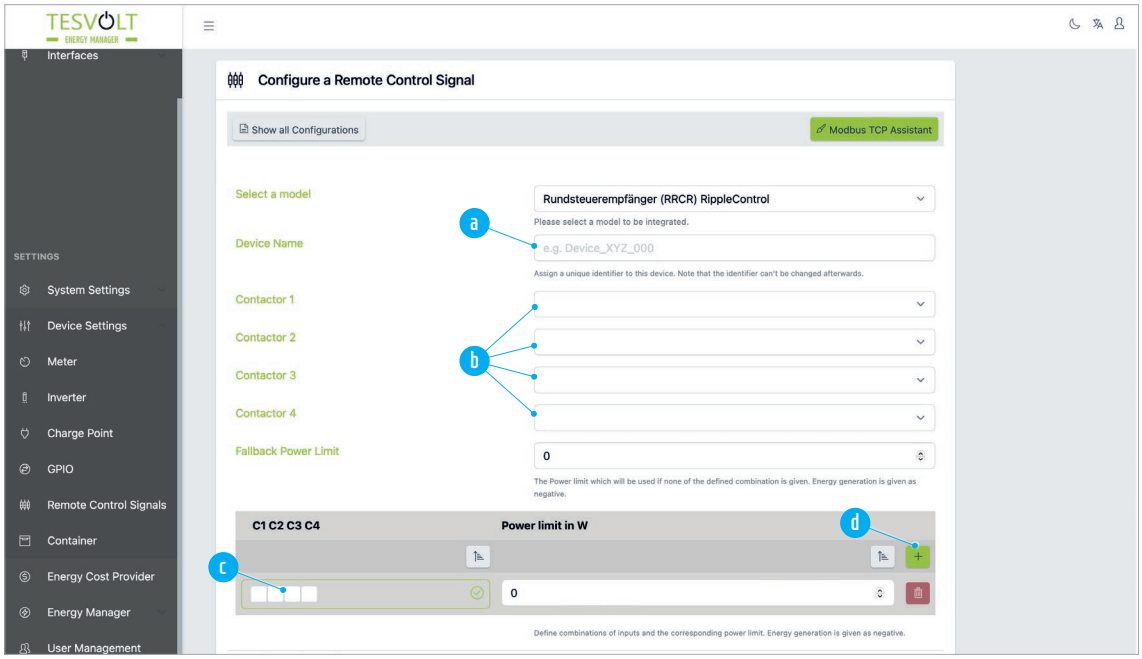
To add a ripple control receiver in the TESVOLT Energy Manager open the [Device Configuration > External Settings] page and click on "Configure External Settings".

3



Now click on "Select a model" and select the entry "Ripple Control Receiver (RRCR) RippleControl" from the drop-down menu.

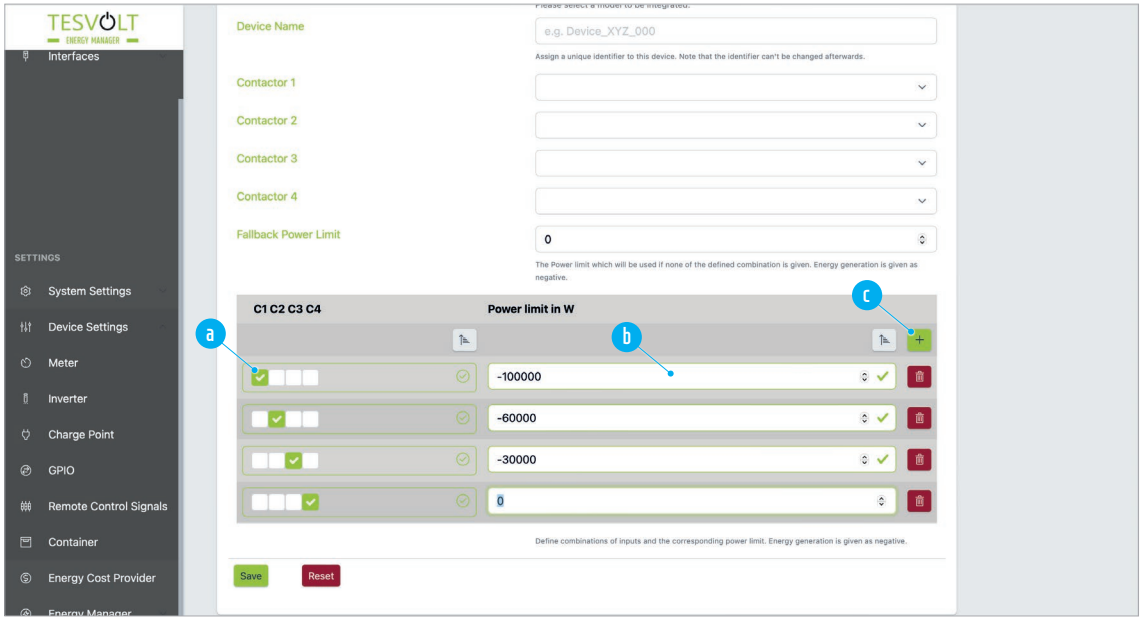
4



Configure the available settings: In the a field, enter a name and under connections 1 to 4 b select the matching wired inputs of the Energy Manager. The numbers 1 to 4 correspond to the outputs of the ripple control receiver.

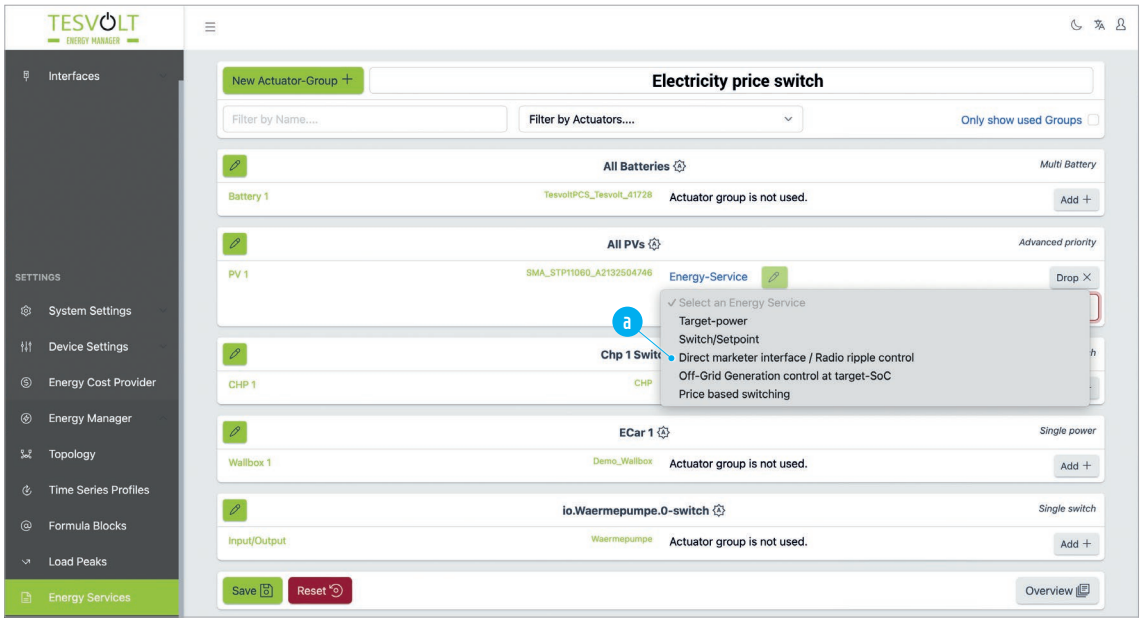
NOTE: Please note that the assigned name cannot be changed later.

5



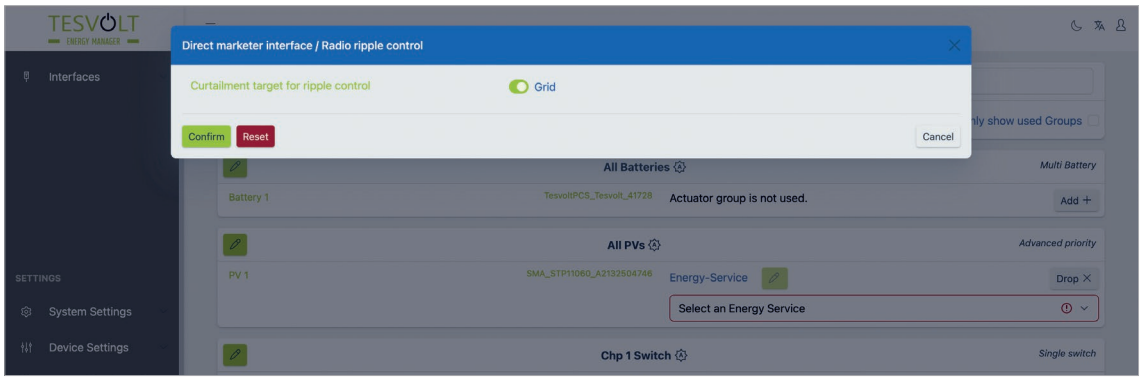
Please enter the corresponding generation limits in watts for the connection combinations (4 bits = 16 combinations) below the connection assignment. If you only want to use the four default settings, click the [+] button c three times to configure three additional switching combinations and activate only one contact A1 to A4 for each. The generation limits b are assigned to the contacts a in the next step. Now enter the corresponding power setting points for these switching combinations. Save these settings by clicking [Save].

6



You can then use these feed-in limits in an energy service strategy by assigning the energy service "Marketer Interface/Ripple Control Receiver" to the corresponding actuator group.

7

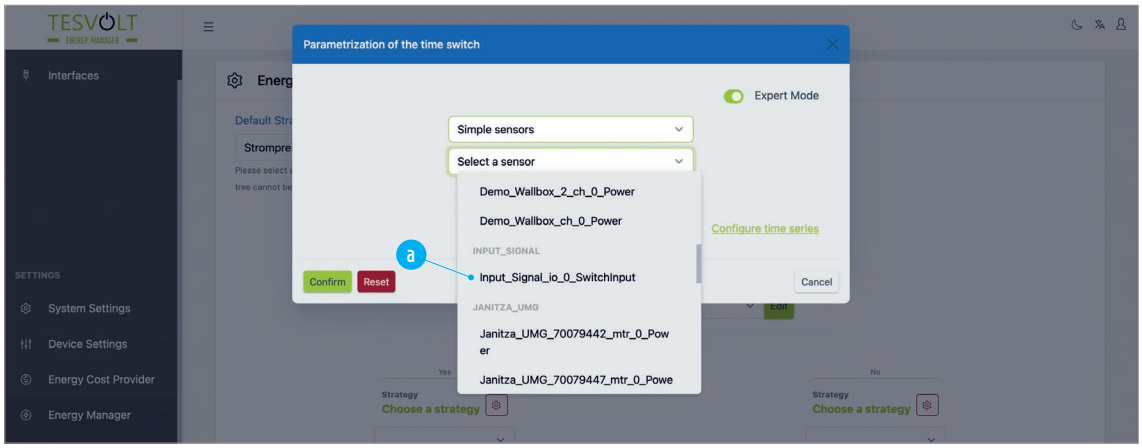


Then, determine the position in the topology that the restrictions should affect. “Utility grid” should normally be selected here.

Control using GPIO inputs

Once you have completed the configuration of the input according to section “Digital input (GPIO) configurations” on page 48 and the input is shown as “Online” in the overview on the GPIO page, it is available as a sensor under “Simple Sensors”. You can now evaluate it in decision trees and use it to control switching and setting points, for example. Here is an example of a decision question in a decision tree:

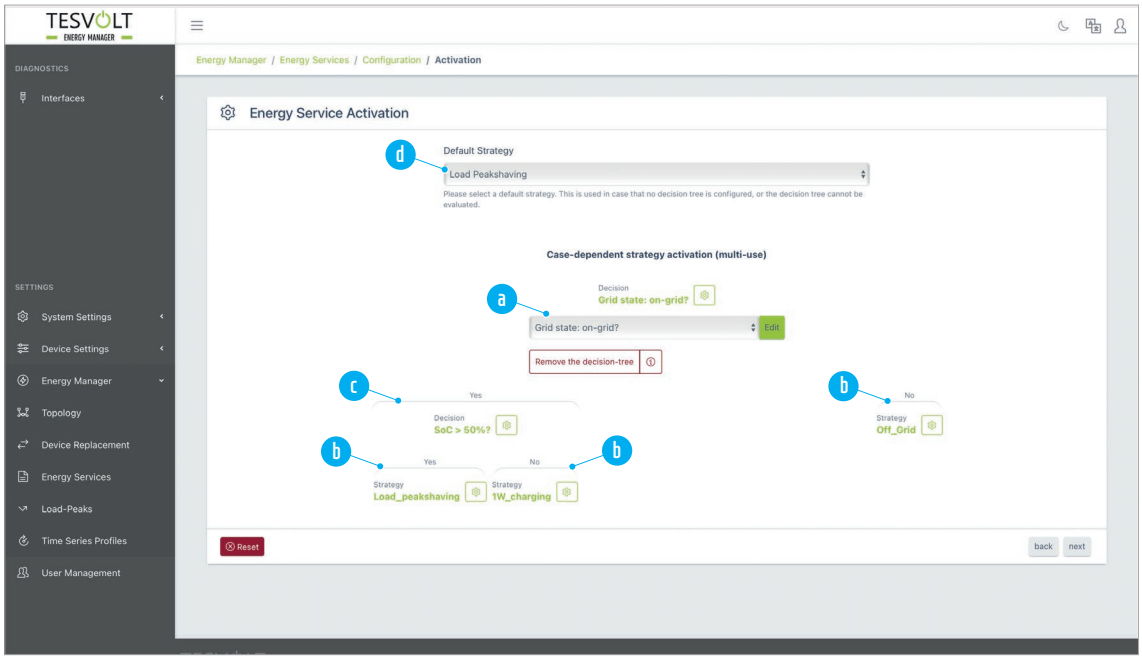
1



Select “Time switch on?” as the decision question and click “Edit”. Select “Simple Sensors” in the upper field and the input in the lower field, e.g.: “Input_Signal_io_0_SwitchInput“. If this contact is now closed, the decision leads to the YES path. If the contact is open, the decision leads to the NO path of the other tree.

9.5 APPLICATIONS (PRO LICENCE)

Multi-use



Multi-use enables you to execute different strategies on a case-dependent basis. To achieve this, decision nodes are set up in a decision tree (a), at which point certain conditions are checked and one of two strategies (b) is activated. In place of the strategies, additional decision nodes (c) can also be configured with new conditions. Options that can be selected as conditions:

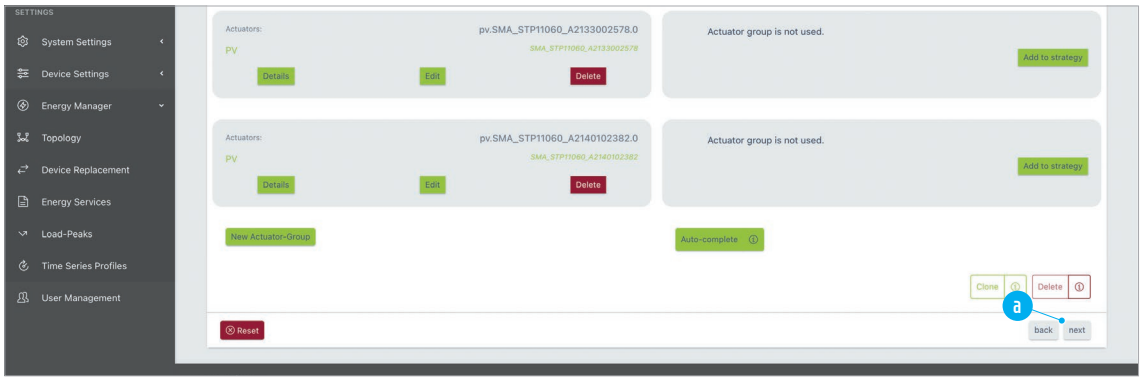
1. SoC > ... %?

2. Network status? (Grid operation, off-grid operation, error, grid isolation process, grid connection process, etc.)

3. Time switch on?

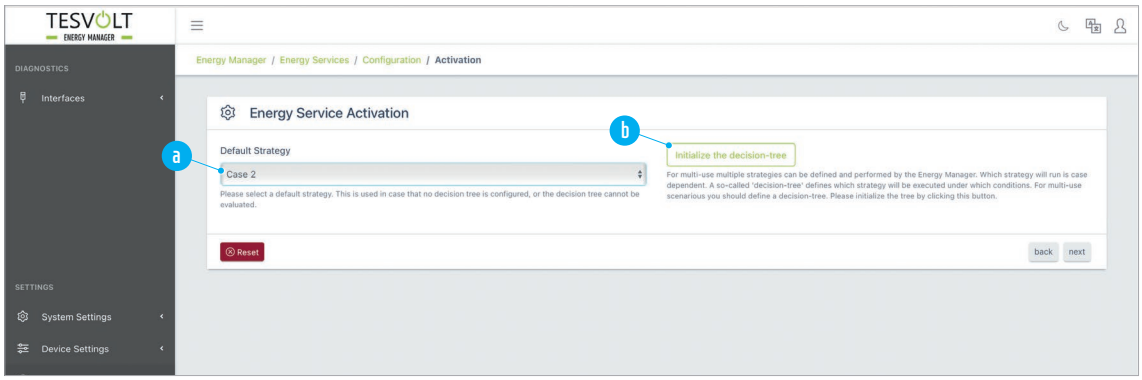
In addition, you must specify a default strategy (d), which is used if problems occur with evaluation within the decision tree.

1



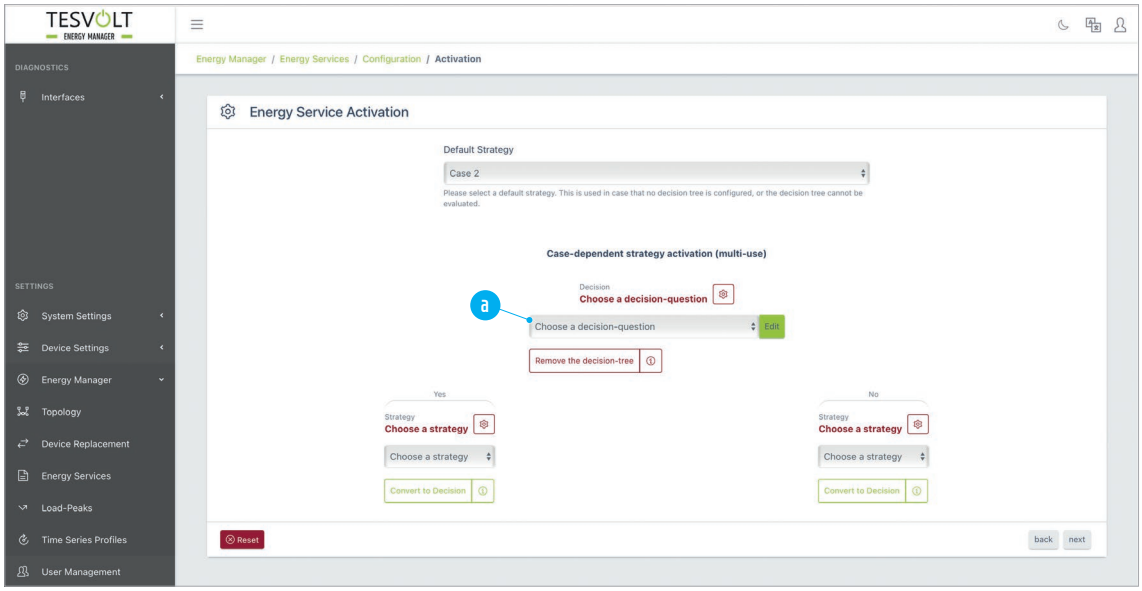
In order to configure the decision tree, first you must set up all the strategies that will be used (as described in the section “Self-consumption optimisation” on page 65, step 2). Then, click on “next” (a).

2



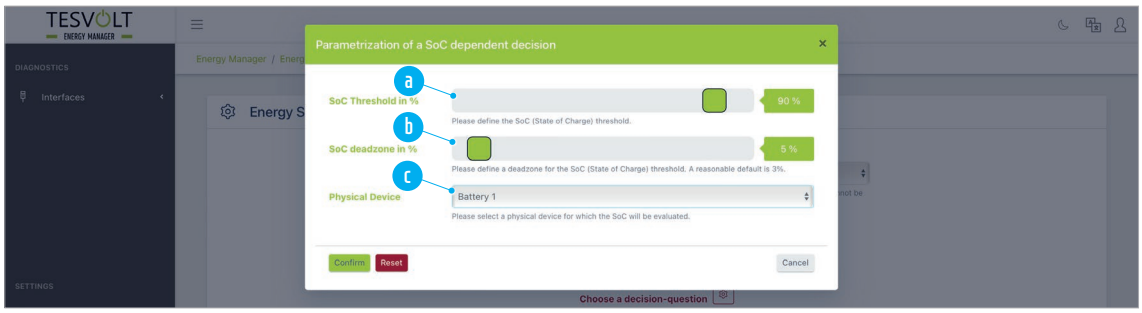
First, select the default strategy a. Then click on “Initialize the decision-tree” b.

3



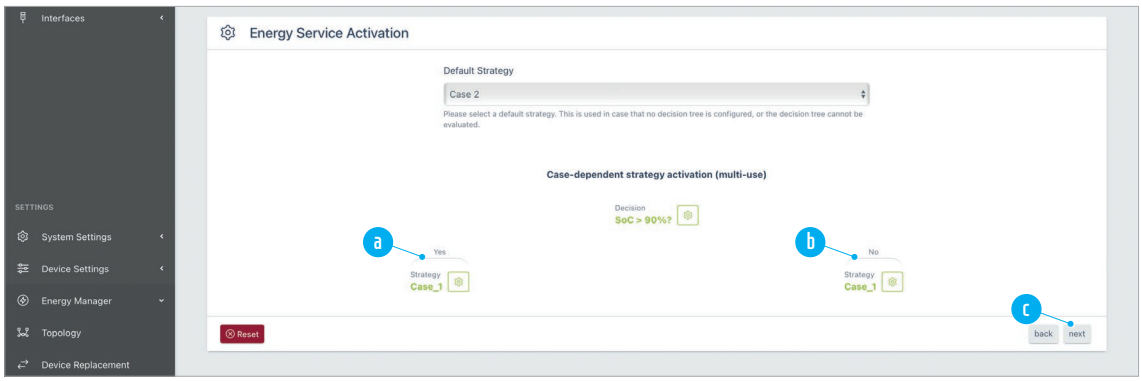
Once the page has automatically refreshed, you will see the unconfigured decision tree. Now start setting up the first decision node by clicking on the drop-down menu “Choose a decision-question” a.

4



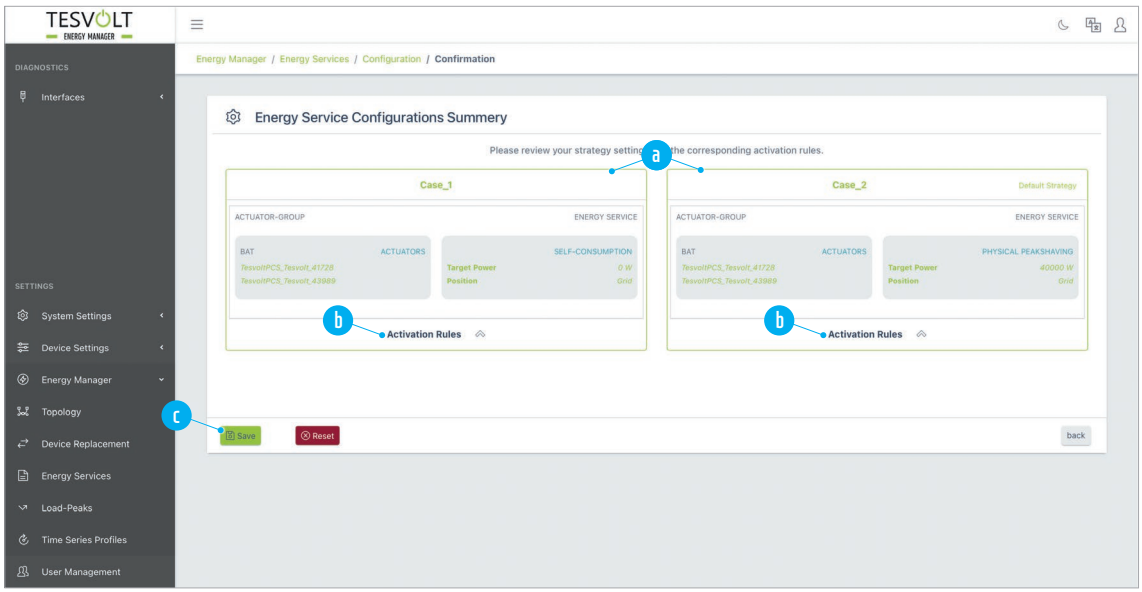
In this example, the condition to be checked is whether the SoC is more than 90 %. To set this up you must adjust the slider next to "SoC Threshold in %" a to a value of 90 %. "SoC deadzone in %" b defines by how much the threshold must be exceeded after a switching process, before another switching process can take place. This aims to prevent ON-OFF oscillation. Then, under "Physical Device" c, select the device that the settings should refer to.

5



Now select the strategy that should be carried out if the answer to the question in the first decision node is "Yes". To do this, click on the drop-down menu a on the left side of the decision node and select the planned strategy. Now configure the right side ("No") of the decision node b with the alternative strategy and then click on "next" c.

6

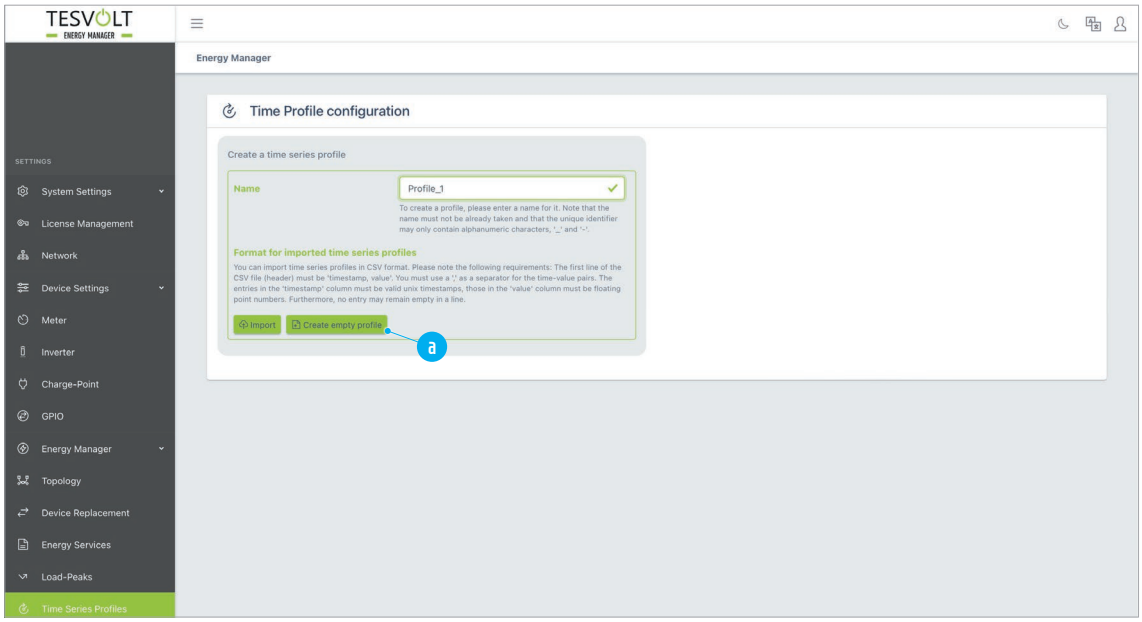


On the next page you can see an overview of the configured energy services. First, the strategies used in the decision tree are listed a. You can expand these by clicking on "Activation Rules" b. Finally, click on "Save" c. The decision tree is saved and activated.

Time of Use

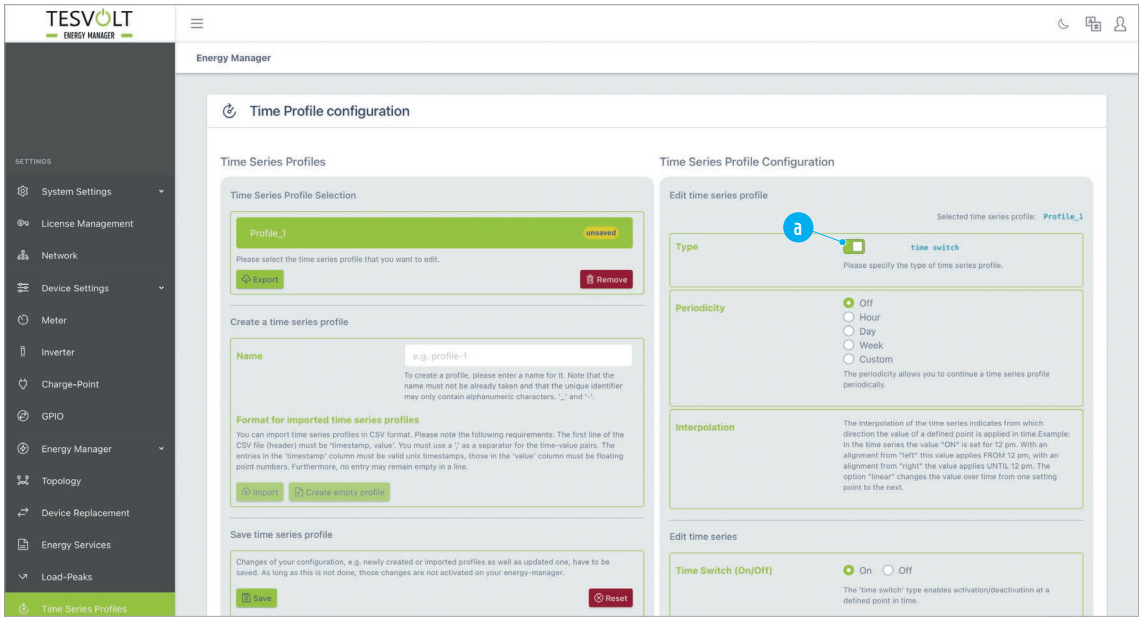
The Time of Use application enables time-dependent generation and load control in grid operation. The function is based on time series profiles, in which switching points are temporally defined. The time series profiles can then be evaluated in decision trees and linked with the desired actuators. A distinction is made between “generic” and “time switch” time switch profiles. A “time switch” time switch profile can only contain “On/Off” values. As with a time switch, this enables actuators to be switched on and off at specific times. Generic time series profiles can contain any positive or negative numerical values. These values can be sent to the relevant actuators at the specific times.

1



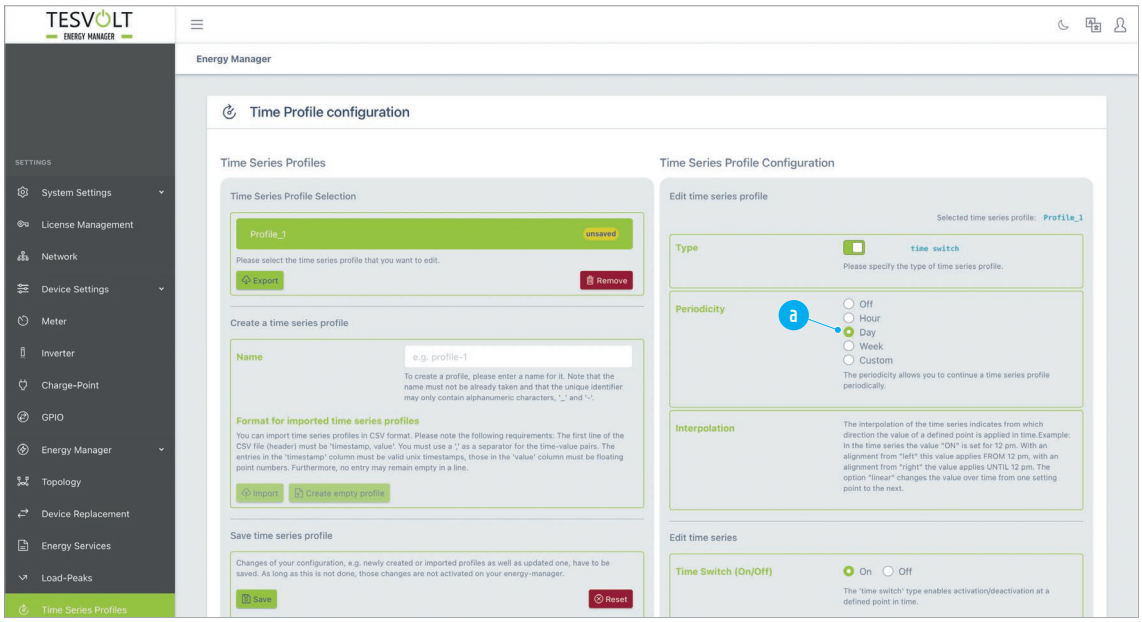
In the side menu under “Energy Manager”, click on “Time Series Profiles”. In the field “Name” a enter a name for the time series profile you are creating. Then click on “Create empty profile”.

2



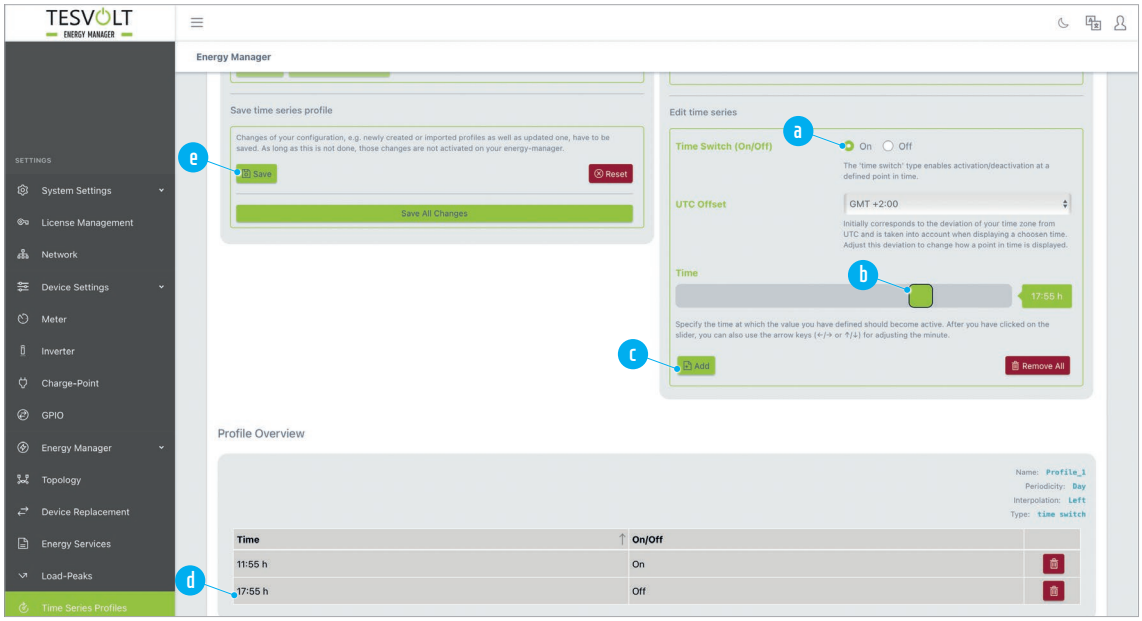
The page will refresh with several additional sections. You now need to configure the time series profile on the right side. Click on the switch next to “Type” a to select the setting “time switch”. “Time switch” only recognises the states “On” and “Off”.

3



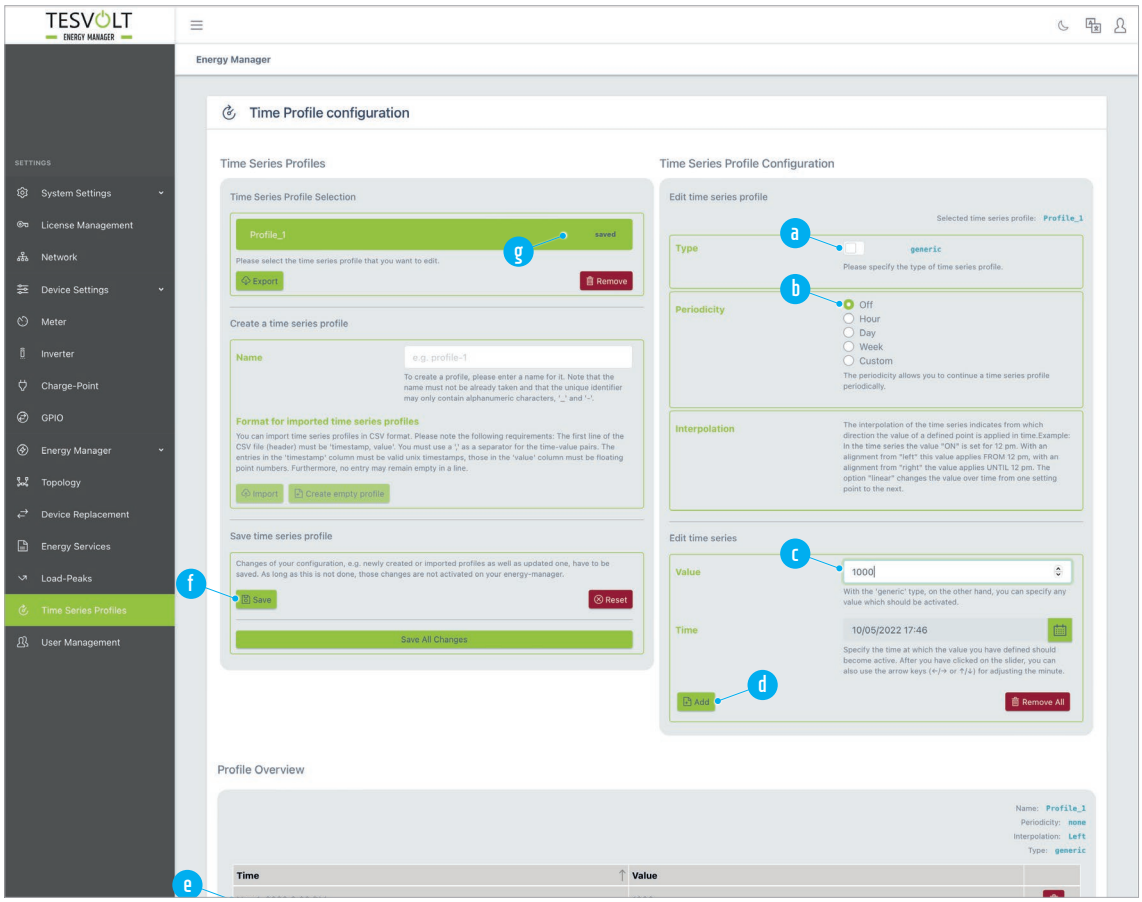
Now specify the periodicity a, i.e. what time span the time series profile covers (before it repeats). If you leave the setting on "Off", you can select any time in the future. In this case, the switching process is only carried out once and not repeated. For our example, we select a periodicity of a day.

4



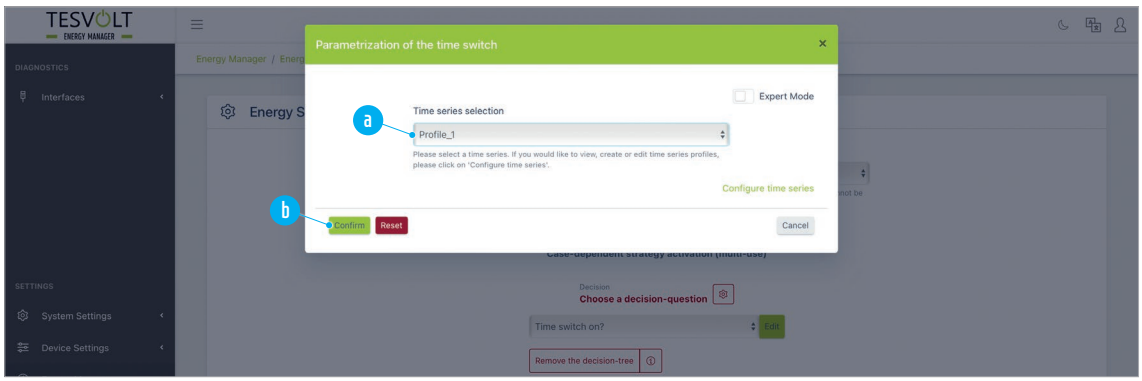
In the next step, in the "Edit time series" section, define the switching times/states. For "Time Switch (On/Off)" a select the desired switch state, and for "Time" b set the time for the first switching process by adjusting the slider or using the arrow keys on your keyboard. Then click on "Add" c. You can now see the new entry for the switching process in the "Profile Overview" list d. Finally, under the heading "Save time series profile" click on "Save" e. The profile status in the section "Time Series Profile Selection" should now have changed to "saved".

5



If you would like to create a generic time profile, begin as described in step 1 (if necessary select a new name). In the configuration of the time series profile, set the type a to "generic". Under "Periodicity" b select the desired option if applicable or select "Off" to set a time in the future at which the value c should be sent to the actuator. Then click on "Add" d. You can now see the new entry for the switching process in the "Profile Overview" list e. Finally, under the heading "Save time series profile" click on "Save" f. The status g of the profile in the section "Time Series Profile Selection" should now have changed to "saved".

6



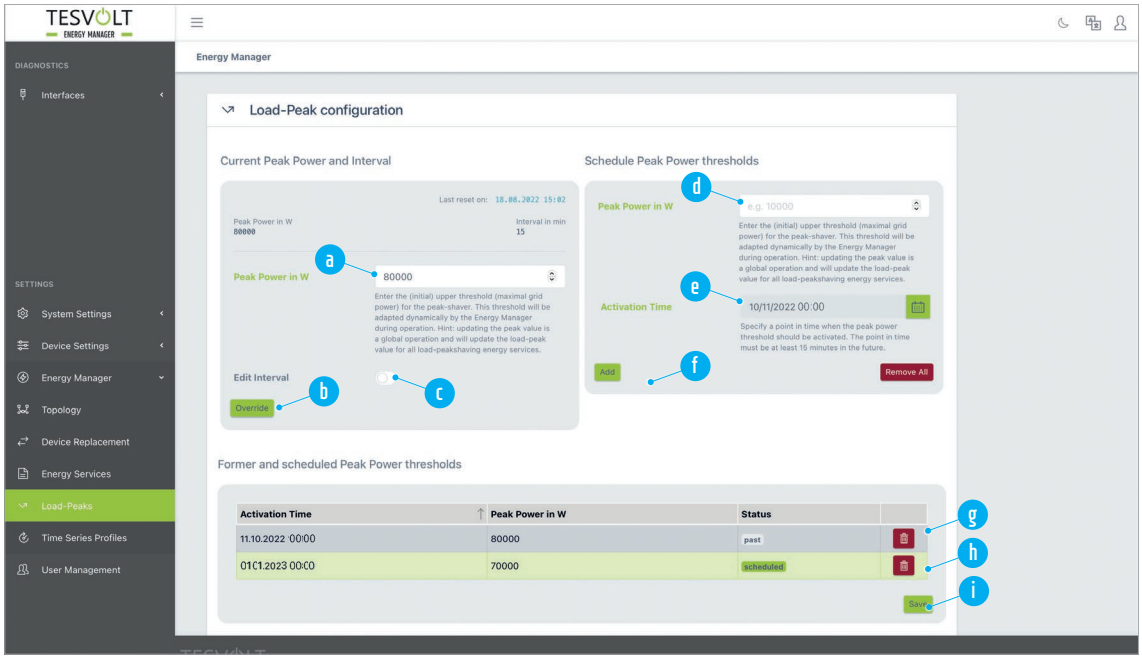
You can now control actuators that are dependent on the time series profile created in a decision tree. Proceed as described in the section "Multi-use" on page 84) to set up a decision tree. In a decision node, click on the drop-down menu "Choose a decision-question" and select "Time switch on?". You will now see the dialogue box "Parameterisation of the time switch". In the drop-down menu "Time series selection" a select the desired time series profile by clicking on it and then click on "Confirm" b. Then continue with the configuration of the decision tree.

Load peak shaving

The “Load peak shaving” function optimises the behaviour of the connected battery storage system on the grid connection point. Unlike physical peak shaving, a freely selectable time period is considered here during which the average drawn output from the public utility grid may not exceed a specific value. In Germany, the interval for load peak shaving is 15 minutes.

NOTE: If the peak shaving fails, i.e. the specified maximum value for the amount drawn from the grid is exceeded, the peak demand reached in this case is automatically set as the new maximum power value. If necessary, you can manually reset this value via the load peaks configuration and the function “Schedule Peak Power thresholds” at any time in the future, or via “Current Peak Power and Interval”.

1

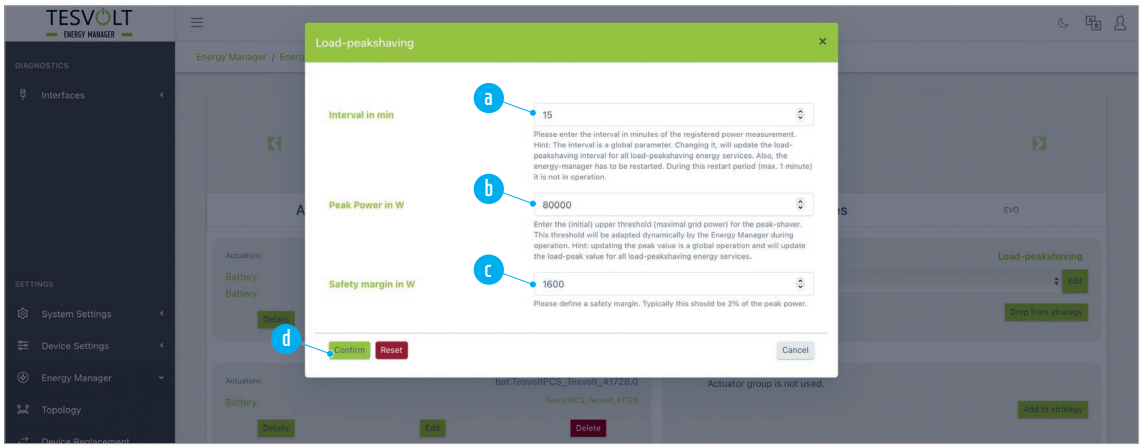


First, configure the global settings for load peak shaving. In the side menu, click on “Energy Manager” → “Load-Peaks”. In the field “Peak Power in W” (a) enter the value for the power limit. To confirm the value, click on “Override” (b). The interval is preset at 15 minutes. If you would like to specify a different interval, click on the “Edit Interval” switch (c) and enter a new interval in the field “Interval in min”. In the section “Schedule Peak Power thresholds” you have the option to activate a new peak power at a specified time. To do this, enter the new peak power in the field “Peak Power in W” (d). Next, set the activation time. As soon as you move the mouse pointer over the “Activation Time” field (e), a small calendar display appears, where you can enter a date and time. To apply the changes, click on “Add” (f). In the section “Former and scheduled Peak Power thresholds”, you can now see a grey entry (g) with the current peak power limit and an entry recorded in green (h) with the date you have scheduled. If the details are correct, then click on “Save” (i).

2

Now, in the side menu go to “Energy Manager” → “Energy Services”. Set up a new strategy (as described in the section “Self-consumption optimisation” on page 65, step 2). Enter a new name for the strategy (e.g. “Load peak shaving”) and then confirm your entry by clicking on the [+] symbol.

3



Then, on the “Strategies” page, select the item “Load-peakshaving” for the actuator group “Battery” in the drop-down menu “Select an Energy Service”. In the “Load-peakshaving” dialogue box, for the field “Interval in min” a you can enter the length of the interval over which the average value of the peak load should be calculated.
For “Peak Power in W” b enter the value for the maximum power drawn (e.g. 80000 for 80 kW). You have already specified both values previously in step 1. If you adjust the values, they will be changed across the system. For “Safety margin in W” c you can define a safety margin, which should prevent the threshold being unintentionally exceeded. Then, click on “Confirm” d. If you have several batteries in your system that are not configured as a group, repeat this step for each additional battery as needed.

4

Finally, click on “next”. You now come to the “Energy Service Activation” page. Here, select a default strategy and/or create a decision tree with the new strategy (see also the following section “Back-up power”, which describes a multi-use application with load peak shaving), or click again on “next”. On the following page, “Energy Services Configurations Summary”, scroll all the way down to the very bottom of the page and click on the “Save” button.

Back-up power (Multi-use with peak shaving)

In a power outage, a battery inverter supplies the grid independently, without the TESVOLT Energy Manager having to step in. For the “Back-up power” application, therefore, strategies are required that ensure that the storage system has sufficient energy available in the case of back-up power being needed, and that additional applications can still be employed where applicable. As requirements and topologies vary widely, only the basic procedure is explained here using an example.

Energy service: “Multi-use” with the applications peak shaving and back-up power
Strategy 1-1: Load peak shaving with actuator group battery
Position in topology: Grid connection point
Strategy 1-2: Target power advanced with actuator group battery
Position in topology: Battery
Strategy 2: Grid isolation with actuator group battery
Description: The first decision node checks whether there is grid operation. If “Yes”: next decision node; if “No”: grid isolation.
The second decision node checks whether the SoC is over 50 %. If “Yes”: load peak shaving is carried out; if “No” the battery is charged with 1 W (setting for dead zone 50 %: the battery cannot be discharged as this is only possible if both strategies demand it – which is not possible due to Strategy 1. Following discharge through grid isolation, charging of the battery storage system resumes when there is grid operation again, taking into account the max. load power limit).

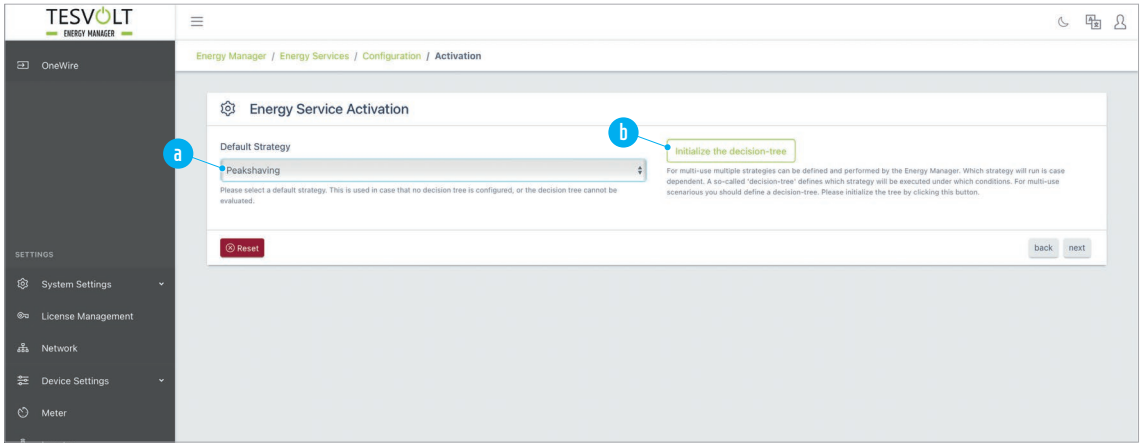
1 First, configure the global settings for load peak shaving as described in the previous section “Load peak shaving” on page 90.

2 Set up a new “Load peak shaving” strategy (Strategy 1-1) (as described, for example, in the section “Self-consumption optimisation” on page 65, step 2). For the actuator group Battery 1, select “Load peak shaving” as the energy service and configure the function.

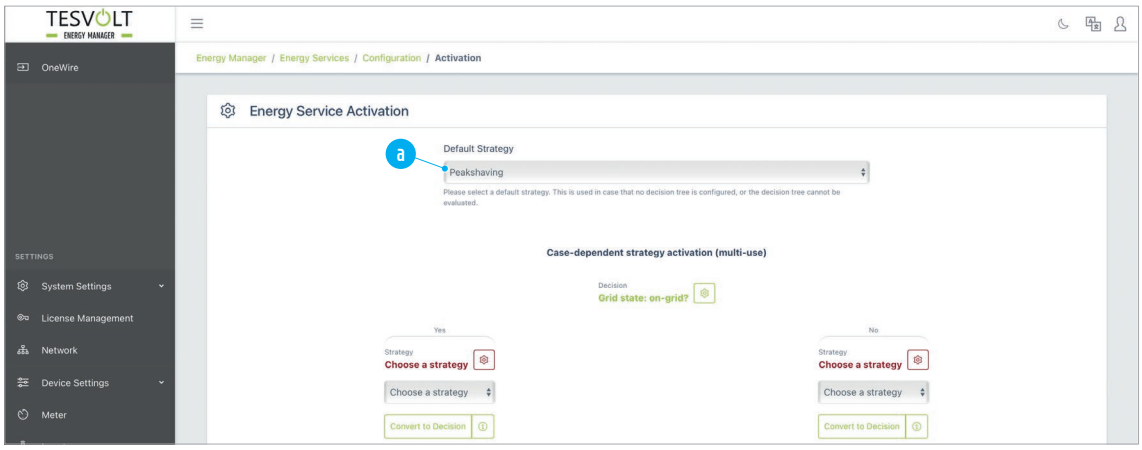
3 Set up a new “1 Watt battery charging” strategy (Strategy 1-2). For the actuator group Battery 1, select “Target-power/advanced” as the energy service. Set the target power to 1 W, and the position in the topology as “Battery”.

4 Set up a new “Grid isolation” strategy (Strategy 2). Select Battery 1 for the actuator group, and “Grid isolation” as the energy service.

5 Scroll to the bottom of the page and click on “next”.

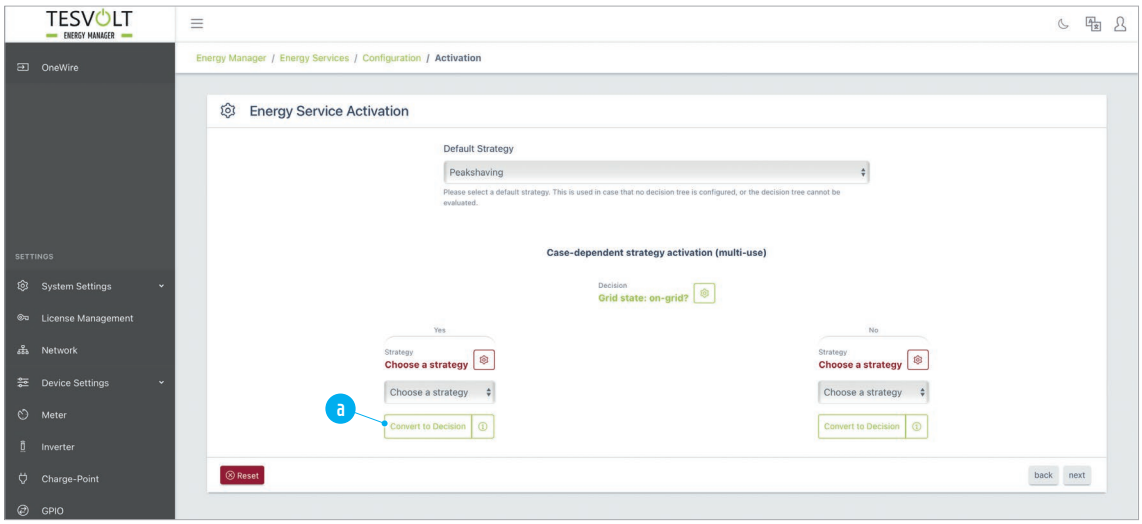
6 

On the newly loaded page, first select your default strategy a. This is used if problems occur with evaluation in the decision tree. Then click on “Initialize the decision-tree” b.

7 

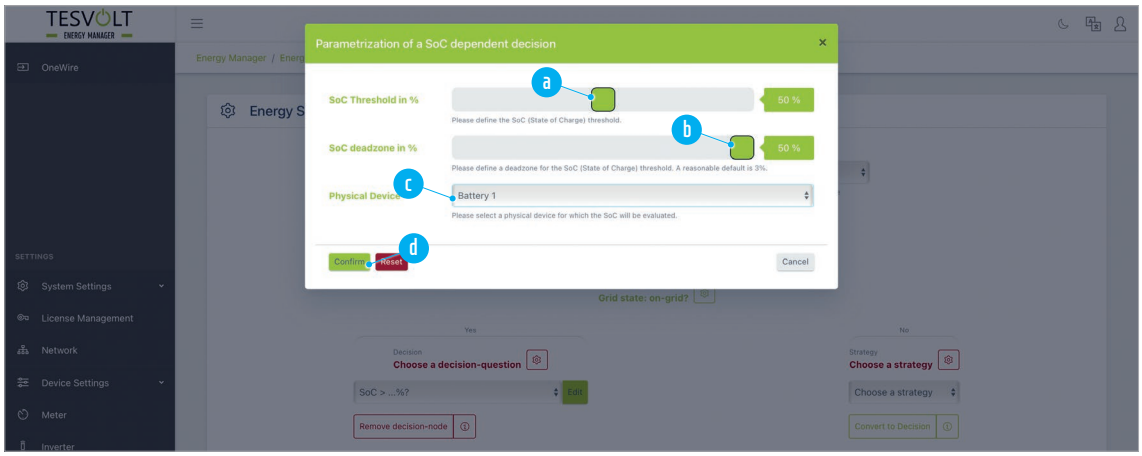
First select the question for the first decision node a. In back-up power applications, the question about the grid state is normally at the start. Select the “on-grid” state as the parameter. If the system is in grid operation, this question is answered with “Yes”; in grid isolation, with “No”.

8



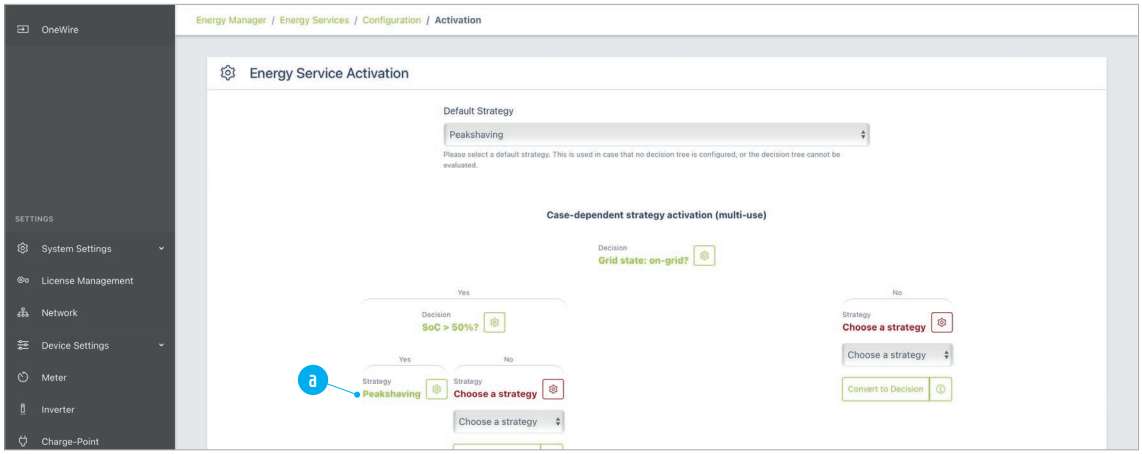
Now, on the left, "Yes" side, click on "Convert to Decision" a.

9



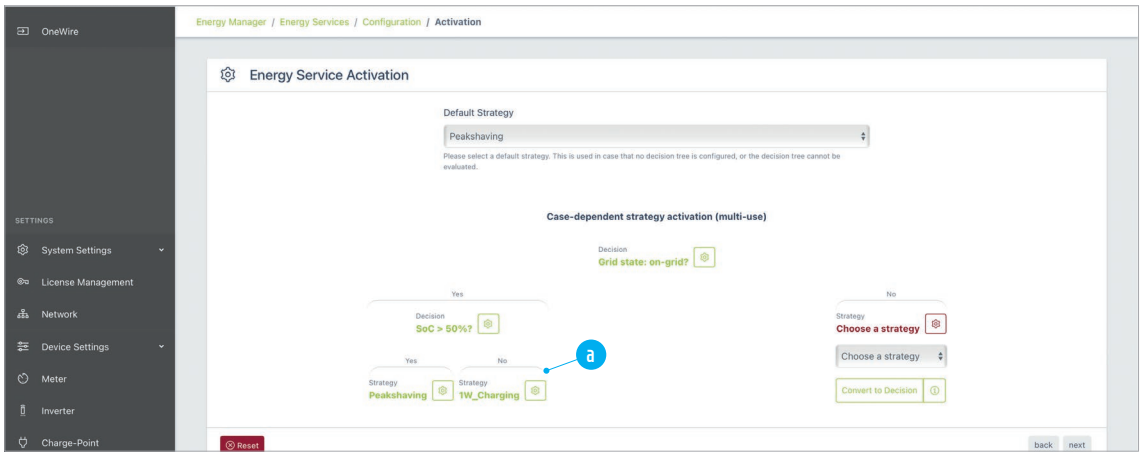
When the strategy has been converted into a decision node, select as the decision question "SoC > ...?". In the dialogue box that opens for setting the parameters, select for "SoC Threshold in %": 50 % a; for "SoC deadzone in %": 50 % b; for "Physical Device" c: Battery 1. Finally, click on "Confirm" d.

10



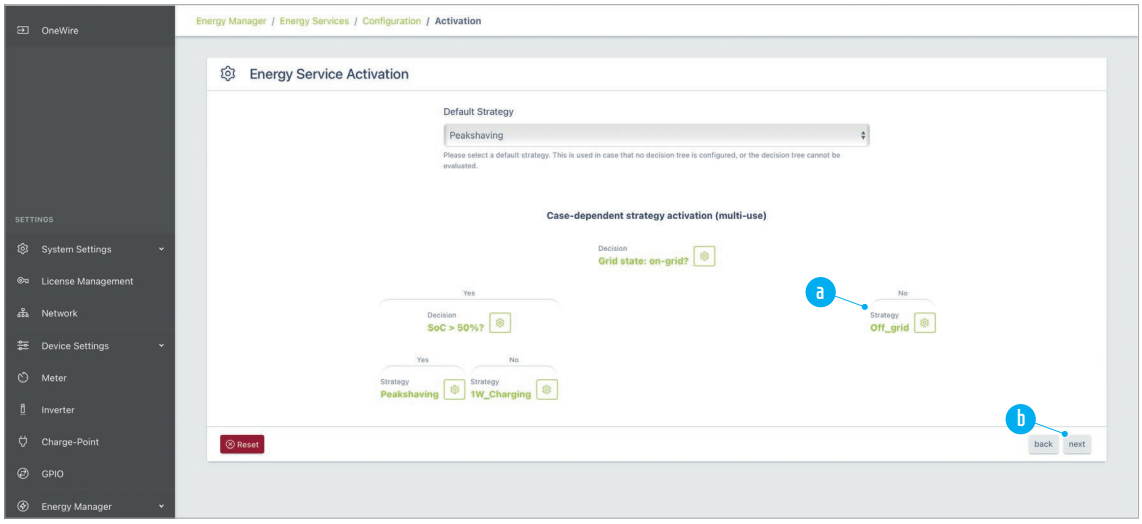
Now select the strategy for the left, "Yes" side a of the second decision node. Here you select the strategy that is to be used if the SoC is 50–100 %. So select "Load peak shaving".

11



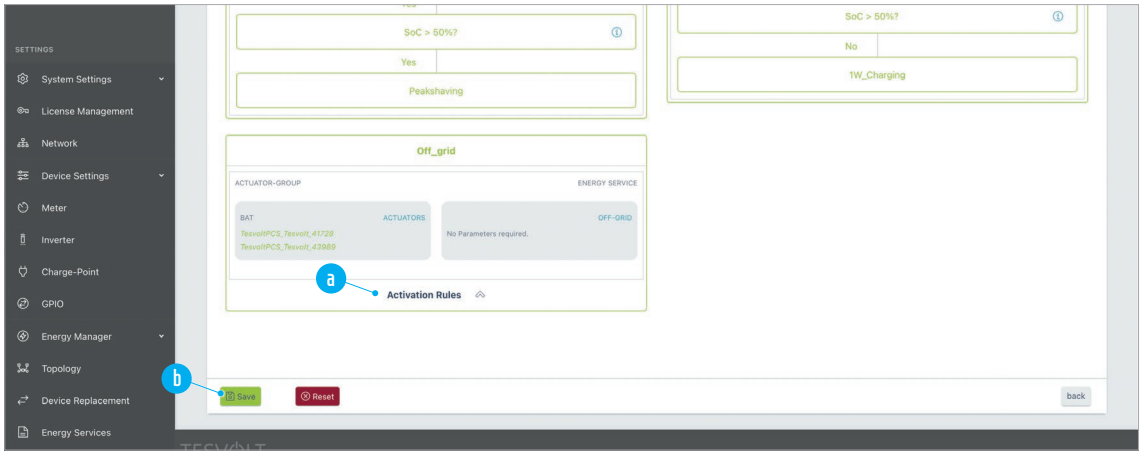
Now select the strategy for the right, "No" side a of the second decision node. Here you select the strategy that is to be used if the SoC is 0–50 %. Select "1 W battery charging" here.

12



Finally, select the strategy for the right, "No" side a of the first decision node. Here you select the strategy that is to be used if there is no grid operation. Select the strategy "Grid isolation" here and finally click on "next" b.

13



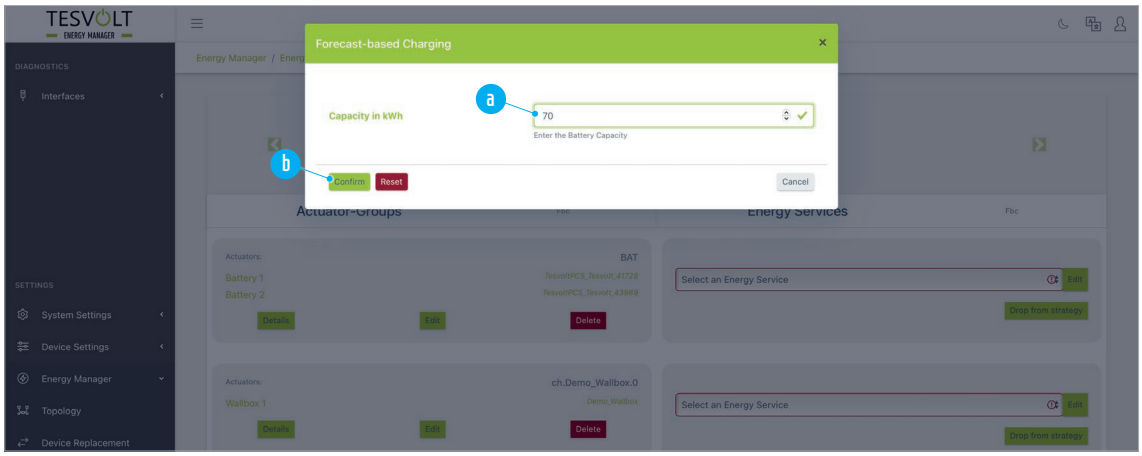
You come to the page "Energy Service Configurations Summary". Here you can see three demarcated sections with the existing strategy configurations. Click on "Activation Rules" a, and these are also displayed. Finally, click on "Save" b.

Forecast-based charging

To maximise self-consumption while simultaneously minimising feed-in peaks, battery capacity is maintained according to the weather forecast in order to avoid feed-in and/or curtailment of the PV installation (e.g. 70% regulation). The TESVOLT Energy Manager automatically controls the charging and discharging of the battery such that curtailment of the PV installation is kept to a minimum. The Energy Manager has a smart way of doing this, namely by determining the forecast PV output from local meteorological data. The Energy Manager therefore always knows how much energy is available at what point in time.

1 Set up a new strategy (as described in the section "Self-consumption optimisation" on page 65, step 2). Enter a new name for the strategy (e.g. "Forecast-based charging") and then confirm by clicking on the "+" symbol.

2 Now, in the side menu go to "Energy Manager" → "Energy Services". Add the actuator group "Battery" to the strategy. Click on the drop-down menu "Select an Energy Service" and select "Forecast-based Charging".

3 

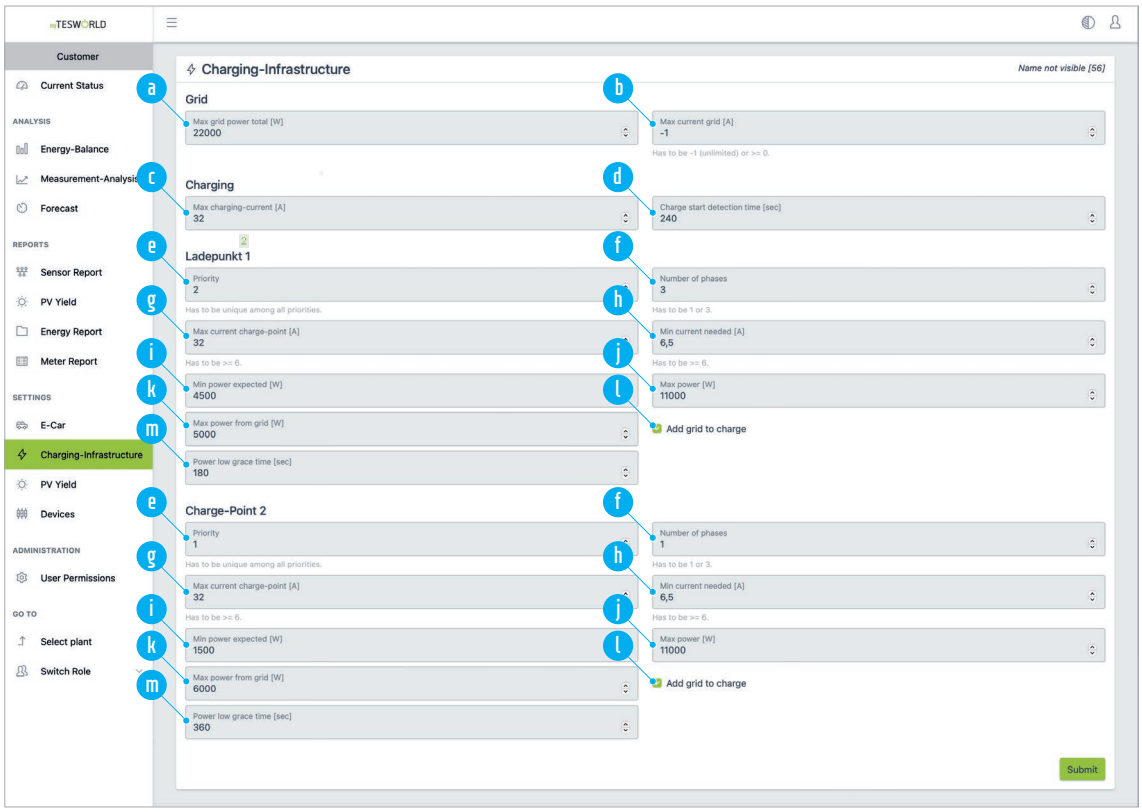
In the "Forecast-based Charging" dialogue box, enter the capacity of the battery in the field "Capacity in kWh" (a). Then click on "Confirm" (b). If you have several batteries to configure in your system, you can group them beforehand, or repeat the process from step 2 for each additional battery.

4 Finally, click on "next". You now come to the "Energy Service Activation" page. Here, select a default strategy and/or create a decision tree with the new strategy (see also the section "Back-up power (Multi-use with peak shaving)" on page 91, which describes a multi-use application with load peak shaving), or click again on "next". On the following page, "Energy Services Configurations Summary", scroll all the way down to the very bottom of the page and click on the "Save" button.

NOTE: Please note that the energy service strategy **forecast-based charging** must be approved by TESVOLT Support.

Charging station control

During operation, a wide range of settings can be adjusted by the user.



a	**Max. grid power total**	Maximum connected load at the grid connection point
b	**Max. current grid**	Maximum grid current at the grid connection point; unlimited = -1 or value ≥ 0
c	**Max. charging-current**	Maximum charging current (all charging points together)
d	**Charge start detection time**	If a vehicle is connected to a charging station and the charging process has still not started when the detection time runs out, the process is aborted.
e	**Priority charging point**	Specifies the priority compared to other charging points; each priority can only be allocated once; 1 = highest priority
f	**Number of phases**	Number of phases of the charging point; 1 or 3
g	**Max. current charge-point**	Maximum current of the charging point; value ≥ 6 A
h	**Min. current needed**	Minimum current of the charging point for charging to take place; value ≥ 6 A
i	**Min. power expected**	As a rule, i = h x f x 230 V; however, if e.g. a vehicle produces a lot of reactive power, a value deviating from this formula can be specified here. If 0 is entered for i, the value calculated through the formula applies.
j	**Max. power**	Maximum power for the charging point.
k	**Max. power from grid**	Defines the max. power that can be drawn from the utility grid for charging at this charging point. If "0", charging is solely with PV electricity.
l	**Add grid to charge**	When active, the power specified in k can also be drawn from the utility grid, even if the min. power expected i is exceeded. Enables fastest charging times (when active).
m	**Power low grace time**	Defines the length of time for which the max. power from grid k can be exceeded by the charging point (e.g. to prevent a charging process being interrupted if a cloud reduces the PV yield, more grid electricity can be used for charging for the length of m).

Off-grid generator curtailment for target SoC

The energy service off-grid generator curtailment enables generator systems to be curtailed off-grid. The energy management system ensures that the maximum charging capacity of the generator's battery is never exceeded.

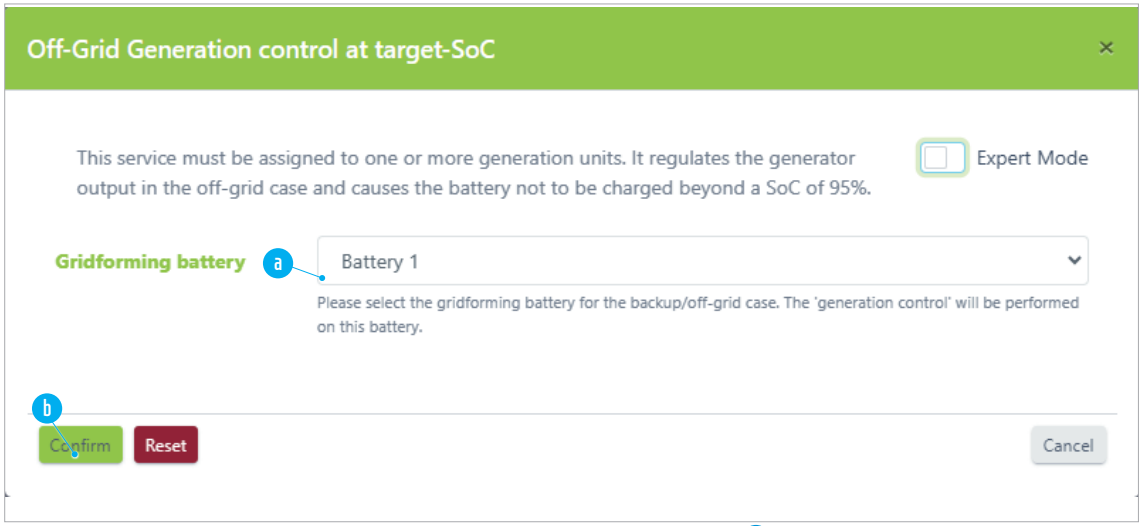
The generator installation (e.g. photovoltaic installation) complies with the battery's maximum SoC limit and keeps battery discharge and charge to a minimum.

NOTE: Please note that, for the energy service strategy **off-grid generator curtailment for target SoC**, you must select a generator.

1 Create a new energy service strategy (as described e.g. in section "Self-consumption optimisation" on page 65, step 2). Enter a new name for the strategy (e.g. "Generator curtailment") and then confirm by clicking on the "+" symbol.

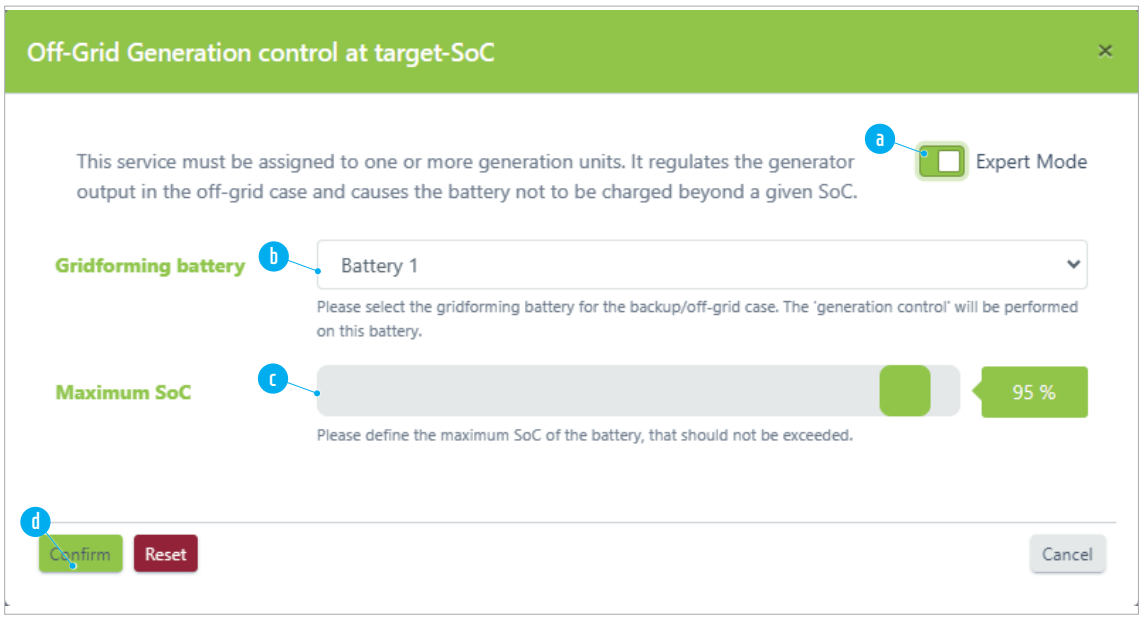
2 Now go to "Energy Manager" → "Energy Services" in the side menu. Add the actuator group "PV 1" to the strategy. Click on the drop-down menu "Select energy service" and select "Off-grid generator curtailment for target SoC".

3



In the dialogue box "Off-grid generator curtailment for target SoC" a, select the desired battery in the drop-down menu next to "Grid provision battery".
Then click on "Confirm" b.

4

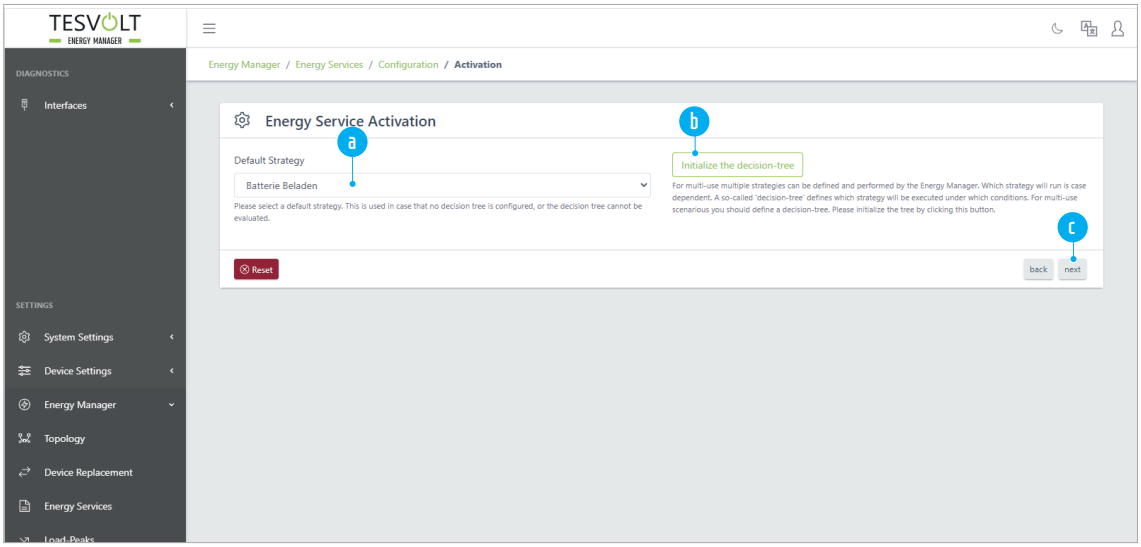


Or activate the expert mode a by ticking the box in the dialogue window "Off-grid generator curtailment for target SoC".
Select a battery in the drop-down menu under "Grid provision battery" b.
Use the slider to set the maximum state of charge c.
Then click on "Confirm" d.

5

On the overview page of the new energy service strategy, click on "Next" (at the bottom). This takes you to the "Energy Services Activation" page.

6



Select a standard strategy a here if required and/or create a decision tree with the new strategy by clicking on "Initialise the decision tree" b. Also see section "Back-up power (Multi-use with peak shaving)" on page 91, which describes a multi-use application with load peak shaving.

7

Then click on "Next" c.
The "Energy Service Configurations Summary" page opens.
On this "Energy Service Configurations Summary" page, scroll to the very bottom and click on the "Save" button.

Dynamic electricity tariffs

There are a number of ways you can use the TESVOLT Energy Manager dynamic electricity tariffs:

Energy cost provider: you can store your access data for the providers aWATTar and Tibber in the configuration so that the TESVOLT Energy Manager can retrieve and process this data.

Classification into high/medium/low: the TESVOLT Energy Manager automatically classifies the electricity prices it receives into three categories: high, medium and low. You can use this classification in the time series format as a basis for various strategies, energy services and decisions.

Electricity price-based switching: you can also switch consumers on or off based on fixed, individually defined electricity price limits. It is also possible to set the desired power consumption depending on the price level.

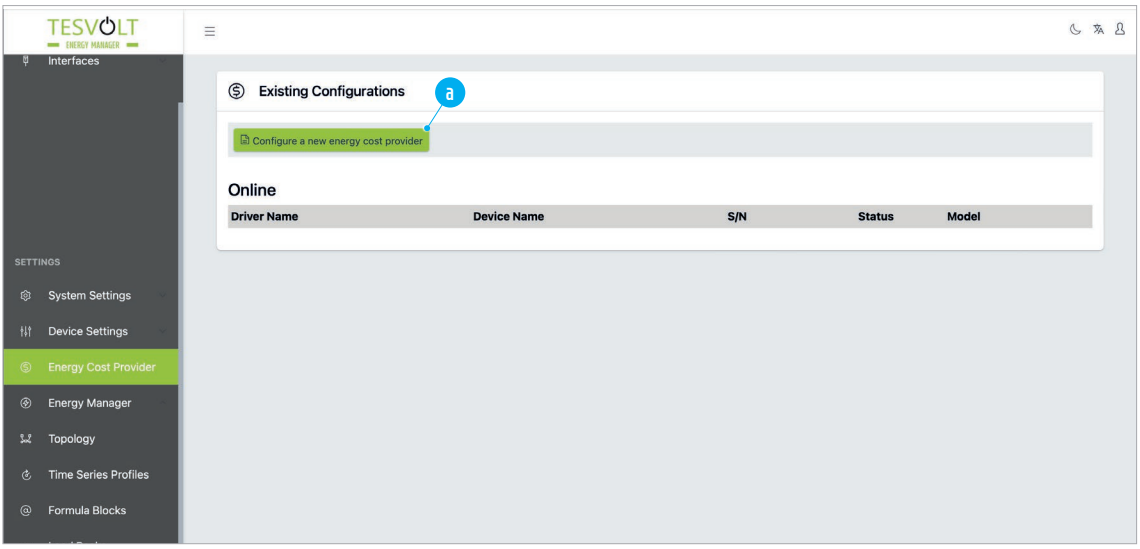
Electricity price-based wall box control: you can charge electric vehicles automatically at the optimum cost based on electricity price fluctuations. Simply enter the desired amount of energy in kWh and the desired departure time.

Energy cost provider

The linkage of dynamic data from energy cost providers (e.g. Tibber, aWATTar) allows this data to be used by the TESVOLT Energy Manager e.g. for price-based switching of generators, charging of electric cars or calculations of energy services or in decision trees.

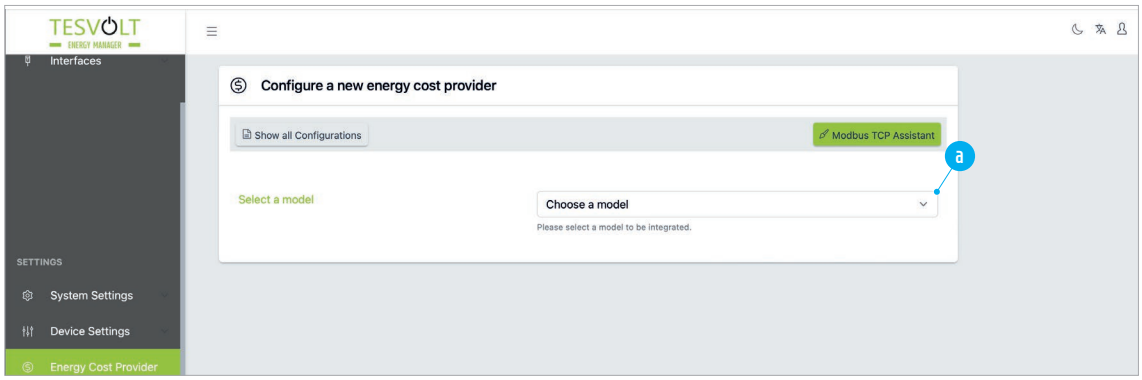
To configure a provider for dynamic electricity prices, please proceed as follows:

1. Click on the "Energy Cost Provider" entry in the menu on the side.

2. 

Clicking on a "Set up new energy cost provider" will take you to the selection page of energy cost providers that are currently available.

3



Now click on "Select a model" (a) and select the desired provider from the drop-down field with a mouse click. Please provide any additional information that may be required.

4 Click on "Save" to receive and use the data of the configured provider in the TESVOLT Energy Manager.

NOTE: The Energy Manager must be able to access the Internet in order to set up an energy provider.

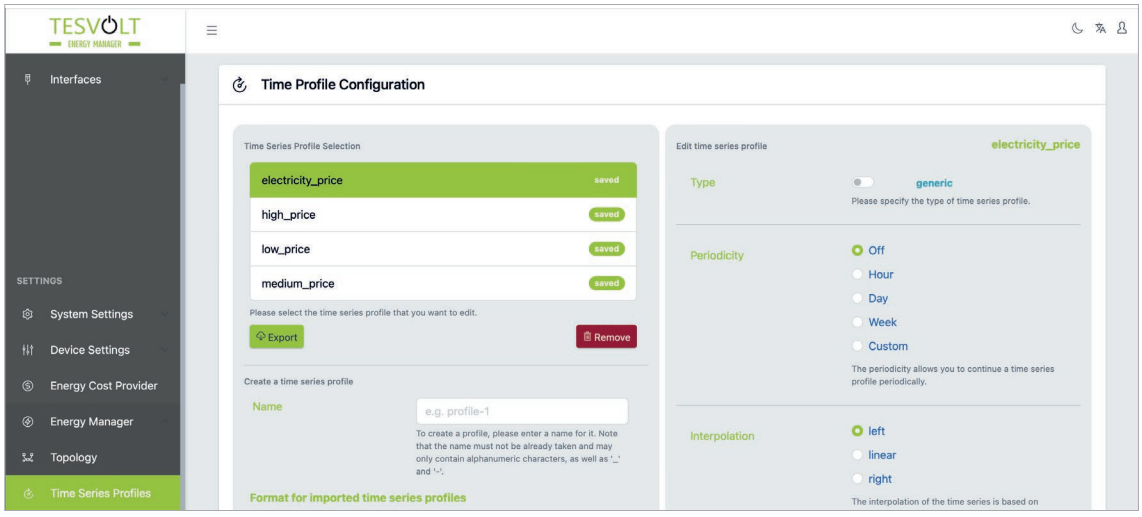
WARNING: Only one energy cost provider should be configured to ensure consistency of the electricity price data used.

Price classification

In order to respond to the options provided through dynamic electricity pricing, the Energy Manager records the data from the configured provider and automatically classifies it into three categories: high, medium and low. The classification is applied to the prices received on a daily basis:

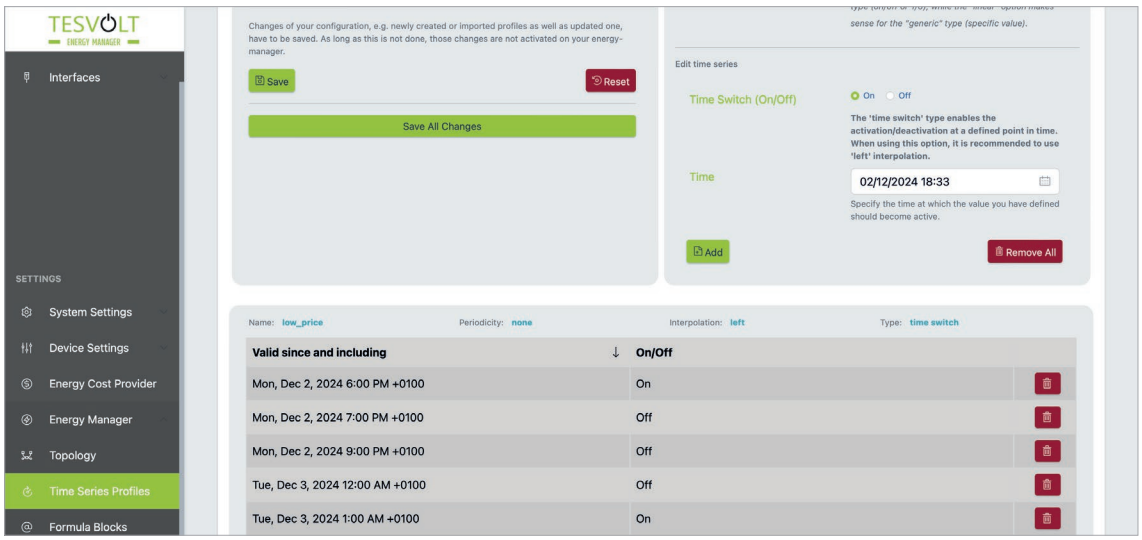
- The electricity price is considered "high" when it is in the upper third for the day
- It is considered "low" when in the lower third
- Otherwise it is considered to be "medium"

These categories are then made available to you in the form of time series profiles, with the option of having them evaluated accordingly by theTESVOLT Energy Manager:



The time series profile "electricity_price" contains the entire list of dynamic electricity prices received. The "high_price" profile shows the periods in which a high price is to be expected, the "medium_price" profile shows those with medium prices and the "low_price" profile those with low prices.

NOTE: Please note that these profiles are created in such a way that the price shown is valid up to the specified hour.



In this example, the time series profile "low_price" indicates that low prices still apply until 6 pm Central European Summer Time (the value is "On"). However, prices starting at 6:01 pm are no longer considered low (the value is "Off" until midnight). This classification continues until 12:01 am, because low prices apply again from then until 1:00 am (the value is "On").

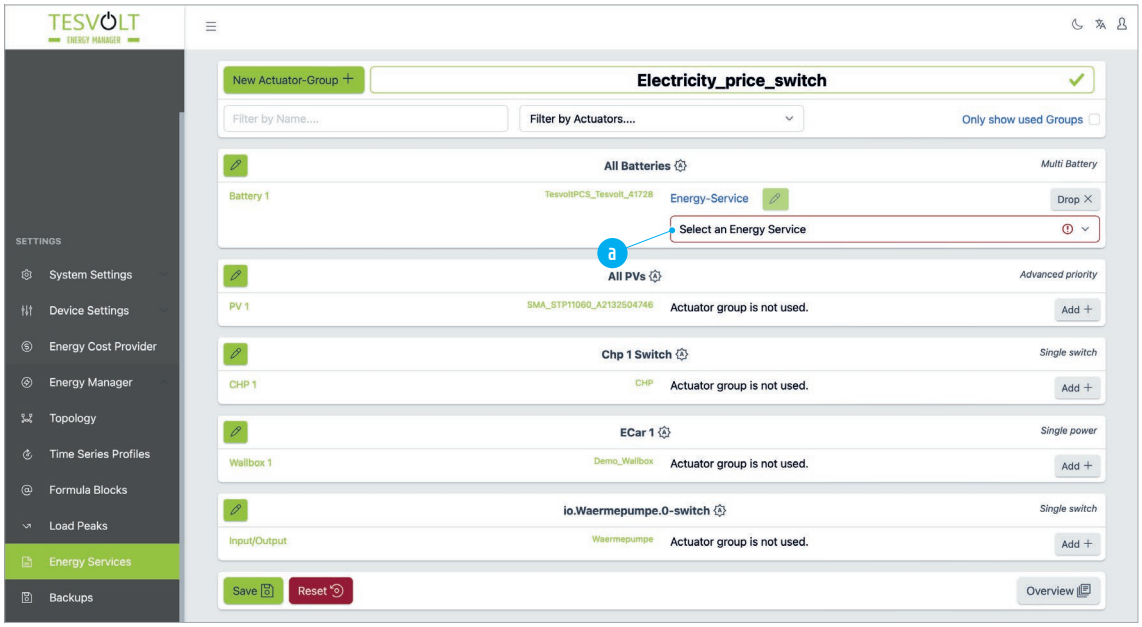
Electricity price-based switching

With the "Electricity price-based switching" function, devices can be switched on or off when a certain electricity price is exceeded or not reached, or can be operated at a certain power setting point.

A distinction is made here based on the type of actuator group:

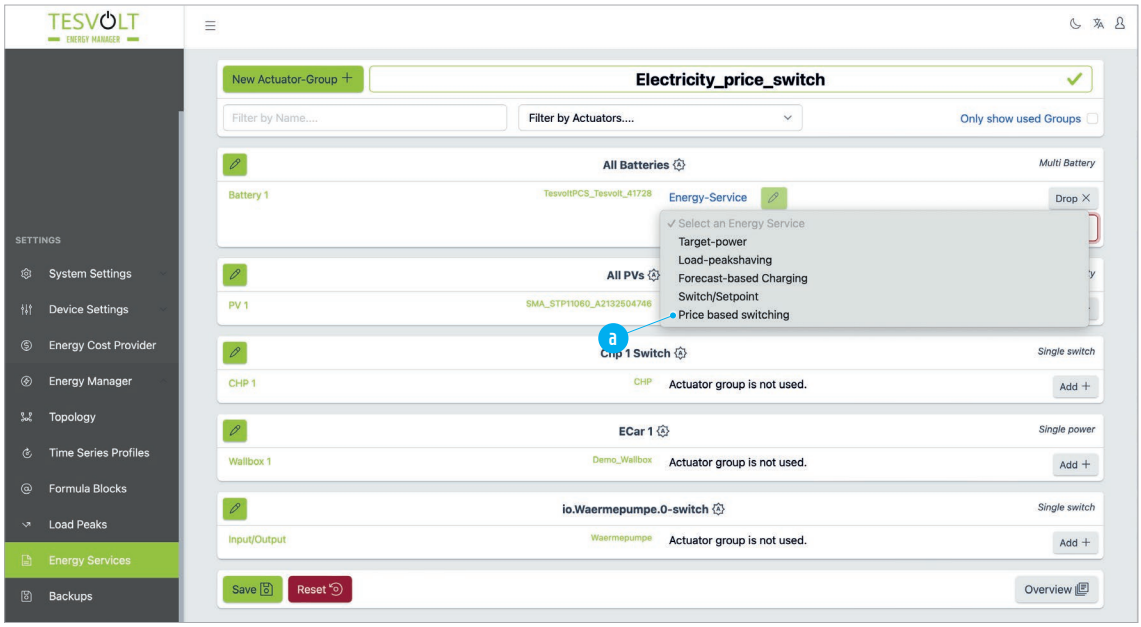
- Switch setting point actuator group (e.g. heat pumps with SGReady connection)
- Power setting point actuator group (e.g. PV inverter)

1



Create a new strategy in the energy services area (e.g. "electricity_price_switching"). First, click on the "Add" button for the actuator group that will execute the strategy and then on "Select energy service" a.

2

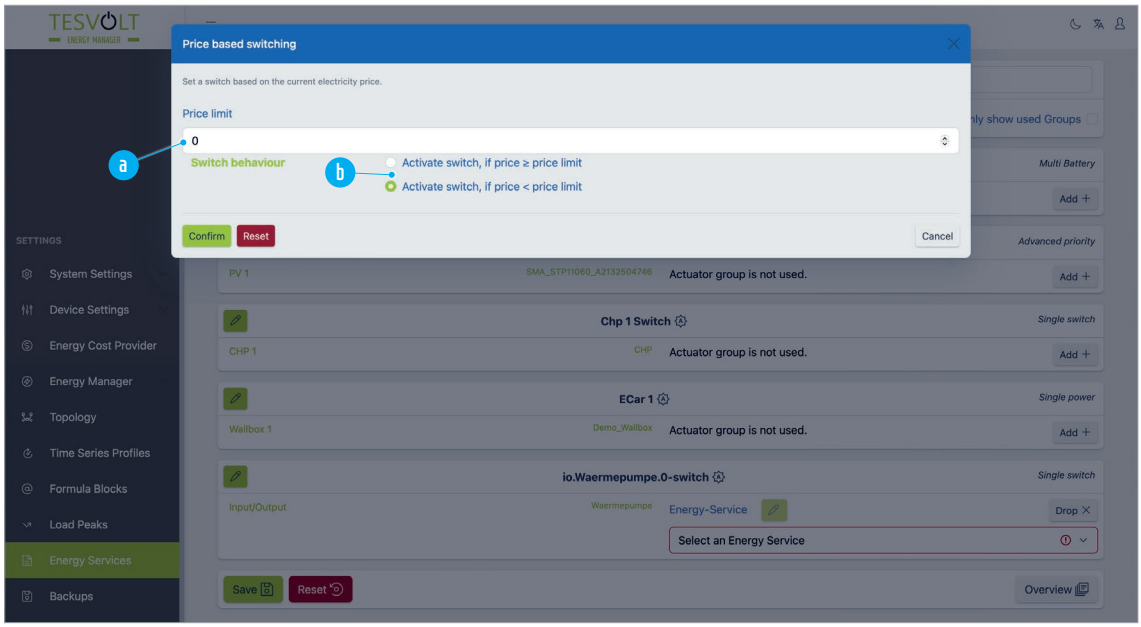


Select "Price-based switching" from the drop-down menu.

NOTE: This energy service can only be selected if (variable) electricity prices are also activated.

Electricity price-based switching of switch setting point actuator groups

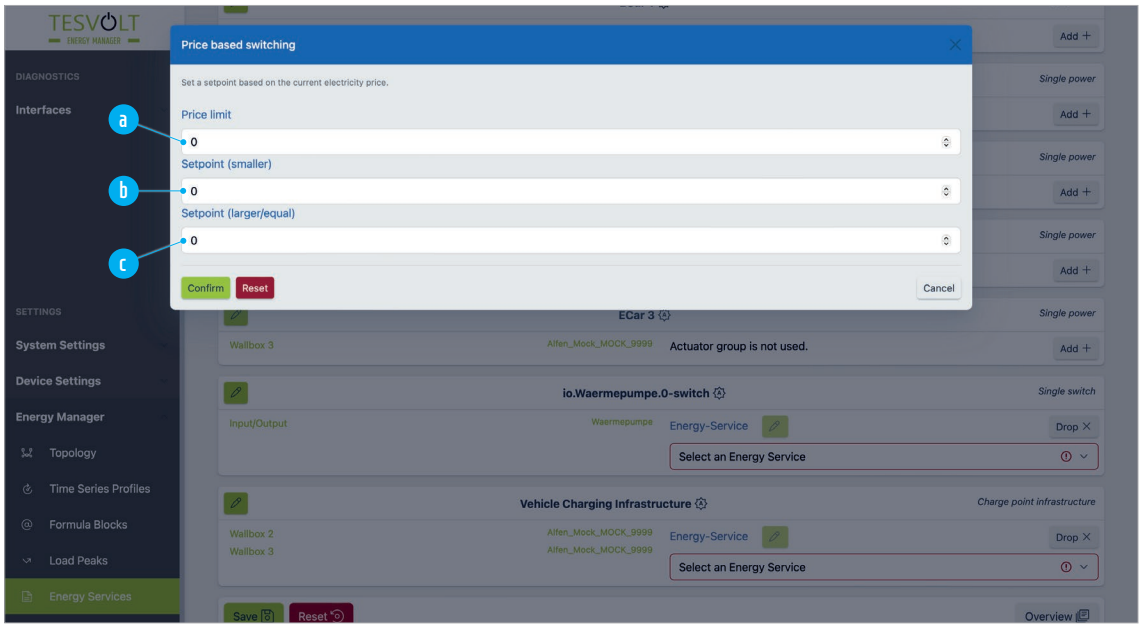
1



You can set the switching threshold in ct/kWh in the "Price limit" a input field. When you configure the settings for the switch behaviour, b you can determine the direction in which the price limit should apply when activating the switch.

Electricity price-based switching of power set point actuator groups

1



Enter the switching threshold in ct/kWh in the “Price limit” a input field. In the “Set point (less than)”, b input field you can define the set point for the actuator group when the price is below the set price limit. This means that the specified power value is sent to the corresponding actuator group as a default setting as long as the price is less than the set price limit.
This means the “Set point (greater than or equal to)” a defines the set point for the actuator group when the price is equal to or greater than the set price limit.

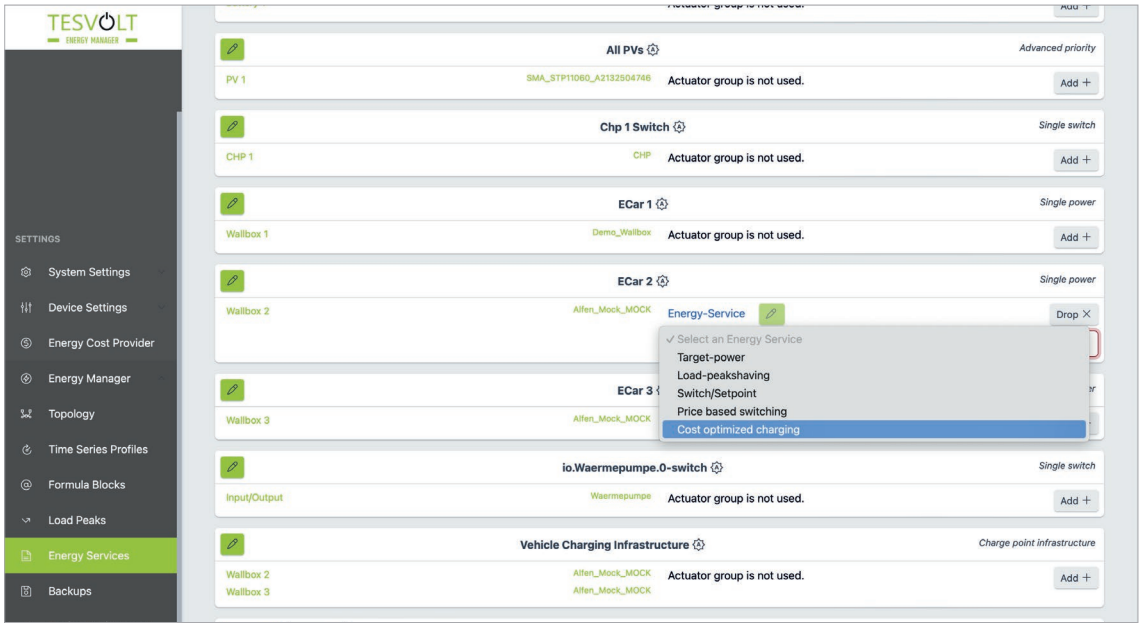
NOTE: If the energy service strategy cannot be evaluated, then no set point is transmitted to the actuator group. Reasons for a failed evaluation may be missing price information from the energy cost provider or a prolonged loss of connection between the TESVOLT Energy Manager and the internet.

Cost-optimised charging

With price-based charging, you can tell the TESVOLT Energy Manager at what price you want to charge your electric car, when you want charging to be completed, and how much energy you want to charge during this time. For this purpose, the corresponding wall box is assigned an energy service called “Cost-optimised charging”. Further settings can be made on the myTESWORLDportal.

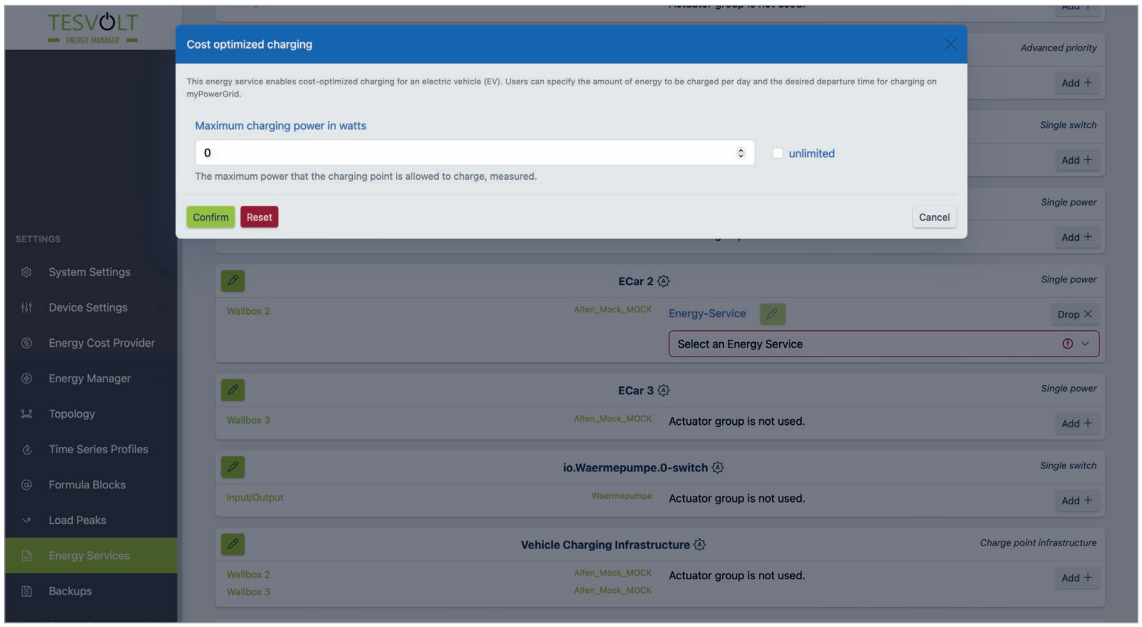
To enable electricity price-based charging, please proceed as follows:

1



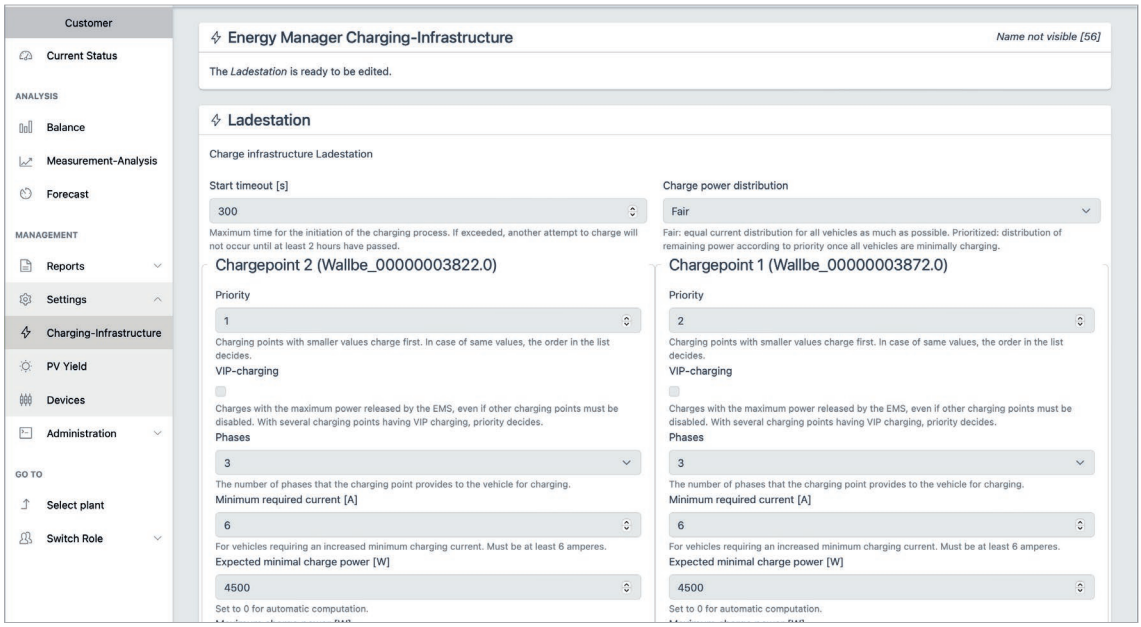
Open energy service strategy settings and select the energy service “Cost-optimised charging” for a wall box.

2



You can now specify the maximum charging power in watts for this energy service in the settings. Checking the box “unlimited” removes this limitation. The charging power is then limited by the charging point and the electric car.

3



As soon as an energy service “Cost-optimised charging” is available, you can make the dynamic settings in the myTESWORLD portal under [Settings > Electric car]. Select the appropriate actuator group first if there is more than one actuator group with cost-optimised charging.

4

You will then have the following input options:

- Mode
- Desired amount of energy in kWh
- Planned departure time

For mode, you can choose from the following predefined options:

- Optimum cost: the vehicle is charged when the electricity price is low.
- One-time fast charging: one time full charge as quickly as possible, regardless of the price.
- Continuous fast charging: always charge as quickly as possible when the vehicle is charging.
- Desired amount of energy in kWh: here you enter the desired amount of energy to be charged within the defined time.
- Planned departure time: specifies the time by which the specified amount of energy should be charged.

5

Click on “Transfer” to send the values to your Energy Manager, where they will be implemented.

Further applications

The implementation of the following applications is carried out exclusively on a project-specific basis:

- Off-grid
- Micro-grid
- Semi-off-grid operation
- Power quality

Our TESVOLT Service Line +49 (0) 3491 87 97 - 200 will be happy to plan and configure your system together with you according to your requirements.

10 SYSTEM MONITORING IN MYTESWORLD

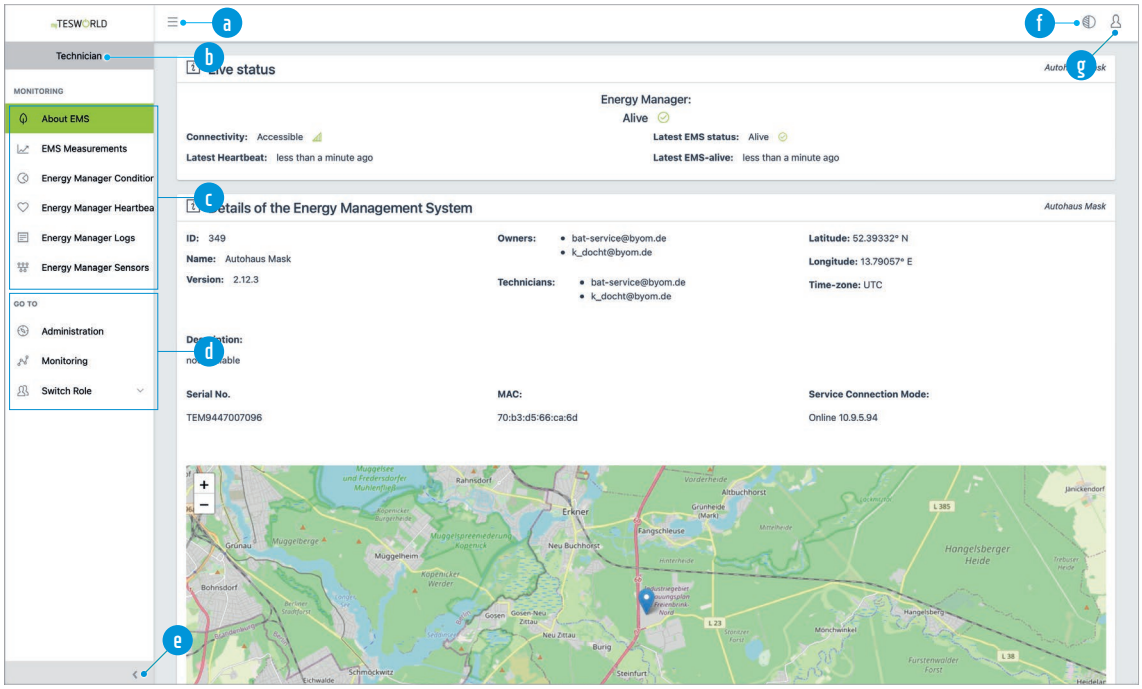
10.1 myTESWORLD USER INTERFACE

The myTESWORLD portal is operated from a graphic user interface and displayed in a browser. Current and past data are visualised in the portal. In addition to this, settings can also be adjusted on compatible devices on the connected systems.

Customer view

a	**Show/hide the menu**	Show or hide the menu
b	**Role**	Shows the role of the current user
c	**Analysis**	Access to forecast data, current data and past data
d	**Reports**	Access to past data incl. download as Excel/PDF
e	**Settings**	Configuration of: electric car/charging infrastructure (optional), presentation of PV yield, device names
f	**Administration**	User rights settings and automatic report setup
g	**Go to**	Go to the system displayed or switch roles
h	**Menu display**	Reduced menu display with symbols or full display including text
i	**Bright/dark display**	Switch between bright or dark user interface
j	**User settings**	User settings and logout of current users

Technician view



a	**Show/hide the menu**	Show or hide the menu
b	**Role**	Shows the role of the current user
c	**Monitoring**	Access to current and past data incl. download as Excel/PDF
d	**Go to**	Go to the system displayed, switch role or go to the administration section
e	**Menu display**	Reduced menu display with symbols or full display including text
f	**Bright/dark display**	Switch between bright or dark user interface
g	**User settings**	User settings and logout of current users

10.2 USER MANAGEMENT

User roles

In the myTESWORLD portal, you have two possible user roles available. The "Customer" role enables the user to view the current system status and various visualisations of power and energy values, and to manage user permissions if necessary. If you want to make changes to settings in the myTESWORLD portal, you need the technician role for this. To assign a technician role to a newly created user, you need another user account with administrator permissions, or you can contact TESVOLT Service Line +49 (0) 3491 87 97 - 200 to have the new account assigned the relevant permissions.

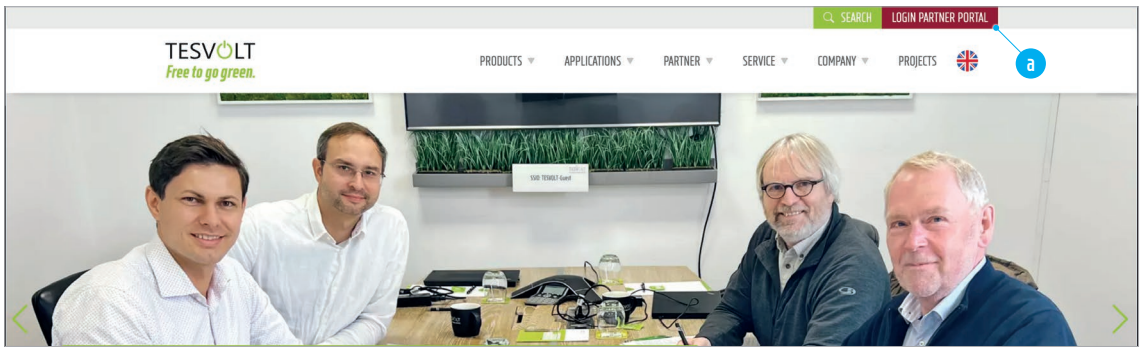
Administrator rights

Rights for the administration of the system can be assigned to the customer and technician roles. In the customer role, settings can only be managed for the rights of other users. Administrator rights can be transferred in two ways. First, administrator rights can be assigned to a user when creating a new EMS, but these rights only apply to this EMS. However, administrator rights can also be granted to entire groups or sub-groups. Administrator group rights can only be set up via the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

New registration in myTESWORLD via the TESVOLT Partner Portal

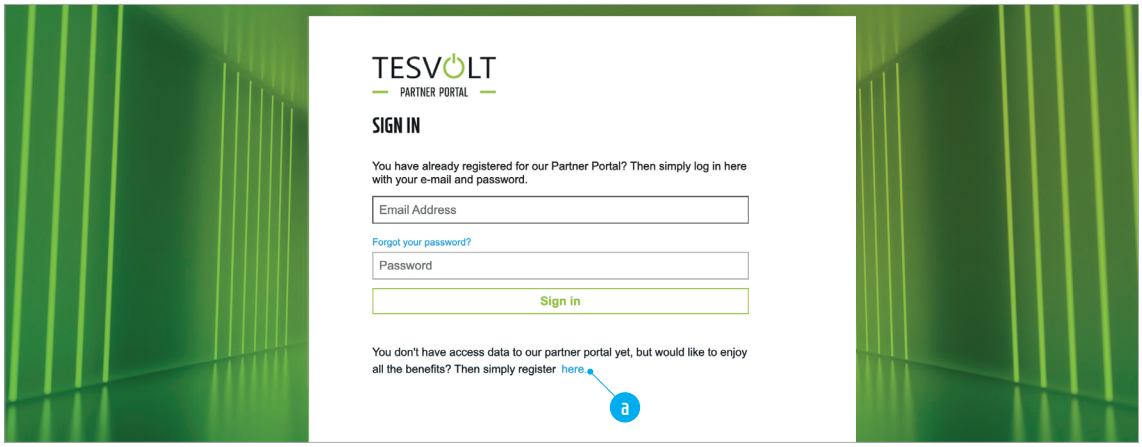
NOTE: Please only create one account per installer/customer via the partner portal. To register other necessary accounts, for example for employees of your company, please use the "Sign up" link on the https://mytesworld.tesvolt.com/ page.

1



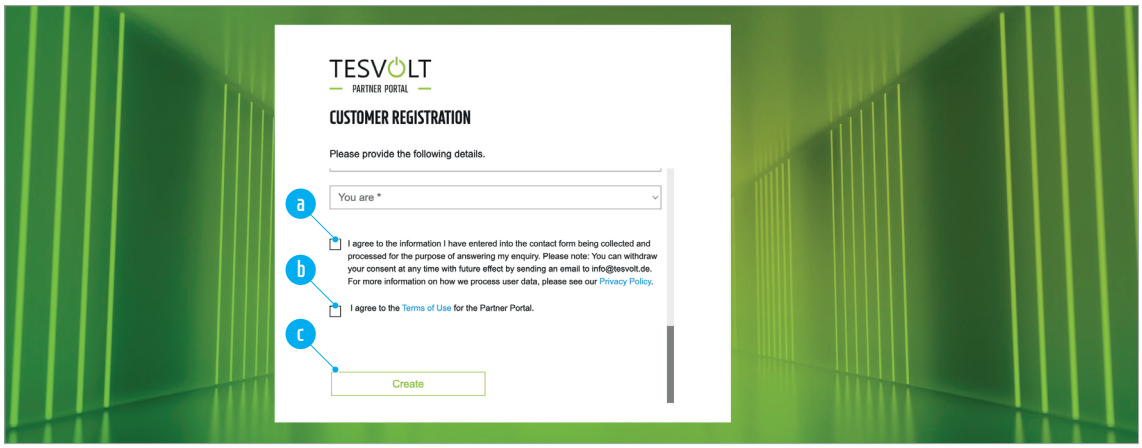
Access https://tesvolt.com/ in an internet browser. Click on the "Login Partner Portal" link a in the top right hand corner. If you (as an end customer) already have an account in the myTESWORLD portal, you can move straight on to the next section.

2



On the login page that opens, click on the "here" link a.

3



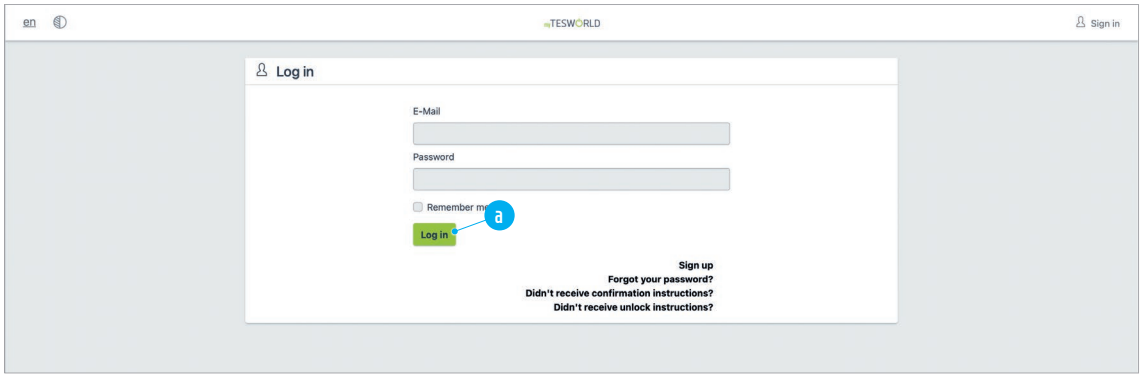
Now fill in the user registration form and, if you can agree to the information provided, tick the privacy a and terms of use b boxes. Finally, click on "Create" c.

4 You will first receive a confirmation email and then a verification email. Click on the "Verification" link in the email. Create and confirm a password in the dialogue box.

5 You can now log in to the TESVOLT Partner Portal. To log in to the myTESWORLD portal, open the dashboard page in the partner portal and click on the "myTESWORLD" tile. If you are already on the login page of the myTESWORLD portal, please use the "Log in with Tesvolt" button to log in via the partner portal.

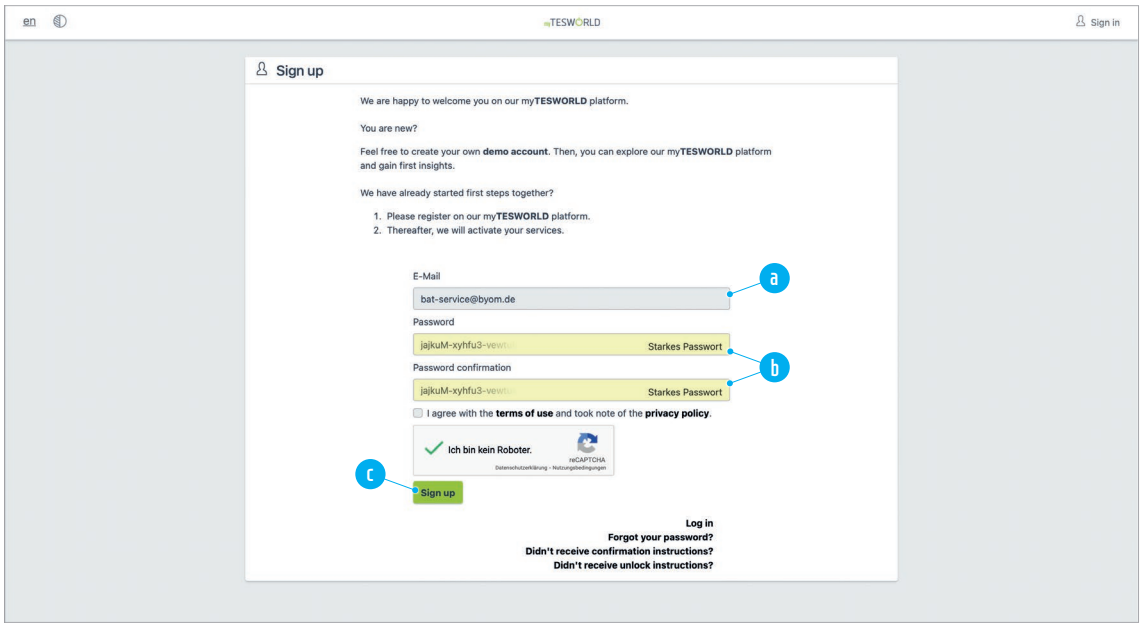
Register a new user directly in the myTESWORLD portal

1



Access https://mytesworld.tesvolt.com/ in an internet browser. If you are not yet set up as a user in the portal, click on the link "Sign up" a. If you already have an account in myTESWORLD, you can move straight on to the next section.

2



Enter the email address of the new user in the field “E-Mail” a. The password must be entered in the next two fields b. After agreeing to the terms of use and confirming the reCaptcha, click on the “Sign up” button c. You will then receive an email with a link to confirm your registration. Click on this link and log in again if needed.

NOTE: It is only possible to configure the TESVOLT Energy Manager in myTESWORLD in the technician role. If you do not have a technician account or access to a user account with administrator permissions, please contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200 to activate the role for the desired user(s).

NOTE: If you have access to a user account with administrator permissions and would like to activate the role for the desired new user(s), follow the procedure described in the section “10.4 Technician role” on page 122.

Groups

Groups combine any number of energy management systems (EMS) for user management. Within a group, global rights can be granted to users, i.e. the rights granted to a user via the group apply to all EMSs in that group. For example, if a new EMS group is added, all users in the group will automatically have access to the EMS according to their group rights, without the user having to register in the EMS. This makes it easier to manage users and rights. For example, if a new technician is hired in a company, a user does not need to be added to each individual EMS, but only once to the group.

The “Group” functionality is therefore recommended for all installation companies with several employees who regularly purchase and install TESVOLT Energy Managers.

Administrator rights can be delegated to qualified users within a group, allowing them to create new EMSs, add users to the EMS, delete users and edit user rights.

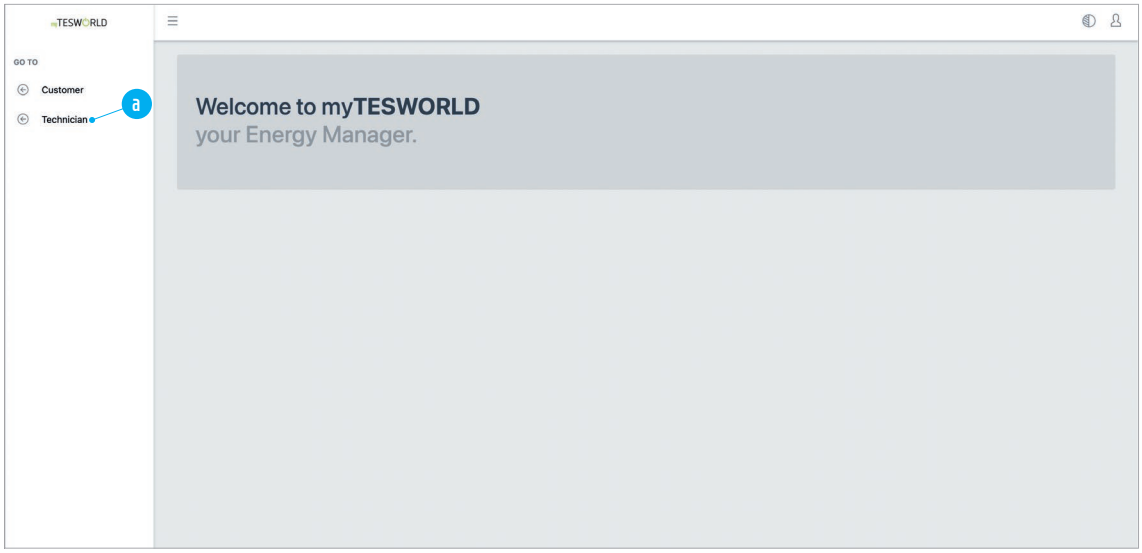
NOTE: If you want to set up one or more user subgroups for your company in myTESWORLD, please contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

10.3 EMS CONFIGURATION

Setting up the EMS and linking it with the hardware

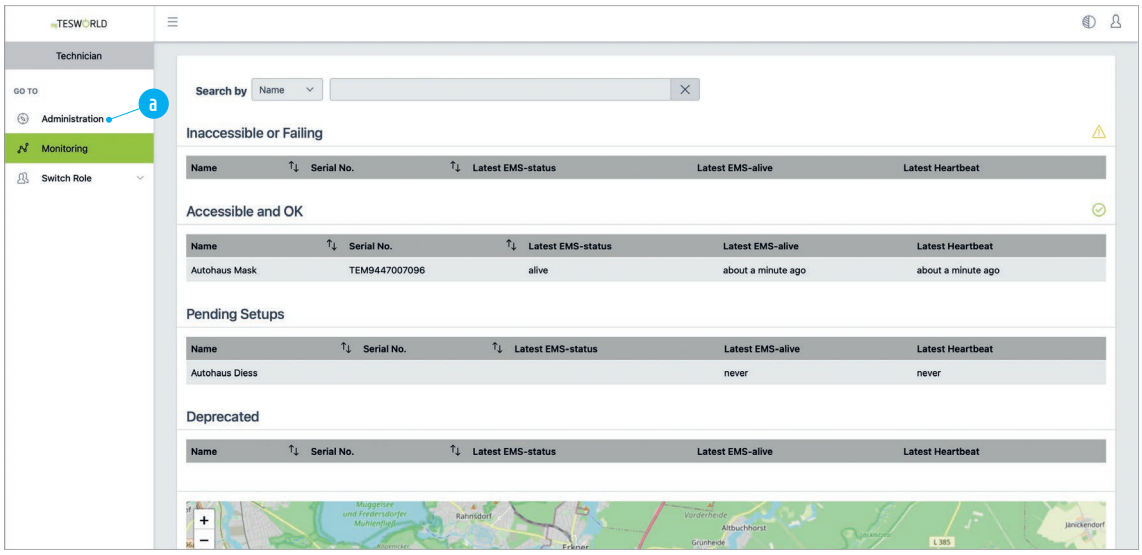
NOTE: To link an existing EMS to a TESVOLT Energy Manager, you will need a technician clearance, which you will receive after successfully completing the certification training.. For questions about setting up the myTESWORLD portal, please contact the TESVOLT Service Line +49 (0) 3491 87 97 - 200.

1



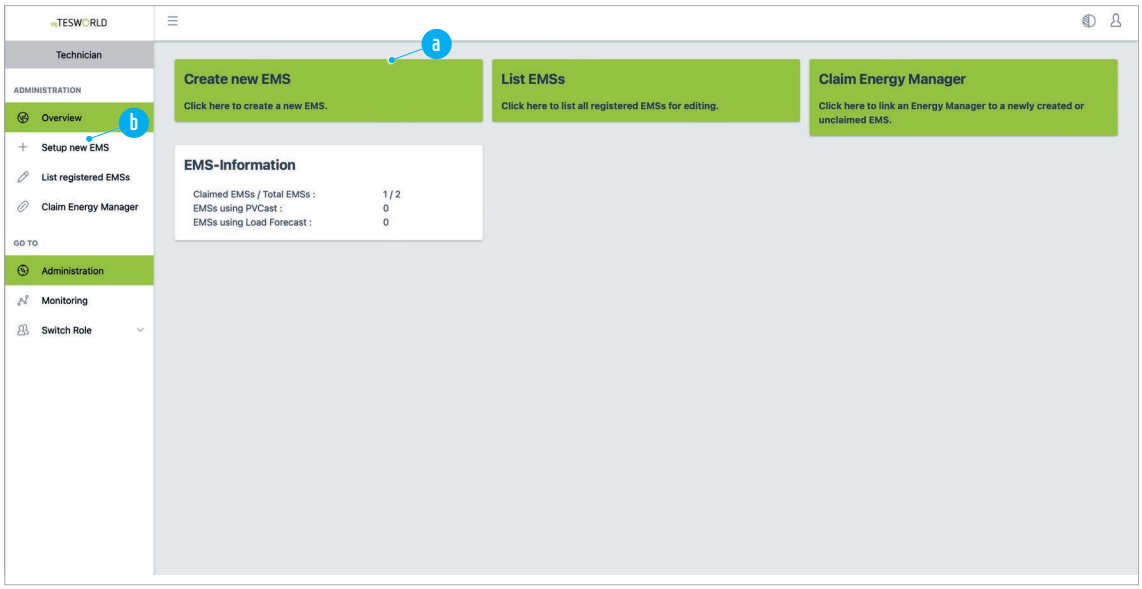
Log into myTESWORLD and in the side menu select the “Technician” role a.

2



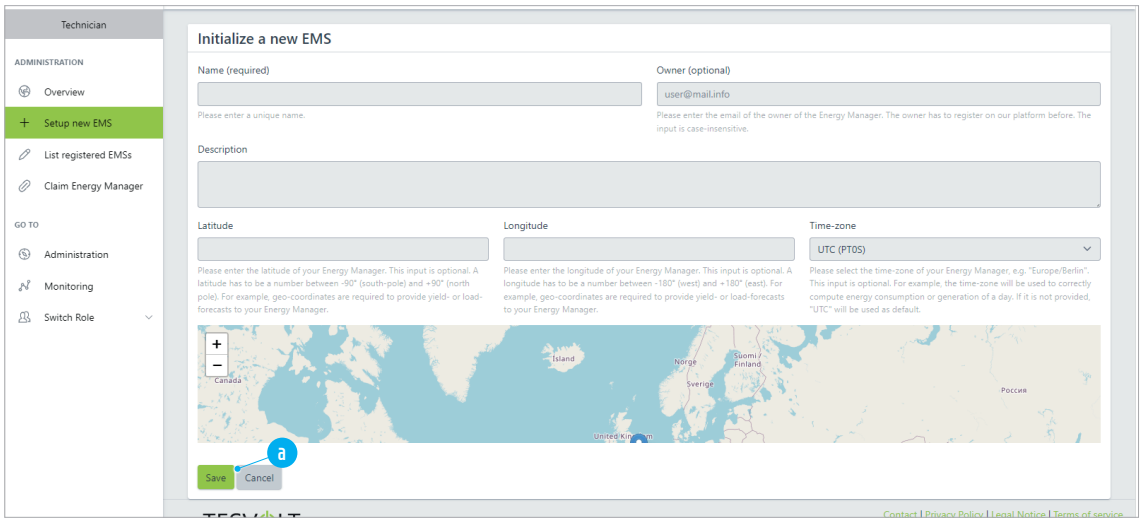
Go to the administration section by clicking on the corresponding item a in the side menu.

3



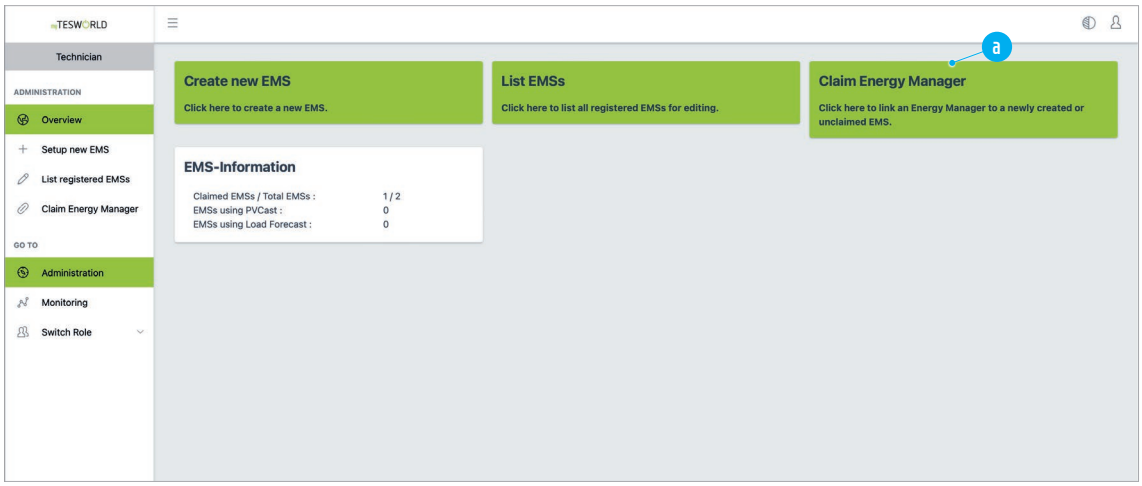
Click the button “Create new EMS” a or the menu item “+ Set up a new EMS” b in the side menu.

4



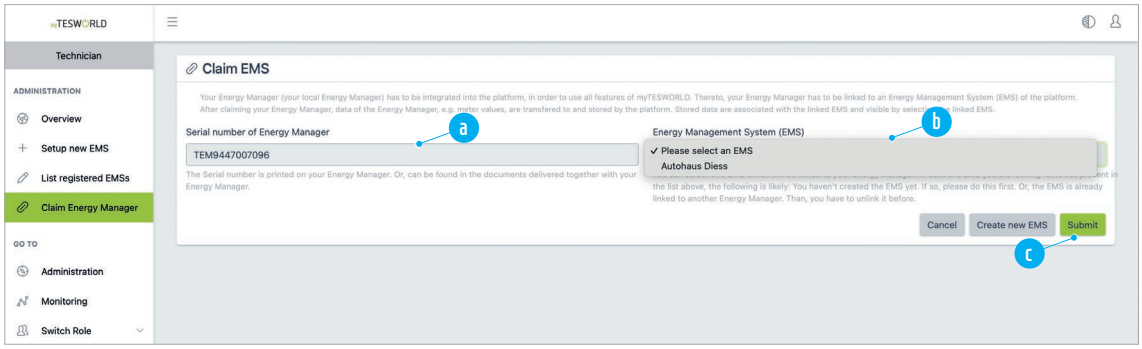
The page “Initialising new EMS” opens. Complete the following fields:
Name (required) > Name freely selectable
Owner (optional) > Email address of the owner
Description (optional) > Information about the EMS
Latitude (optional) > Coordinates of the EMS (geographical latitude)
Longitude (optional) > Coordinates of the EMS (geographical longitude)
Time-zone (optional) > Time zone that the EMS is located in
Finally, confirm your entries by clicking on the “Save” button a.

5



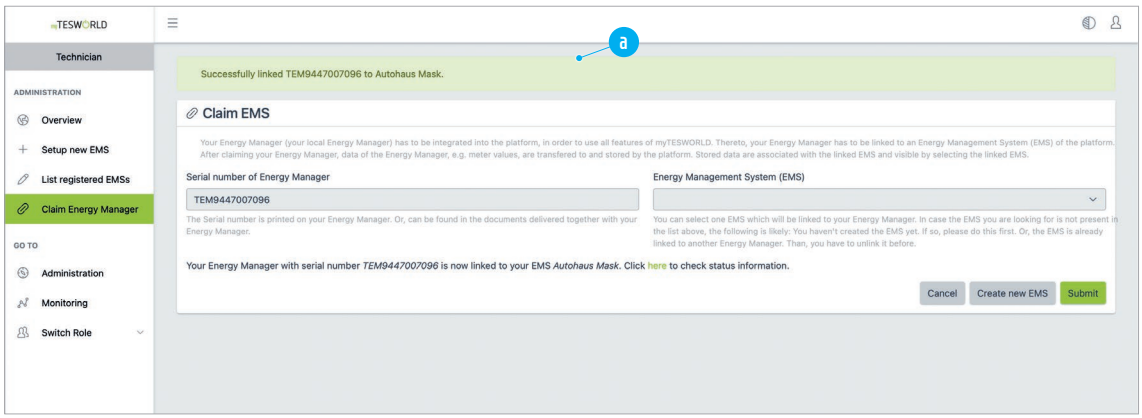
Now click on the button “Claim Energy Manager” a.

6



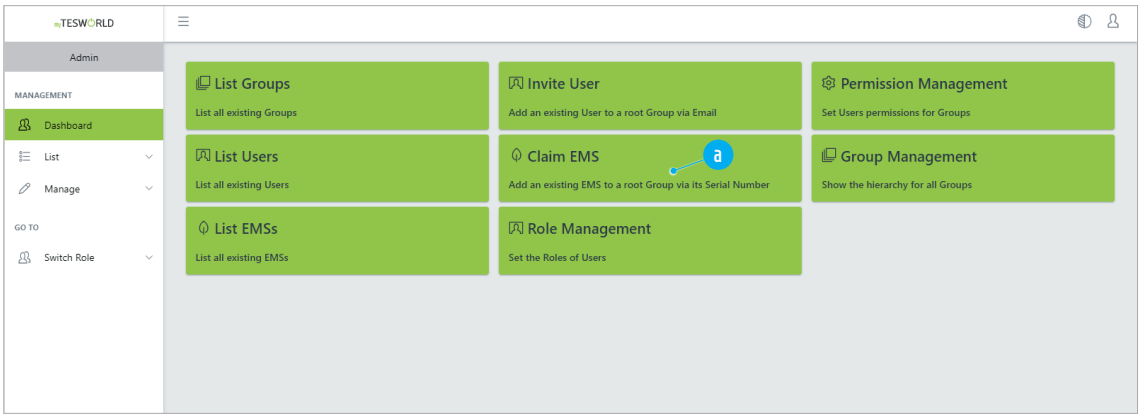
Enter the serial number of the TESVOLT Energy Manager (hardware) to be linked in the “Serial number of Energy Manager” field a of the new dialogue window. The serial number is found on the stickers included in the packaging of the unit. The serial number begins with “TEM”, followed by a 10-digit number. Then select the EMS to be linked from the drop-down menu “Energy management system (EMS)” b. Then click on the “Confirm” button c.

7



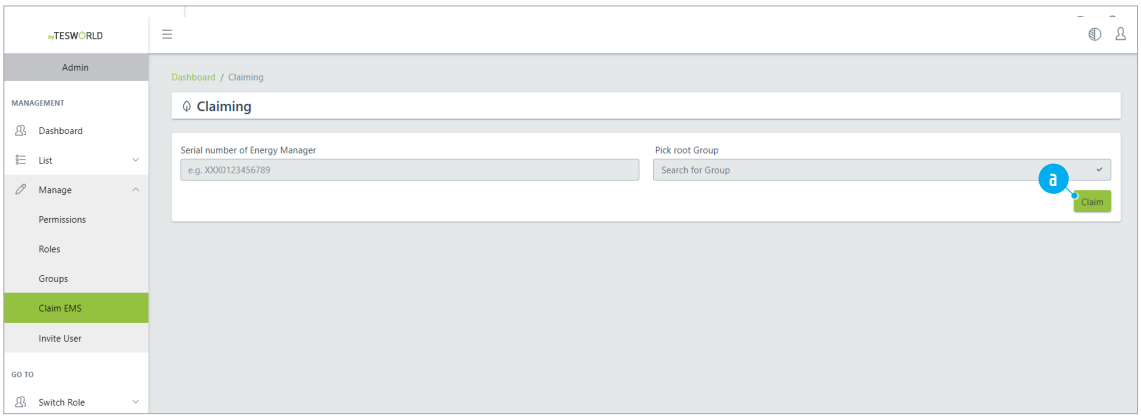
When the EMS has been successfully linked, the page will refresh automatically and you can see a confirmation a of the procedure at the top of the page.

8



Switch back to the administrator role.
Now click on the “Claim EMS” button in the overview a.

9



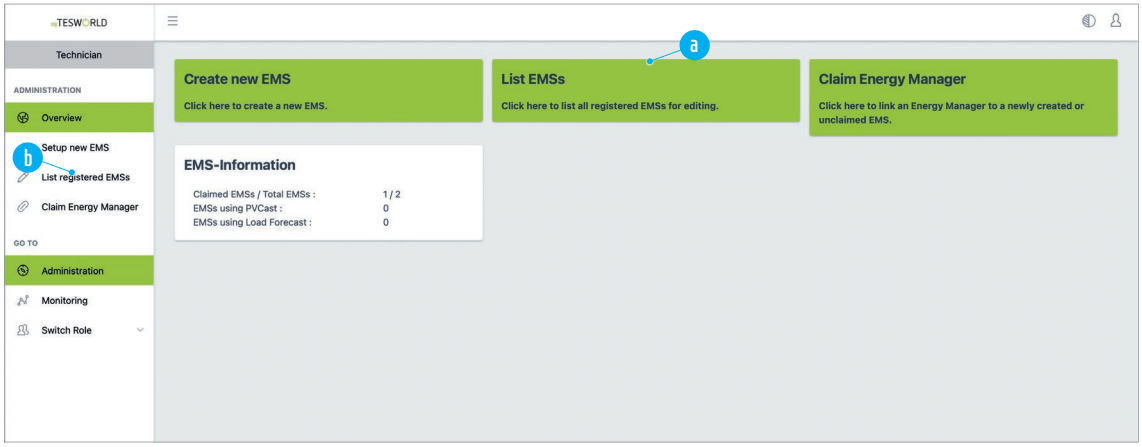
Re-enter the serial number of the TESVOLT Energy Manager (hardware) to be linked in the “Serial number of Energy Manager” a field of the new dialogue window. Select your organisation from the drop-down menu “Add organization objective” b (this was created during certification training). Finally, click on the “Claim” button c.

Editing the EMS

NOTE: To edit an EMS, you need technician clearance.

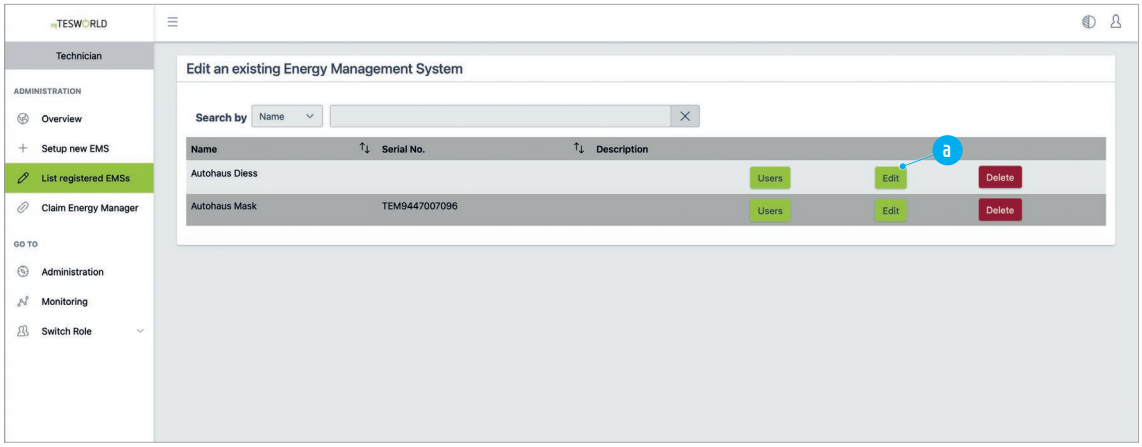
1 Log into the myTESWORLD portal, select the "Technician" role and go to the "Administration" section (see steps 1 and 2 in the section "Setting up the EMS and linking it with the hardware" on page 112).

2



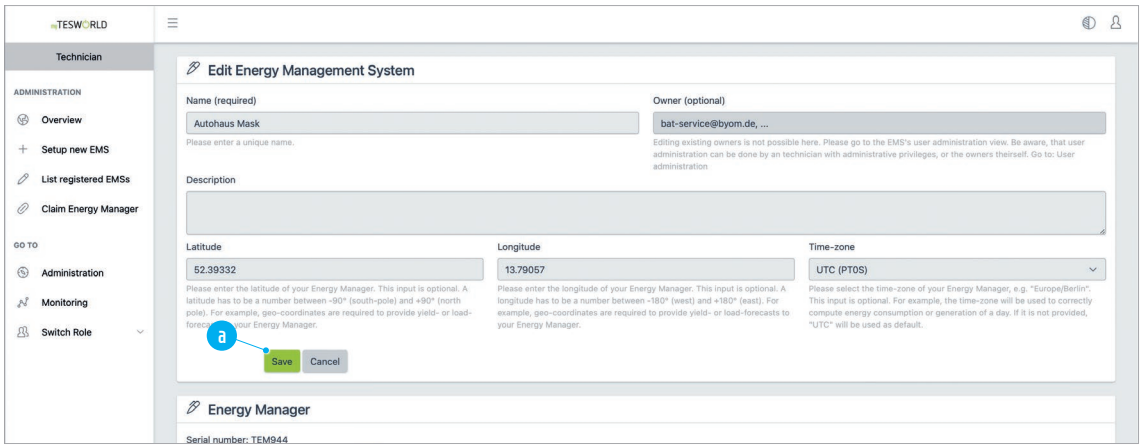
Now click on the button "List EMSs" a or "List registered EMSs" b in the side menu.

3



Find the entry of the EMS/TESVOLT Energy Manager and click on the "Edit" button a.

4



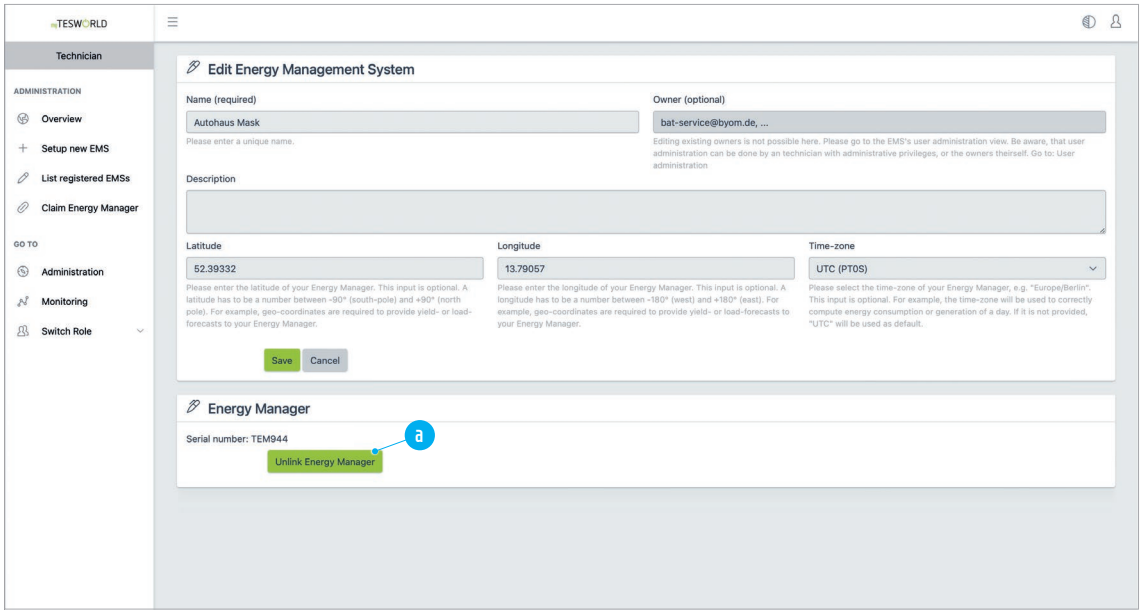
Make the desired changes and then click on the "Save" button a.

Unlinking an EMS from hardware

NOTE: To unlink an EMS from a TESVOLT Energy Manager, you need technician clearance.

1 Log into the myTESWORLD portal, select the "Technician" role, go to the "Administration" section and click on "List registered EMSs" in the side menu or on the button "List EMSs". Then, in the entry for the relevant EMS, click on "Edit" (see steps 1 to 3 in the section "Editing the EMS" on page 116 et seq.).

2



Now click on the button "Unlink Energy Manager" a.
The page will then automatically refresh and in the "Energy Manager" side section there will only be a "Link" button alongside the text "There is currently no Energy Manager linked with this EMS."

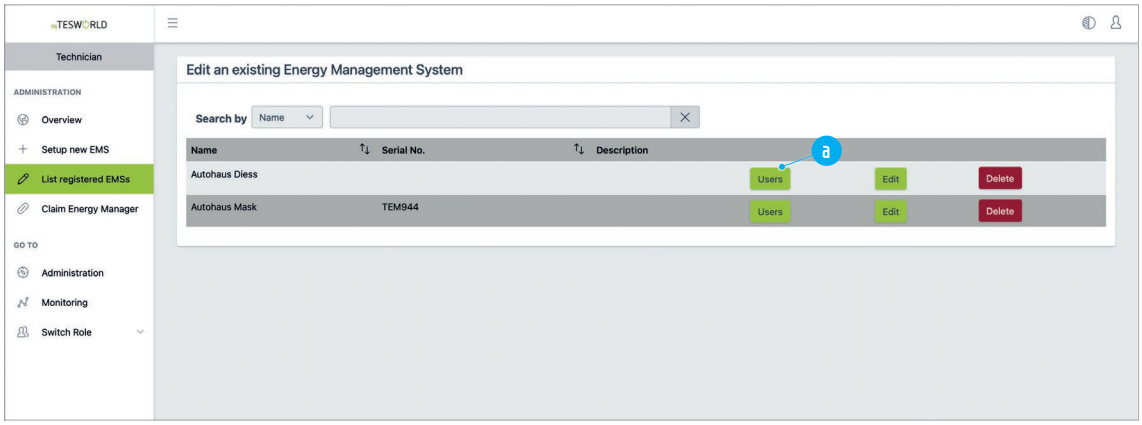
Adding users to an EMS

NOTE: To add a user to an EMS, you need administrator permissions.

NOTE: A user who has registered via the TESVOLT Partner Portal must have logged into the myTESWORLD portal once before the user in question is visible in the portal's user management.

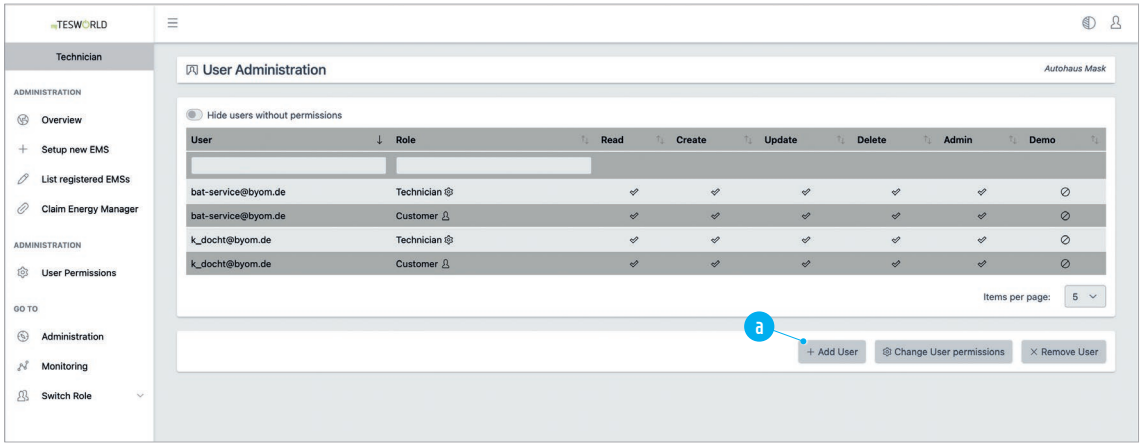
Log into the myTESWORLD portal, select the "Technician" role, go to the "Administration" section and click on "List registered EMSs" in the side menu or on the button "List EMSs" (see steps 1 to 2 in the section "Editing the EMS" on page 116 et seq.). Alternatively, you can also make the changes in the customer role. For this, see the section "Administration – notifications" on page 136.

1



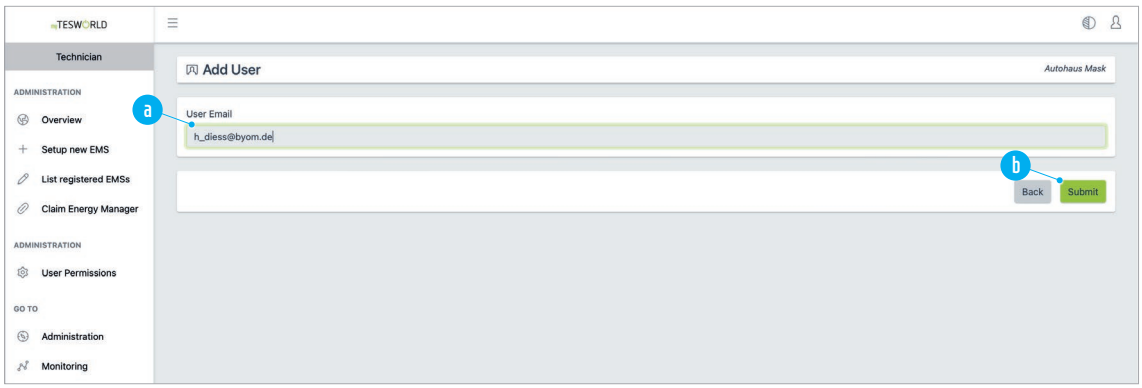
You will now see a list of all the EMSs you have access to. In the entry of the relevant EMS, click on the button "Users" a.

2



Now click on the button "+ Add User" a.

3



Enter the email address of the user in the field "User Email" a and then click on "Submit" b. The user must have previously registered on myTESWORLD with this email address.

4 You now return to the "User Administration" page. The new user will be visible in the table. However, newly added users have no permissions assigned to them. Assigning permissions to users is explained in the following section.

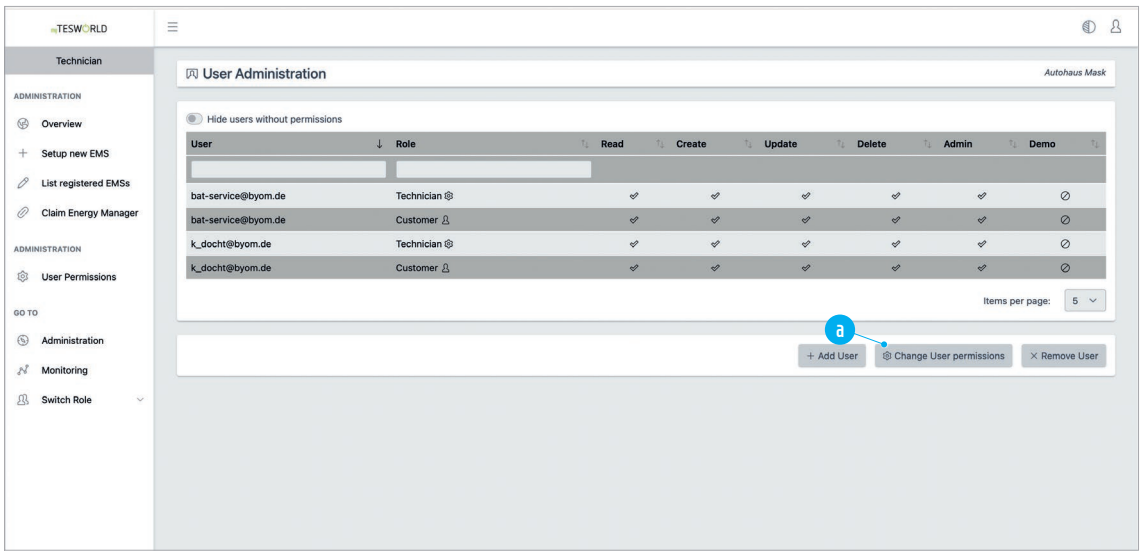
NOTE: If you are an installer, please make sure that you remove the demo rights of customer users at the latest after commissioning, otherwise these users will be unable to access the actual installation data.

Editing the rights of users of an EMS

NOTE: To edit user permissions for an EMS, you need administrator permissions.

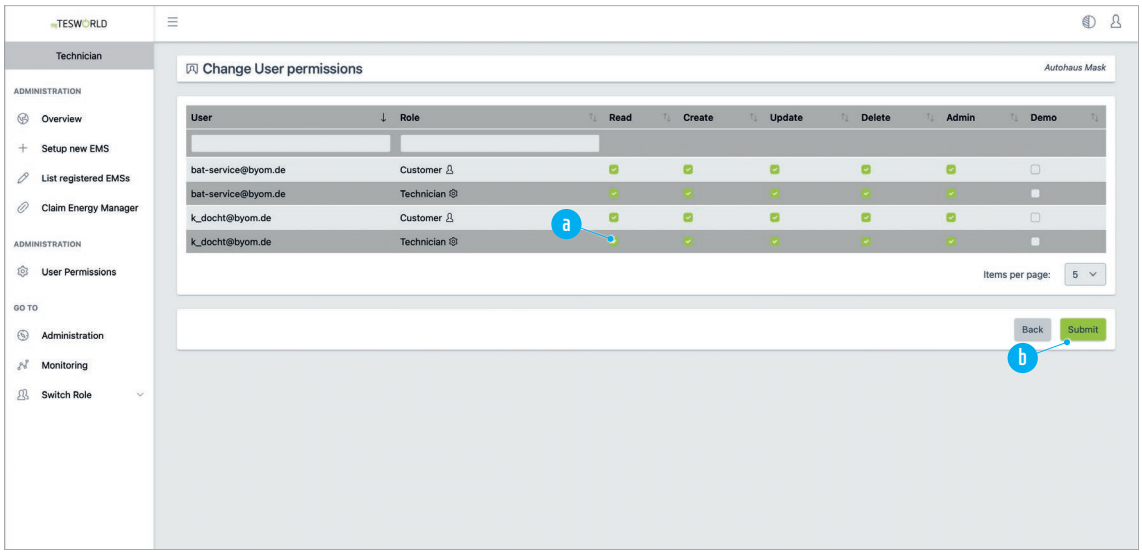
1 Log into the myTESWORLD portal, select the "Technician" role, go to the "Administration" section and click on "List registered EMSs" in the side menu or on the button "List EMSs"". Then, in the entry of the relevant EMS, click on the button "Users" (see steps 1 to 2 in the section "10.4 Technician role" on page 122). Alternatively, you can also make the changes in the customer role. For this, see the section "Administration – notifications" on page 136.

2



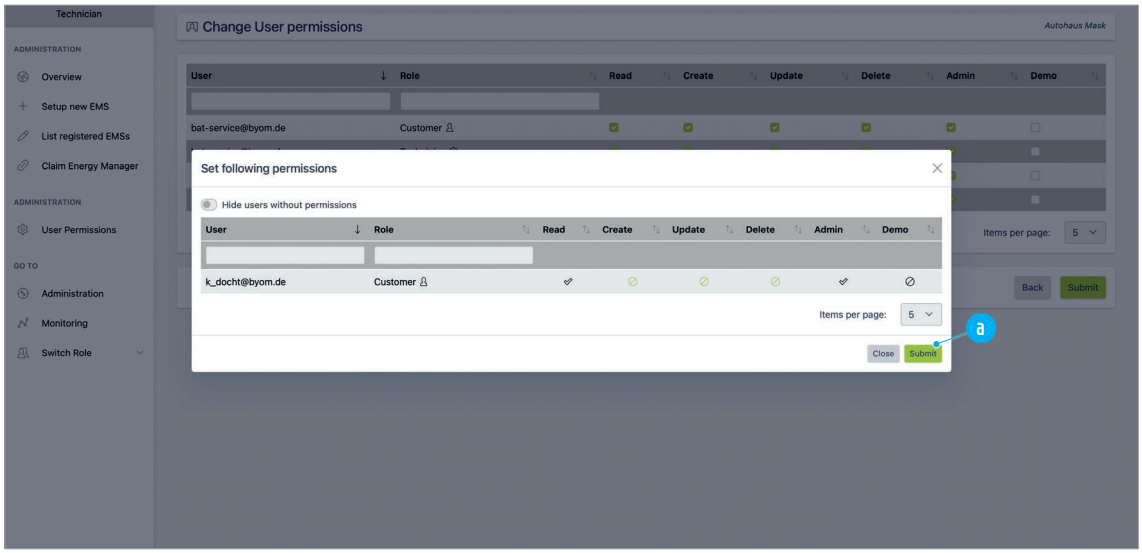
Now click on the button "Change User permissions" a.

3



You can now adjust the permissions for the two available roles of the user. If you would like to assign a particular permission to the user, click on the corresponding tick box (see example a). Usually, the "Customer" role is only assigned read permissions, while the "Technician" role is granted all available permissions. When you have made all the desired changes, click on "Submit" a.

4



A confirmation page is now displayed, which again shows all the user's rights. If you are happy with the details, click on "Submit" a.

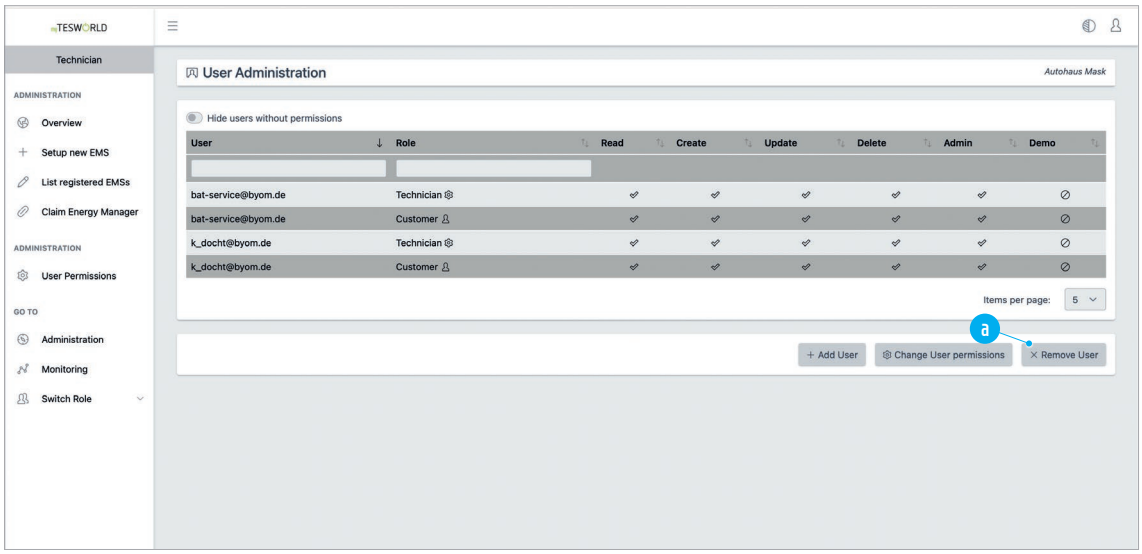
Deleting users of an EMS

NOTE: To edit user permissions for an EMS, you need administrator permissions.

1

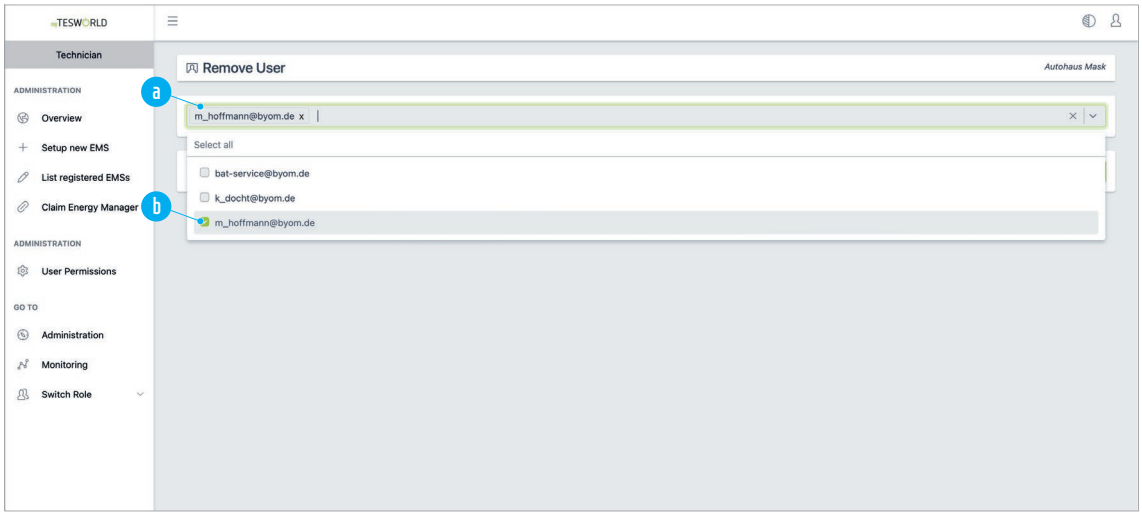
Log into the myTESWORLD portal, select the "Technician" role, go to the "Administration" section and click on "List registered EMSs" in the side menu or on the button "List EMSs". Then, in the entry for the relevant EMS, click on "Users" (see steps 1 to 2 in the section "10.4 Technician role" on page 122 et seq.). Alternatively, you can also make the changes in the customer role. For this, see the section "Administration – notifications" on page 136.

2



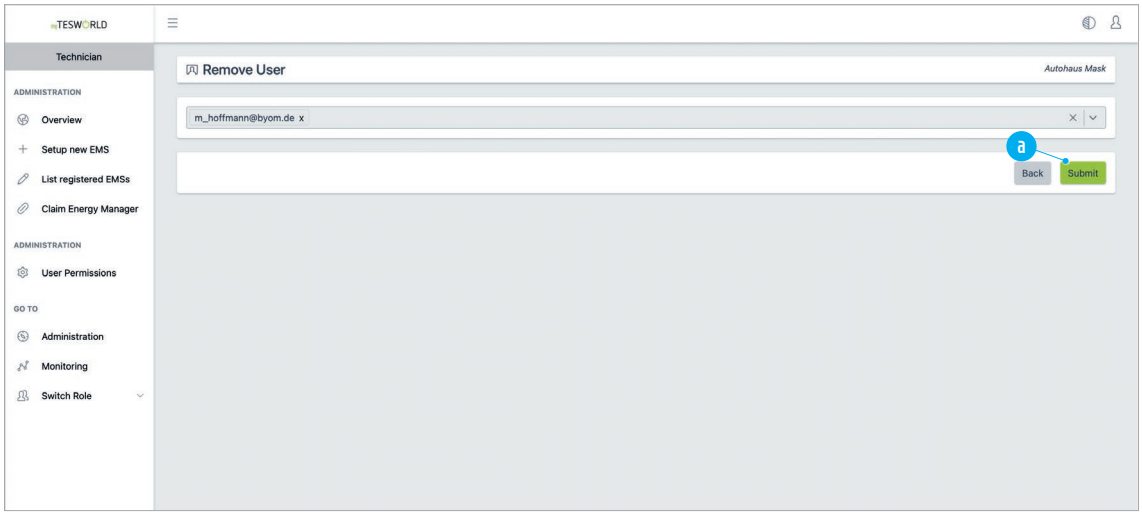
Now click on the button “X Remove User” a.

3



Click on the entry field a and select the user to be deleted by clicking on the tick box b.

4



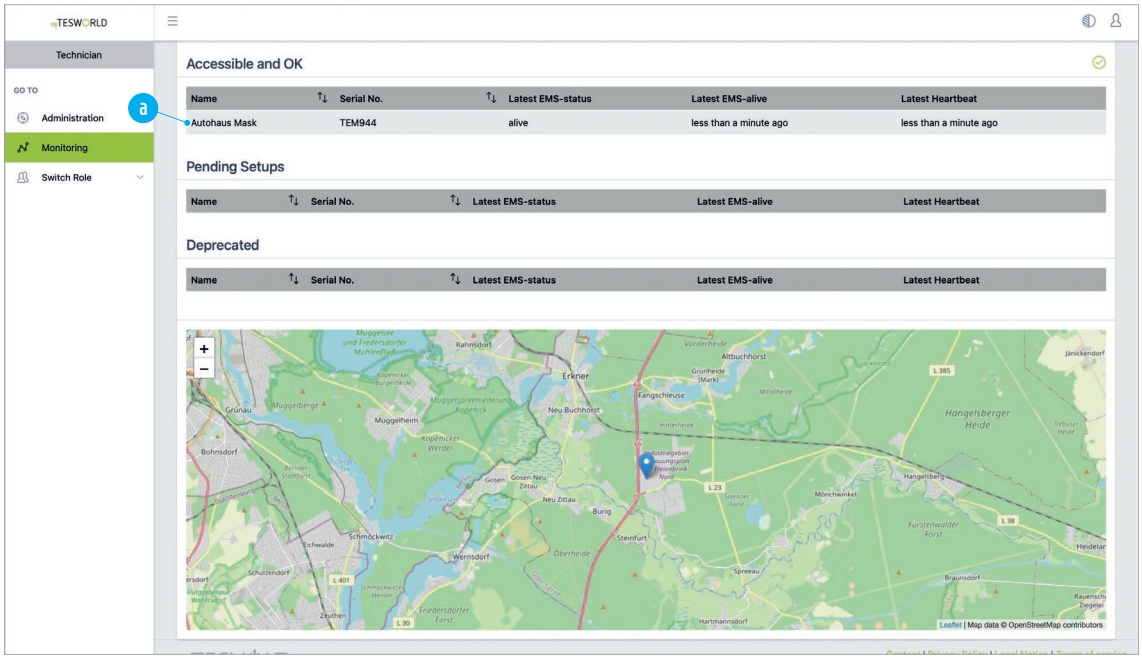
You now need to click once more outside the expanded drop-down menu in order to collapse it. Finally, click on “Submit” a.

10.4 TECHNICIAN ROLE

1 Log into the myTESWORLD portal, select the “Technician” role and go to the “Monitoring” section.

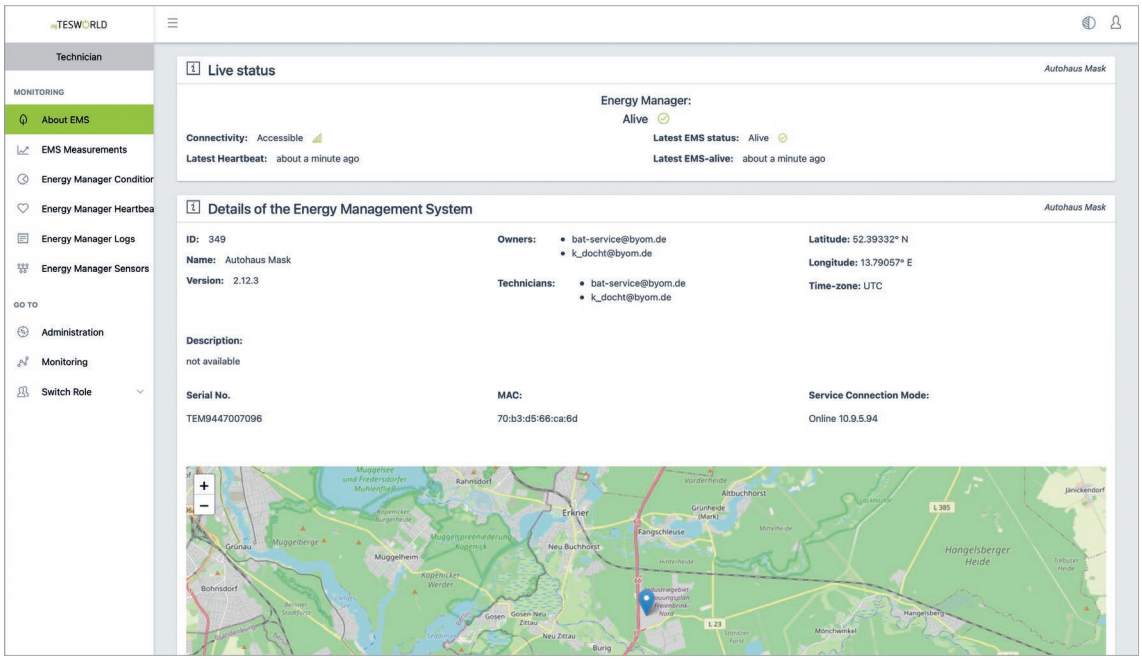
About EMS

1



You can now see an overview of all EMSs that the user currently logged in has access to. Select the desired entry by clicking on it a.

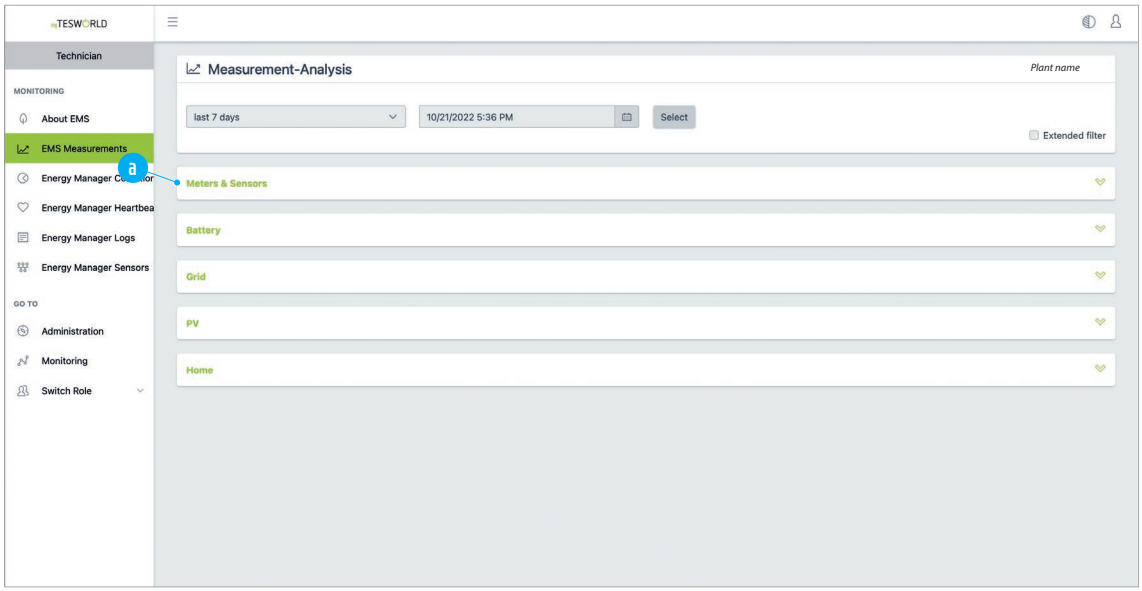
2



You now come to the overview page for the selected “EMS: Technician” → “Monitoring” → “About EMS”.

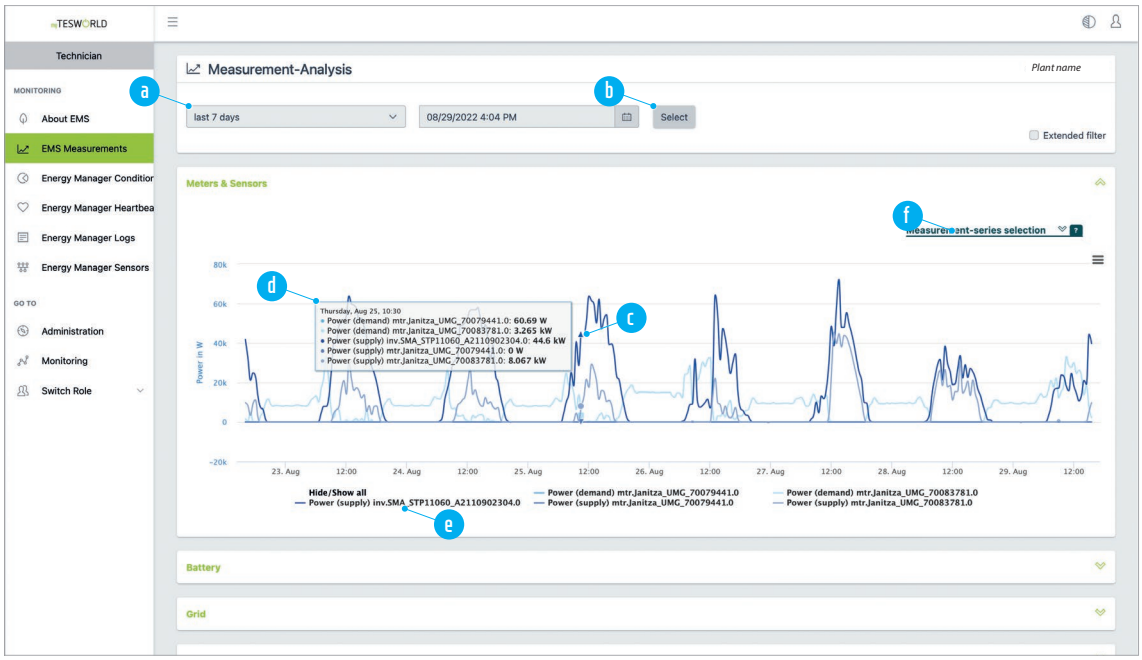
EMS Measurements

1



In the side menu, click on "Technician" → "Monitoring" → "EMS Measurements". In the window that opens, you can see various sections of grouped measurements. The first section, "Meters & Sensors" (a) encompasses the sensors of all logical devices. To open a section, click on it.

2

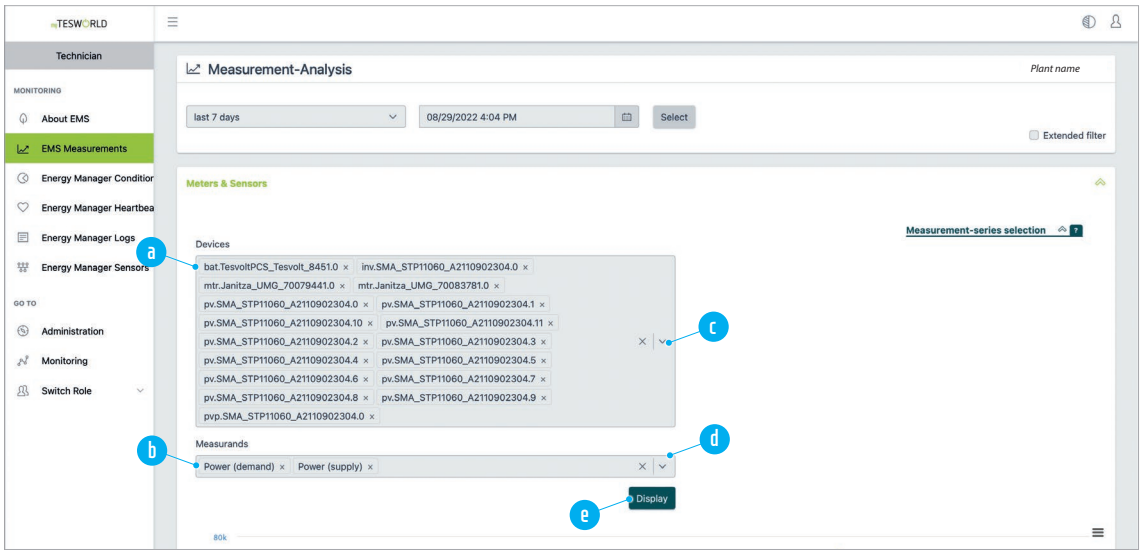


At the top of the page, directly below the title "Measurement-Analysis" (a) you can define the period and start date of the measurements displayed. To apply the filter, click on "Select" (b). In the opened section, you can see graphs of the measurements in the centre. If you would like more specific information, you can click on any point in the diagram (c). This will open a small window (d) showing the numerical values of all measurements displayed in the diagram for the selected point in time. By clicking on an item in the legend of the diagram (e), you can hide individual series of measurements. You can also change more settings by clicking on "Measurement-series selection" (f) (see next step).

NOTE: Delay between measurement and display

Please note that there may be a delay of 45 minutes between the actual measurement and the display of the measurement data in the portal. This delay only occurs when selecting a view that is more than 24 hours old. If you select the current day or the last 24 hours in the view, the display is in near real time.

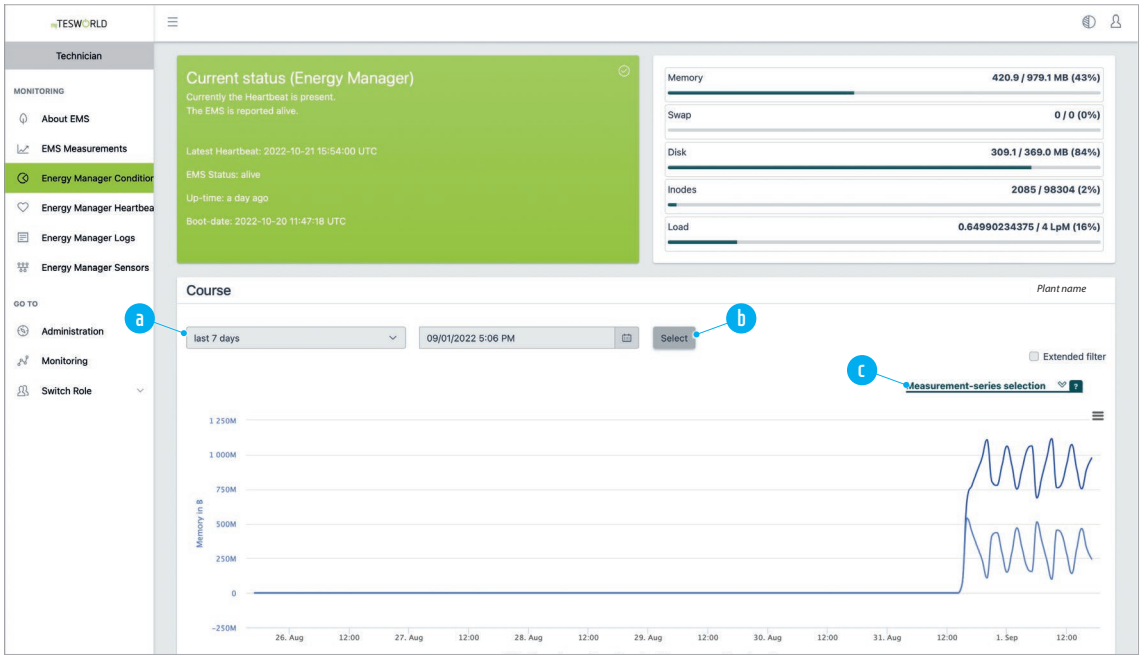
3



If you open the section “Measurement-series selection”, under “Devices” a you can see all the sensors whose measurements are displayed in the diagram. Under “Measurands” b you can see the measurands currently being measured and displayed. If you would like to remove sensors or restore previously removed sensors, click on the tick c. This will open a pop-up window when you can activate or deactivate sensors by clicking on them. If you would like change the selection of measurands, click on the tick d. To apply the changes to devices (sensors) or measurands, click on “Display” e.

Energy Manager Condition

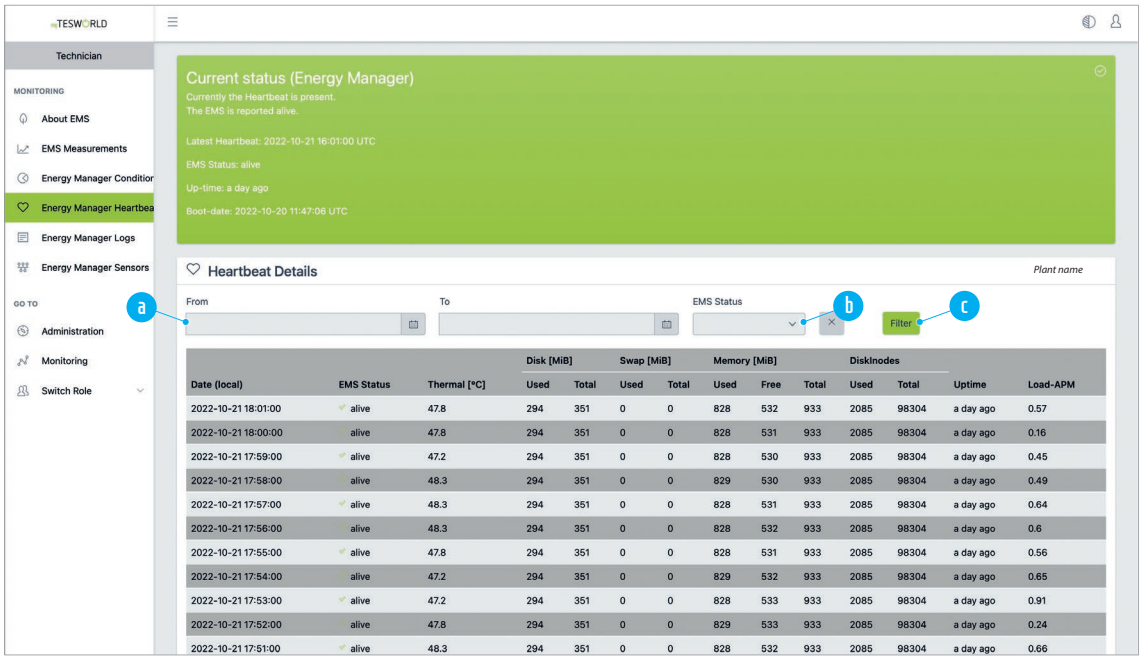
1



At the top of the section, directly below the section heading “Course” a you can define the period and start date of the measurements displayed. To apply the filter, click on “Select” b. In the opened section, you can see graphs of the measurements in the centre. If you would like more specific information, you can click on any point in the diagram. This will open a small window showing the numerical values of all measurements displayed in the diagram for the selected point in time. By clicking on an item in the legend of the diagram, you can hide individual series of measurements. By clicking on “Measurement-series selection” c, you can select or deselect the available measurands.

Energy Manager Heartbeats

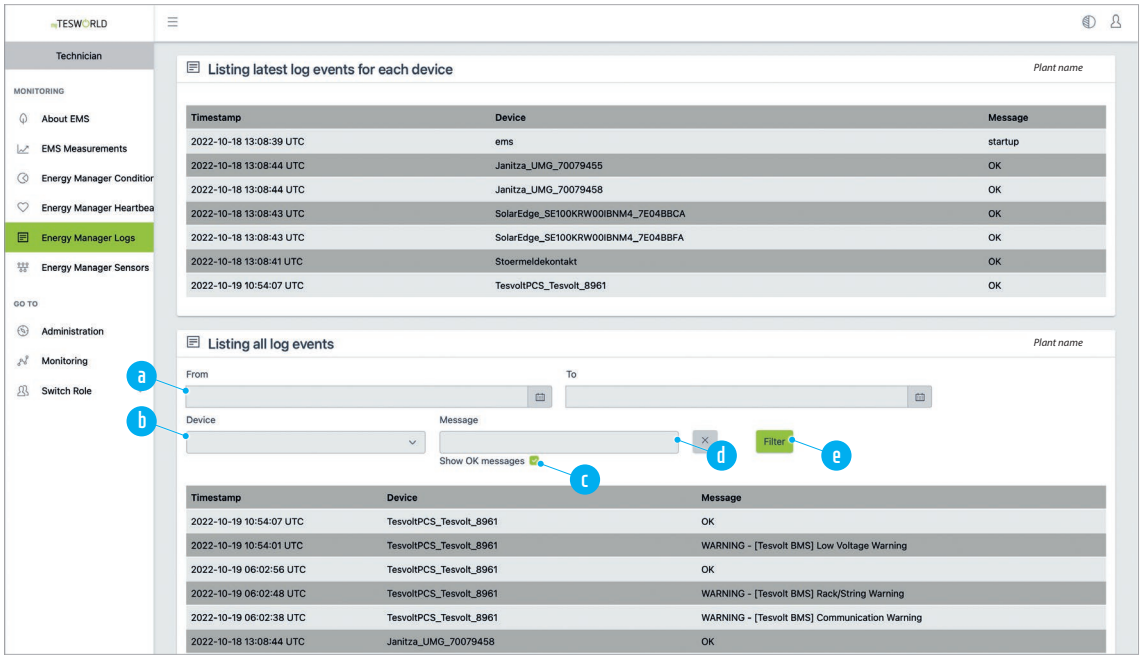
1



At the top of the section “Heartbeat Details”, directly below the section heading, you can set the period a and the EMS status b to filter the data displayed in the table. To apply the filter, click on “Filter” c.

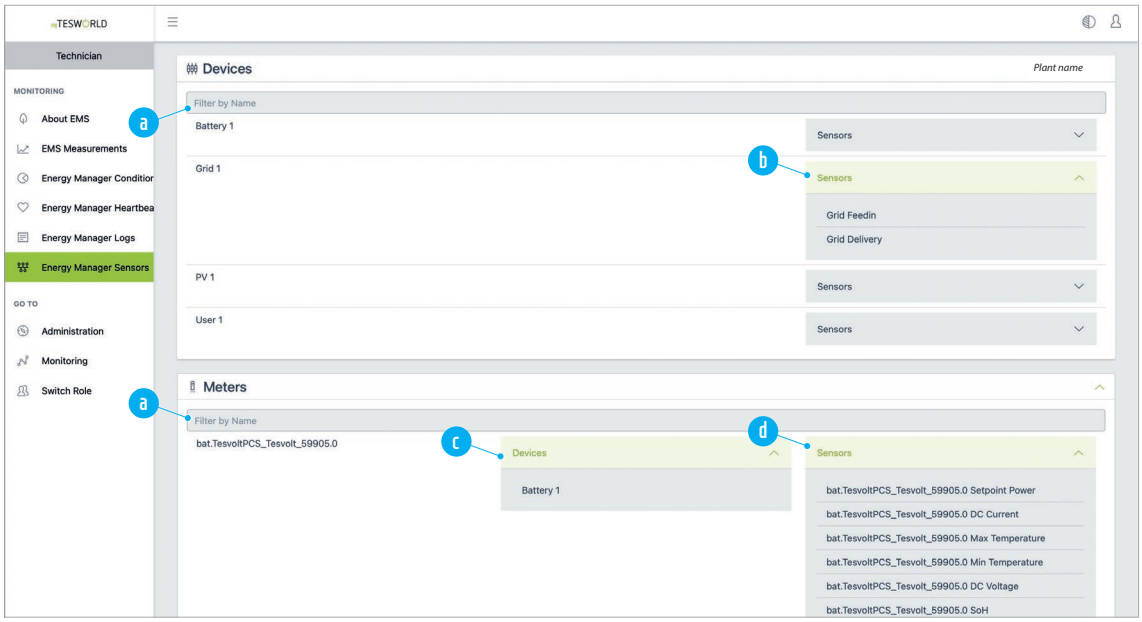
Energy Manager Logs

1



At the top of the section “Listing of all log events”, directly below the section heading, you can create a filter for displaying the log events: time period selection a, device selection b, content of the message c. Confirm the filter settings by clicking on “Filter” d. If you are only looking for errors, you can click to deactivate c. This makes the list clearer, as all “OK” messages will be hidden. Alternatively/additionally, you can also search for specific terms in the messages using the d box.

Energy Manager Sensors

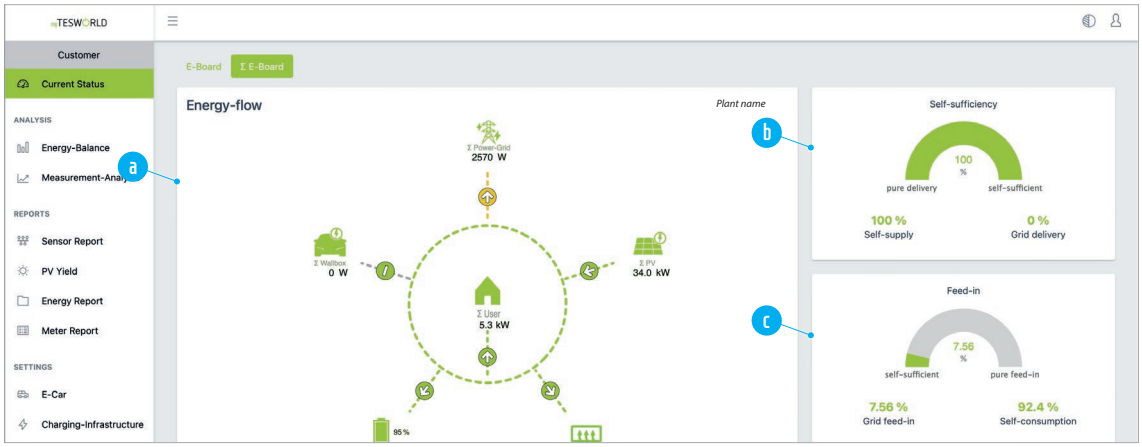


At the top of the page you will find the "Devices" section. All physical devices are listed here, along with the sensors assigned to them. Use the filter (a) to search for a specific device/meter. To see the individual sensors, click on the "Sensors" field (b), which will then be expanded. In the following section, "Meters", you will find all logical devices described as meters. To see the physical devices assigned to them, click on the corresponding "Devices" field (c). For information on the corresponding sensors, click on the "Sensors" field (d).

10.5 CUSTOMER VIEW

1 Log into the myTESWORLD portal and select the "Customer" role. A list of all EMSs assigned to the user will be displayed. Select the desired EMS by clicking on it.

Current Status



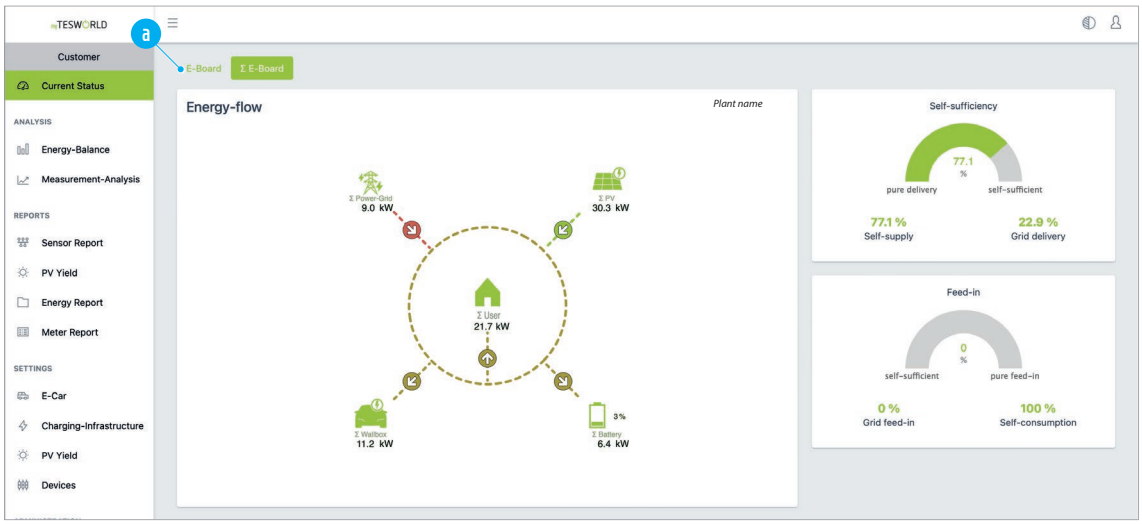
In the section "Energy-flow" (a) you can see a schematic diagram of the physical devices in the system, including current energy flow. "Consumption", in the middle of the circle, is always the physical device "User 1". In the section "Self-sufficiency" (b) (on the right), you can see what percentage of the system's own demand is currently covered by its own electricity production. To see the numerical values, move the mouse pointer over the graphic (mouse-over). In the section "Feed-in" (c) you can see how much electricity is being fed into the utility grid.

Summarising the energy flow

1

If there are several physical devices of the same type, the system overview on the “Energy-flow” page can become hard to read. In this case, you can select a grouped display of the energy flow a by clicking as shown.

2

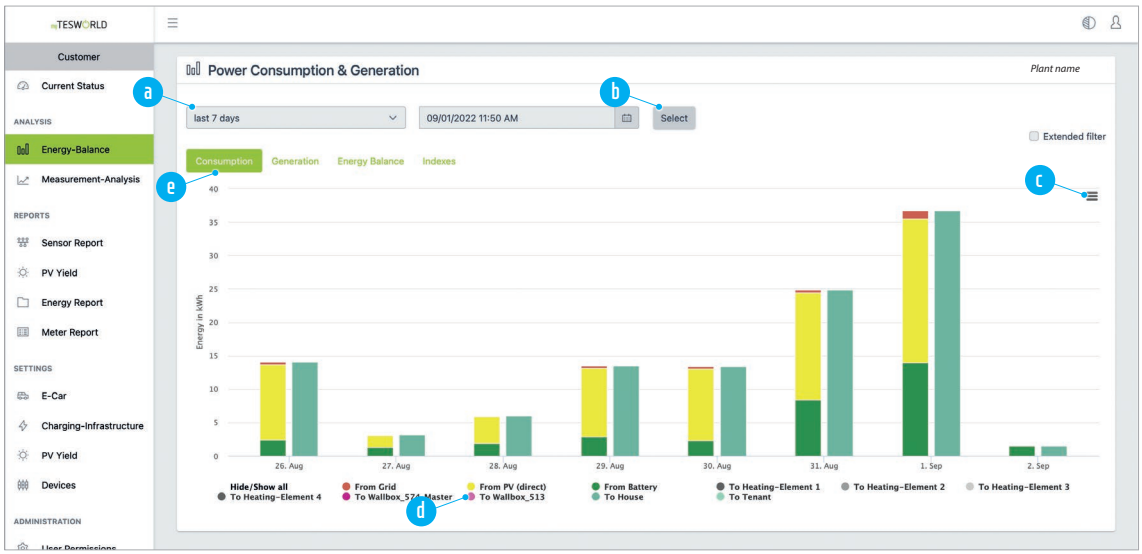


In the grouped display, all devices of the same type are represented in the overview by just one symbol. Click on “E-Board” a to switch back to the ungrouped view.

Analysis – Energy-Balance

Consumption

1



At the top of the page "Energy-Balance" → "Consumption", you can filter the period and start date a of the data displayed in the diagram. To apply the filter, click on "Select" b. By clicking on the menu symbol c you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend d to hide or show the corresponding values in the diagram. For the other diagrams of the energy balance, click on one of the other menu options e.

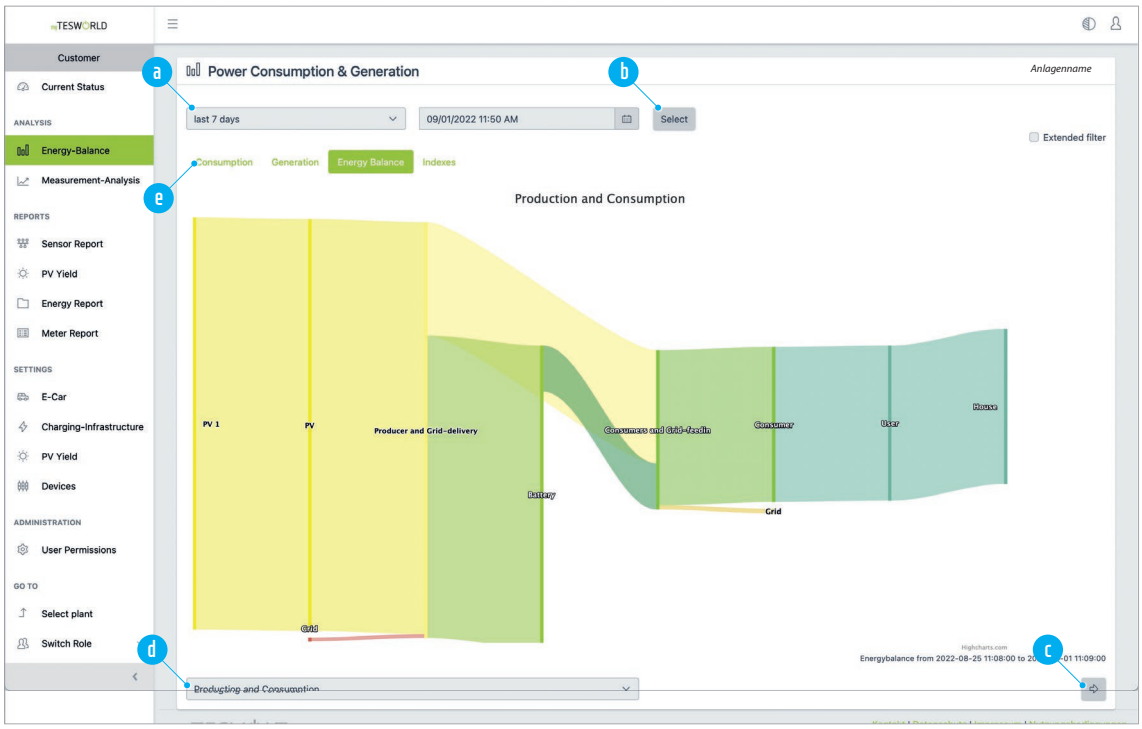
Generation

1

At the top of the page "Energy-Balance" → "Generation", you can filter the period and start date a of the data displayed in the diagram. To apply the filter, click on "Select" b. By clicking on the menu symbol c you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend d to hide or show the corresponding values in the diagram. For the other diagrams of the energy balance, click on one of the other menu options e.

Energy Balance

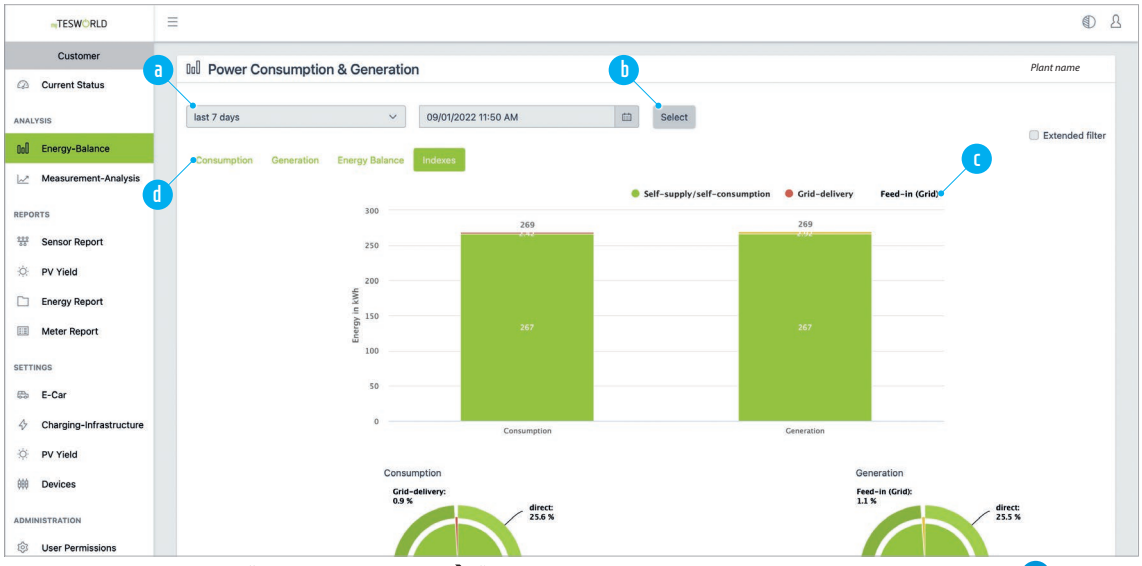
1



At the top of the page "Energy-Balance" → "Energy Balance", you can filter the period and start date a of the data displayed in the diagram. To apply the filter, click on "Select" b. By clicking on the arrow symbol c you can flip the diagram horizontally. Click on the drop-down menu d to select which values (generation/consumption) should be displayed. The numerical values are displayed if you move the mouse pointer over the relevant areas of the diagram (mouse-over). For the other diagrams of the energy balance, click on one of the other menu options e.

Indexes

1

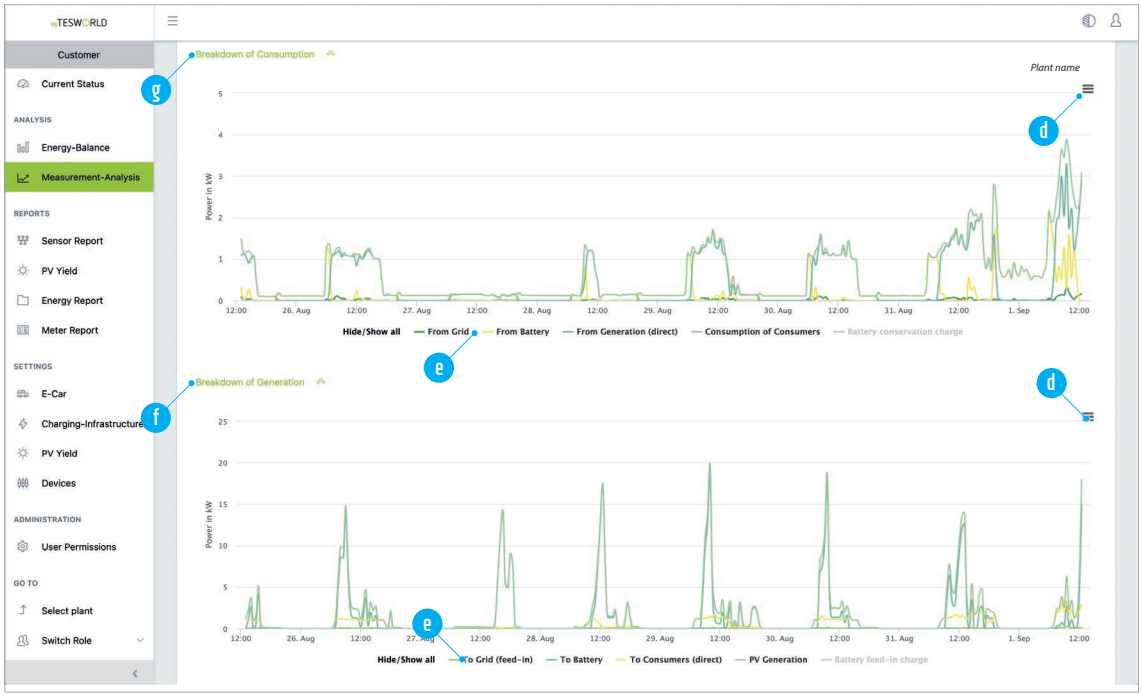


At the top of the page "Energy-Balance" → "Indexes", you can filter the period and start date a of the data displayed in the diagram. To apply the filter, click on "Select" b. Click on an entry in the legend c to hide or show the corresponding values in the diagram. The numerical values are displayed if you move the mouse pointer over the relevant areas of the diagram (mouse-over). For the other diagrams of the energy balance, click on one of the other menu options d.

Analysis – Measurement-Analysis

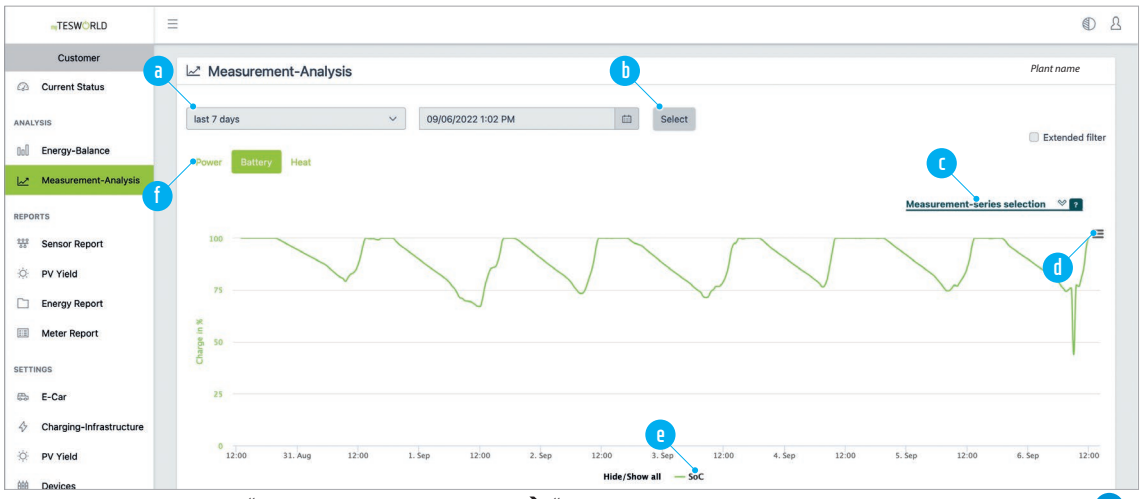
Power

1



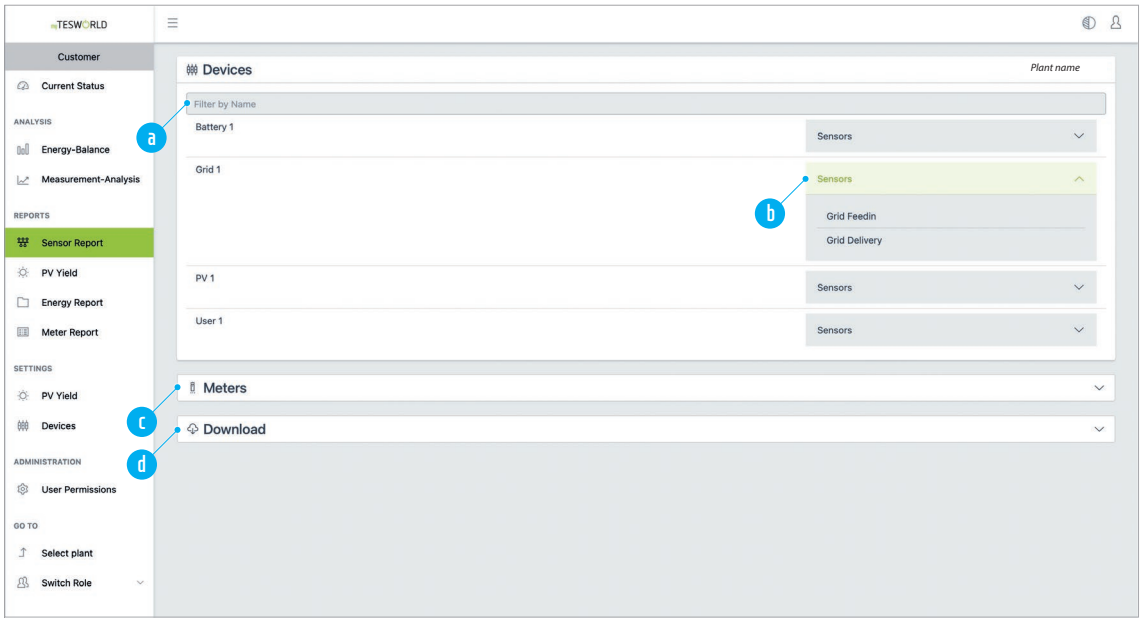
At the top of the page "Measurement-Analysis" → "Power", you can filter the period and start date **a** of the data displayed in the diagram. To apply the filter, click on "Select" **b**. By clicking on the switch labelled "Stack", you can switch between display as a stacked chart or as a line graph. In the stacked chart display, the positive values show the generation and the negative the consumption. By clicking on the menu symbol **d** you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend **e** to hide or show the corresponding values in the diagram. Click on "Breakdown of Consumption" **f** or "Breakdown of Generation" **g** to show a corresponding diagram in each case. The numerical values are displayed if you move the mouse pointer over the relevant areas of the diagram (mouse-over). For the "Battery" diagram, click on the menu option **h**.

Battery



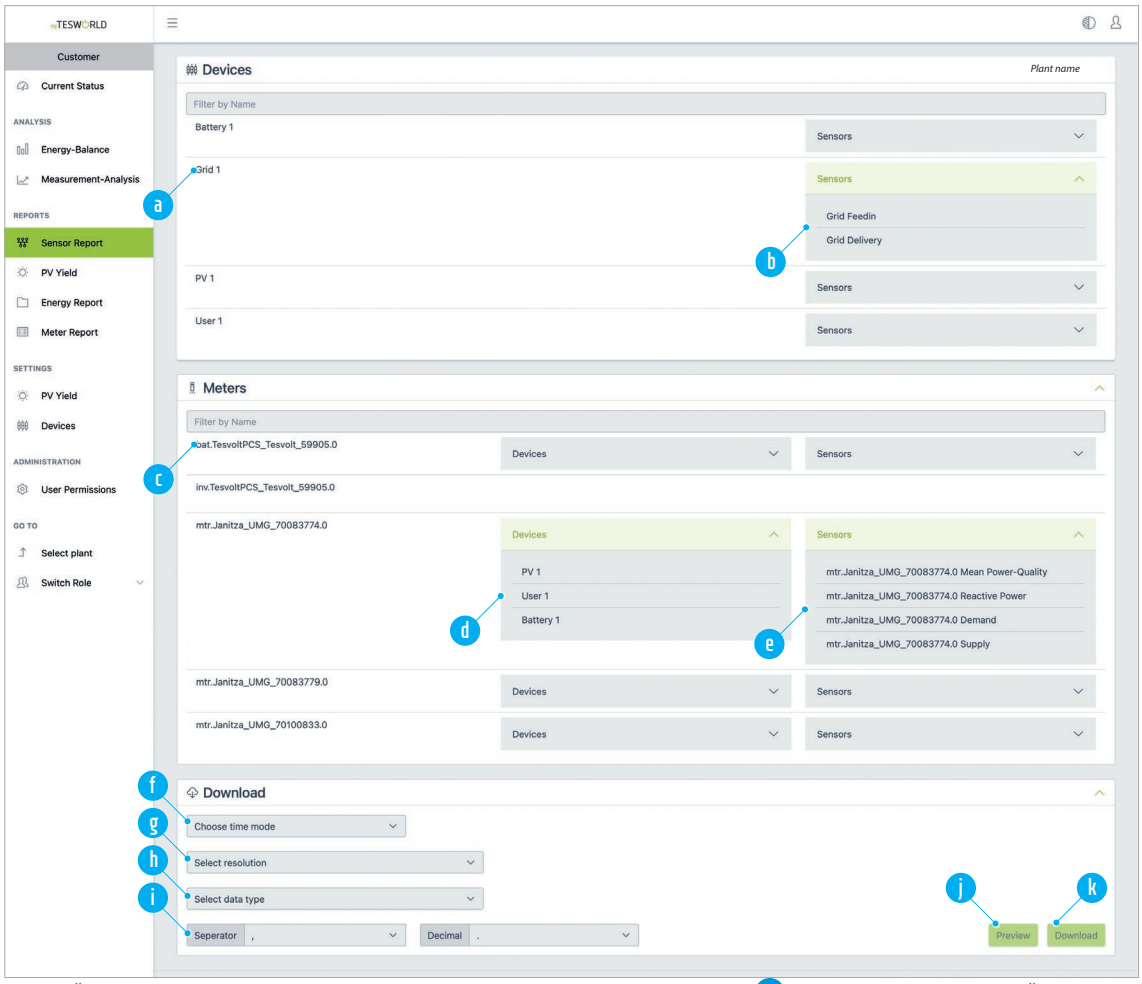
At the top of the page "Measurement-Analysis" → "Battery", you can filter the period and start date a of the data displayed in the diagram. To apply the filter, click on "Select" b. By clicking on "Measurement-series selection" c, you can select or deselect the measurands available to display. By clicking on the menu symbol d you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend e to hide or show the corresponding values in the diagram. The numerical values are displayed if you move the mouse pointer over the relevant areas of the diagram (mouse-over). For the "Power" diagram, click on the relevant menu option f.

Reports – Sensor Report



At the top of the page you will find the "Devices" section. All physical devices are listed here, along with the sensors and measurands assigned to them. Use the filter a to search for a specific device. For information on the corresponding sensors or the available measurands, click on the "Sensors" field b.
To open the next section, "Meters", click on the field c. In this section you will find all logical devices described as meters, as well as the physical devices they measure and the available measurands.
To open the last section, "Download", click on the field d. In this section you can download any sensor data.

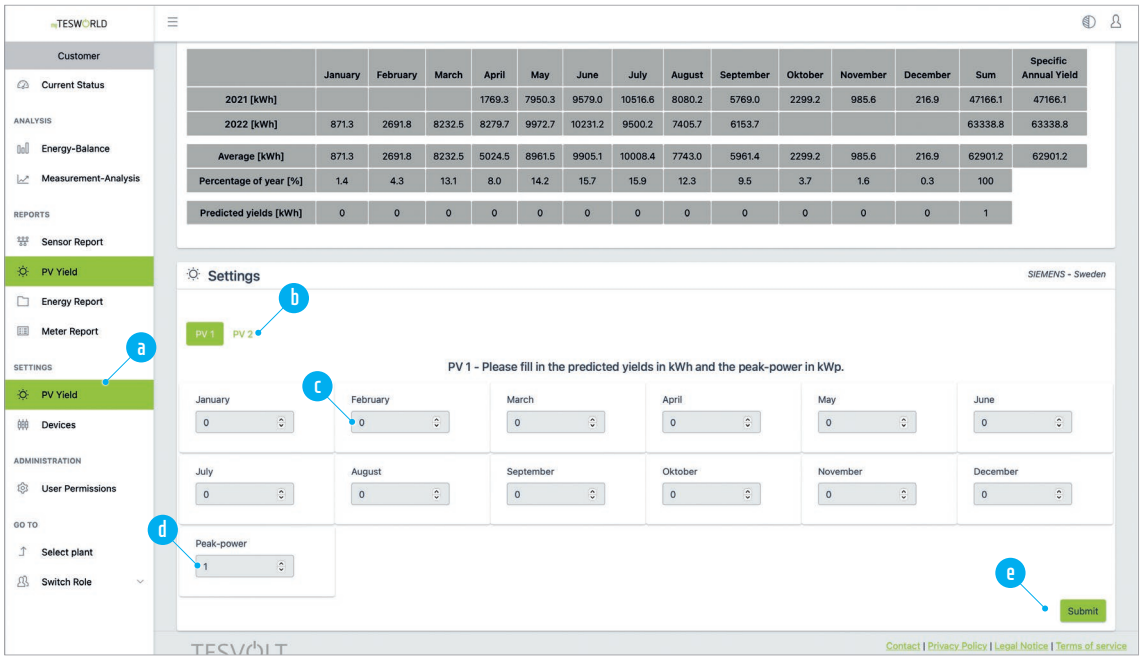
7



In the "Devices" section, select a physical device, e.g. the grid meter a. In the corresponding "Sensors" section b, you can see that the meter measures the amount drawn from the grid and the grid feed-in. Open the "Meters" section by clicking on it, and look for the corresponding logical device c. The first two device names begin with "bat" (battery) and "inv" (inverter), so they cannot be the grid meter. Click on the "Devices" field of the third meter to check whether this is the "Grid" meter. As it is measuring all existing physical devices, this must be the "Grid" meter. Now click on the corresponding "Sensors" field to see the available measurands e. If you would like to download the measurements, open the "Download" section by clicking on it.
Select the desired time period f incl. date and time zone. Enter the temporal resolution required g. In the "Select data type" field h you can choose between power and energy, or whether you want interpolated data (missing data is calculated), average values or original meter data. When you have made a selection, another field appears where you can select the sensors and measurands. Finally, specify separators and decimals i. If you want to check the data before the final export, click on "Preview" j, or click on "Download" k to download the data straight away.

Reports – PV Yield and Settings – PV Yield

1



Open "Settings" → "PV Yield" (a) for the configuration of "Reports" → "PV Yield". At the bottom of the page, an additional section, "Settings", is shown. If applicable select the PV installation (b) whose settings you want to configure. Enter the predicted yields of the PV installation (c) and the installation size (d) and then click on "Submit" (b).

2

At the top of the page "Reports" → "PV Yield", you can switch the display between the different PV installations if applicable (a). By clicking on the menu symbol (b) you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend (c) to hide or show the corresponding values in the diagram. The table allows you to see the values as either "kWh" or "kWh/kWp", and you can switch between these displays using the buttons (d) (please note that for this the installation size must have been entered in "Settings" → "PV Yield").

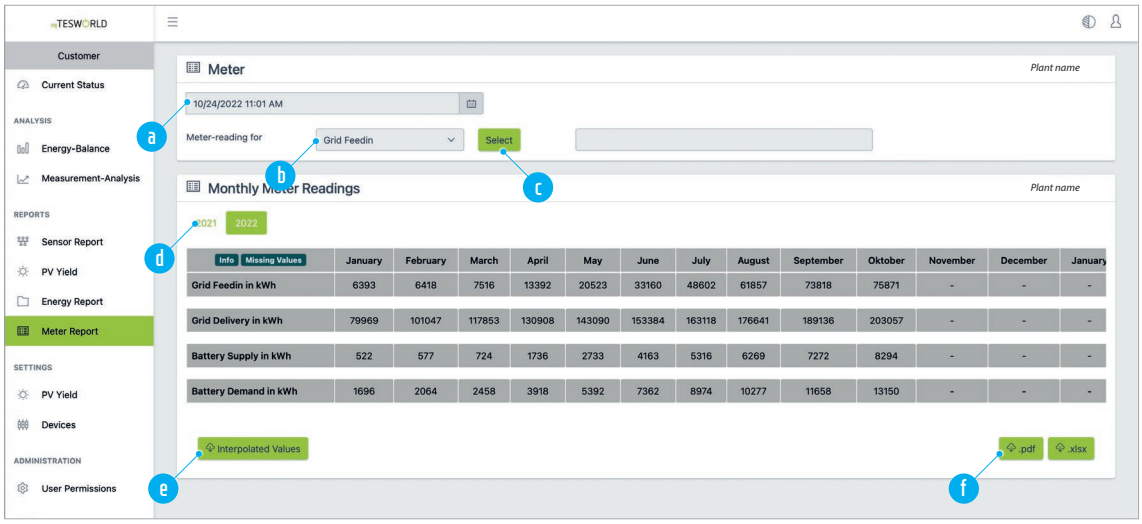
Reports – Energy Report

1

At the top of the page you can select the year a whose data you want to display. By clicking on the menu symbol b you can access options to print the diagram, export it as a graphic, or download it as a document (xls, csv). Click on an entry in the legend c to hide or show the corresponding values in the diagram. Using the two buttons d below the table, you can export the data in the table as a PDF or XLS file.

Reports – Meter Report

1



At the top of the page you can define the terms for a specific meter report. Enter the desired date and time in the field a, select the relevant meter b and click on "Select" c to display the meter report. At the top of the section "Monthly Meter Readings", you can select the year d whose data you want to display in the table below. Clicking on "Interpolated Values" e will take you to the page "Reports" → "Sensor Report", where you can download interpolated data, among other things (see the section "Reports – Sensor Report" on page 131, step 2).

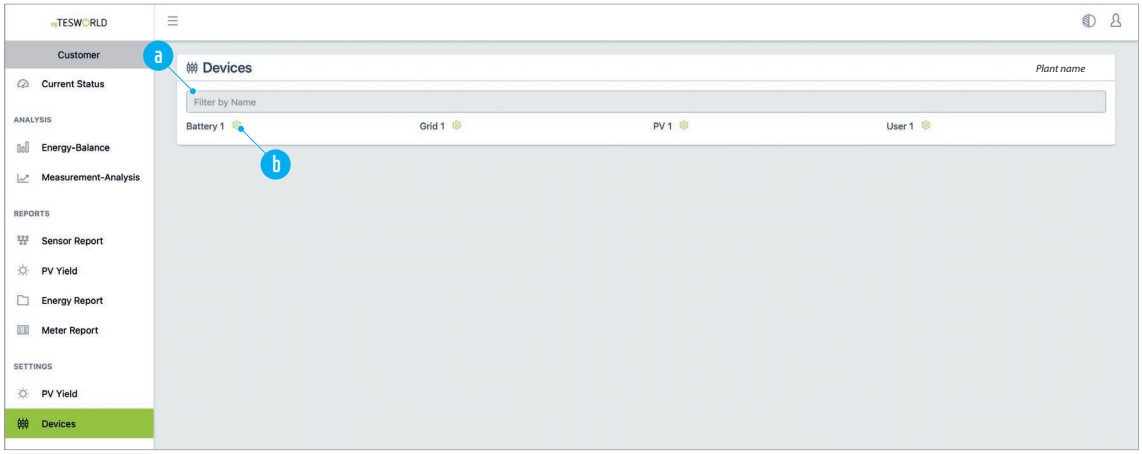
Settings – PV Yield

1

In this section you can configure the settings for the section "Reports" → "PV Yield". Detailed information can be found in the section "Reports – Sensor Report" on page 131, step 2.

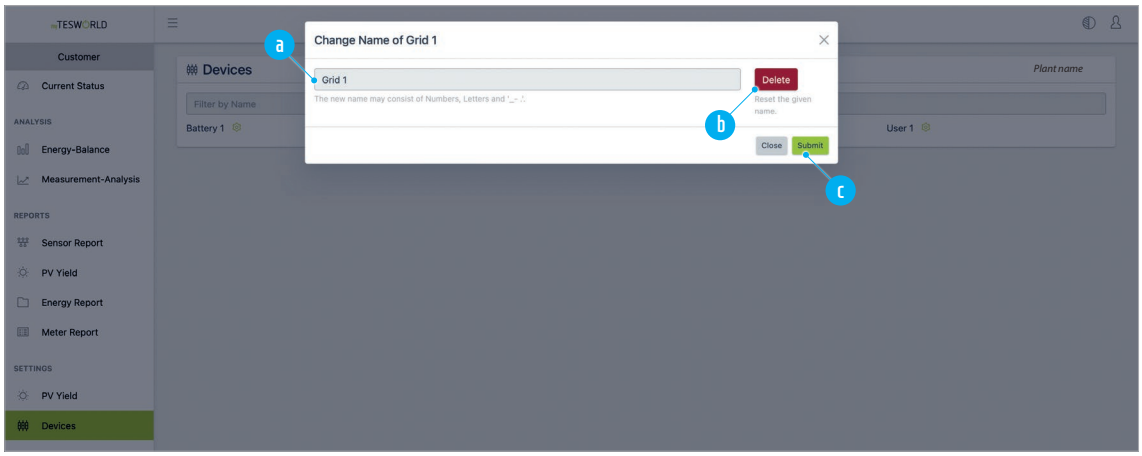
Settings – Devices

1



Here you can change the names of physical devices. If necessary, use the search field a to find the device. To edit a name, click on the cog symbol next to the device entry b.

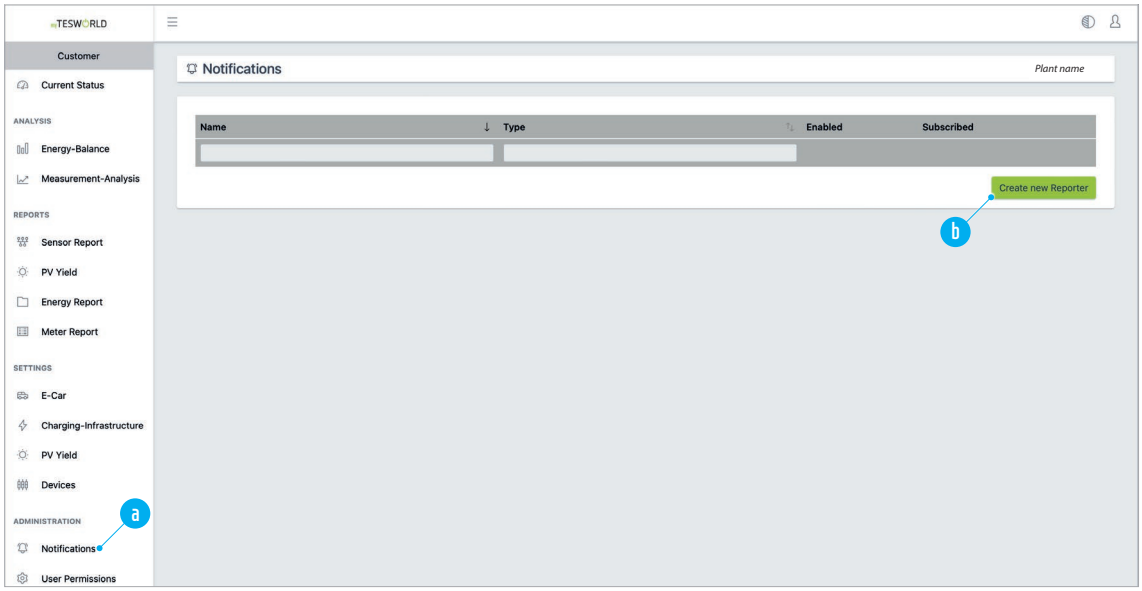
2



Enter a new name in the field a. To reset the name to the original, automatically assigned name, click on “Delete” b. To apply the changes, click on “Submit” c.

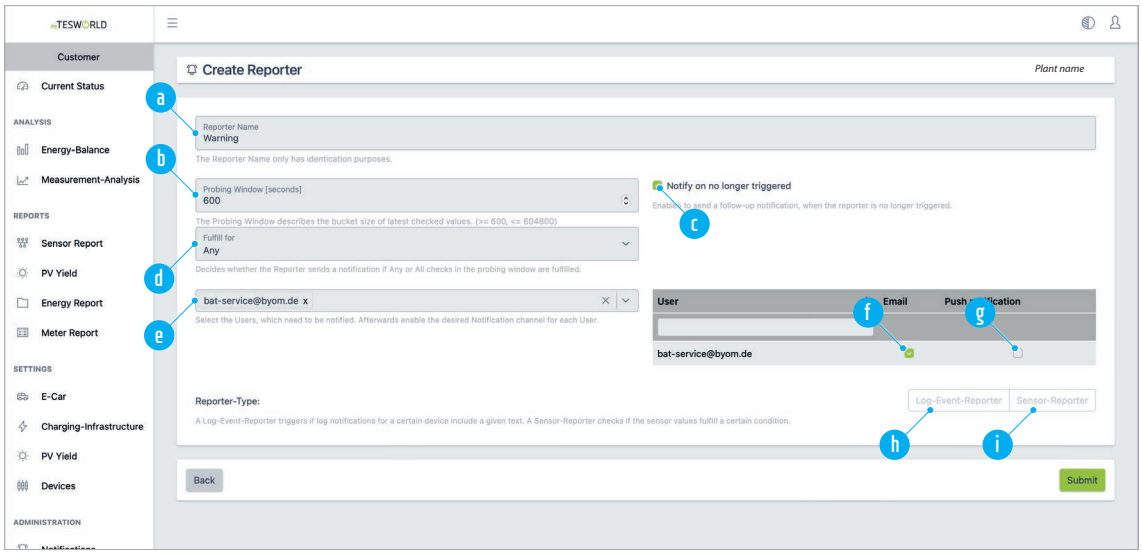
Administration – notifications

1



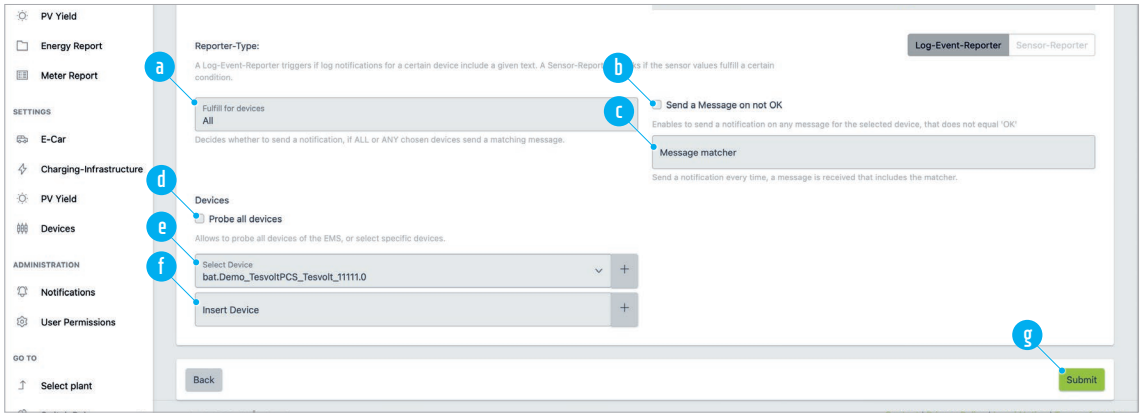
The TESVOLT Energy Manager can automatically send notifications to any users when devices generate messages or sensors detect measurement values inside or outside certain value ranges. To set up notifications, click on notifications a in the side menu and then on “Create new reporter” b.

2



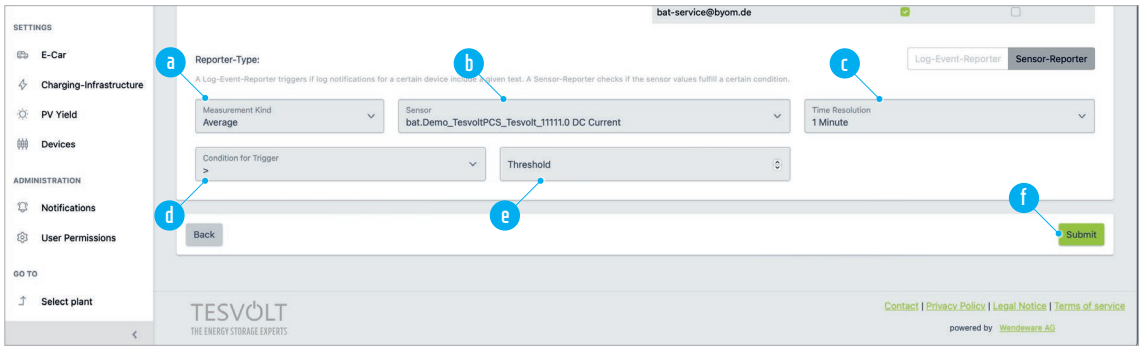
Enter a descriptive name in the “Reporter name” field a. A time period must be specified in the “Probing window” b within which the conditions specified below must be met in order to create and send a report. If you tick the “Notify on no longer triggered” box c, a notification will be sent as soon as the conditions are no longer met. The “Fulfill for” field d determines whether a notification is sent when “all” conditions are met or when “one” of the conditions is met. In the “Select user” box e, you must now select the recipient(s) of the notifications (only registered users can be selected). As soon as a user is selected, a table with the email address appears on the right side. After the entry, you can use two tick boxes to select whether a notification is sent via email f and/or push notifications g. Below the table there are two buttons: “Log Event Reporter” h and “Sensor Reporter” i. Here, you can select the data to be evaluated for notifications. Clicking on “Log Event Reporter” evaluates the log messages from the device, and clicking on “Sensor Reporter” evaluates the actual measurement values. Click on desired button.

3



Clicking on “Log Event Reporter” will display other fields. In the “To be met for devices” box a, specify whether a notification is to be sent if all messages from a device meet the conditions, or if only one message meets the conditions. If you tick the “Send message on not OK” box b, all messages from the selected device that are not OK messages will be sent as a notification. If it is not ticked, all messages are sent that contain the text entered in box c. If you tick the “Probe all devices” box d, messages from all devices will be checked. If the box is not ticked, you can select a specific device using the “Select device” e or “Insert device” f boxes. Finally, click on “Submit” g.

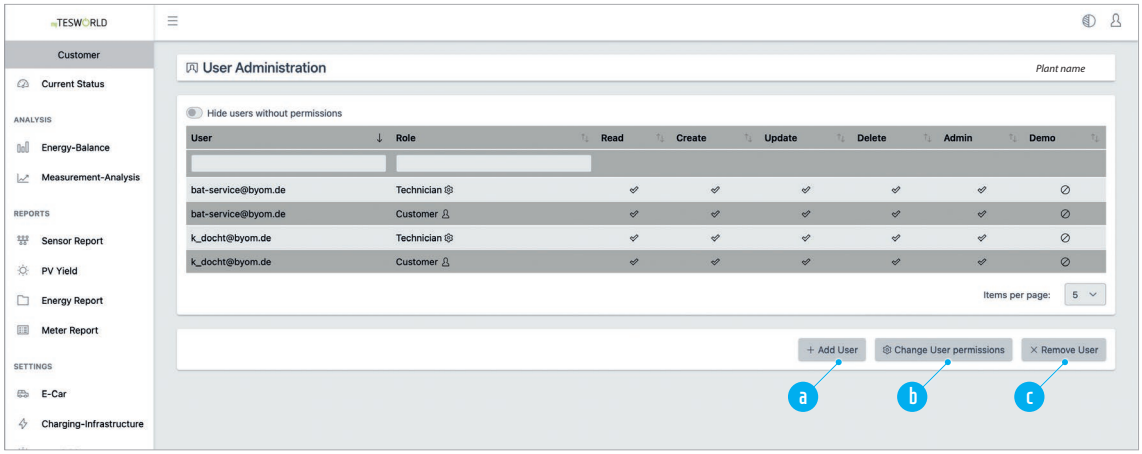
4



Clicking on “Sensor Reporter” will display other fields. In the “Measurement Kind” box a, you can select whether the value is an average value, energy value or power value. In the “Sensor” drop-down menu b you can select the desired sensor. The “Time Resolution” box c allows you to determine the temporal resolution of the measurements. The “Condition for Trigger” box d allows you to define how the “Threshold” e is interpreted (the “Threshold” is always positive, depending on the selection for “Measurement Kind” W/Wh/V/A/°C/%). Then, click on “Submit” f.

Administration – User permissions

1



If you would like to set up a new user, click on “+ Add User” a. To change the permissions of existing users, click on “Change User permissions” b. On the page that opens, you can then add or remove permissions by clicking on them. Finally, click on “Confirm”. You must then confirm the changed permissions again on a new page.

To delete a user, click on “X Remove User” c. On the page that opens, select the user to be removed and click on “Confirm”.

User permissions can also be managed from the technician role (see also the section “7.5 User management” on page 29).

11 DECOMMISSIONING

WARNING: Not following the decommissioning procedures for the system components can lead to damage to the units.
Before decommissioning the system, take careful note of the decommissioning procedures for the individual system components in the relevant product documentation, as not following the prescribed decommissioning processes can lead to damage to the units.

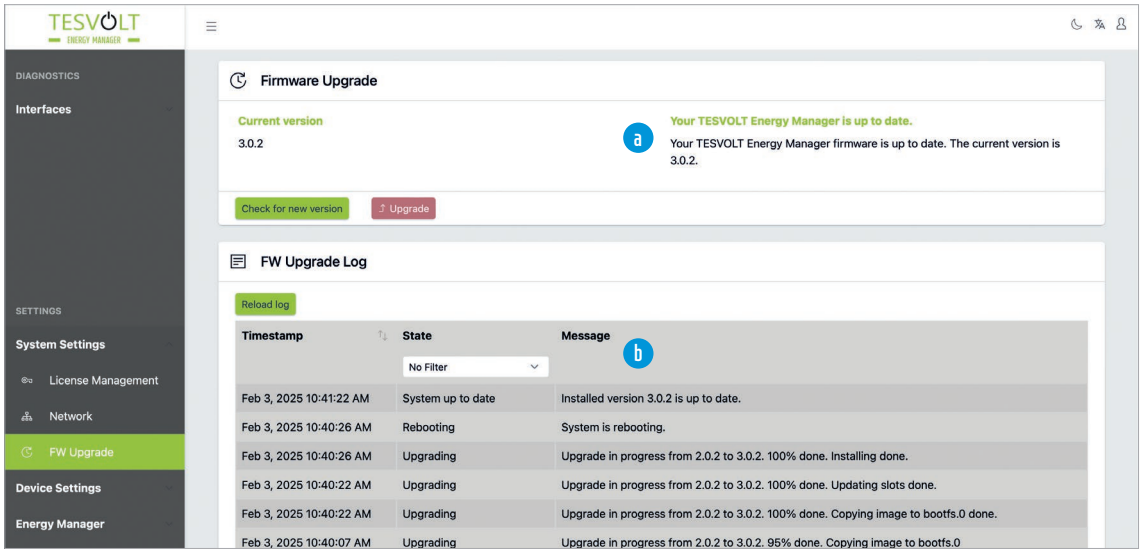
1 To decommission the Energy Manager, disconnect it from the power supply and ensure it is voltage-free.

12 FIRMWARE-UPDATE

NOTE: With version 3.0.0 and higher, users can update the firmware themselves. If you are running a version prior to 3.0.0, please contact TESVOLT Support.

Proceed as follows to update the firmware:

1 In the side menu, click on System Settings > FW Upgrade.

2 

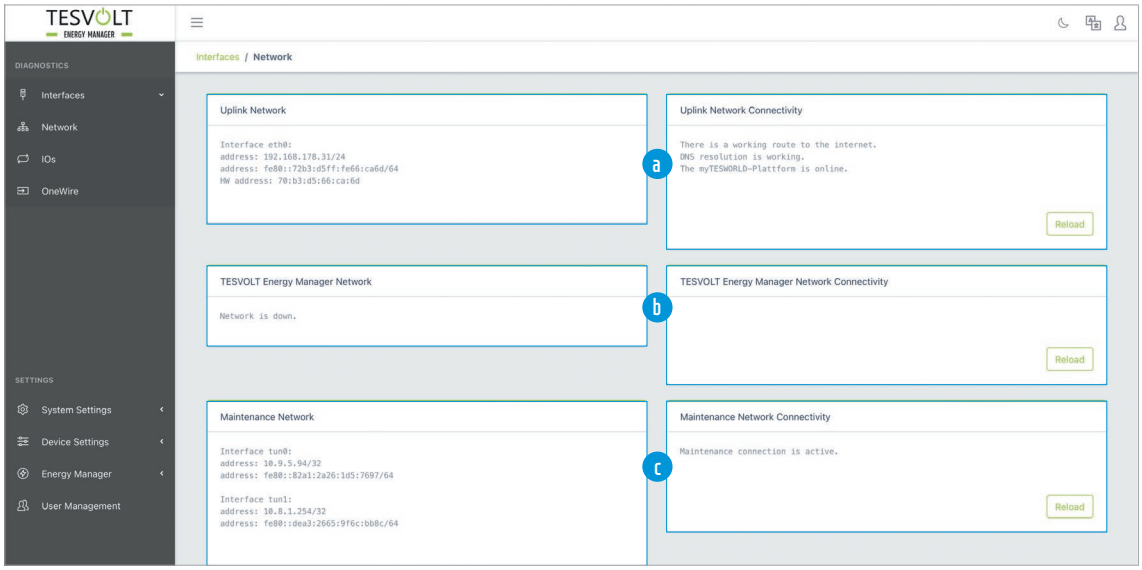
You will see the status of the FW version a used by your TESVOLT Energy Manager, as well as log entries from past FW updates b.

3 If there is a newer firmware version available, start the update by clicking on "Upgrade". The new firmware version is then installed, followed by an automated restart. Notifications indicate the progress.

4 As soon as the TESVOLT Energy Manager is restarted, check whether your EMS appears to be working. As soon as you have ensured fault-free operation, complete the update by clicking on "Finalise". The TESVOLT Energy Manager will then install the update a second time. After the TESVOLT Energy Manager is restarted for the second time, you have successfully completed the process.

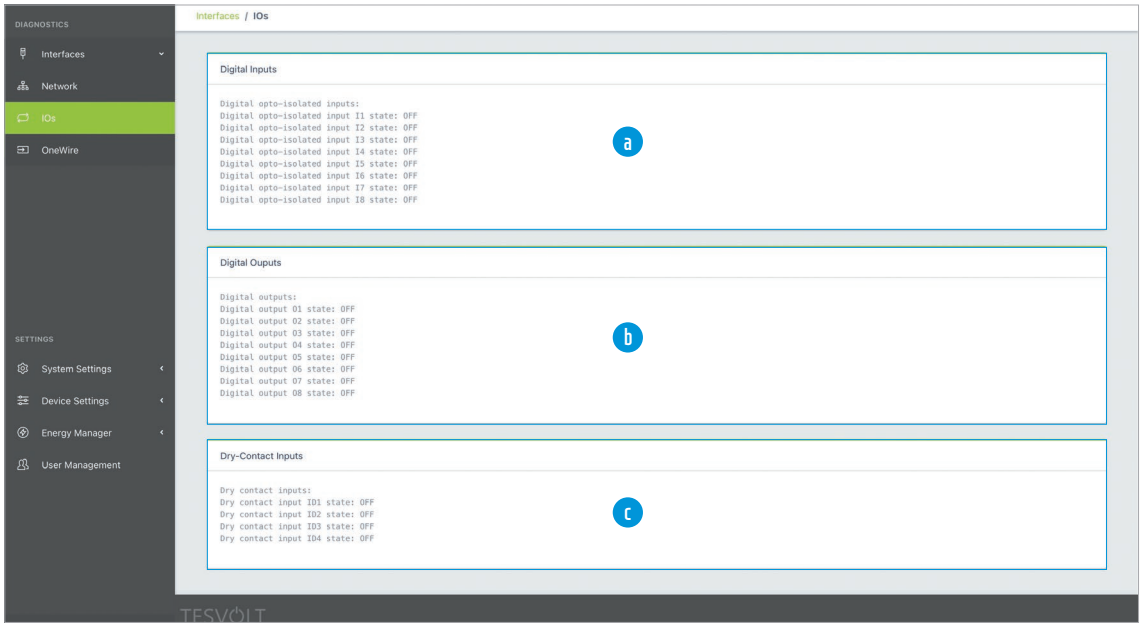
13 ANALYSIS FUNCTION AND TROUBLESHOOTING

13.1 NETWORK ANALYSIS



a	**Network status LAN 1**	Status of the local network (internet)
b	**Network status LAN 2**	Status of the dedicated Modbus network
c	**Maintenance network**	Status of the maintenance network

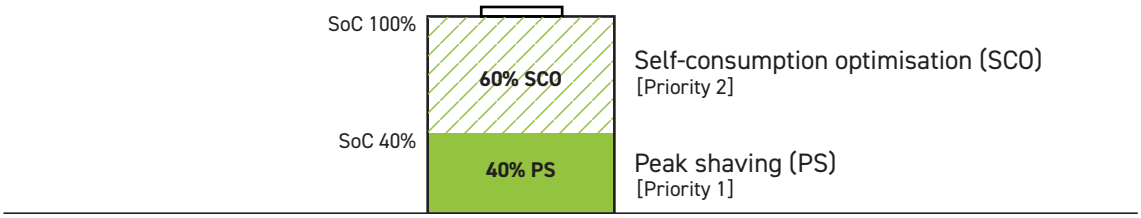
13.2 INPUTS AND OUTPUTS ANALYSIS



a	**Opto-isolated inputs** J	Status of opto-isolated inputs
b	**Digital outputs** K	Status of digital outputs
c	**Dry contact inputs** I	Status of dry contact inputs

14 EXAMPLE ENERGY SERVICE STRATEGIES (MULTI-USE)

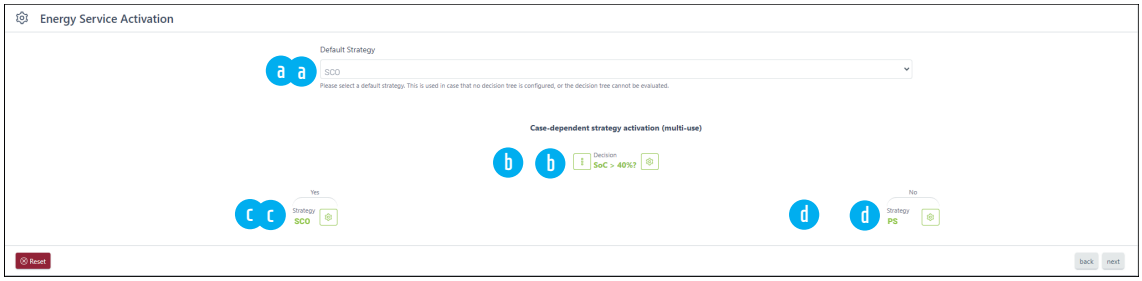
14.1 PEAK SHAVING + SELF-CONSUMPTION OPTIMISATION



In this energy service strategy, the energy service strategies peak shaving and self-consumption optimisation are combined to achieve the benefits listed below.

For this multi-use application, only the Basic version of the TESVOLT Energy Manager is required.

Configuring this energy service strategy in the decision tree



a **Standard strategy**	Self-consumption optimisation
b **Case-dependent strategy activation (multi-use)**	Decision SoC > 40%?
c **SoC > 40%**	Strategy: Self-consumption optimisation
d **SoC < 40%**	Strategy: Peak shaving

Benefits

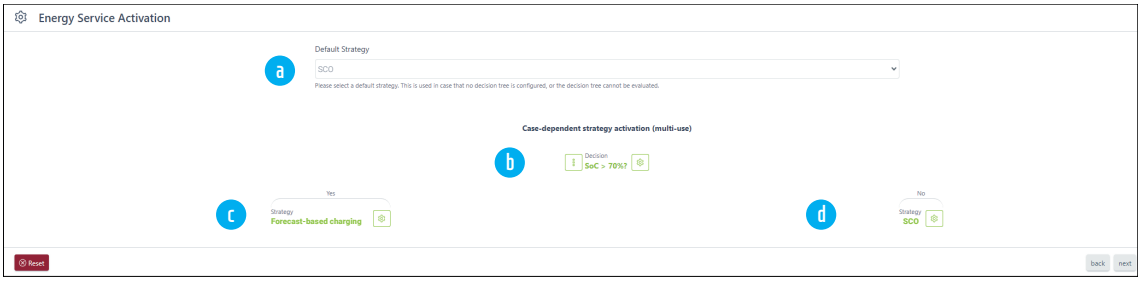
- Maintains a minimum usable energy content to guarantee peak shaving
- With the Pro version and dynamic peak shaving, a maximum battery lifespan can be guaranteed.

14.2 FORECAST-BASED CHARGING + SELF-CONSUMPTION OPTIMISATION

In this energy service strategy, the energy service strategies forecast-based charging and self-consumption optimisation are combined to achieve the benefits listed below.

For this multi-use application, the Pro version of the TESVOLT Energy Manager is required.

Configuring this energy service strategy in the decision tree

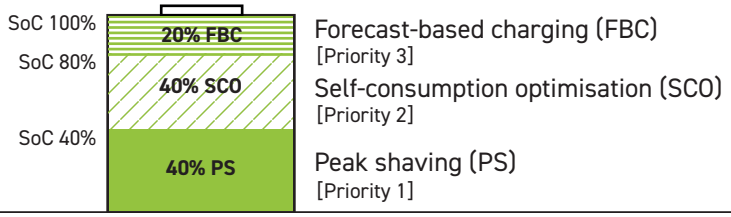


a **Standard strategy**	Self-consumption optimisation
b **Case-dependent strategy activation (multi-use)**	Decision SoC > 70%?
c **SoC > 70%**	Strategy: Forecast-based charging
d **SoC < 70%**	Strategy: Self-consumption optimisation

Benefits

- Extends the battery lifespan (lithium-ion batteries age more quickly in the 80–100% SoC range)
- Battery is used effectively during its lifespan
- Guarantees maximum degree of system self-sufficiency

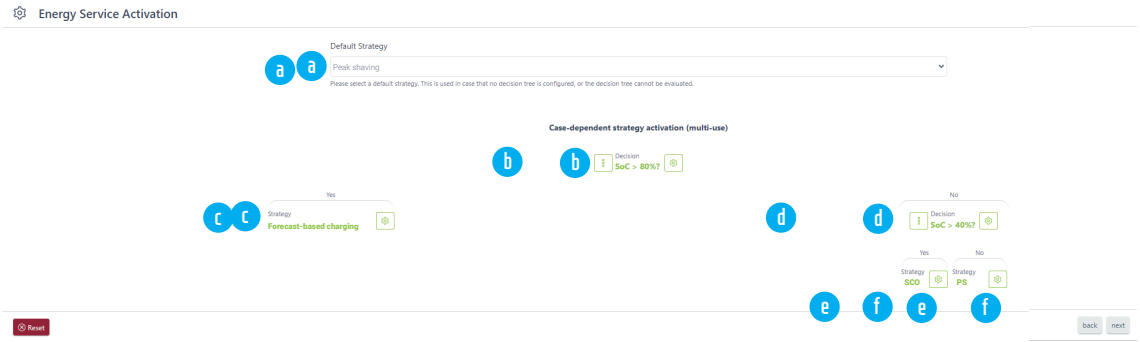
Forecast-based charging + peak shaving + self-consumption optimisation



In this energy service strategy, the energy service strategies forecast-based charging, peak shaving and self-consumption optimisation are combined to achieve the benefits listed below.

For this multi-use application, the Pro version of the TESVOLT Energy Manager is required.

Configuring this energy service strategy in the decision tree



a Standard strategy	Peak shaving
b Case-dependent strategy activation (multi-use)	Decision: SoC > 80%?
c SoC > 80%	Forecast-based charging
d SoC < 80%	Decision: SoC > 40%?
e SoC > 40%	Strategy: Self-consumption optimisation
f SoC < 40%	Strategy: Peak shaving

Benefits:

- Extends the battery lifespan (lithium-ion batteries age more quickly in the 80–100% SoC range)
- Maintains a minimum usable energy content to guarantee peak shaving – even where forecast data differs (e.g. weather report)
- Battery is used effectively during its lifespan

15 MAINTENANCE

Check all screwed electrical connections: Loose connections must be retightened.

Use a dry cleaning cloth to clean the unit. The connections must be kept free of moisture. Do not use solvents of any kind!

16 DISPOSAL

Once a unit has been withdrawn from service, it must be disposed of in accordance with the locally applicable disposal regulations for electronic waste.

17 LEGAL NOTICE

TESVOLT Energy Manager Installation and Operating Manual

Last revised: 03/2025

Applies to Tesvolt Energy Manager version 3.03 or higher

Subject to technical changes.

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