Solar charge controller

Installation and User Instructions
Tarom MPPT 6000-M
Tarom MPPT 6000-S

EN

756.404 | Z01 | 16.06

For further languages please visit: www.stecasolar.com

Table of contents

1 General information

1.1 General safety instructions

- This document is part of the product.
- Only technical professionals may perform the work described in this manual.
- Install and use the device only after reading and understanding this document.
- Always perform the measures described in this document in the sequence specified.
- Keep this document in a safe place for the entire service life of the device. Pass the document on to subsequent owners and operators of the device.
- Incorrect operation can reduce solar system yields or damage system components.
- The device must not be connected to the DC cables if it has a damaged casing.
- Immediately take the device out of operation and disconnect it from the battery and modules if any of the following components is damaged:
  - device (not functioning, visible damage, smoke, penetration of liquid etc.),
  - connected cables,
  - solar module,
  - battery.

  Do not switch the system on again before the following requirements are satisfied:
  - The device has been repaired by a dealer or the manufacturer.
  - Damaged cables or solar modules have been repaired by a technical specialist.
- Battery acid splashes on skin or clothing should be immediately treated with soap suds and rinsed with plenty of water. Immediately seek medical advice in the case of injuries.
- If battery acid splashes into the eyes, immediately rinse with plenty of water and seek medical advice.
- Never cover the device.
- Do not open the casing: Risk of death! Invalidation of the guarantee! Only the terminal cover may be removed by a technical professional for installation or repair purposes.
- Do not operate the device without the terminal cover installed. Risk of death!
- Factory labels and markings must never be altered, removed or rendered unreadable.
- Observe the manufacturer's manual when connecting an external device that is not described in this document. Incorrectly connected devices can damage the controller.
- This device is not intended for:
  - children,
  - persons with physical, sensory or mental impairment,
  - persons without sufficient experience or knowledge, unless they are instructed in the use of the device, and initially supervised, by a person responsible for their safety.

1.2 Identification

General information

Feature	Description
Types	MPPT 6000-M; MPPT 6000-S
Issue version of the manual	Z01

Feature	Description
Certificates	See www.steca.com *'Solar Electronics ➔ PV Off Grid ➔ Solar Charge Controllers ➔ Steca Tarom MPPT'*.
Optional accessories	■ Steca PA TS-S external temperature sensor [1)] ■ StecaLink-compatible Steca PA HS400 current sensor [2)] ■ RJ45 termination plug for the StecaLink bus [1)] ■ RJ45 cable for connecting the MPPT 6000-M and MPPT 6000-S

[1)] Included in the scope of delivery with the 6000-M.

[2)] Can only be used with the MPPT 6000-M.

1.3 Scope of delivery

MPPT 6000-S:

- MPPT 6000-S device
- Fastening set (screws, dowels)
- Socket, 2-pin, green, for connecting the battery voltage sensor cable
- Operating instructions

MPPT 6000-M:

- MPPT 6000-M device
- Fastening set (screws, dowels), socket, 2-pin, green, for connecting the battery voltage sensor cable
- Steca PA TS-S external temperature sensor, with socket, 2-pin, green
- Socket, 3-pin, green, for AUX IO connection
- Socket, 3-pin, green, for RS-232 connection
- 3 sockets, 2-pin, green, for the AUX1/2/3 connections
- Termination plug (RJ45)
- Operating instructions

1.4 Proper usage

The solar charge controller, hereinafter named as the controller or device, may only be used in stand-alone photovoltaic systems for charging and controlling the following types of battery.

- MPPT 6000-S: lead acid batteries
- MPPT 6000-M: lead acid batteries, lithium-ion batteries (Li-Ion), nickel-cadmium batteries (NiCd)

When the device is used with lithium-ion systems, an external battery management system (BMS) must be present to provide the protection and safety functions necessary for such systems (e.g. temperature monitoring, safety switch-off, equalisation of cell voltages). These functions are not provided by the MPPT 6000-M/S.

! NOTICE!

MPPT 6000-M: In a networked system with MPPT 6000-M and MPPT 6000-S devices, the charging of Li-Ion and NiCd batteries is only possible using a Master/Slave system controlled by the MPPT 6000-M. The charging of Li-Ion and NiCd batteries via the MPPT 6000-S is deactivated as soon as the MPPT 6000-M is no longer active in the network.

The following also applies:

- The controller must not be connected to the public electricity grid.
- Only solar modules may be connected to the solar module connections.
- Possible system voltages for the MPPT 6000-M/-S (nominal battery voltages): 12 V, 24 V, 36 V, 48 V, 60 V; (12 V, 24 V and 48 V: automatic detection; 36 V, 60 V: manually set via the Expert menu).
- The controller performs, in particular, the following tasks:
  - Maximisation of power extraction from the modules via an integrated MPP tracker.
  - Controlling of the charging process.
  - Recording of yield and system data.
  - Recording of data on a microSD card (MPPT 6000-M only).
  - Integration of StecaLink-compatible devices (MPPT 6000-M only).
  - Charging control via the AUX IO input (MPPT 6000-M only).
  - Programmable AUX1/2/3 outputs (MPPT 6000-M only).
  - UART/RS-232 data output (MPPT 6000-M only).

1.5 Markings

1.5.1 Symbols for warnings and notices

Symbol	Description	Location
	General danger warning.	Instructions
	Danger from electricity.	Instructions
	Danger from hot surfaces.	Instructions
	Danger from battery acid.	Instructions
	Read the manual before using the product.	Device
	General information.	Instructions
✓	The following information describes prerequisites for further operation.	Instructions

1.5.2 Keywords

The following keywords are used together with corresponding symbols for warnings and notices.

Keyword	Description
Danger	Immediate danger of death or serious bodily injury.
Warning	Possible danger of death or serious bodily injury.
Caution	Possible danger of light or medium bodily injury.
Attention	Possible damage to property.
Notice	Note on operation of the device or use of the manual.

1.5.3 Terms and abbreviations used

Term, abbreviation	Description
Battery	This manual uses the singular term *'battery'*. The battery can however consist of multiple batteries connected together (battery bank).
Module	See ☞ *Chapter 4.3.5 'Connecting the solar module' on page 30*.
Solar module	This manual uses the singular term *'solar module'*. The solar module can however consist of multiple solar modules connected together (string, solar module array).
String	Multiple solar modules connected in series or parallel.
Lead-acid battery	Collective term for batteries using lead technology. Includes variants such as lead-acid batteries with liquid electrolyte, gel batteries and AGM batteries.
Li-Ion battery	Collective term for batteries using lithium ion technology.
NiCd battery	Collective term for batteries using nickel-cadmium technology.

2 Quick guide

DANGER!

Risk of death by electrocution. Observe the safety notice at the start of the section *'Installation of the base system'* (*'Installation of the base system' on page 23*)!

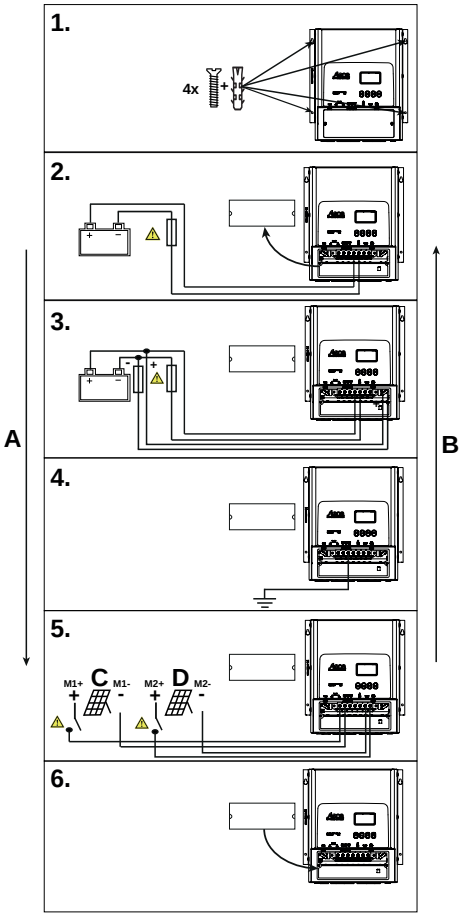


Fig. 1: Quick guide

A Installation
B Removal
C Module 1
D Module 2

⚠ = Mandatory!

3 Overview

3.1 Controller power unit

NOTICE!

The power unit connector assignments of the MPPT 6000-M and MPPT 6000-S are identical. The MPPT 6000-M and MPPT 6000-S differ in the additional components that can be connected.

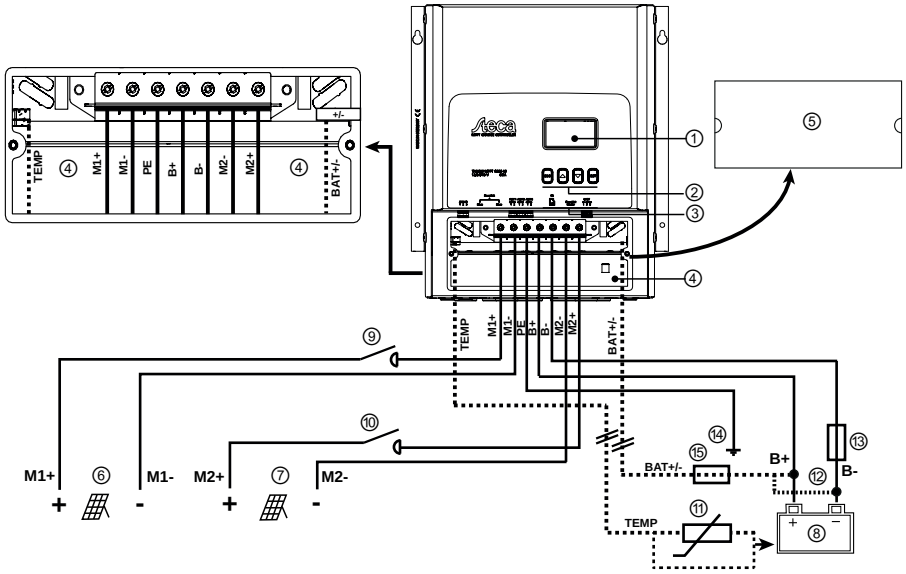


Fig. 2: Overview of the casing and connections on the power units for the MPPT 6000-M and MPPT 6000-S

Component		Description
1	Display	
2	Operating buttons	ESC, Δ, ∇, SET
3	2 x RJ45 sockets for StecaLink slave (MPPT 6000-S)	Service interface for technical professionals, connection to an MPPT 6000-M and connection to additional StecaLink expansion devices such as (e.g.) the PA HS400.

Component		Description
4	Terminal area	■ "M1+"/"M1−" (solar module 1) ■ "M1+"/"M1−" (solar module 2) ■ "B+"/"B−" (battery) ■ "PE" (ground) ■ "BAT+/−" (battery voltage sensor cable) [2)] ■ "TEMP" (ext. battery temperature sensor) [3)]
5	Terminal cover	The terminal cover is fastened with 2 Phillips screws.

External components		Description
6	Solar module 1	Connect to terminals "M1+" and "M1−".
7	Solar module 2	Connect to terminals "M2+" and "M2−".
8	Battery	Connect to terminals "B+" and "B−".
9, 10	DC load circuit breaker [4)] for solar module1/2	 **Danger** Danger from electrical voltage. Installation is legally prescribed!
11	External battery temperature sensor PA TS-S [3)]	 **Attention** Use only an original Steca PA TS-S sensor. The connection polarity is unimportant.
12	Battery voltage sensor cable connection [2)]	■ Connect the cable directly to the battery. ■ Observe the polarity specified in the drawing.
13	External battery fuse (safety fuse or DC circuit breaker [1) 4)]	 **Caution** Danger from high currents. Installation is legally prescribed!

External components		Description
14	Central grounding point	If a grounding point is not already present then this must be created, e.g. by hammering in a grounding spike! Using the PE connection on the MPPT 6000-M and MPPT 6000-S is legally prescribed.
15	Fuse for battery voltage sensor cable	The installation is mandatory if the optional battery voltage sensor cable is used!

[1] For technical data see *Chapter 12 'Technical data' on page 124*.

[2] Optional, connector included in the scope of delivery. Connecting cable not included in the scope of delivery.

[3] Included in the scope of delivery with the 6000-M.

[4] Not included in the scope of delivery.

3.2 Additional connections on the MPPT 6000-M

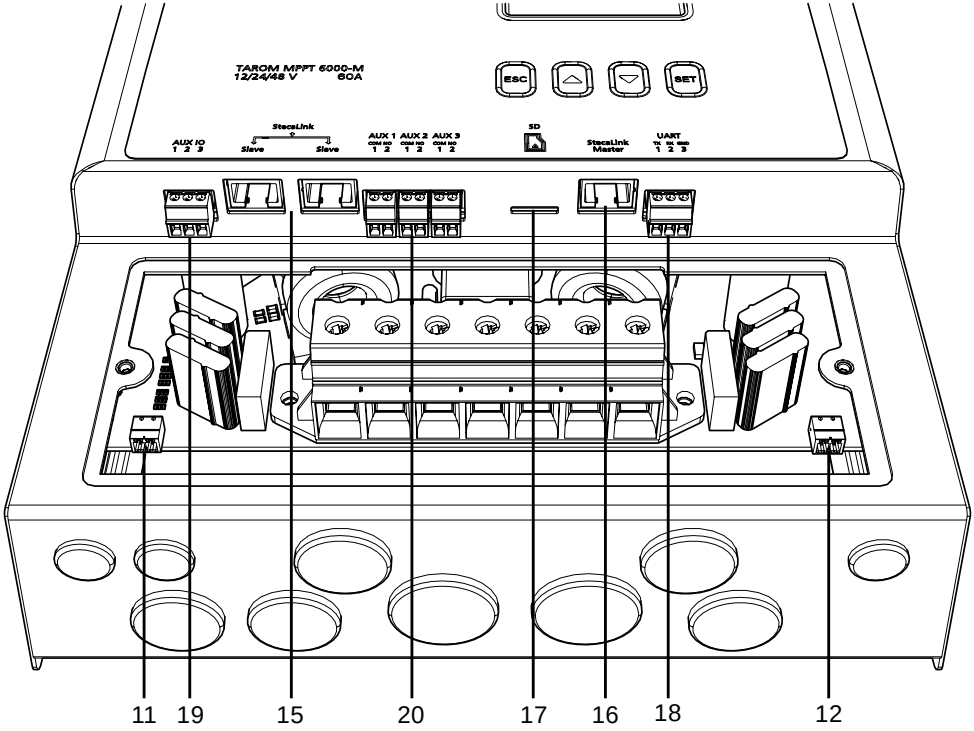


Fig. 3: Overview of additional connections on the MPPT 6000-M

Component		Description
15	2 x RJ45 sockets for StecaLink Slave (MPPT 6000-M)	Service interface for technicians and connection for superordinate StecaLink systems.
16	1 x RJ45 socket for StecaLink Master (MPPT 6000-M)	Connection for subordinate StecaLink extensions such as e.g. PA HS400, MPPT 6000-S.
17	Slot for microSD card [4] (MPPT 6000-M)	MicroSD card for data logging and storing parameters.
18	Open UART interface[1] [2], RS-232 levels of +5 V/0 V/-5 V (MPPT 6000-M)	RS-232 data output, with Tx, Rx, GND connections.
19	AUX IO input [2] (MPPT 6000-M)	Remote control input for activating/deactivating charging of the battery.
20	AUX 1/2/3 outputs [2] (MPPT 6000-M)	Programmable, potential-free relay outputs for various control functions.

External components		Description
11	External battery temperature sensor PA TS-S [3]	 **Attention** Use only an original Steca PA TS-S sensor. The connection polarity is unimportant.
12	Battery voltage sensor cable connection [2]	■ Connect the cable directly to the battery. ■ Take care to ensure the correct polarity, as shown in Fig. 2, terminal area enlargement.

[1] For technical data see *Chapter 12 'Technical data' on page 124*.

[2] Optional, connector included in the scope of delivery. Connecting cable not included in the scope of delivery.

[3] Included in the scope of delivery with the 6000-M.

[4] Not included in the scope of delivery.

3.3 Additional connections on the MPPT 6000-S

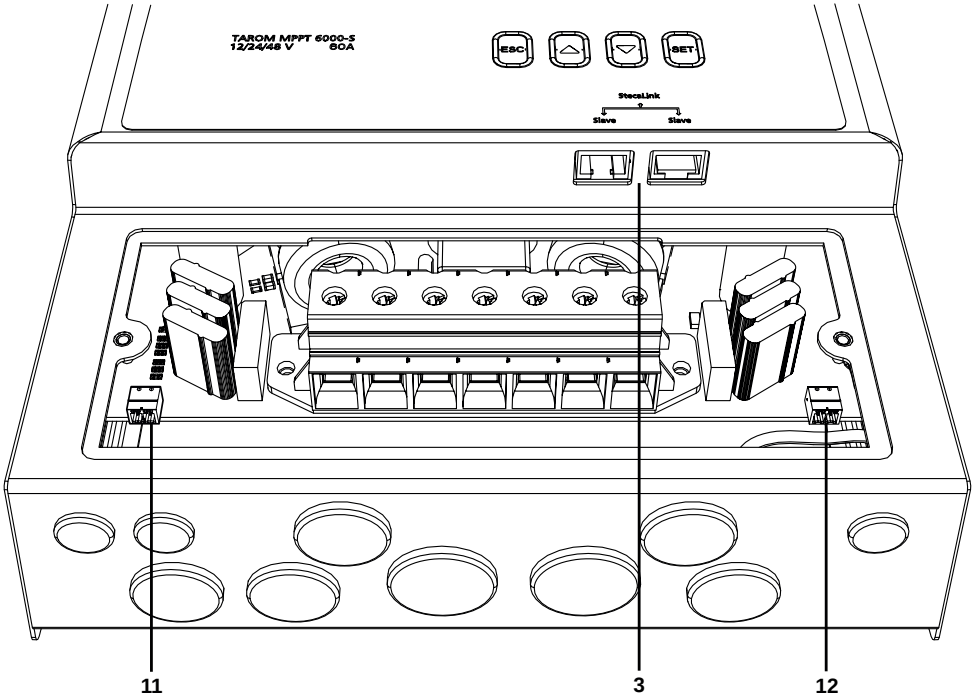


Fig. 4: Overview of additional connections on the MPPT 6000-S

Component		Description
3	2 x RJ45 sockets for StecaLink Slave (MPPT 6000-S)	Service interface for technical professionals and connection to an MPPT 6000-M and connection to additional StecaLink expansion devices such as (e.g.) the PA HS400.

External components		Description
11	External battery temperature sensor PA TS-S [3]	 **Attention** Use only an original Steca PA TS-S sensor. The connection polarity is unimportant.
12	Battery voltage sensor cable connection [2]	■ Connect the cable directly to the battery. ■ Observe the polarity specified in the drawing.
13	External battery fuse (fuse or DC circuit breaker) [1] [4]	 **Caution** Danger from high currents. Installation is legally prescribed!
14	Central grounding point	If a grounding point is not already present then this must be created, e.g. by hammering in a grounding spike! Using the PE connection on the MPPT 6000-M and MPPT 6000-S is legally prescribed.

[1] For technical data see *Chapter 12 'Technical data' on page 124*.

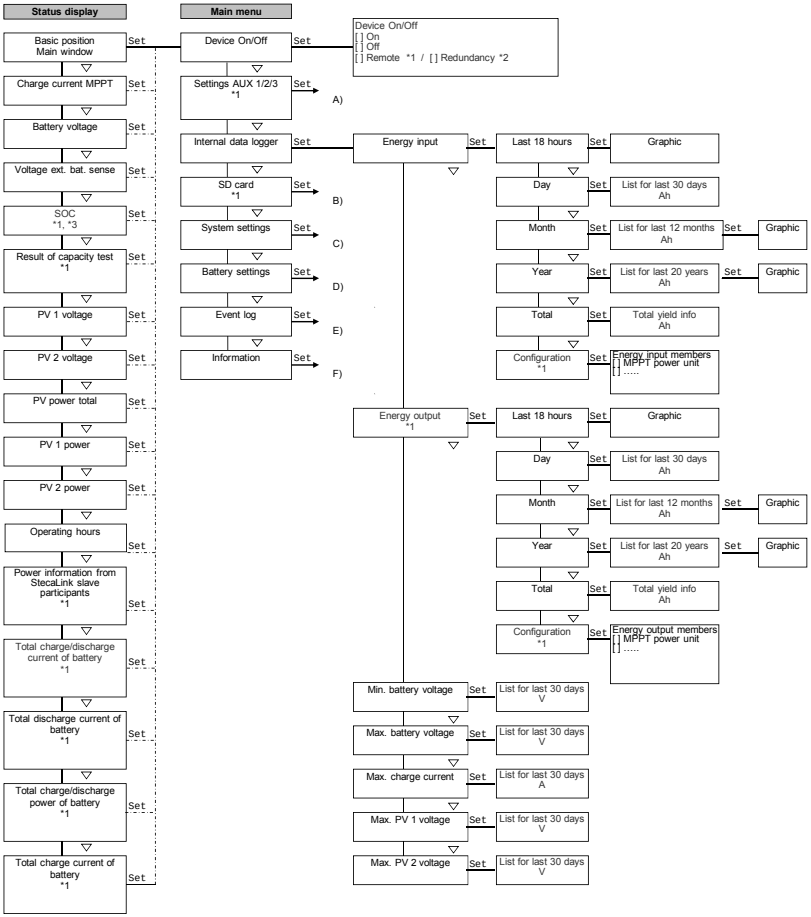
[2] Optional, connector included in the scope of delivery. Connecting cable not included in the scope of delivery.

[3] Included in the scope of delivery with the MPPT 6000-M.

[4] Not included in the scope of delivery.

3.4 Menu structure

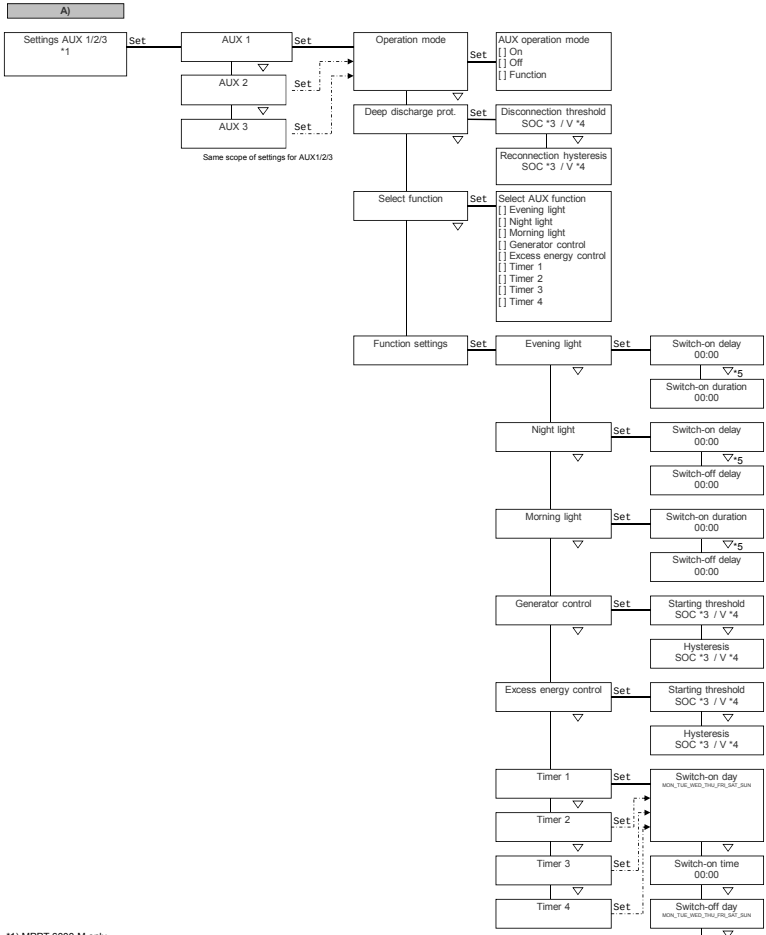
For the sake of clarity, only the ▽ and SET operating buttons are illustrated.

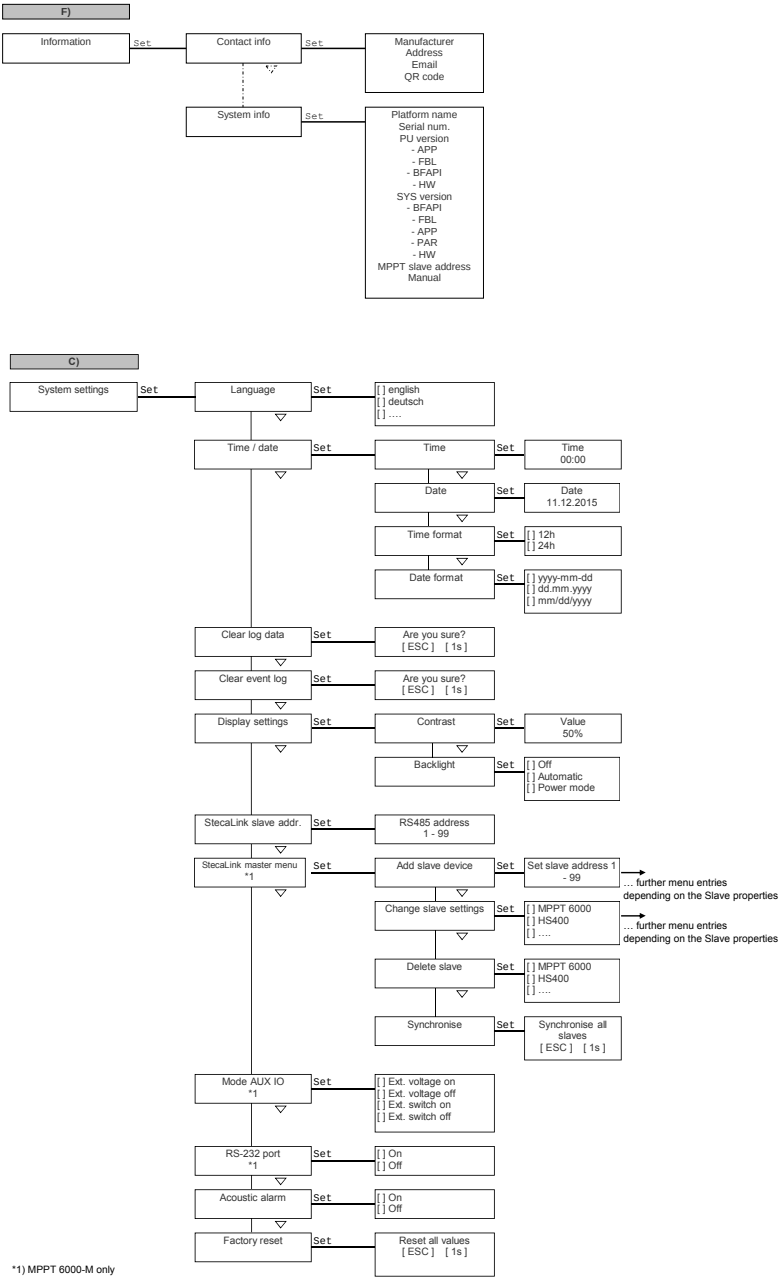


*1) MPPT 6000-M only

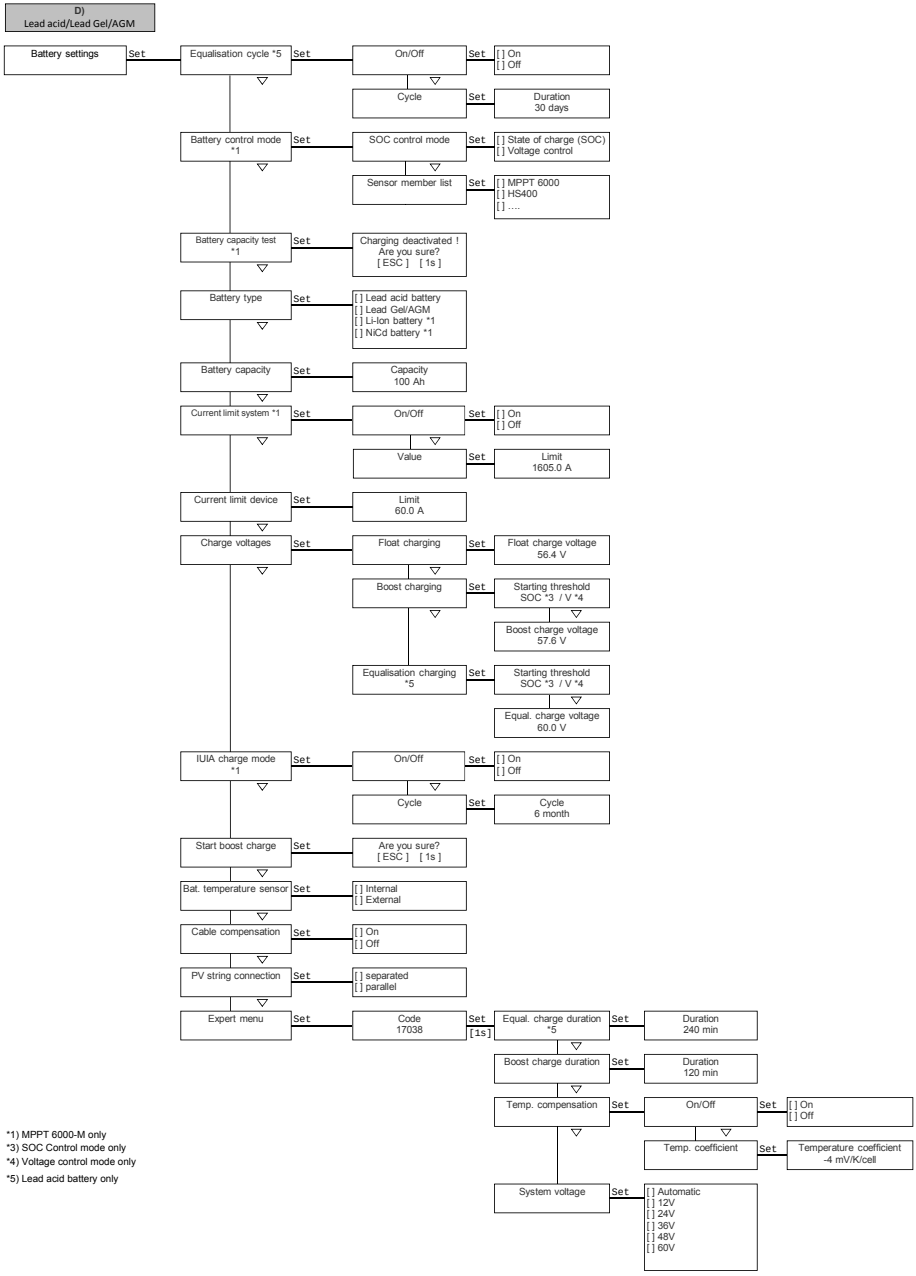
*2) MPPT 6000-S only

*3) SOC Control mode only

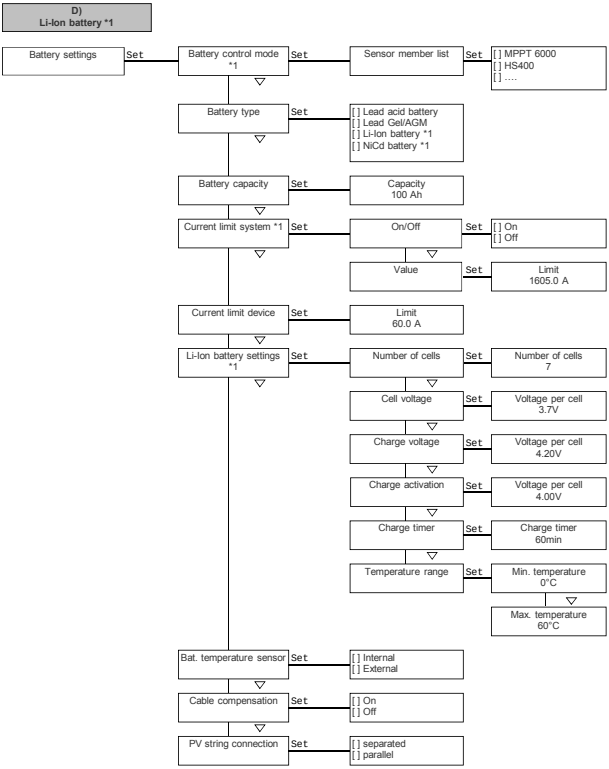

A)
Settings AUX 1/2/3 *1
Set
AUX 1
AUX 2
AUX 3
Same scope of settings for AUX1/2/3
Operation mode
AUX operation mode
[ ] On
[ ] Off
[ ] Function
Deep discharge prot.
Disconnection threshold SOC *3 / V *4
Reconnection hysteresis SOC *3 / V *4
Select function
Select AUX function
[ ] Evening light
[ ] Night light
[ ] Morning light
[ ] Generator control
[ ] Excess energy control
[ ] Timer 1
[ ] Timer 2
[ ] Timer 3
[ ] Timer 4
Function settings
Evening light
Switch-on delay 00:00
Switch-on duration 00:00
Night light
Switch-on delay 00:00
Switch-off delay 00:00
Morning light
Switch-on duration 00:00
Switch-off delay 00:00
Generator control
Starting threshold SOC *3 / V *4
Hysteresis SOC *3 / V *4
Excess energy control
Starting threshold SOC *3 / V *4
Hysteresis SOC *3 / V *4
Timer 1
Timer 2
Timer 3
Timer 4
Switch-on day
MON_TUE_WED_THU_FRI_SAT_SUN
Switch-on time 00:00
Switch-off day
MON_TUE_WED_THU_FRI_SAT_SUN
Switch-off time 00:00
Same scope of settings for timer 1/2/3/4
*1) MPPT 6000-M only
*3) SOC Control mode only
*4) Voltage control mode only
*5) Separate entry of hh and mm, therefore press multiple times to change to the next window
B)
SD card *1
Datalogger On/Off
[ ] On
[ ] Off
Load parameter
[ESC] [1s]
Store parameter
[ESC] [1s]
*1) MPPT 6000-M only
E)
Event log
01/30 Event message
30/30 Event message



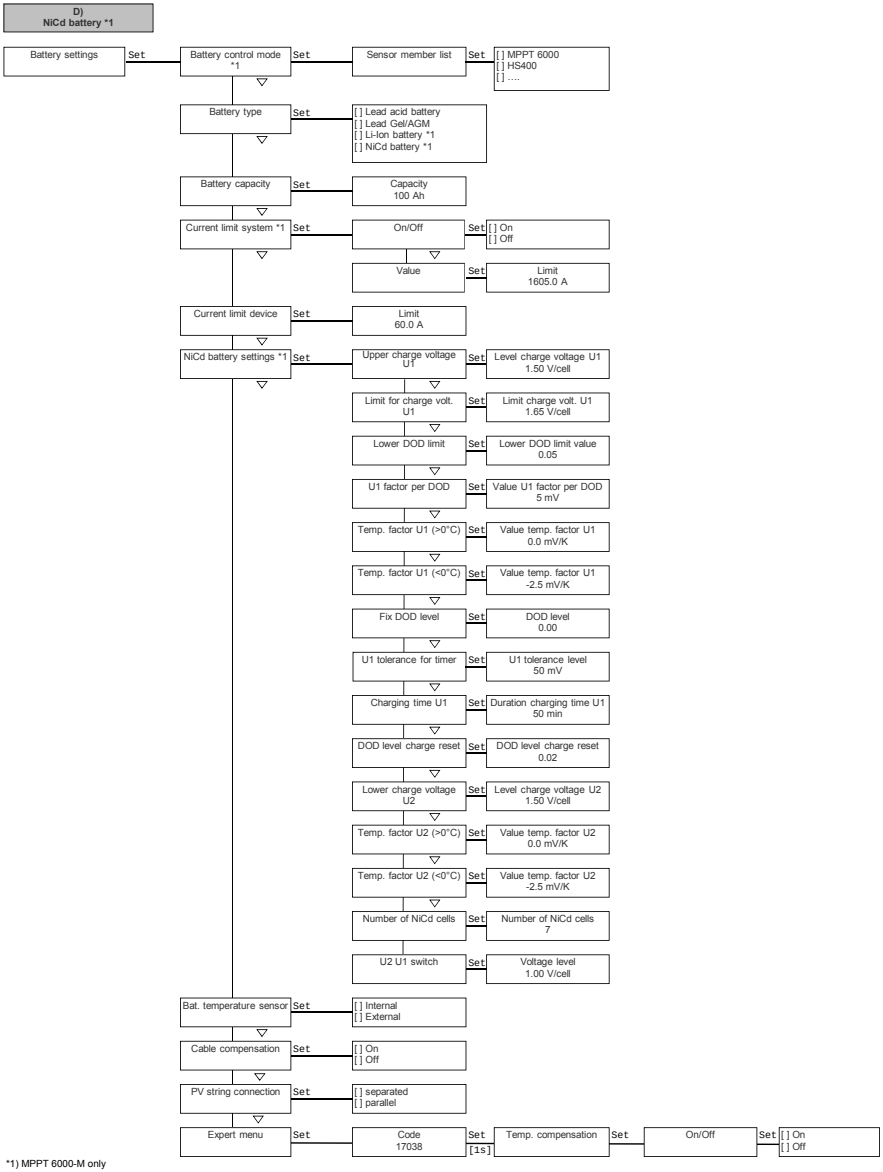
*1) MPPT 6000-M only



*1) MPPT 6000-M only
*3) SOC Control mode only
*4) Voltage control mode only
*5) Lead acid battery only



*1) MPPT 6000-M only



*1) MPPT 6000-M only

4 Installation of the base system

Topics

4.1 Safety instructions

DANGER!

Risk of death by electrocution! Observe the following safety instructions when performing the measures described in section *'Installation of the base system' on page 23*.

General information

- Only technical professionals may perform the work described in the section *'Installation of the base system'* .
- The PE connection must be connected to the system ground (grounding spike).
  - If the system is to be positively grounded then "PE" must be additionally connected to battery terminal "B+". The external battery fuse must then be installed in the "B−" cable! With this grounding method, the module relay and battery relay provide safe isolation from the PV module.
  - This safe isolation from the PV module is disabled when the system is negatively grounded via "B−" or "B−" and "PE". In the case of a simple fault (module relay does not open), grounding of "B−" results in the "M−" potential being present on the casing of the MPPT via the "PE" – ground connection. Only implement this grounding method when the system has additional protection against touching live and electrically conductive system components.
  - Common grounding of "M1−/M2−" with "B−", "M1+/M2+" with "B+", "M1−/M2−" with "B+" or "M1+/M2+" with "B−" is generally not permitted.
  - The solar module frames can always be grounded.
- The solar module installation branch, including the DC load circuit breaker up to the controller terminal area, must be implemented to protection class II.
- The battery installation branch must be implemented to protection class II.
- The following components must be installed:
  - battery,
  - at least 1 solar module,
  - external battery fuse (safety fuse or DC circuit breaker) and
  - a DC load circuit breaker for solar modules 1 and 2.
- Do not open the controller casing. Only the terminal cover may be removed by a technical professional for installation.

Always take the following measures before working on the controller:

1. Switch off all loads.
2. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again or safely cover the solar module (ensure that wind cannot blow off the covering!).
3. Switch off the external battery fuse: Remove the fuse insert from the fuse holder (safety fuse) or switch off the DC line circuit breaker and secure it against being switched on again.
4. Disconnect the battery cable from both battery terminals.

Cable connections

- The module cables carry voltage when the solar module is illuminated.
- Insulate exposed cable ends with insulation tape or wire connector blocks.
- Connect the cables for the battery and solar module to the controller in the described sequence (Fig. 1).
- Secure the cables with a strain relief clamp. Clearance of strain-relief to controller: 200 mm.
- Connect only 1 cable to each connection terminal.
- Cable to be used: Observe the specifications in section *'Technical data' on page 124*.
- Lay the cables so that:
  - connections cannot accidentally come loose,
  - persons cannot tread on or trip over these and
  - fire protection devices are not impaired or obstructed.
- The entire installation must be designed with protection class II if the open-circuit module voltage exceeds 60 V DC at least once anywhere over the entire temperature range.
- Observe all applicable installation regulations and standards, national laws and connection values specified by the regional power supply company.

Fuses and switching devices

Installation of an external battery fuse (safety fuse or DC line circuit breaker) is mandatory! Observe the following:

- Mount the external battery fuse directly next to the battery.
- The external battery fuse must conform to the specifications described in section *'Technical data' on page 124*.
- The external battery fuse is not included in the scope of delivery.

WARNING!

Danger of acid injuries

- Do not subject the battery to open flames or sparks.
- Provide adequate ventilation in the installation location of the battery. Inflammable gases can escape from the battery.
- Follow the charging instructions of the battery manufacturer.

CAUTION!

Danger of bodily injury. The device weighs over 6 kg. If in doubt, install the device with two persons.

CAUTION!

Danger of destroying the device through overloading

- Conform to the technical specifications, especially the connection values. See type plate and section *'Technical data' on page 124*.
- When selecting the solar module, note that the open-circuit module voltage is higher than the value specified on the type plate at temperatures below 25 °C.
- Do not connect the solar module to 2 controllers in parallel. The solar module can however be connected in parallel to both solar module inputs of one controller. Make the appropriate settings under `Battery settings` ➔ `PV string connection`!
- Installation of a fuse in the battery voltage sensor cable is prescribed by law.

NOTICE!

The following section describes only the installation of the controller. Observe the instructions in the manual from the respective manufacturer when installing the external components.

4.2 Installing the device

CAUTION!

Danger of damage to the inverter and reduction of power. Observe the following safety requirements during installation:

- The mounting location and immediate environment are permanently fixed, vertical, flat, non-inflammable and not subject to constant vibration.
- A free space of at least 60 mm must be present on all sides of the controller (③ in Fig. 5).
- The controller must be easily accessible and the display easily readable.
- The controller is mounted as close as possible to the battery; the prescribed minimum safety clearance of 0.5 m between the controller and battery is adhered to.
- The controller must not be located
  - outdoors or in a location subject to rain or splashing water,
  - in dusty environments,
  - in stalls with active animal husbandry or
  - in direct sunlight.
- The battery cable is no longer than 2 m (recommended), to keep cable losses and the compensation voltage as low as possible.
- Do not drill through the fastening openings ①/② (Fig. 5).

1. Select the mounting location under consideration of the previously mentioned safety requirements.
2. Position the controller level on the mounting surface and mark the mounting holes through the fastening openings ①/② shown in Fig. 5.

NOTICE!

The keyhole form of the two upper fastening holes makes it possible to first install the screws for ① and then mark the holes to be drilled for ② with the device hung in place (lower risk of incorrectly positioned drilled holes).

3. Remove the controller and drill the mounting holes.

4. Use the screws/dowels supplied to fasten the controller to the mounting surface.

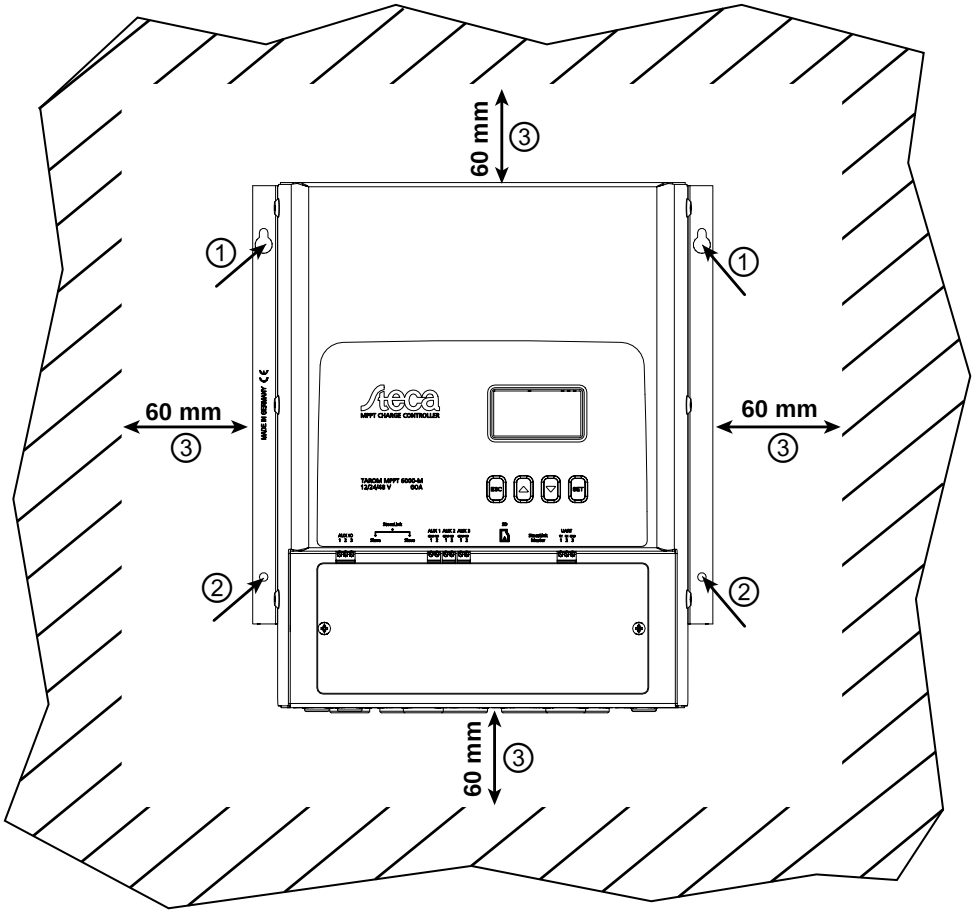


Fig. 5: Fastening openings ① / ② and free space ③

4.3 Establishing the electrical connections

CAUTION!

Always make connections in the following sequence:

1. First connect the load and then the source.

Example: First connect the cable to the controller and then to the battery.

2. First connect the positive pole then connect the negative pole.

Example: First connect "B+" then connect "B–".

NOTICE!

Use the cable pass-through holes plugged with rubber stops on the bottom of the casing as follows:

– 2 large cable pass-through holes for the battery cables;
  5 medium-sized cable pass-through holes for the module and "PE" cables;
  3 small cable pass-through holes for the sensor cables (1 as a reserve).
– Feed each cable through the corresponding cable pass-through hole lying opposite to the cable connection, see Fig. 2.
– Use a screwdriver to punch a hole in the rubber stop of the respective cable pass-through hole.

4.3.1 Preparing the cables

1. Label the cable ends according to Fig. 2 ("M1+", "M1–", "M2+", "M2–", "B+", ...).
2. Lay the battery and module cables directly next to each other. Do not yet connect the cables!
3. Connect the external battery fuse to the "B–" battery cable, in an easily accessible position close to the battery (Fig. 2 ⑬).
4. Switch off the external battery fuse: Remove the fuse insert from the fuse holder (safety fuse) or switch off the DC line circuit breaker and secure it against being switched on again.
5. Connect the DC load circuit breaker to the module cables "M1+" and "M2+" (Fig. 2 ⑨/⑩), in an easily accessible position close to the controller.
6. Switch off the DC load circuit breaker and secure it against being switched on again.
7. Remove the terminal cover (release the 2 fastening screws with a Phillips screwdriver).

4.3.2 Connecting the battery

✓ No devices are connected to the battery.

CAUTION!

Danger of damage to the controller. Observe the maximum battery voltage as per *'Technical data' on page 124*.

Connect the battery cable and external battery fuse to the battery connection of the controller and to the battery.

NOTICE!

We recommend installing the external battery fuse in the "B–" cable.

4.3.3 Connecting the battery voltage sensor

NOTICE!

The external battery voltage sensor cable allows the controller to directly measure the voltage at the battery. This voltage value can be used for compensation of voltage drops across the battery cables. This means that the voltage measurement is not affected by (e.g.) power-dependent voltage drops across the battery cables.

– A 2-pin plug with screw terminals for connecting the sensor cable is supplied with the device. A cable with a cross-section of 0.14–1.5 mm^2 (AWG 28-16) can be used.
– The necessary sensor cable is not supplied with the device.

✓ A sufficiently long battery voltage sensor cable conforming to the technical data is available.

DANGER!

Install a fuse in the connection between the battery voltage sensor cable and the battery. The fuse rating must match the cross-section of the cable used. This protects the cable from burning in the case of a short-circuit in the battery voltage sensor cable.

1. Fit the green 2-pin socket (supplied) to the other end of the cable.
2. Plug the 2-pin socket into the"BAT+/–" connection so that the "+" conductor is at the left and the "–" conductor is at the right; see the enlarged view of the terminal area in Fig. 2.
3. Install an external fuse for protecting the battery voltage sensor cable.
4. Connect the battery voltage sensor cable directly to the battery; see ⑫ in Fig. 2.
5. Activate usage of the battery voltage sensor cable in the cable compensation settings. *'Battery settings ➔ Cable compensation'*.

4.3.4 Connect the ground (PE)

DANGER!

Risk of death by electrocution. The controller must be grounded via PE (controller has protection class I).

CAUTION!

Danger of damaging the devices (e.g. computer) connected to the StecaLink master bus, StecaLink slave bus or the UART interface. The galvanic isolation normally present at the AUX IO, StecaLink master/slave bus and UART connections is disabled if the connected peripheral devices are connected to the "PE" connection of the controller via a common ground/ equipotential bonding cable.

If the entire system is commonly grounded then all StecaLink bus connections, UART connections and AUX IO connections must be additionally externally galvanically isolated!

➔ Connect the ground cable to the "PE" terminal.

4.3.5 Connecting the solar module

1. Safely cover the module (ensure that wind cannot blow off the covering!).
2. Connect the module cable with the (open) DC load circuit breaker to the solar module connection of the controller and the solar module as follows:
   - A common DC load circuit breaker (in the common part of the module cable), when 1 solar module is connected in parallel to solar module inputs "M1" and "M2".
   - Two separate DC load circuit breakers, when 2 solar modules are each separately connected to solar module inputs M1 and M2; see Fig. 2.
3. Remove the covering from the solar module.

4.3.6 Install lightning protection

➔ Install suitable lightning protection.

4.4 Supplying the controller with voltage

✓ At least the battery and the solar module have been connected as described previously.

1. Fit the terminal cover so that the danger notice is legible (and not upside-down).
2. Fit the fastening screws.
3. Switch on the external battery fuse: Insert the fuse insert into the fuse holder (safety fuse) or switch on the DC line circuit breaker. The controller automatically starts operating, displays the company logo after a few seconds and then displays the detected system voltage in an event message (`System voltage xx V)` or `RTC not set` (Fig. 6).

> **! NOTICE!**
>
> English is set as the default menu language at the factory.

4. Press Δ, ∇ to display the `System voltage xx V`. Note the displayed system voltage.
5. If additional event messages are displayed, or no messages are displayed (display dark), then check the installation and if necessary correct the error using *Chapter 10 'Troubleshooting' on page 111*.
6. Press `ESC` to acknowledge the event message. The standard status display appears (Fig. 7).
7. Check that the noted system voltage corresponds to the actual battery voltage. If not, then set the correct system voltage via the expert menu (*'Main menu ➔ Battery settings ➔ Expert menu ➔ System voltage'*; *Chapter 8.5.14 'Expert menu' on page 72*).

> **! NOTICE!**
>
> When commissioning an MPPT 6000-S slave in a master/slave system via the StecaLink bus, the system voltage used locally at the device is specified by the MPPT 6000-M master, without changing the information message at the MPPT 6000-S. In a master/slave system the system voltage detection must always be checked, and corrected if necessary, at the master device. When operating the MPPT 6000-S in single mode the system voltage detected at the device must be checked as described. In systems with lead-acid batteries the detected system voltage is used for defining the charge voltage and deep-discharge protection ranges. The detected system voltage is only displayed for information when using Li-Ion or NiCd battery types. The charging range is determined based on the configured number of battery cells.

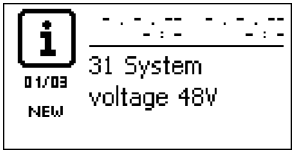


Fig. 6: Event message with the detected system voltage (in the example: 48 V)

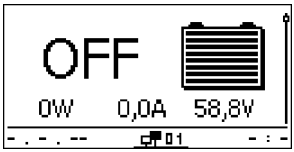


Fig. 7: Display after switching on the external battery fuse

NOTICE!

The battery can be charged from multiple sources. The following applies:

- The battery can be charged by multiple controllers connected to the battery in parallel. The MPPT 6000-M can assume control of other MPPT 6000-S devices. In this type of master/slave system, a single MPPT 6000-M can control up to 22 MPPT 6000-S devices.
- MPPT 6000-M only: Other suitable charging sources can also be connected to the battery in addition to the controller. These charging sources can be switched on and off by the controller via relay outputs AUX 1–3.
- MPPT 6000-M only: The controller can only perform sensible calculation of the state of charge (SOC) when it is able to measure the charge and discharge currents of additional sources and loads via additional PA HS400 current sensors.
- We recommend having the connection of additional controllers and other charging sources planned by a technical expert.

5 Initial commissioning of the base system

CAUTION!

Danger of damage to the device and reduction of power. Only technical professionals may perform the work described in this section.

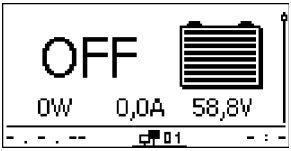
NOTICE!

A basic system consists of only a single MPPT 6000-M or a single MPPT 6000-S. The description of the initial commissioning process only covers the absolute minimum settings necessary. Please consult the relevant sections below for information on further configuration possibilities. To install and commission a master/slave system the individual units are installed as specified according to the respective initial commissioning procedure but remain in the OFF state until all cabling is completed and all StecaLink bus settings in the master device have been completed.

Topics

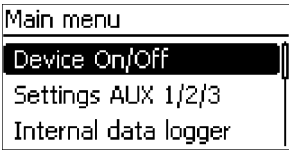
✓All the measures described in ‘Installation of the base system’ on page 23 have been taken in full.

Show the basic setting of the status display



▶ If necessary, press ESC for 1 s to show the basic setting of the status display.

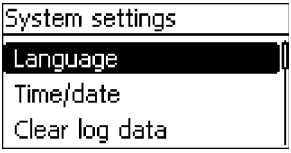
Set the language



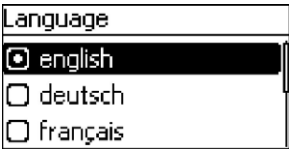
1. Press SET. The main menu appears and the Device On/Off entry is selected (Fig. left).

   NOTICE

   English is set as the default menu language at the factory. In a master/slave system, enabling the Save setting parameter for the slave allows the language setting of the master to be transferred to the slave, see *Chapter 8.8.3 'Changing the MPPT 6000-S slave settings (MPPT 6000-M only)' on page 87*.
2. Press ∇ until System settings is selected.

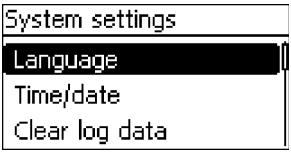


3. Press SET. The System settings menu appears and Language is selected (Fig. left).

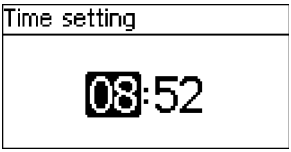


4. Press SET. The Language menu appears (Fig. left).
5. Press Δ, ∇ to select another language as required.
6. Press SET.
7. PressESC, the System settings menu appears and the selected language is active.

Set the time

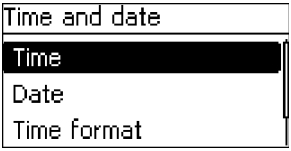


1. The System settings menu appears after completing the language selection (Fig. left).
2. Press ∇ to select Time/date.
3. Press SET. The Time and date menu appears and Time is selected.
4. Press SET. The Time setting dialogue appears (Fig. left).



5. Press SET. The hours display flashes.
6. Press Δ, ∇ to change the hour.
7. Press SET. The hour stops blinking.
8. Press ∇. The minutes are selected.
9. Repeat steps 5 to 7 for the minutes.

Set the date



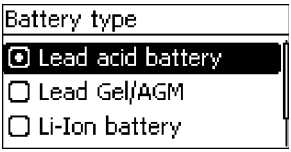
1. Press ESC. The Time and date menu appears (Fig. left).
2. Press ∇ to select Date.
3. Press SET. The Date setting dialogue appears (Fig. left).
4. Press SET. The day flashes.
5. Press Δ, ∇ to change the day.
6. Press SET. The day stops blinking.
7. Press ∇ to select the month.

8. Repeat steps 4 to 6 for the month.
9. Press ∇ to select the year.
10. Repeat steps 4 to 6 for the year.

NOTICE

Correctly setting the time and date is essential for correct operation of the device. In a master/slave system, enabling the `Save setting` parameter for the slave allows the language and time settings of the master to be transferred to the slave, see *Chapter 8.8.3 'Changing the MPPT 6000-S slave settings (MPPT 6000-M only)' on page 87*. In the case of a power failure, the time and date settings are retained for approx. 4 days.

Set the battery type



1. Press `ESC` for 1 s. The standard status display appears.
2. Press `SET`. The main menu appears.
3. Press ∇ to select `Battery settings`.
4. Press `SET`. The `Battery settings` menu appears.
5. Press ∇ to select `Battery type`.
6. Press `SET`. The `Battery type` dialogue appears (Fig. left).
7. Press Δ, ∇ to select a different battery type.
8. Press `SET`. The selected battery type is set.

NOTICE

MPPT 6000-M: The following battery types can be selected:

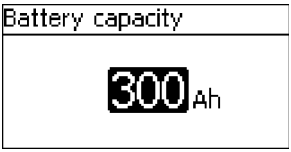
- `Lead acid battery`
- `Lead Gel/AGM battery`
- `Li-Ion battery`
- `NiCd battery`

MPPT 6000-S: The following battery types can be selected:

- `Lead acid battery`
- `Lead Gel/AGM battery battery`

In a master/slave system, enabling the `Save setting` parameter for the slave allows the Lead acid and Lead Gel/AGM battery type settings of the master to be transferred to the slave. Settings for the Li-Ion and NiCd battery types cannot be stored in the MPPT 6000-S. The MPPT 6000-M can however function as the master and control the charge function of the slaves for all battery types when the `Master mode` configuration for the slave is active, see *Chapter 8.8.3 'Changing the MPPT 6000-S slave settings (MPPT 6000-M only)' on page 87*.

Set the battery capacity



1. Press ESC. The Battery settings menu appears.
2. Press ∇ to select Battery capacity.
3. Press SET. The Battery capacity dialogue appears (Fig. left).
4. Press SET. The value flashes.
5. Press Δ, ∇ to change the value.
6. Press SET. The value stops blinking.

NOTICE

Enter the specified nominal capacity of the battery here. This value is required by functions such as the state of charge calculation (SOC), IUIA charging and the capacity test. In a master/slave system, enabling the Save setting parameter for the slave allows the battery capacity setting of the master to be transferred to the slave.

Setting the charge parameters

WARNING!

Charging the battery with incorrect parameters can damage the battery. This can result in conditions that are a danger to persons. Ensure that the correct charging parameters for the selected battery type are used. Consult the battery manufacturer if necessary.

NOTICE!

Newly delivered MPPT 6000-M and MPPT 6000-S devices are configured with the lead-acid battery type. Always check the charge parameters.

– For the charge parameter settings applying to the lead-acid and lead-gel/AGM battery types, see *Chapter 8.5 'Lead-acid battery system functions' on page 62*.
– For the charge parameter settings applying to the Li-Ion battery type, see *Chapter 8.6 'Li-Ion battery system functions (MPPT 6000-M only)' on page 74*.
– For the charge parameter settings applying to the NiCd battery type, see *Chapter 8.7 'NiCd battery system functions (MPPT 6000-M only)' on page 77*.

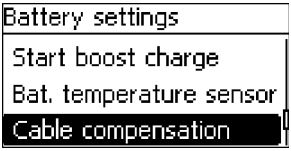
In a master/slave system, enabling the Save setting parameter for the slave allows the lead-acid and lead-gel/AGM battery type settings of the master to be transferred to the slave. When the slave has been configured with the Master mode operating mode then the slave is controlled using the charge parameters configured in the master for all battery types.

Switching on the cable compensation

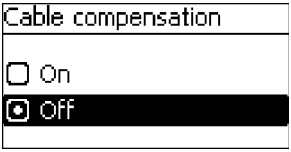
The cable compensation corrects the deviation of the measured battery voltage resulting from the voltage drop across the battery cable.

NOTICES

- The unit is supplied with cable compensation switched off.
- The battery voltage sensor cable must be connected in order to use cable compensation, see ↳ *Chapter 4.3.3 'Connecting the battery voltage sensor' on page 29*.
- The voltage measured via the battery voltage sensor cable is displayed in the measurements shown on the status display of the device.
- Measuring the actual voltage at the battery allows the device to compensate for voltage drops across the battery cables. This can result in higher voltages at the battery connection terminals on the controller.
- An Error event message is displayed if the battery voltage sensor cable is not connected when the cable compensation is switched on.
- If cable compensation is to be used in every member of a master/slave system then this must be individually installed and activated at each device.



1. Press `ESC`. The `Battery settings` menu appears.



2. Press Δ, ∇ to select `Cable compensation` (Fig. left).
3. Press `SET`. The `Cable compensation` dialogue appears (Fig. left).
4. Press Δ, ∇ to select `On`.
5. Press `SET`. The line compensation is switched on.

Configuring the temperature sensor

The end-of-charge voltage can be adjusted according to the measured ambient temperature of the battery. If an external temperature sensor is used then this must be activated in the corresponding menu.

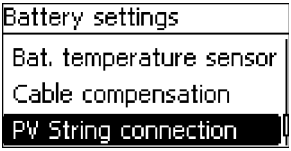
NOTICES

- The external temperature sensor is switched off in newly delivered devices. The internal sensor is used.
- We recommend connecting and using the external temperature sensor supplied with the device (MPPT 6000-M only).
- In a master/slave system the master device performs the central temperature compensation and controls the slaves accordingly if these are configured for master-controlled operation.
- MPPT 6000-M: An external temperature sensor must be installed and activated for the battery capacity test function.

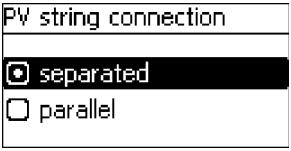
See ↬ *Chapter 8.5.11 'Battery temperature sensor' on page 71* for information on activating the PA TS-S external temperature sensor.

Setting the PV string connection

Newly delivered devices are configured for separate use of the two module inputs "M1+/M1–" and "M2+/M2–". The PV string connection parameter must be changed to "parallel" if both module connections are wired in parallel.



1. Press `ESC`. The `Battery settings` menu appears.
2. Press Δ, ∇ as required to select `PV string connection` (Fig. left).
3. Press `SET`. The `PV string connection` dialogue appears (Fig. left).
4. Press Δ, ∇ to select `parallel`.
5. Press `SET`. The string connection is now changed to parallel connection of the modules.



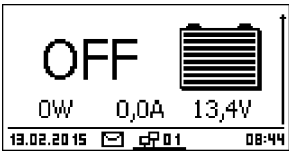
Finishing initial commissioning

NOTICE!

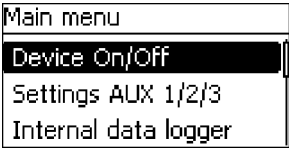
After completing basic installation of a master/slave system the devices must then be connected via the StecaLink bus. Finish the installation of all devices before switching on any devices.

MPPT 6000-M, MPPT 6000-S: If further optional components, ↳ *Chapter 6 'Installation and initial commissioning of optional components' on page 40*, are to be installed and configured, finish the installation of all devices before switching on the unit.

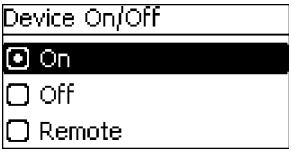
Basic systems consisting of only one MPPT 6000-M or only one MPPT 6000-S can now be switched on.

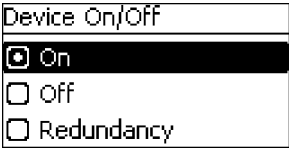


▶ Press ESC for 1 s. The basic setting of the status display appears and initial commissioning is finished.



1. Press SET. The Main menu appears.
2. Press Δ, ∇ to select Device On/Off (Fig. left).





3. Press SET. The Device On/Off dialogue appears (Fig. left for the MPPT 6000-M display. The MPPT 6000-S display is shown below).
4. Press Δ, ∇ to select On.
5. Press SET. The device switches on.
6. Press ESC for 1 s. The standard status display appears.

6 Installation and initial commissioning of optional components

Topics

6.1 Commissioning the SD card (MPPT 6000-M only)

CAUTION!

Never forcibly insert or remove the microSD card. This can damage the card holder and/or the microSD card.

NOTICE!

- A microSD card is not included in the scope of delivery for the device.
- microSD and microSDHC cards with a capacity of up to 8 GB can be used.
- The microSD card must be formatted with a FAT16 or FAT32 file system.
- Data from the MPPT 6000-M and any connected StecaLink slave devices can be recorded on the microSD card.
- Settings parameters for the MPPT 6000-M can be saved to and read from the microSD card.
- Take care to observe the correct insertion direction, as shown on the microSD card and the device.
- Carefully and gently push the microSD card into the opening in the device casing until it latches into place.
- Remove the microSD card by pushing it further into the device until it unlatches, then let go of the card and allow it to eject and finally pull the card out of the socket (Push-Pull connector).
- Data recording onto the SD card is deactivated at the factory for newly delivered devices.

1. Insert a formatted microSD card.
2. Configure the data logging function and save/load the parameters as described in *Chapter 8.15 'SD card (MPPT 6000-M only)' on page 101*.

6.2 AUX 1,2,3 relay output connection (MPPT 6000-M only)

CAUTION!

Danger of destruction of the relays. Observe the technical data of the relays, see *Chapter 12 'Technical data' on page 124*. Only use AUX 1/2/3 for switching DC voltages of max. 60 VDC.

NOTICE!

- A 2-pin plug with screw terminals for the external cable is supplied with the MPPT 6000-M.
- Each AUX connection has a separate COM and NO connection.
- The relay outputs are potential-free, normally-open contacts.
- The initial state of the contacts is normally-open.
- Multiple different events can be assigned to the AUX 1/2/3 outputs. Multiple events are combined as logical "OR" values.
- The relay outputs can be used for switching devices or loads.
- Heavy loads connected directly to the battery can be switched using an additional power relay connected to the AUX connection, e.g via the Steca PA EV 200.

1. Connect the external components to the AUX relay outputs.
2. Configure the relay outputs as described in *Chapter 9 'Control functions via AUX 1/2/3 (MPPT 6000-M only)' on page 103*.

AUX 1	AUX 2	AUX 3	Description
1 (COM)	1 (COM)	1 (COM)	Common relay contact
2 (NO)	2 (NO)	2 (NO)	Normally open relay contact; the contact is open when the relay is switched off.

6.3 AUX IO remote control input connection (MPPT 6000-M only)

CAUTION!

Risk of destroying the signal input. Observe the technical connection data, see *Chapter 12 'Technical data' on page 124*.

NOTICE!

- The charging function can be switched on or off by external devices via the AUX IO signal input.
- An external signal voltage of 5 VDC – 24 VDC at max. 3 mA or an external contact can be connected. The external contact must be able to switch max. 15 VDC at 5 mA.
- Connect an external signal voltage between AUX IO (1) and (2). AUX IO (1) is the GND, AUX IO (2) is the signal voltage input.
- Connect an external contact between AUX IO (2) and (3).
- A 3-pin plug with screw terminals for the external cable is supplied with the MPPT 6000-M.

AUX IO	Description
1 (GND)	GND reference for external signal voltage.
2 (Signal input)	External signal voltage input connection.
3 (Signal output)	Signal output for external switch.

1. Connect the external control source to the AUX IO signal input.
2. Configure the AUX IO function.
3. Configure the Device On/Off control.

Configuration of the AUX IO control function

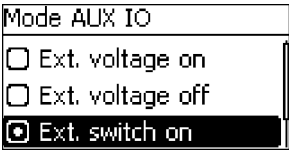
NOTICE!

- The following properties can be assigned to the AUX IO connection:
  - **Ext. voltage on**
    Application of an external voltage at the AUX IO connection switches on charging by the MPPT 6000-M.
  - **Ext. voltage off**
    Application of an external voltage at the AUX IO connection switches off charging by the MPPT 6000-M.
  - **Ext. switch on**
    The closing of an external switch at the AUX IO connection switches on charging by the MPPT 6000-M.
  - **Ext. switch off**
    The closing of an external switch at the AUX IO connection switches off charging by the MPPT 6000-M.

▸ Press ESC for 1 s. The standard status display appears.

1. Press SET. The Main menu appears.
2. Press Δ, ∇ to select System settings (Fig. left).

3. Press SET. The System settings menu appears (Fig. left).
4. Press Δ, ∇ to select Mode AUX IO.

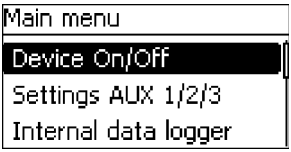


5. Press SET. The Mode AUX IO dialogue appears (Fig. left).
6. Press Δ, ∇ to select the desired function.
7. Press SET. The selected function is activated.
8. Press ESC for 1 s. The standard status display appears.

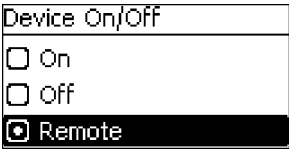
Configuring Device On/Off control

NOTICE!

If the Device On/Off setting is not changed to Remote then the switching signal at the AUX IO connection has no effect on the charging operation of the MPPT 6000-M.



1. Press SET. The Main menu appears.
2. Press Δ, ∇ to select Device On/Off (Fig. left).



3. Press SET. The Device On/Off dialogue appears (Fig. left).
4. Press Δ, ∇ to select Remote.
5. Press SET. The selected function is activated.
6. Press ESC for 1 s. The standard status display appears.

6.4 PA TS-S external temperature sensor connection

CAUTION!

Use only a Steca PA TS-S external temperature sensor approved for use with the device. Incorrect sensors can lead to incorrect temperature compensation of the charge voltage and damage the battery. Observe the safety notices in *Chapter 4.1 'Safety instructions' on page 23* when connecting the sensor.

NOTICE!

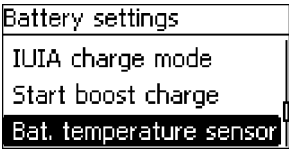
– A PA TS-S external temperature sensor is supplied with the device (MPPT 6000-M only).
– An event message of type Error is generated if the external temperature sensor is activated but not connected.

If the controller and battery are not located in the same room then an external temperature sensor for measuring the battery temperature must be installed. The polarity of the contacts for the connection is irrelevant.

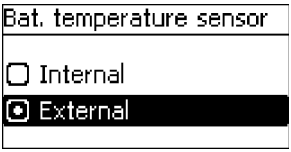
1. Mount the Steca PA TS-S temperature sensor close to the battery.
2. Insert the sensor cable plug into the TEMP connection (polarity irrelevant!). See Fig. 2.

Activating an external temperature sensor

▶ Press ESC for 1 s. The standard status display appears.
1. Press SET. The Main menu appears.



2. Press Δ, ∇ as required to select Battery settings (Fig. left).
3. Press SET. The Battery settings menu appears (Fig. left).
4. Press Δ, ∇ to select Bat. temperature sensor.



5. Press SET. The Bat. temperature sensor dialogue appears (Fig. left).
6. Press Δ, ∇ to select External.
7. Press SET. The external temperature sensor is now activated.
8. Press ESC for 1 s. The standard status display appears.

6.5 StecaLink slave connection

NOTICE!

- The StecaLink slave connection is an RS-485 communication interface using a proprietary bus protocol.
- The StecaLink slave connection allows connection of superordinate communication levels and control devices. The superordinate communication partner functions as the master and controls the device via the StecaLink slave interface.
- The StecaLink slave interface can be used for e.g. updating the firmware via a Windows PC with an RS-485-/USB-adapter and Steca Grid Bootloader software.
- A standard RJ45 network cable (CAT-5 Patch cable, 1:1) is used for connecting StecaLink communication bus members.
- The last unused StecaLink slave connection in a communication chain must be terminated. A termination plug for the StecaLink communication bus is supplied with the MPPT 6000-M.
- A StecaLink slave device may only be connected to one StecaLink master. Multiple StecaLink slave devices are connected to form a communication chain. Only one StecaLink slave device is connected to the StecaLink master device.
- Up to 22 MPPT 6000-S devices can be chain connected via their StecaLink slave sockets to the StecaLink master socket of the MPPT 6000-M.
- The StecaLink slave bus is galvanically separated from the power unit of the MPPT 6000-M.
- The MPPT 6000-M provides a supply voltage at the StecaLink slave and StecaLink master connections for slave devices that do not have their own power supply. Connecting a slave to the StecaLink master loops the supply voltage through the slave members.
- Each slave must have its own unique address within a range of 1 to 99. No duplicate addresses may be present. Set the address of the slave according to the slave manual.
- The maximum length of the entire bus cabling should not exceed 25 m.
- The MPPT 6000-M:
  - has 2 StecaLink slave bus connections,
  - is a slave at the StecaLink slave connection,
  - has a StecaLink master connection,
  - is always the master at the StecaLink master connection.
- The MPPT 6000-S:
  - has 2 StecaLink slave connections,
  - is always a slave at the StecaLink slave connection.

1. Set a unique slave address at the device with the StecaLink slave connection; see *Chapter 8.8.1 'StecaLink slave address setting' on page 86*.
2. Connect the StecaLink slave connection to the *'StecaLink master'* connection of the superordinate master device.
3. Use a free *'StecaLink slave'* connection for looping the connection through further slaves.

4. Terminate the free *'StecaLink slave'* connection of the last slave member using the termination plug.

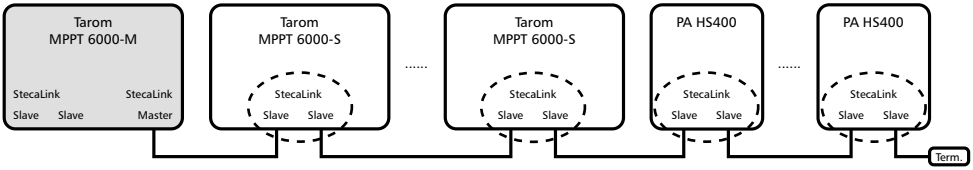


Fig. 8: Bus cabling example using an MPPT 6000-M, MPPT 6000-S and PA HS400 current sensors

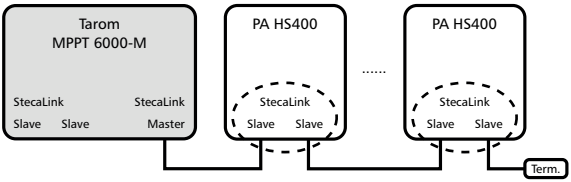


Fig. 9: Bus cabling example using an MPPT 6000-M and additional PA HS400 current sensors

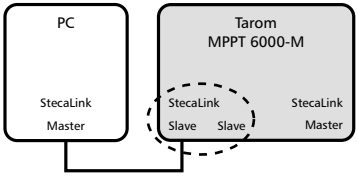


Fig. 10: Example of connecting a PC to the MPPT 6000-M, e.g. for the update function

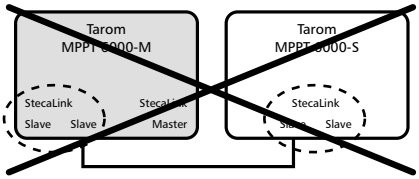
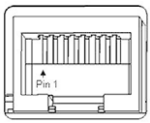


Fig. 11: Connection of the MPPT 6000-M slave connection to other MPPT 6000-S or PA HS400 slave connections is not permitted

The bus cable pin assignments are specified in the following table.

The StecaLink slave connection of the MPPT 6000-M and MPPT 6000-S is galvanically isolated from the power unit.



Pin	1	2	3	4	5	6	7	8
Signal	A	B	-	-/(15 VDC) [1)]	-	-	GND [2)]/15 VDC	SGND [3)]/A,B

[1)] The 15 VDC supply voltage for the slaves is looped through by the master device.

[2)] GND for the 15 VDC supply voltage for the slaves. SGND is connected to GND/15 VDC in the MPPT 6000-M.

[3)] SGND for signal lines A/B. Not connected to GND/15 VDC in the MPPT 6000-S. Connecting the StecaLink slave socket to the StecaLink master socket creates a connection via the MPPT 6000-M, see [2)].

6.6 StecaLink master connection (MPPT 6000-M only)

NOTICE!

- The StecaLink master connection is an RS-485 communication interface using a proprietary bus protocol.
- The StecaLink master connection allows the connection of subordinate communication partners.
- The StecaLink slave devices connected to the StecaLink master connection are controlled by the MPPT 6000-M functioning as the communication master device.
- Devices such as PA HS400 external current sensors or the MPPT 6000-S can be connected to the StecaLink master connection.
- A standard RJ45 network cable (CAT-5 Patch cable, 1:1) is used for connecting StecaLink communication bus members.
- A termination plug for the StecaLink communication bus is supplied with the MPPT 6000-M. The last free StecaLink slave connection in the communication network connected to the StecaLink master must be terminated.
- Only one StecaLink master may be connected to a StecaLink communication network.
- The maximum number of StecaLink slaves is limited. A maximum of 32 devices can be connected to the StecaLink master connection of a single MPPT 6000-M.
- The MPPT 6000-M can control a maximum of 8 PA HS400 devices and 22 MPPT 6000-S devices.
- Each slave must have its own unique address within a range of 1 to 99. No duplicate addresses may be present. Set the address of the slave according to the slave manual.
- The StecaLink master connection is galvanically isolated from the power unit.
- The maximum length of the entire bus cabling should not exceed 25 m.
- The MPPT 6000-M:
  - has 1 StecaLink master connection,
  - has 2 StecaLink slave bus connections,
  - is always the master at the StecaLink master connection.
- The MPPT 6000-S:
  - does not have a StecaLink master connection.

! NOTICE!

MPPT 6000-S devices can be connected to each other when the MPPT 6000-M has a software version of IFUSYS4 APP 1.5.0 or later.

1. Set a unique address at the device with the StecaLink slave connection. For the MPPT 6000-S, see *Chapter 8.8.1 'StecaLink slave address setting' on page 86*.
2. Plug the slave device into the StecaLink master connection. Connect the *'StecaLink master'* connection to the *'StecaLink slave'* connection.
3. Additional slaves are connected to the free *'StecaLink slave'* connection on the slave device.
4. Terminate the free *'StecaLink slave'* connection of the last slave member using the termination plug.
5. Register and configure the added StecaLink slave devices at the MPPT 6000-M, see *Chapter 8.8.2 'StecaLink master setting (MPPT 6000-M only)' on page 86*.

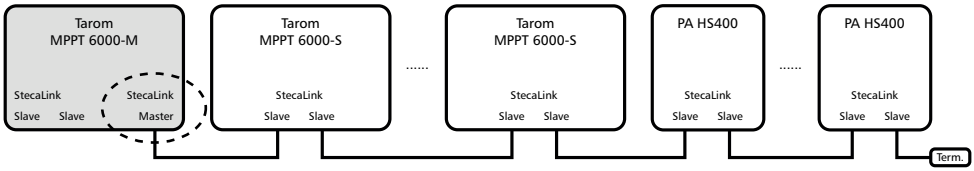


Fig. 12: Bus cabling example using an MPPT 6000-M, MPPT 6000-S and PA HS400 current sensors

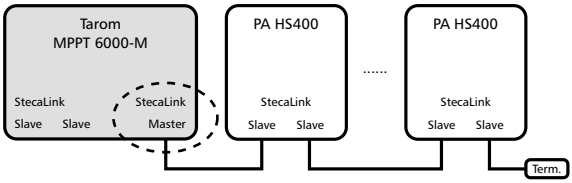


Fig. 13: Bus cabling example using an MPPT 6000-M and additional PA HS400 current sensors

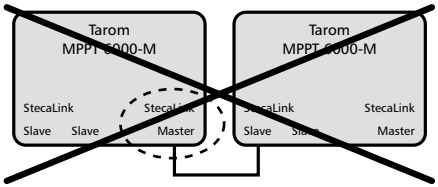


Fig. 14: Master/slave connection of two or more MPPT 6000-M devices is not possible

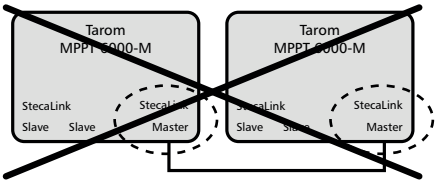


Fig. 15: Connection of two MPPT 6000-M devices via the master connection is not possible

The bus cable pin assignments are specified in the following table.

The StecaLink master connection of the MPPT 6000-M is galvanically isolated from the power unit.

StecaLink bus cable pin assignment: see *further information on page 47*.

6.7 UART/RS-232 interface connection (MPPT 6000-M only)

NOTICE!

- The UART connection on the unit provides a serial interface with RS-232-compatible signal levels. See *Chapter 12 'Technical data' on page 124*.
- The interface can be used for sending data from the device to a PC.
- Data transmission from a PC to the device is not possible.
- A 3-pin plug with screw terminals for constructing an individual cable is supplied with the device.
- TxD, RxD and GND (signal ground) are present at the 3-pin connection, see printed label.
- The serial interface is galvanically isolated from the power unit connections.
- The interface can be switched on and off.
- The data output is fixed by the device and cannot be changed.
- Data is output at 1 minute intervals.
- For information on the data content of the serial output, see *Chapter 12.3 'UART/ RS-232 interface protocol (MPPT 6000-M only)' on page 142*.
- After activating the UART interface it can take up to one minute before the first data is output.

1. Connect an external receiving device to the UART connection.
2. For information on activating data output at the MPPT 6000-M, see *Chapter 8.13 'UART/ RS-232 interface (MPPT 6000-M only)' on page 100*.

Pin assignments:

Pin	1 (TX)	2 (RX)	3 (GND)
Signal	TX	RX	Ground

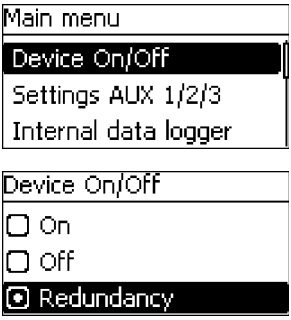
6.8 Redundancy function (MPPT 6000-S only)

CAUTION!

The redundancy function allows charging by the MPPT 6000-S to be automatically switched on after a new start/reset or a failure in communication with the MPPT 6000-M in a master/slave system. Before using the function, make sure that automatically switching on the charging cannot lead to dangerous system states under all application and error conditions. If switching off the MPPT 6000-M in a master/slave system should stop all charging processes then the device control mode must be changed from Redundancy to Off.

NOTICE!

– The redundancy function at the MPPT 6000-S can be used in single-device mode and also in master/slave mode.
– The charging parameters used for the redundancy function correspond to the local settings of the MPPT 6000-S or are adopted from the MPPT 6000-M via the `Store configuration parameter` function. See *Chapter 8.8.3 'Changing the MPPT 6000-S slave settings (MPPT 6000-M only)' on page 87* ▸ *'Configuring the operating mode' on page 89*.



✓ *'Main menu ➔ Device On/Off '*

1. Press ∆, ∇ to select `Redundancy`.
2. Press `SET`. Charging of the battery is now switched on automatically.

6.9 Install cable strain relief

CAUTION!

Danger of damage to the device. Secure all cables connected to the MPPT 6000-M/-S with a strain relief fixture. This ensures that the cables cannot be unintentionally disconnected and cause short-circuits or malfunctions.

The cable feed-throughs on the housing of the MPPT 6000-M/-S do not provide reliable strain relief.

→ Secure the cables with a strain relief fixture. Clearance to controller: 200 mm.

7 Display (layout, function, operation)

7.1 Operating buttons

Button	Function
SET	■ Navigates one menu level down. ■ Changes the state of a control element (check box/radio button). ■ Causes the selected numeral to blink so that it can be modified. ■ Answers a query dialogue with Yes. ■ Adopts a change.
ESC	■ Navigates one menu level up. ■ Jumps to the status display (press for 1 s). ■ Answers a query dialogue with No. ■ Discards any changes.
Δ, ∇	■ Moves the selection bar or the display content upwards/downwards. ■ Moves the selection 1 position to the left/right on a settings page. ■ Increases/decreases a setting value by 1 step. ■ Repeated button presses: Press button for a longer time.

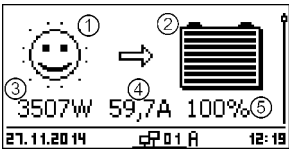
7.2 Overview/Menu structure

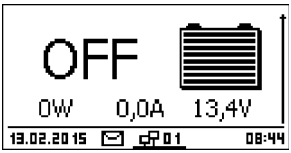
An overview of the operating structure of the display is provided in *Chapter 3.4 'Menu structure' on page 17*.

7.3 Status display

The status display consists of the basic settings, the pages with the measurements and the information bar.

Basic settings





The figures show the respective basic settings when battery charging is switched on (top left) and when the charging is switched off (bottom left).

① The Solar module/system symbol shows the status of the solar module and the system as follows:

The solar module is illuminated, the controller has detected the Day condition. There are no event messages of type Information [1] present.

The solar module is illuminated, the controller has detected the Day condition. An event message of type Warning [1] or Error [1] is present.

The solar module is not illuminated, the controller has detected the Night condition. There are no event messages of type Information [1] present.

The solar module is not illuminated, the controller has detected the Night condition. An event message of type Warning [1] or Error [1] is present.

[1] See *Chapter 10.2.2 'Function' on page 111* for more information.

② The Battery symbol indicates charging of the battery as follows:

Battery almost full

Battery almost empty

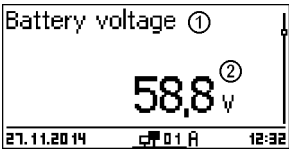
③ Actual power currently being used by the MPPT 6000-M/-S for charging the battery.

④ Battery charge current of the MPPT 6000-M/-S.

⑤ Display of the battery voltage in volts or the state of charge (SOC) in %.

The battery voltage is displayed in volts when the battery control mode is set to voltage control. The state of charge (SOC) is displayed when the battery control mode is set to state of charge (SOC).

The SOC value can only be displayed by the MPPT 6000-M.



① Measurement name
② Measurement with units

The following measurements are displayed in the same sequence as described here:

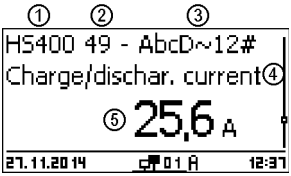
- Charge current MPPT: The current flowing from the controller to the battery, in Amperes.
- Battery voltage: The battery voltage measured at connection "B+/B–", in volts (V).
- Voltage ext. bat. sense [1)]: Battery voltage measured via the battery voltage sensor cable, in volts (V).
- SOC (MPPT 6000-M only): Charge state of the battery in % (displayed only when the battery setting *'Battery control mode ➔ State of charge (SOC)'* is active.
- Result of capacity test (MPPT 6000-M only) [2)]: Result of a manually started battery capacity test. Measured value displayed in Ah.
- PV 1 voltage: Voltage present at module connection M1, in volts (V).
- PV 2 voltage: Voltage present at module connection M2, in volts (V).
- PV power total: Actual power being used for charging the battery, measured at the module connections M1 and M2 , in watts (W).
- PV power 1: Actual charging power at module connection M1, in watts (W).
- PV power 2: Actual charging power at module connection M2, in watts (W).
- Operating hours: Number of operating hours since initial commissioning of the device.
- Power information from additional StecaLink slave participants (MPPT 6000-M only): The scope and designations of the display depend on the respective slave device and its configuration. Observe the notes on this in ☞ *Chapter 8.8 'StecaLink bus' on page 85*.
- Total battery charge/discharge current (MPPT 6000-M only): Total current of all components activated in the menu *'Battery settings ➔ Battery control mode ➔ Sensor member list'*. Display of the average current in A.
- Total battery discharge current (MPPT 6000-M only): Total battery discharge current of all components activated in the menu *'Battery settings ➔ Battery control mode ➔ Sensor member list'*. Display of the average current in A.
- Total battery charge/discharge power (MPPT 6000-M only): Total power of all components activated in the menu *'Battery settings ➔ Battery control mode ➔ Sensor member list'*. Display of the average power in W.

- Total battery charge current (MPPT 6000-M only): Total battery charge current of all components activated in the menu *'Battery settings ➔ Battery control mode ➔ Sensor member list'*. Display of the average current in A.

[1] "-" is displayed instead of the battery voltage when the battery voltage sensor cable is not connected.

[2] "-" is displayed while the capacity test is running or has not yet been executed. The result of a successfully completed capacity test is retained until successful completion of the next capacity test. The result of the capacity test is deleted if the device is disconnected from the power supply.

Measurement display for additional StecaLink slave devices



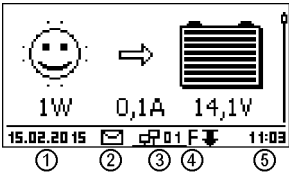
① Identifier of the StecaLink slave device.
② StecaLink bus address of the device.
③ Device name assigned by the user.
④ Measuring position of the device.
⑤ Measured current, average value in A.

! NOTICE!

The controller is not approved as a calibrated measuring device.

The displayed measurements and internally calculated values are subject to product-specific tolerances and can therefore deviate from reference measurements made using calibrated measuring instruments. Not all measurements and the values calculated from these are updated in the same time frame. This can result in delayed updating of the displayed values.

Information bar

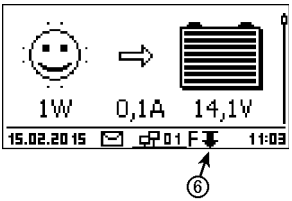


① Date
② Symbol for Non-confirmed event messages; see *Chapter 10.2 'Event messages' on page 111* for more information.
③ Connect symbol with 2-digit controller address: Indicates data traffic on the StecaLink slave bus connection.
④ Symbol for the charging function presently being executed:

E (Equal charge)

F (Float charge)

B (Boost charge)



Additional symbols used in the MPPT 6000-M

I (IUIA charge)

C (Capacity test running)

L (Li-Ion charge mode)

A (NiCd charge mode)

Additional symbols used in the MPPT 6000-S

S (StecaLink slave mode active)

⑤ Time

⑥ Derating symbol. Active when the device automatically reduces the output power due to overloading.

7.4 Display of special states

- When the inverter is processing large amounts of data it is not able to process any user input. This is indicated by an animated sun symbol: ✳
- The backlight blinks red when faults occur. An event message is also displayed. More information on this is provided in *Chapter 10.2 'Event messages' on page 111*.

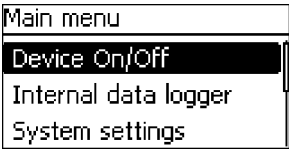
7.5 General operation

Paging through displays and menu levels

1. If necessary, press ESC for 1 s to show the basic setting of the status display.
2. Press Δ, ∇ to display the measurements.
3. Press SET. The main menu appears and the top entry is selected.
4. Press Δ, ∇ to select a different entry.
5. Press SET. The submenu appears.
6. Repeat steps 4 and 5 if necessary.
7. Press ESC briefly to jump one menu level higher or press ESC for a longer time (1 s) to show the basic settings of the status display.

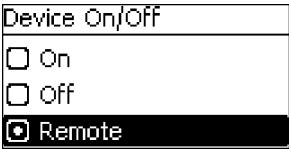
7.6 Advanced operation

Switching the device on/off



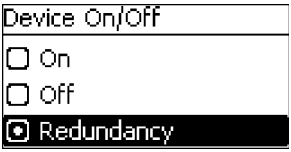
✓ *'Main menu ➔ Device On/Off'*

1. Press Δ, ∇ to select On or Off.
2. Press SET. Charging of the battery is switched on/off. OFF is displayed in the basic setting of the status display when charging is switched off.



MPPT 6000-M:

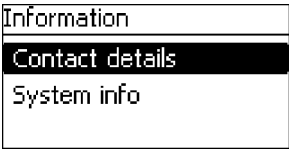
For the `Remote` setting, see *Chapter 6.3 'AUX IO remote control input connection (MPPT 6000-M only)' on page 41*.

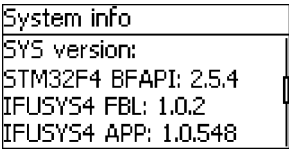


MPPT 6000-S:

For the `Redundancy` setting, see *Chapter 6.8 'Redundancy function (MPPT 6000-S only)' on page 51*.

Displaying advanced information





✓ *'Main menu ➔ Information'*

1. Press ∆, ∇ to select an entry (Fig. left).
2. Press `SET` to open the entry.

   The entries contain the following information:

   - `Contact details` (Fig. left): The manufacturer's address as text and QR code.
   - `System info` (Fig. left):
     - Product designation
     - Serial number
     - Version of the software module
     - Address of the controller on the StecaLink slave bus
     - Version of the operating instructions for the inverter

Calling up the expert menu for battery settings

CAUTION!

Risk of damaging the system. The expert menu allows modification of settings that require specialist technical knowledge. The expert menu must therefore only be used by professional personnel who know the applicable regulations and standards.

NOTICE!

The availability and scope of the settings in the expert menu depends on the currently selected battery type (not available for Li-Ion batteries), see *Chapter 3.4 'Menu structure' on page 17* and the configuration of the system functions for the selectable battery types.

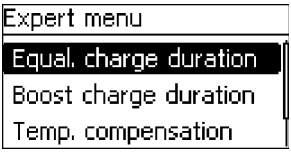
✓ *'Main menu ➔ Battery settings ➔ Expert menu'*

1. Press SET. The password entry dialogue appears, the 1st character from the left is selected (Fig. left).

NOTICE

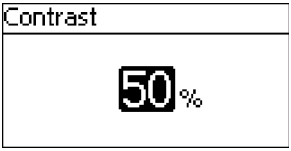
The password is 17038.

2. Press SET.
3. Set a value of *'1'* using Δ, ∇ and then confirm with SET.
4. Press ∇ to select the 2nd character from the left.
5. Press SET.
6. Set a value of *'7'* using Δ, ∇ and then confirm with SET.
7. Repeat steps 4 to 6 for the other digits.
8. Press SET for 1 s. The expert menu appears (Fig. left).
9. Press Δ, ∇ to select an entry.
10. Press SET to open the entry.



7.7 Display settings

Contrast setting



✓ *'Main menu ➔ System settings ➔ Display settings ➔ Contrast'*

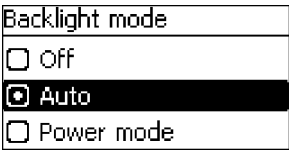
1. Press SET. The Display settings dialogue appears (Fig. left).
2. Press SET. The Contrast dialogue appears (Fig. left).
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Backlight settings

NOTICES

- Off: Backlight permanently deactivated.
- Auto: The backlight is activated when any key is pressed and switches off automatically after 30 s.
- Power mode: The backlight is activated at reduced brightness when the device is supplying power. The backlight is switched off when the device is not supplying power, e.g. at night.

✓ *'Main menu ➔ System settings ➔ Display settings ➔ Backlight'*



1. Press SET. The Backlight mode dialogue appears (Fig. left).
2. Press Δ, ∇ to select a setting.
3. Press SET. The selected mode is set.

8 System functions

Topics

8.1 Protection functions

8.1.1 Controller overload

The controller is protected from the following faults and is not damaged when these faults only occur individually:

- Solar module or battery connected with the wrong polarity.
- Solar module or battery not connected with the wrong polarity but connected to the wrong connection.
- Solar modules are short-circuited (charging is switched off (OFF); charging cannot be switched on if a short-circuit is detected).
- Battery is not connected.

Once the individual fault has been corrected the controller will operate correctly without taking any further measures.

CAUTION!

The following faults damage the controller:

– A solar module is connected to multiple controllers in parallel.
– The solar modules are short-circuited while the device is charging.

NOTICE!

The controller responds to different battery voltages in the following different ways:

- Battery voltage below 9.5 VDC: Safe and reliable operation is no longer guaranteed. The controller stops all functions, especially charging of the battery.
- Battery voltage between 9.5 VDC and 10.0 VDC: The device responds to operating commands and the display functions correctly.
- Battery voltage above 10,0 VDC: The batteries are charged. Normal operation of the device.

8.1.2 Overheating of the controller

The cooling ribs on the rear side and the internal temperature controller prevent the controller from overheating. If the controller still becomes too hot it reduces the charging of the battery stepwise (derating) and stops charging completely if necessary (power unit switched off). Charging of the battery is automatically resumed after the device has cooled down.

8.1.3 Deep discharging of the battery (MPPT 6000-M only)

The relay outputs AUX 1/2/3 can be used to protect the battery from becoming deeply discharged. For more information see *Chapter 6.2 'AUX 1,2,3 relay output connection (MPPT 6000-M only)' on page 41*.

8.2 Battery type setting

CAUTION!

Different settings and charging parameters are possible depending on the battery type that is set.

Selecting the wrong battery type can permanently damage the existing battery.

For settings see . *Chapter 5 'Initial commissioning of the base system' on page 33*▸ *'Set the battery type' on page 35*.

8.3 Current limit system setting (MPPT 6000-M only)

NOTICE!

In a StecaLink master/slave network the MPPT 6000-M can control the total charge current of all MPPT 6000-S and MPPT 6000-M in the network.

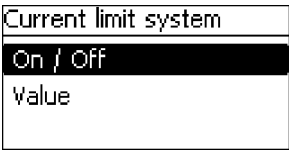
The configured maximum system charge current is dynamically distributed across all the MPPT 6000-M and MPPT 6000-S power units.

The local Current limit device setting of the device is taken into account in determining the distribution.

The actual charge current of the devices is taken into consideration for the distribution.

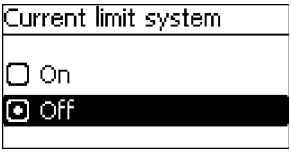
Usage of the local Current limit device setting can be switched on and off.

Current limit system: On/Off



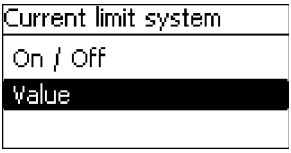
✓ *'Main menu ➔ Battery settings ➔ Current limit system'*

1. Press SET. The Current limit system menu appears (Fig. left).
2. Press Δ, ∇ to select the menu item On/Off.



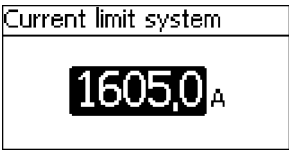
3. Press SET. The Current limit system dialogue appears (Fig. left).
4. Press Δ, ∇ to select On/Off.
5. Press SET. Control of the maximum system charge current is switched on or off accordingly.

Current limit system: Value



✓ *'Main menu ➔ Battery settings ➔ Current limit system'*

1. Press SET. The Current limit system menu appears (Fig. left).
2. Press Δ, ∇ to select the menu item Value.



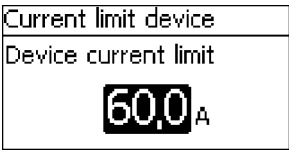
3. Press SET. The Current limit system dialogue appears (Fig. left).
4. Press SET. The value flashes.
5. Press Δ, ∇ to change the value.
6. Press SET. The value stops blinking.

8.4 Current limit device setting

NOTICE!

It may be necessary to limit the maximum charge current used for charging the battery. The specifications and notes of the battery manufacturer must be adhered to. Take care to observe the specifications of the battery management system (BMS) when using Li-Ion batteries. This limit is set to the maximum possible current of 60 A in newly delivered MPPT 6000-M and MPPT 6000-S devices.

Current limit device: Value



✓ *'Main menu ➔ Battery settings ➔ Current limit device'*

1. Press SET. The dialogue Device current limit appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

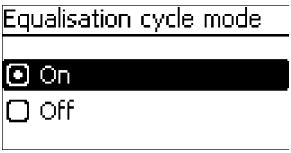
8.5 Lead-acid battery system functions

8.5.1 Equalisation cycle mode

! NOTICE!

Cyclic equalisation charging settings are only available for the lead-acid battery type. These settings allow activation/deactivation of cyclic equalisation charging and configuration of a fixed duration between each cyclic equalisation charging process.

Deactivating/activating cyclic equalisation charging



✓ *'Main menu ➔ Battery settings ➔ Equalisation cycle mode ➔ On/Off'*

1. Press SET. The Equalisation cycle mode dialogue appears (Fig. left).
2. Press Δ, ∇ to select On or Off.
3. Press SET. Cyclic equalisation charging is switched on or off accordingly.

Cycle duration

✓ *'Main menu ➔ Battery settings ➔ Equalisation cycle ➔ Cycle'*

1. Press SET. The Equalisation cycle dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

8.5.2 Battery control mode (MPPT 6000-M only)

NOTICE!

- The state of charge (SOC) mode or voltage control mode can be selected for lead-acid or lead-gel/AGM battery types.
- Voltage control is the predefined fixed mode for Li-Ion and NiCd battery types.
- The `State of charge (SOC)` control mode activates calculation of the state of charge of the battery. This calculated SOC value is shown in the status display and the measurements, see *Chapter 7.3 'Status display' on page 53*.
- In the `State of charge (SOC)` control mode, the calculated state of charge controls execution of the following functions:
  - Deep discharge protection
  - Excess energy control
  - Generator control

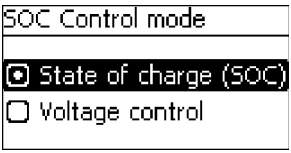
  See *Chapter 9 'Control functions via AUX 1/2/3 (MPPT 6000-M only)' on page 103*.
- This also controls activation of the following charge modes:
  - Boost charging
  - Equalisation charging

  See *Chapter 8.5.8 'Charge voltages' on page 66*.
- In the `voltage control` mode, the actual battery voltage controls execution of the following functions:
  - Deep discharge protection
  - Excess energy control
  - Generator control

  See *Chapter 9 'Control functions via AUX 1/2/3 (MPPT 6000-M only)' on page 103*.
- The actual battery voltage also controls activation of the following charge modes:
  - Boost charging
  - Equalisation charging

  See *Chapter 8.5.8 'Charge voltages' on page 66*.
- Using the state of charge (SOC) control mode only makes sense when all battery charge and discharge currents can be measured by the MPPT 6000-M. Additional PA HS400 current sensors are required for measuring the discharge currents. Additional external PA HS400 current sensors are also required for measuring charge currents that do not flow through the MPPT 6000-M or through MPPT 6000-S devices in the master/slave network.
- No additional current sensors are required when using the voltage control mode.
- If the discharge depth is to be taken into consideration for adjusting the upper charge voltage U1 when charging NiCd batteries then the discharge current must be measured by external PA HS400 current sensors. The necessary sensors must be activated via the `Sensor member list` menu item.
- All devices to be used for calculating the total battery current must be specified in the `Sensor member list` menu item. The total of all currents selected here is used for calculating the state of charge and is displayed in the `Total charge/discharge current of battery` field of the status display, see *Chapter 7.3 'Status display' on page 53*.

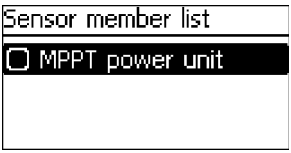
SOC Control mode



✓ *'Main menu ➔ Battery settings ➔ Battery ➔ control mode ➔ SOC control mode '*

1. Press `SET`. The `SOC Control mode` dialogue appears (Fig. left).
2. Press Δ, ∇ to change the control mode.
3. Press `SET`. The selected control mode is marked and adopted.

Sensor member list



✓ *'Main menu ➔ Battery settings ➔ Battery ➔ control mode ➔ Sensor member list '*

1. Press `SET`. The `Sensor member list` dialogue appears (Fig. left).
2. Press Δ, ∇ to select the members.
3. Press `SET`. The selected member is marked and adopted.

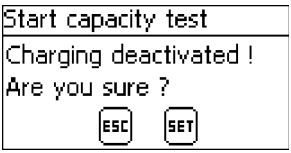
Repeat the selection process until all members relevant for determining the total battery charge/discharge current are selected.

8.5.3 Battery capacity test (MPPT 6000-M only)

NOTICE!

- The capacity test function is only available for lead-acid and lead-gel/AGM battery types.
- The capacity test allows the controller to measure the usable capacity of the battery while it is being discharged by the connected loads.
- The measured value is displayed as the `Result of capacity test` measurement in the status window, see *Chapter 7.3 'Status display' on page 53*.
- During the capacity test, the battery is not charged by the MPPT 6000-M or any other MPPT 6000-S devices controlled via the StecaLink bus. The device enters the `OFF` state.
- After completion of the capacity test, charging must be manually started via the MPPT 6000-M. *'Main menu ➔ Device On/Off ➔ On'*.
- The following conditions must be satisfied in order to execute the capacity test:
  - The nominal capacity of the battery must be set. The nominal capacity is usually specified on the battery type plate.
  - A PA HS400 external current sensor must be installed and registered at the MPPT 6000-M in order to measure the charge currents. The external current sensor must be selected via *'Main menu ➔ Battery settings ➔ Battery control mode ➔ Sensor member list'*.
  - The external battery temperature sensor must be installed and activated, see *Chapter 6.4 'PA TS-S external temperature sensor connection' on page 43*.
  - The generator control function must be manually disabled. Charging from external sources must be ruled out during execution of the capacity test.
  - The external control function via the AUX IO connection must be disabled in order to use the capacity test.
  - The battery must be discharged by the "loads" connected to the system. The controller deep discharge protection via the AUX 1/2/3 outputs is active during the test.
- The necessary conditions must be established before starting the capacity test. Changes made after starting the test will cancel the test. The test must then be started anew.
- The capacity test almost completely discharges the battery. This can result in the battery being discharged below the configured deep discharge protection threshold. Only the consumers controlled via the AUX 1/2/3 outputs can be automatically switched off to prevent deep discharging of the battery. The capacity test is cancelled without a result if the deep discharge protection function of the MPPT 6000-M prevents the discharging required for completing the capacity test.
- Switching the device on/off cancels the capacity test.
- Execution of the capacity test can take several hours or even days, depending on the battery size and condition and the discharge current of the available loads. For a sensible execution, the average discharge current of the loads should approximately correspond to the 10-hour discharge current. A changing load profile is beneficial for the capacity test.
- Execute the capacity test only if the system must not continuously supply energy. It might not be possible to supply the loads with energy during the necessary subsequent battery recharging period.
- Ensure a prompt and full recharging of the battery after finishing a capacity test. Be aware of the the fact that poor weather conditions can restrict the performance of the PV system.

Battery capacity test



✓ *'Main menu ➔ Battery settings ➔ Battery capacity test '*

1. Press `SET`. The `Start capacity test` dialogue appears (Fig. left).
2. Press and hold `SET` for 1 s. The capacity test starts.
3. The display switches to the `Battery settings` menu.

If the capacity test could be successfully started then charging is deactivated (`OFF`) and the code `C` is displayed in the footer of the status screen, see *Chapter 7.3 'Status display' on page 53*.

8.5.4 Battery type

For information on switching between the lead-acid, lead-gel/AGM, Li-Ion and NiCd battery types, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.5.5 Battery capacity

For the battery capacity settings see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.5.6 Current limit system (MPPT 6000-M only)

For the current limit system setting, see *Chapter 8.3 'Current limit system setting (MPPT 6000-M only)' on page 60*.

8.5.7 Current limit device

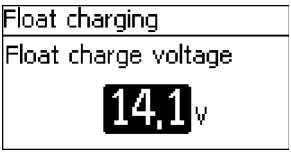
For the current limit device setting, see *Chapter 8.4 'Current limit device setting' on page 61*.

8.5.8 Charge voltages

CAUTION!

Ensure that the charge limit settings agree with the specifications of your battery. Incorrect settings can destroy the battery.

Float charging



✓ *'Main menu ➔ Battery settings ➔ Charge voltages ➔ Float charging'*

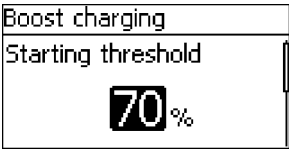
1. Press `SET`. The `Float charging` dialogue appears (Fig. left).
2. Press `SET`. The `Float charge voltage` value flashes.
3. Press ∆, ∇ to change the value.
4. Press `SET`. The value stops blinking.

Boost charging

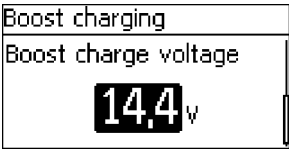
NOTICES

- If the `State of charge (SOC)` control mode is selected then the starting threshold is specified as %-SOC.
- If the `Voltage control` control mode is selected then the starting threshold is specified as V.

✓ *'Main menu ➔ Battery settings ➔ Charge voltages ➔ Boost charging'*



1. Press `SET`. The `Boost charging` dialogue appears (Fig. left).
2. Press `SET`. The `Starting threshold` value flashes.
3. Press ∆, ∇ to change the value.
4. Press `SET`. The value stops blinking.



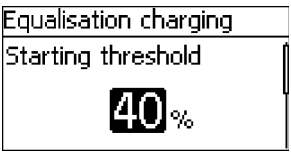
5. Press ∇ to select `Boost charge voltage`.
6. Press `SET`. The `Boost charge voltage` value flashes.
7. Press ∆, ∇ to change the value.
8. Press `SET`. The value stops blinking.

Equalisation charging

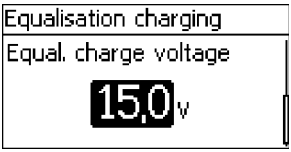
NOTICES

- This setting is only possible for the lead-acid battery type.
- If the `State of charge (SOC)` control mode is selected then the starting threshold is specified as %-SOC.
- If the `Voltage control` control mode is selected then the starting threshold is specified as V.

✓ *'Main menu ➔ Battery settings ➔ Charge voltages ➔ Equalisation charging'*



1. Press `SET`. The `Equalisation charging` dialogue appears (Fig. left).
2. Press `SET`. The `Starting threshold` value blinks.
3. Press ∆, ∇ to change the value.
4. Press `SET`. The value stops blinking.



5. Press ∇ to select `Equal. charge voltage`.
6. Press `SET`. The `Equal. charge voltage` value blinks.
7. Press Δ, ∇ to change the value.
8. Press `SET`. The value stops blinking.

8.5.9 IUIA charge mode (MPPT 6000-M only)

CAUTION!

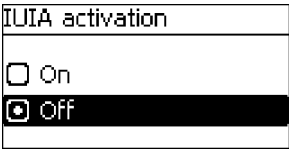
IUIA charging performs targeted overcharging of the battery. This can result in voltages of up to 2.6 V/cell. All loads connected to the battery must be able to tolerate these higher voltages, even when these are only in Standby mode.

NOTICE!

- The IUIA charge mode is only available for lead-acid and lead-gel/AGM battery types.
- The IUIA charge mode can be activated for these battery types in the menu. The IUIA charge mode is executed repeatedly according to a configurable 1–6 monthly cycle.
- The first execution of the IUIA charge mode after it has been activated only occurs after completion of the first boost charging subsequent to the time of activation. The repetition cycle is based on the month of first execution. The repetition cycle is not accurate to the day. The IUIA charging mode is executed after completion of the first boost charging during the active month for the repetition cycle.
- Execution of equalisation charging never activates the IUIA charge mode. Repeat execution of a boost charge during the repetition cycle does not cause premature execution of IUIA charging.
- An active IUIA charge mode is cancelled when the device is switched off, state `Off`.
- The following conditions must be satisfied in order to execute the IUIA charge mode:
  - The nominal capacity of the battery must be set. The nominal capacity is usually specified on the battery type plate. The battery capacity specification is used for determining the I50 charge current. I50 = Ah/50h.
  - The battery used must have a minimum capacity of 50 Ah.
  - Energy loads connected to the battery must be regulated so that the battery charge current can drop to I50. Loads must be disconnected if necessary.
- The MPPT 6000-M regulates its power unit charge current to I50. Regulation of external currents, that can be e.g monitored with PA HS400 current sensors is not performed.
- In the IUIA charge mode, the capacity counting is performed according to the selections made in *'Main menu ➔ Battery settings ➔ Battery control mode ➔ Sensor member list'*.
- The IUIA consists of three phases:
  - I phase: The I phase corresponds to charging the battery using the boost charging settings. After the period configured for boost charging expires the state changes to the U phase.
  - U phase: In the U phase charging continues with a voltage of 2.4 V/cell until the charge current is less than I50 of the battery for at least 50 s. The IUIA charging stops if more than 40 % of the specified battery capacity is charged in the period until the charge current drops to I50. The device then switches to the Float charging mode. If a voltage of 2.4 V/cell cannot be maintained during the U phase due to insufficient charging power then the device remains in the U phase but the capacity counter is stopped. The capacity counter is started again when the charging power is sufficient for maintaining a voltage of 2.4 V/cell.
  - IA phase: The charge current is limited to I50 during the IA phase. An active IA phase is indicated by the letter I in the footer of the status display, see *Chapter 7.3 'Status display' on page 53* . When the battery voltage reaches the range of 2.53 V/cell to 2.55 V/cell the amount of charged energy is now measured using a capacity counter. The IA phase ends when the battery is charged to 20 % of the specified nominal battery capacity. This ends the entire IUIA charging cycle and the MPPT 6000-M

switches to the Float charging mode. If the battery voltage cannot be maintained at >2.53 V/cell for longer than 120 s during the the IA phase then the IA is ended and the sequence starts again in the I phase. If the battery voltage reaches a value >= 2.6 V/cell during the IA phase then the MPPT 6000-M switches off the charging. The device enters the `OFF` state. This ends the IUIA charging cycle.

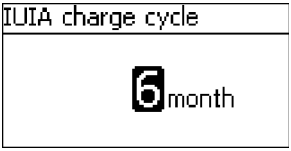
IUIA charge mode On/Off



✓ *'Main menu ➔ Battery settings ➔ IUIA activation ➔ On/Off '*

1. Press `SET`. The `IUIA activation` dialogue appears (Fig. left).
2. Press ∆, ∇ to change the value.
3. Press `SET`. The value is adopted.

IUIA charge mode Cycle



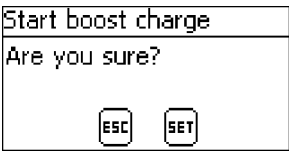
✓ *'Main menu ➔ Battery settings ➔ IUIA charge mode ➔ Cycle '*

1. Press `SET`. The `IUIA charge cycle` dialogue appears (Fig. left).
2. Press ∆, ∇ to change the value.
3. Press `SET`. The value stops blinking.

8.5.10 Start boost charge

NOTICE!

- `Start boost charge` allows boost charging to be started manually.
- The boost charging is executed using the previously configured parameters.
- The device switches to float charging on completion of boost charging.
- This function is only available for lead-acid and lead-gel/AGM battery types.
- Once started, boost charging can only be stopped by switching the device off (`OFF`).



✓ *'Main menu ➔ Battery settings ➔ Start boost charge'*

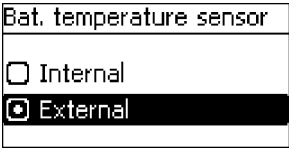
1. Press `SET`. The `Start boost charge` dialogue appears. (Fig. left).
2. Press `SET` for 1 s to start the boost charge.

8.5.11 Battery temperature sensor

NOTICE!

- Observe the notices on connecting the external temperature sensor in *Chapter 6.4 'PA TS-S external temperature sensor connection' on page 43*.
- The MPPT 6000-M/MPPT 6000-S devices have a function allowing automatic temperature compensation of the end-of-charge voltage used for charging.
- The device must measure the ambient temperature of the battery in order to use this function. The internal temperature sensor can be used if the battery and device are in the same temperature area. An external temperature sensor must be used if the battery and device are in different temperature areas.
- We recommend always using the external temperature sensor because this provides more accurate temperature measurements.
- The external temperature sensor must be correctly connected if it is selected as the source. Otherwise an Error event message is generated.

Battery temperature sensor



✓ *'Main menu ➔ Battery settings ➔ Bat. temperature sensor'*

1. Press `SET`. The `Bat. temperature sensor` dialogue appears (Fig. left).
2. Press ∆, ∇ to change the selection.
3. Press `SET`. The selection stops blinking and is adopted.

8.5.12 Cable compensation

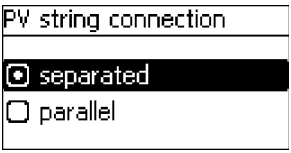
For the cable compensation settings, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.5.13 PV string connection

NOTICE!

- Observe the technical data of the device when designing and connecting the PV string inputs.
- The device is capable of performing separate power control and MPP tracking for each PV string input. This requires both PV string inputs to be electrically isolated from each other. Separate use of the strings is recommended.
- The *'separated'* setting must be selected for separate inputs, otherwise the power yield for battery charging is reduced. The default setting is *'separated'*.
- If a suitable division of the PV generator across the two PV strings is not possible then parallel connection can be used.
- In addition to the necessary changes in the menu, this also requires the "M1–"/"M2–" and "M1+"/"M2+" connections to be electrically wired in parallel (bridged).

PV string connection



✓ *'Main menu ➔ Battery settings ➔ PV string connection '*

1. Press SET. The PV string connection dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press SET. The selection stops blinking and is adopted.

8.5.14 Expert menu

NOTICE!

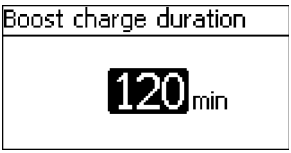
- For information on accessing this menu, see *Chapter 7.6 'Advanced operation' on page 56*.
- For lead-acid batteries, the expert menu allows configuration of the following parameters:
  - duration of boost charging and equalisation charging,
  - switching the temperature compensation on/off,
  - changing the factors used for temperature compensation and
  - system voltage.

Equalise charge duration

✓ *'Main menu ➔ Battery settings ➔ Expert menu ➔ 17038 [SET] 1s ➔ Equal. charge duration'*

1. Press SET. The Equal. charge duration dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Boost charge duration



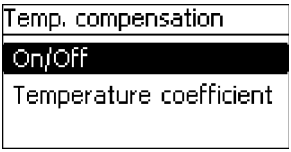
✓ *'Main menu ➔ Battery settings ➔ Expert menu ➔ 17038 [SET] 1s ➔ Boost charge duration'*

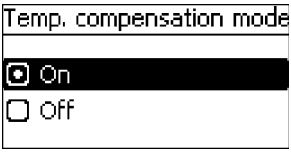
1. Press SET. The Boost charge duration dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

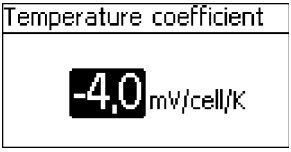
Temperature compensation

! NOTICE!

The temperature compensation offsets the charge cut-off voltage by the specified value per battery cell (2 V cells in lead-acid batteries) and per degree Kelvin. For example, a temperature coefficient of -4,0 mV/cell/K for a 48 V lead-acid battery causes the charge cut-off voltage to be offset by -96 mV per degree Kelvin temperature difference relative to 25 °C.



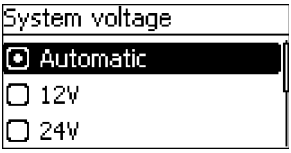




✓ *'Main menu ➔ Battery settings ➔ Expert menu ➔ 17038 [SET] 1s ➔ Temp. compensation'*

1. Press `SET`. The `Temp. compensation` dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Select `On/Off` and press `SET`. The `Temp. compensation mode` dialogue appears.
4. Press Δ, ∇ to change the selection.
5. Press `SET`. The selection is adopted.
6. Press `ESC` to exit the selection dialogue.
7. Press Δ, ∇ to change the selection.
8. Select `Temperature coefficient` and press `SET`. The `Temperature coefficient` dialogue appears.
9. Press `SET`. The value flashes.
10. Press Δ, ∇ to change the value.
11. Press `SET`. The value stops blinking and is adopted.

System voltage



✓ *'Main menu ➔ Battery settings ➔ Expert menu ➔ 17038 [SET] 1s ➔ System voltage'*

1. Press `SET`. The `System voltage` dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press `SET`. The selection is adopted.

! NOTICE!

For lead-acid batteries, the system voltage always relates to the nominal voltage of the battery. The device is configured for automatic voltage detection at the factory. This allows automatic detection of the voltage levels 12 V, 24 V and 48 V. The system voltage must be directly selected if the controller is to be used with system voltages of 36 V or 60 V. The system voltage setting defines various other preset values and setting ranges.

CAUTION!

Check the correct system voltage before changing the system voltage setting and check all device settings immediately after changing the system voltage setting. Incorrect settings can damage the battery.

8.6 Li-Ion battery system functions (MPPT 6000-M only)

NOTICE!

- Ensure that all settings agree with the specifications provided by the manufacturer of the Li-Ion battery. The initial default settings provided are not recommendations.
- Observe the safety notices for the battery used.
- The scope of the Battery settings menu changes when the Li-Ion battery type is selected.
- When the Li-Ion battery type is selected, the possible settings for the following functions assigned to the AUX 1/2/3 outputs also change:
  - deep discharge protection,
  - generator control,
  - excess energy control.

8.6.1 Battery control mode

NOTICE!

For the Li-Ion battery type, the measurement sources to be used for determining the total battery charge/discharge current are defined via the Battery control mode menu.

For the sensor member list settings, see *Chapter 8.5.2 'Battery control mode (MPPT 6000-M only)' on page 63*.

8.6.2 Battery type

For information on switching between the lead-acid, lead-gel/AGM, Li-Ion and NiCd battery types, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.6.3 Battery capacity

For the battery capacity settings see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.6.4 Current limit system

For the current limit system setting, see *Chapter 8.3 'Current limit system setting (MPPT 6000-M only)' on page 60*.

8.6.5 Current limit device

For the current limit device setting, see *Chapter 8.4 'Current limit device setting' on page 61*.

8.6.6 Li-Ion battery settings

Prerequisite

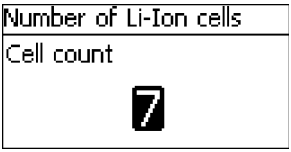
✓*'Main menu ➔ Battery settings ➔ Battery type ➔ Li-Ion battery'*

Number of cells

NOTICE

The number of Li-Ion cells connected in series.

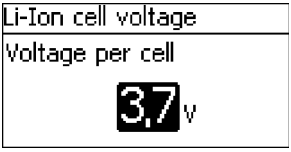
'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Number of cells'



1. Press SET. The Number of Li-Ion cells dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Cell voltage

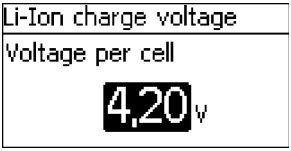
✓ *'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Cell voltage'*



1. Press SET. The Li-Ion cell voltage dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Charge voltage

✓ *'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Charge voltage'*



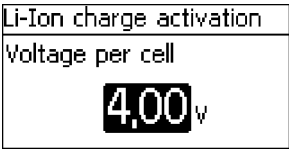
1. Press SET. The Li-Ion charge voltage dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Charge activation

NOTICE

Voltage threshold of the individual Li-Ion cell, below which charging by the MPPT 6000-M is activated. Charging is not started if the cell voltage does not drop below the charge activation value.

✓ *'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Charge activation'*



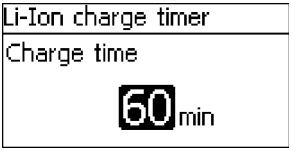
1. Press `SET`. The `Li-Ion charge activation` dialogue appears (Fig. left).
2. Press `SET`. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press `SET`. The value stops blinking.

Charge timer

NOTICES

- Period during which the MPPT 6000-M maintains the charge voltage at the Li-Ion battery.
- When the charge timer expires, charging is stopped until the cell voltage once more drops below the charge activation value.

✓ *'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Charge timer'*



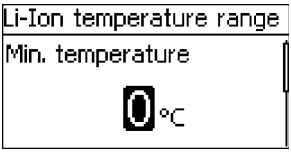
1. Press `SET`. The `Li-Ion charge timer` dialogue appears (Fig. left).
2. Press `SET`. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press `SET`. The value stops blinking.

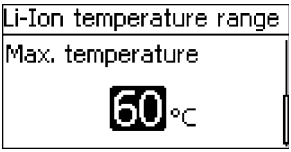
Temperature range

NOTICES

- Li-Ion batteries are only charged when they have a temperature lying in the range specified by the minimum and maximum temperature values.
- The MPPT 6000-M stops charging if the measured battery temperature lies outside this range.
- The internal or external temperature sensor of the MPPT 6000-M can be used for measuring this temperature, see *Chapter 8.5.11 'Battery temperature sensor' on page 71*. The external sensor should preferably be used because it offers higher accuracy.

✓ *'Main menu ➔ Battery settings ➔ Li-Ion battery settings ➔ Temperature range'*





1. Press SET. The Li-Ion temperature range dialogue appears (Fig. left).
2. Press SET. The Min. temperature value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.
5. Press ∇ to select the Max. temperature value.
6. Press SET. The Max. temperature value flashes.
7. Press Δ, ∇ to change the value.
8. Press SET. The value stops blinking.

8.6.7 Battery temperature sensor

NOTICE!

- For the Li-Ion battery type, the temperature sensor is used for monitoring the temperature range configured for charging.
- The charge voltage is not temperature compensated.

For settings see *Chapter 8.5.11 'Battery temperature sensor' on page 71*.

8.6.8 Cable compensation

For the cable compensation settings, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.6.9 PV string connection

For settings see *Chapter 8.5.13 'PV string connection' on page 71*.

8.7 NiCd battery system functions (MPPT 6000-M only)

NOTICE!

- Ensure that all settings agree with the specifications provided by the manufacturer of the NiCd battery. The initial default settings provided are not recommendations.
- Observe the safety notices for the battery used.
- The scope of the Battery settings menu changes in comparison to the lead-acid/Li-Ion settings when the NiCd battery type is selected.
- When the NiCd battery type is selected, the possible settings for the following functions assigned to the AUX 1/2/3 outputs also change:
  - deep discharge protection,
  - generator control,
  - excess energy control.

8.7.1 Battery control mode

For the sensor member list settings, see *Chapter 8.5.2 'Battery control mode (MPPT 6000-M only)' on page 63*.

8.7.2 Battery type

For the lead-acid, lead-gel/AGM, Li-Ion, NiCd battery type settings, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.7.3 Battery capacity

For the battery capacity settings see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.7.4 Current limit system

For the current limit system setting, see *Chapter 8.3 'Current limit system setting (MPPT 6000-M only)' on page 60*.

8.7.5 Current limit device

For the current limit device setting, see *Chapter 8.4 'Current limit device setting' on page 61*.

8.7.6 NiCd battery settings

NOTICE!

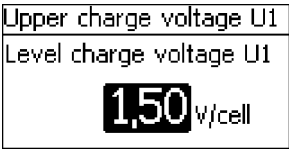
- A two stage charging procedure with an upper charge voltage U1 and a lower charge voltage U2 is used for charging NiCd batteries.
- The parameter settings allow the upper charge voltage U1 to be adjusted according to the actual prior discharge depth or according to an assumed fixed discharge depth. The discharge current of the NiCd battery must be measured using one or more external PA HS400 current sensors in order to determine the actual depth of discharge. The PA HS400 sensors used for measuring the discharge current must be registered via the *'Battery control mode ➔ Sensor member list'* dialogue.
- Temperature compensation of the upper charge voltage U1 can also be programmed. Separate temperature compensation factors can be set for temperature ranges above 0 °C and below 0 °C.
- Adjustment of the upper charge voltage U1 depending on the discharge depth and the temperature compensation is performed up to a configurable limit for U1.
- Charging with the upper charge voltage U1 specified in the configuration is performed for the configurable charging time U1.
- The configured charging time U1 starts counting down when the voltage of the NiCd battery has reached the active charge voltage U1, under consideration of a configurable tolerance threshold, and can be maintained at this value using the available charge current.
- The charging time U1 is reset when the battery drops below a configurable discharge depth. Charging of the NiCd battery is then restarted using the active upper charge voltage U1.
- Charging of the NiCd battery switches to the lower charge voltage U2 after the charging time U1.
- Separate lower charge voltage U2 temperature compensation factors can also be set for temperature ranges above 0 °C and below 0 °C.
- In contrast to the upper charge voltage U1, the lower charge voltage U2 is not adjusted based on the discharge depth.
- Charging at the lower charge voltage U2 continues until the battery is discharged below the configurable U2 U1 switch voltage threshold. Charging of the NiCd battery is restarted using the active upper charge voltage U1 when the battery drops below this threshold.

Upper charge voltage U1

NOTICE

Nominal value of the upper charge voltage in a two-stage charging process.

'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Upper charge voltage U1'



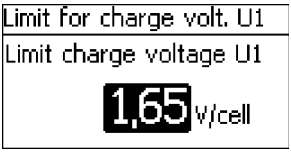
1. Press `SET`. The `Upper charge voltage U1` dialogue appears (Fig. left).
2. Press `SET`. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press `SET`. The value stops blinking.

Limit for charge voltage U1

NOTICES

- Maximum value of the upper charge voltage in a two-stage charging process.
- Automatic adjustment of the upper charge voltage U1 due to temperature compensation and prior depth of discharge will be limited to this maximum value.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Limit for charge volt. U1 U1'*



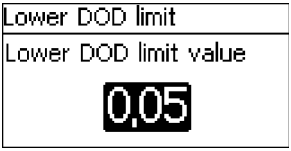
1. Press SET. The Limit for charge volt. U1 dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Lower DOD limit

NOTICES

- Adjustment of the upper charge voltage U1 becomes active when the battery drops below this depth of discharge limit value (depth of discharge - DOD).
- A value of 0.05 means a 5 % depth of discharge relative to the configured battery capacity.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Lower DOD limit'*



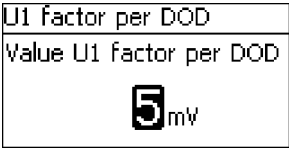
1. Press SET. The Lower DOD limit dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

U1 factor per DOD

NOTICES

- Factor per 1 % DOD, by which the upper charge voltage U1 is adjusted.
- The value is specified in mV per cell.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ U1 factor per DOD'*



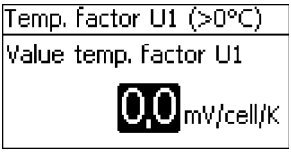
1. Press SET. The U1 factor per DOD dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Temp. factor U1 (>0°C)

NOTICES

- Temperature compensation factor for the upper end-of-charge voltage U1 at positive temperatures.
- Specification of the adjustment factor in mV per cell and per degree of temperature change.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Temp. Factor U1 (>0°)'*



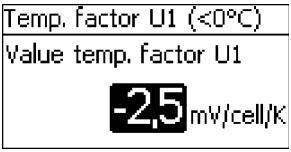
1. Press SET. The Temp. factor U1 (>0°C) dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Temp. factor U1 (<0°C)

NOTICES

- Temperature compensation factor for the upper end-of-charge voltage U1 at negative temperatures.
- Specification of the adjustment factor in mV per cell and per degree of temperature change.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Temp. Factor U1 (<0°)'*



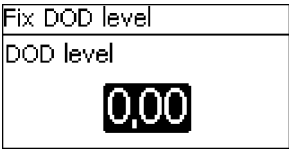
1. Press SET. The Temp. factor U1 (<0°C) dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Fix DOD level

NOTICES

- Selection of whether the actual cycle depth or a fixed cycle depth specified here is to be used for adjustment of the upper charge voltage U1.
- With a setting of 0.00 the actual cycle depth that occurs is used for cycle-dependent adjustment of the upper charge voltage U1.
- A value other than 0.00 is used as a fixed value. A value of 0.05 means a 5 % DOD relative to the configured battery capacity.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Fix DOD level'*



1. Press SET. The Fix DOD level dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

U1 tolerance for timer

NOTICES

- Die charging time U1 counts down when the actual battery voltage lies within the range of the upper charge voltage U1 minus the tolerance threshold.
- This allows toleration of short charging interruptions that only result in a small reduction of the charge voltage.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ U1 tolerance for timer'*

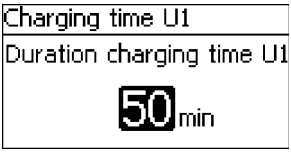
1. Press SET. The U1 tolerance for timer dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Charging time U1

NOTICES

- Period for which the upper charge voltage U1 minus the tolerance threshold is to be maintained.
- Countdown of the charging time U1 is reset when the device is restarted and at the start of a new day.
- This also occurs when the upper charge voltage U1 minus the tolerance threshold is not reached over a period greater than 5 h (continuously).
- Countdown of the charging time U1 is also reset when the specified discharge depth for DOD reset charging is reached.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Charging time U1'*



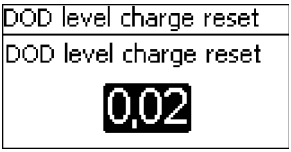
1. Press SET. The Charging time U1 dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

DOD level charge reset

NOTICES

- Discharge depth at which countdown of the charging time U1 is restarted.
- A value of 0.02 means a 2 % depth of discharge relative to the configured battery capacity.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Charging time U1'*



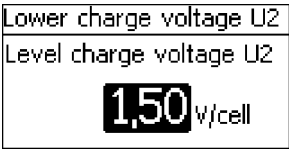
1. Press SET. The DOD level charge reset dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Lower charge voltage U2

NOTICE

Target value for the lower charge voltage U2 in the two-stage charging process.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Lower charge voltage U2'*



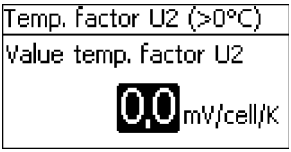
1. Press SET. The Lower charge voltage U2 dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Temp. factor U2 (>0°C)

NOTICES

- Temperature compensation factor for the lower end-of-charge voltage U2 at positive temperatures.
- Specification of the adjustment factor in mV per cell and per degree of temperature change.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Temp. factor U2 (>0°C)'*



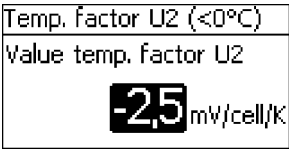
1. Press SET. The Temp. factor U2 (>0°C) dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Temp. factor U2 (<0°C)

NOTICES

- Temperature compensation factor for the lower end-of-charge voltage U2 at negative temperatures.
- Specification of the adjustment factor in mV per cell and per degree of temperature change.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Temp. factor U2 (<0°C)'*



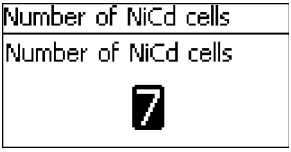
1. Press SET. The Temp. factor U1 (<0°C) dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

Number of NiCd cells

NOTICE

The number of NiCd cells connected in series.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ Number of NiCd cells'*



1. Press SET. The Number of NiCd cells dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

U2 U1 switch

NOTICES

- Threshold for activation of the upper charge voltage U1 in the two-stage charging process.
- The lower charge voltage U2 remains active if this threshold is not crossed.

✓ *'Main menu ➔ Battery settings ➔ NiCd battery settings ➔ U2 U1 switch'*

1. Press SET. The U1 activation level dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

8.7.7 Battery temperature sensor

NOTICE!

– For the NiCd battery type, the temperature sensor is used for temperature compensation of the upper charge voltage U1 and the lower charge voltage U2.

For the battery temperature sensor settings see *Chapter 8.5.11 'Battery temperature sensor' on page 71*.

8.7.8 Cable compensation

For the cable compensation settings, see *Chapter 5 'Initial commissioning of the base system' on page 33*.

8.7.9 PV string connection

For the PV string connection settings, see *Chapter 8.5.13 'PV string connection' on page 71*.

8.7.10 Expert menu

NOTICE!

– The expert menu for NiCd batteries allows the temperature compensation to be switched on/off.

'Expert menu settings ➔ Temperature compensation' see *Chapter 8.5.14 'Expert menu' on page 72*.

8.8 StecaLink bus

NOTICE!

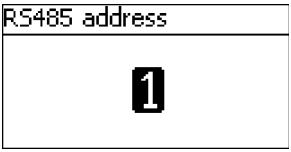
– The StecaLink bus is an RS-485 communication interface that uses a special Steca transmission protocol.
– Various different StecaLink-compatible devices can be networked together via the StecaLink bus.
– Data exchange and/or remote function execution are possible via the StecaLink bus, depending on the respective StecaLink member device.
– For information on connecting StecaLink member devices to the MPPT 6000-M/-S, see *Chapter 6.5 'StecaLink slave connection' on page 45*.
– Please visit www.steca.com for continuously updated documentation on the compatible StecaLink devices and the software versions required.

8.8.1 StecaLink slave address setting

StecaLink slave address

NOTICES

- Setting of the device address used for identifying the device as a StecaLink slave node.
- Every device in a StecaLink communication network must have a unique device address.
- Problems/error messages will occur during device registration if multiple devices have the same address.



✓ *'Main menu ➔ System settings ➔ StecaLink slave addr.'*

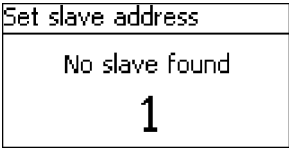
1. Press SET. The RS485 address dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking.

8.8.2 StecaLink master setting (MPPT 6000-M only)

! NOTICE!

– The master device in a StecaLink communication network controls the flow of data to the StecaLink slave members.
– The StecaLink slave members must be registered at the master device. Configuration of the slaves must be performed at the master, depending on the type and functional scope of each respective slave.
– See ↳ *Chapter 6.6 'StecaLink master connection (MPPT 6000-M only)' on page 48* for cabling information.

Add slave device



✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Add slave device'*

1. Press SET. The Set slave address dialogue appears (Fig. left).
2. Press SET. The value flashes.
3. Press Δ, ∇ to change the value.
4. Press SET. The value stops blinking. The StecaLink master queries the entered address.
   The detected StecaLink slave member is displayed (Fig. left).
5. Press SET. If additional settings for the registered slave are possible then an additional menu is displayed.

   For information on the further configuration parameters, see *'Change slave settings'* (↳ *'Change slave settings' on page 87*).

'No slave found' – a StecaLink member device could not be identified at the specified address. See *Chapter 10 'Troubleshooting' on page 111* for possible error correction measures (see event message - Number 79).

'Address already used' - a StecaLink member device is already registered under the specified address, see *Chapter 10 'Troubleshooting' on page 111* for possible error correction measures (see event message - Number 79).

Change slave settings

NOTICES

- Device-specific configuration of the slave registered at the MPPT 6000-M is performed here.
- Different settings are available depending on the functional scope of the slave.

✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Change slave settings'*

1. Press SET. The Change slave settings dialogue appears with a list of the recognized StecaLink slave members. The list is sorted by increasing order of the member addresses (Fig left).
2. Press ∆, ∇ to select the StecaLink slave member whose settings are to be changed.
3. Press SET. The configuration menu for the selected slave appears.

   Further information on the individual configuration settings for each respective slave is provided in the operating instructions for the slave.

   In the operating instructions for the PA HS400 current sensor.

   In *Chapter 8.8.3 'Changing the MPPT 6000-S slave settings (MPPT 6000-M only)' on page 87* of these operating instructions for the MPPT 6000-S.

8.8.3 Changing the MPPT 6000-S slave settings (MPPT 6000-M only)

Topics

Selecting the MPPT slave

✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Change slave settings'*

1. Press SET. The Change slave settings dialogue appears with a list of the recognised StecaLink slave members. The list is sorted by increasing order of the member addresses (Fig left).
2. Press ∆, ∇ to select the MPPT 6000-S whose settings are to be changed.

3. Press SET. The Settings MPPT slave dialogue appears, with the configuration menu for the MPPT 6000 (Fig. left).

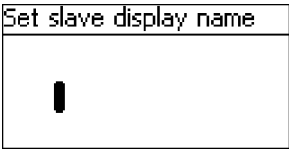
Changing Tarom MPPT 6000-S slave settings

Name

NOTICES

- An individual name can be assigned to each StecaLink MPPT 6000-S.
- Assignment of a name is optional and is not required for operating the device.
- The name is shown in the measurements display on the status screen.
- The following applies to the MPPT 6000-S:
  - The MPPT 6000 device name is assigned as fixed value.
- The following printable ASCII characters can be used for entering an individual name: !"#$%&'()*+,-./ 0123456789:;<=>? @ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklm nopqrstuvwxyz{|}~
- An individual name with a length of up to 8 characters can be entered.

✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Change slave settings ➔ Selection [xx - MPPT 6000] ➔ Name'*



1. Press SET. The Set slave display name dialogue appears (Fig. left).
2. Press ∆, ∇ to select the character position.
3. Press SET. The entry position blinks.
4. Press ∆, ∇ to select the desired character.
5. Press SET. The entry position stops blinking.

   The selected character is adopted.
6. Repeat steps 2.–5. until the desired name with max. 8 characters has been entered.

7. Press ñ to exit the data entry dialogue.

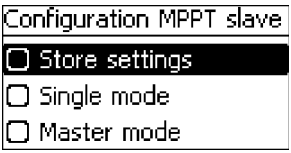
NOTICE!

– The Tarom MPPT 6000-S StecaLink slave member can be integrated into a master/slave system with various different function scopes.
  – `Save setting`: This specifies that the following settings in the master are to be transferred to the slave and locally stored in the slave:
    date format,
    date,
    time format,
    time,
    language,
    acoustic alarm,
    backlighting,
    battery type (only for the lead-acid battery type, not for Li-Ion, NiCd),
    battery capacity,
    float charge voltage,
    boost charge activation threshold,
    boost charge voltage,
    boost charge duration,
    equalisation charge on/off and cycle,
    equalisation charge activation threshold,
    equalisation charge voltage,
    equalisation charge duration.
  – The `Save setting` setting configuration allows the MPPT 6000-S to continue operating locally using the previously transferred settings if communication with the master is interrupted. This function is only available for the lead-acid and lead-gel/AGM battery types supported by the MPPT 6000-S. Settings for other battery types that can be selected at the master cannot be stored in the MPPT 6000 slave.
  – Selecting `Save setting` does not trigger a data transfer to the slave. The `Synchronise` function must be executed in order to transfer the settings from the master to the slave, see ☞ *'Synchronising slave' on page 91*.
  – `Single mode`: This specifies that the slave is to be used as a single device, independently of the master. This allows individual configuration of the slave, independently of the master. In this case the master does not send control parameters to the slave. Information is still exchanged. The master reads information from the slave for display and data logging purposes.
  – `Master mode`: This specifies that the charge functions of the slave are controlled by the master. The master transmits the current control parameter settings to the slave. The slave adopts these control parameter settings and can thus be centrally controlled by the master. The master also reads information from the slave for display and data logging purposes.
    The master mode of the MPPT 6000-S is possible for the lead-acid, lead-gel/AGM and NiCd battery types. The master transmits the necessary charge voltage and current control parameters for all battery types. If communication with the master is interrupted then all registered MPPT 6000-S devices are switched off for safety reasons; disconnected MPPT 6000-S devices perform a reset and then start anew in the *'OFF'* state. If the *'Device On/Off ➔ Redundancy'* function is active at the MPPT 6000-S and a lead-acid battery system was previously charged in conjunction with the MPPT 6000-M then the MPPT 6000-S device(s) begin operating independently if the

control communication with the master is interrupted, see ↳ *Chapter 6.8 'Redundancy function (MPPT 6000-S only)' on page 51*. If the MPPT 6000-M was previously operated with a Li-Ion or NiCd system, then the automatic redundancy function of the MPPT 6000-S is not activated for safety reasons. In this state the battery selection at the MPPT 6000-S is undefined. The user can manually set the charge parameters for lead-acid batteries.

– A combination of the `Save setting` and `Single mode` or `Master mode` configurations is possible.
– A combination of `Single mode` and `Master mode` is not prevented but is not sensible. In this combination the `Master mode` takes precedence.

Configuration MPPT slave



✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Change slave settings ➔ Selection [xx - Tarom MPPT 6000] ➔ Configuration MPPT Slave'*

1. Press `SET`. The `Configuration MPPT slave` dialogue appears (Fig. left).
2. Press ∆, ∇. The selected configuration is marked.
3. Press `SET`. The `Settings MPPT slave` dialogue appears, with the configuration menu for the Tarom MPPT 6000-S (Fig. left).
4. Repeat steps 2. and 3. if necessary until the desired configurations have been selected.
5. Press `ESC` to exit the menu.

Delete slave

! NOTICE!

– StecaLink slave members can be deleted to remove them from the communications network.
– This is necessary when StecaLink slave members have been removed or their slave address has been changed.
– Display and data logging data is no longer exchanged with a StecaLink slave member after it has been deleted.
– Deleted slave members are removed from all other relevant configuration lists in the MPPT 6000-M.

Delete slave

✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Delete slave'*

1. Press `SET`. The `Delete slave` dialogue appears with a list of the recognised StecaLink slave members. The list is sorted by increasing order of the member addresses. (Fig. left).
2. Press ∆, ∇ to select the StecaLink slave member to be deleted.

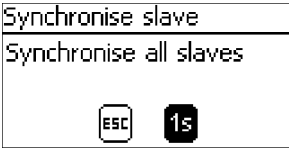
3. Press SET. The Delete slave dialogue appears (Fig. left).
4. Hold SET pressed for 1 s. The selected slave is deleted.

Synchronising slave

! NOTICE!

- The Synchronise slave function actively transfers the parameter settings of the MPPT 6000-M master to all MPPT 6000-S slaves.
- StecaLink PA HS400 slaves are not synchronised. No configurable data is stored in the PA HS400.
- Each MPPT slave executes a reset after receiving the information, in order to adopt the new values.
- The reset interrupts charging, switches off the module and battery relays and executes a complete restart of the device.
- Charging is started again after a restart caused by synchronising, depending on the configuration of the slaves, see *'Configuring the operating mode' on page 89* and the Device On/Off state of the master.
- The restart causes each MPPT 6000-S to perform a new system voltage detection, see *Chapter 4.4 'Supplying the controller with voltage' on page 31*.
- If *'Save setting'* is set for the slave in the Configuration MPPT slave menu , see *'Configuring the operating mode' on page 89*, then the settings are saved in the MPPT 6000-S.

Synchronising



✓ *'Main menu ➔ System settings ➔ StecaLink master menu ➔ Synchronise'*

1. Press SET. The Synchronise slave dialogue appears (Fig. left).
2. Hold SET pressed for 1 s. The transmission is started.
3. The display automatically changes to the higher-level menu.

8.9 Internal data logger

The data logger stores the following data in the internal memory:

- Energy input
- Energy output (MPPT 6000-M only)
- Min. battery voltage
- Max. battery voltage
- Max. charging current
- Max. PV 1 voltage
- Max. PV 2 voltage

Data stored in the internal memory can be

- shown on the display and
- deleted from the memory.

8.9.1 Energy input

The following points can be selected in the Energy input menu:

- Last 18 hours, *'Energy input' on page 92*
- Day, *'Energy input' on page 92*
- Month, *'Energy input' on page 93*
- Year, *'Energy input' on page 93*
- Total, *'Energy input' on page 94*
- Configuration, *'Energy input' on page 94*

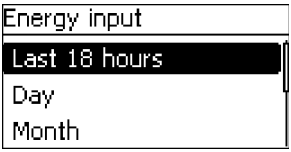
Energy input

Last 18 hours

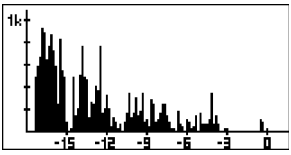
NOTICES

- Memory of the information on the amount of input energy in Ah.
- Graphical overview representing the last 18 hours.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Last 18 hours'*



1. Press SET. The graphical representation is displayed (Fig. left).
2. Press ESC. Navigate back to selection.



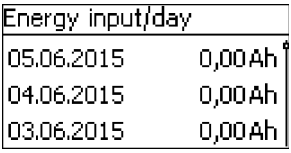
Energy input

Day

NOTICES

- Amount of input energy in Ah over the last 30 days.
- A graphical overview is not possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Day'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to selection.

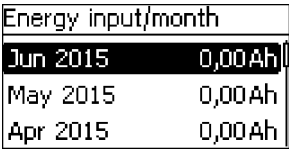
Energy input

Month

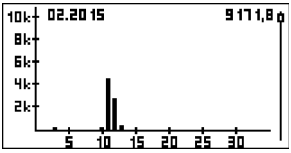
NOTICES

- Amount of input energy in Ah for the current month and the last 11 months.
- A graphical representation is possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Month'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press SET. A graphical representation of the month appears.
4. Press ESC. Navigate back to the list of data.



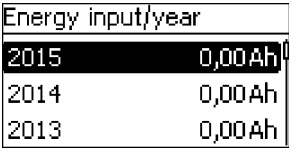
Energy input

Year

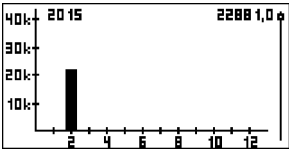
NOTICES

- Amount of input energy in Ah for the current year and the last 19 years.
- Earliest starting year is 2000.
- A graphical representation is possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Year'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press SET. A graphical representation of the year appears.
4. Press ESC. Navigate back to the list of data.



Energy input

Total

NOTICES

- Total amount of energy loaded into the device since initial commissioning.
- A graphical overview is not possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Total'*

1. Press SET. An information window appears (Fig. left).
2. Press ESC. Navigate back to selection.

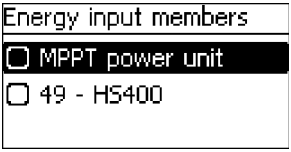
Energy input

Settings

NOTICES

- This dialogue is used for selecting the devices whose current/power information is to be included in the energy input data logging.
- Only the information sources selected in this list are used for determining the energy input values.

✓ *'Main menu ➔ Internal data logger ➔ Energy input ➔ Configuration'*



1. Press SET, the Energy input members dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press SET. The check box is activated or deactivated accordingly and the selection is adopted.
4. Press ESC. Navigate back to the Configuration menu.

8.9.2 Energy output (MPPT 6000-M only)

- Record of the information on the amount of output energy in Ah. Optional StecaLink members such as PA HS400 current sensors are required in addition to the MPPT 6000-M in order to register discharging of the battery.
- Discharge energy values cannot be recorded if no additional devices for measuring discharge currents are present.
- The following points can be selected in the Energy output menu:
  - Last 18 hours, *'Energy output' on page 95*
  - Day, *'Energy output' on page 95*
  - Month, *'Energy output' on page 95*
  - Year, *'Energy output' on page 96*
  - Total, *'Energy output' on page 96*
  - Configuration, *'Energy output' on page 97*

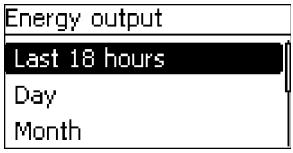
Energy output

Last 18 hours

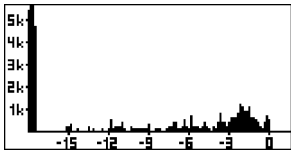
NOTICES

- Memory of the information on the amount of output energy in Ah.
- Graphical overview representing the last 18 hours.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Last 18 hours'*



1. Press SET. The graphical representation is displayed (Fig. left).
2. Press ESC. Navigate back to selection.



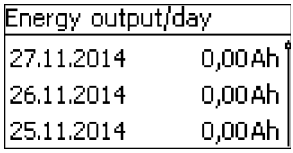
Energy output

Day

NOTICES

- Amount of discharged energy in Ah over the last 30 days.
- A graphical overview is not possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Day'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to selection.

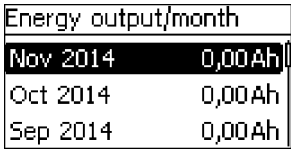
Energy output

Month

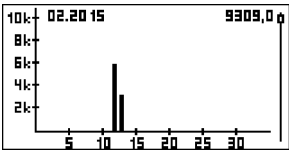
NOTICES

- Amount of discharged energy in Ah for the current month and the last 11 months.
- A graphical representation is possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Month'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.



3. Press SET. A graphical representation of the month appears.
4. Press ESC. Navigate back to the list of data.

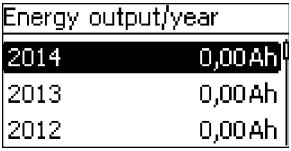
Energy output

Year

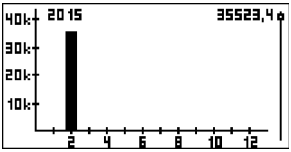
NOTICES

- Amount of discharged energy in Ah for the current year and the last 19 years.
- Earliest starting year is 2000.
- A graphical representation is possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Year'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press SET. A graphical representation of the year appears.
4. Press ESC. Navigate back to the list of data.



Energy output

Total

NOTICES

- Total amount of energy output from the device since initial commissioning.
- A graphical overview is not possible.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Total'*

1. Press SET. An information window appears (Fig. left).
2. Press ESC. Navigate back to selection.

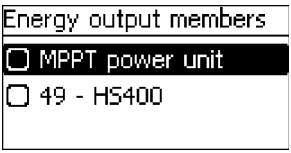
Energy output

Configuration

NOTICES

- This dialogue is used for selecting the devices whose current/power information is to be included in the energy output logging.
- Only the information sources selected in this list are used for determining the energy output values.

✓ *'Main menu ➔ Internal data logger ➔ Energy output ➔ Configuration'*



1. Press SET, the Energy output members dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press SET. The check box is activated or deactivated accordingly and the selection is adopted.
4. Press ESC. Navigate back to the Configuration menu.

8.9.3 Min./Max. values

The following min./max. values can be queried in the Internal data logger menu:

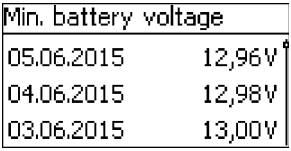
- *'Minimum battery voltage' on page 97*
- *'Maximum battery voltage' on page 97*
- *'Maximum charge current' on page 98*
- *'Maximum PV 1 voltage' on page 98*
- *'Maximum PV 2 voltage' on page 98*

Minimum battery voltage

NOTICES

- Record of the minimum battery voltage for each day over the last 30 days.
- A value of 0.00 V is displayed if the device was not active.

✓ *'Main menu ➔ Internal data logger ➔ Min. battery voltage'*



1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to the menu.

Maximum battery voltage

NOTICES

- Record of the maximum battery voltage for each day over the last 30 days.
- A value of 0.00 V is displayed if the device was not active.

✓ *'Main menu ➔ Internal data logger ➔ Max. battery voltage'*

Max. battery voltage	
05.06.2015	14,10V
04.06.2015	14,12V
03.06.2015	14,16V

1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to the menu.

Maximum charge current

NOTICES

- Record of the maximum battery charge current for each day over the last 30 days.
- A value of 0.00 A is displayed if the device was not active.

✓ *'Main menu ➔ Internal data logger ➔ Max. charge current'*

Max. charge current	
27.11.2014	59,75A
26.11.2014	0,00A
25.11.2014	0,00A

1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to the menu.

Maximum PV 1 voltage

NOTICES

- Record of the maximum voltage measured at connection M1 for each day over the last 30 days.
- A value of 0.00 V is displayed if the device was not active.

✓ *'Main menu ➔ Internal data logger ➔ Max. PV 1 voltage'*

Max. PV 1 voltage	
05.06.2015	34,54V
04.06.2015	35,14V
03.06.2015	35,04V

1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to the menu.

Maximum PV 2 voltage

NOTICES

- Record of the maximum voltage measured at connection M2 for each day over the last 30 days.
- A value of 0.00 V is displayed if the device was not active.

✓ *'Main menu ➔ Internal data logger ➔ Max. PV 2 voltage'*

Max. PV 2 voltage	
05.06.2015	34,44V
04.06.2015	34,44V
03.06.2015	34,24V

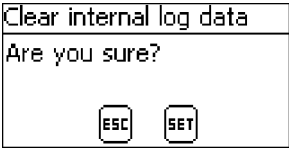
1. Press SET. List of data is displayed (Fig. left).
2. Press Δ, ∇ to page through the list of data.
3. Press ESC. Navigate back to the menu.

8.10 Clear log data

NOTICE!

- The entries in the internal data logger are deleted via the *'Clear log data'* menu item.
- The *'Energy input total'* and *'Energy output total'* information is not deleted.
- The Hours-of-operation value displayed in the measurements section of the status screen is not deleted.
- The logged data on the SD card is not deleted.

Clear log data



✓ ✓*'Main menu* ➔ *System settings* ➔ *Clear log data'*

1. Press `SET`. The `Clear internal log data` dialogue appears (Fig. left).
2. Press `SET` for 1 s. All internal log data, except for the total yield data, is deleted.

8.11 Clear event log

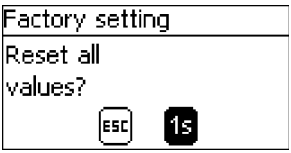
See *Chapter 10.2 'Event messages' on page 111*.

8.12 Factory settings

NOTICE!

- All active device functions are stopped when a factory reset is performed.
- The values configured by a factory reset are specified in *Chapter 12 'Technical data' on page 124*.
- Executing a factory reset deletes all settings and resets the values to the factory default values. The device then performs a reset.
- Executing a factory reset also deletes data in the internal data logger. The operating hours counter and the Energy input total/Energy output total values are retained.
- All application-specific settings must then be configured anew.
- Parameter settings that are not saved on an SD card are lost when a factory reset is executed.
- Save the configured parameters on the SD card before executing a factory reset (MPPT 6000-M only).
- The settings can then be reloaded from the SD card after the device has restarted.

Factory reset



✓ *'Main menu ➔ System settings ➔ Factory reset'*

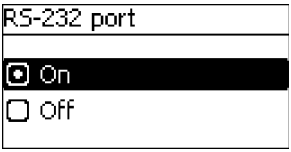
1. Press SET. The Factory setting dialogue appears (Fig. left).
2. Press SET for 1 s. A factory reset is executed and all settings are reset to the factory default values.

8.13 UART/RS-232 interface (MPPT 6000-M only)

NOTICE!

– For the RS-232 interface connection, see *Chapter 6.7 'UART/RS-232 interface connection (MPPT 6000-M only)' on page 50*.
– For the scope of the data transmission, see *Chapter 12.3 'UART/RS-232 interface protocol (MPPT 6000-M only)' on page 142*.

RS-232 port



✓ *'Main menu ➔ System settings ➔ RS-232 port'*

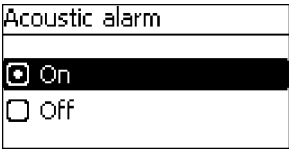
1. Press SET. The RS-232 port dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press SET. The selection is adopted.

8.14 Acoustic alarm

NOTICE!

– The device has an audible alarm unit that emits a beeping alarm signal when an error or warning occurs.
– The alarm signal remains active while the error or warning is active or until the user confirms the error or warning via SET.

Acoustic alarm



✓ *'Main menu ➔ System settings ➔ Acoustic alarm'*

1. Press SET. The Acoustic alarm dialogue appears (Fig. left).
2. Press Δ, ∇ to change the selection.
3. Press SET. The selection is adopted.

8.15 SD card (MPPT 6000-M only)

NOTICE!

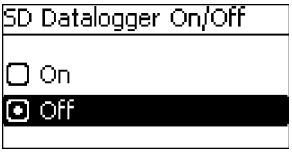
- For information on handling the SD card, see *Chapter 6.1 'Commissioning the SD card (MPPT 6000-M only)' on page 40*.
- Settings parameters for the MPPT 6000-M can be saved to and read from the SD card.
- Various different measurements, states and events can be stored on the SD card.
- When data logging is activated the data is recorded in separate files for each StecaLink member registered at the MPPT 6000-M.

Datalogger On/Off

NOTICES

- Data logging to the SD card can only be generally switched on and off.
- Any existing data files are not deleted. Information is appended to existing files.

✓ *'Main menu ➔ SD card ➔ Datalogger On/Off'*



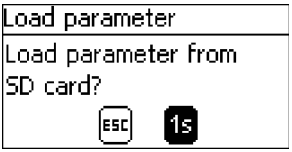
1. Press SET. The SD Datalogger On/Off dialogue appears (Fig. left).
2. Press ∆, ∇ to change the selection.
3. Press SET. The selection is adopted.

Loading parameters

NOTICES

- Only the entire set of parameters can be loaded.
- The applicable set of valid parameters must be stored in a file with the name *'Master.ini'* .
- Selection between various different parameter sets is not possible.

✓ *'Main menu ➔ SD card ➔ Load parameter'*

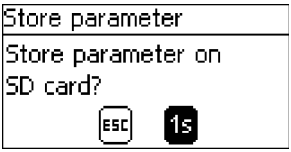


1. Press SET. The Load parameter dialogue appears (Fig. left).
2. Press SET for 1 s. The parameters are then loaded from the SD card and adopted as the settings for the MPPT 6000-M.

NOTICES

- Any existing file is replaced when the parameter file is stored.
- The file name used for the parameter files is not configurable.

✓ *'Main menu ➔ SD card ➔ Store parameter'*



1. Press `SET`. The `Store parameter` dialogue appears (Fig. left).
2. Press `SET` for 1 s. The parameters are then stored on the SD card.

9 Control functions via AUX 1/2/3 (MPPT 6000-M only)

Topics

9.1 Overview

The relay outputs can be automatically switched by the following control functions:

- Evening light function
- Night light function
- Morning light function
- Generator control
- Excess energy control
- Timer 1 ... 4

The following applies to the control functions:

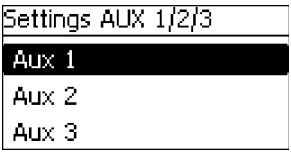
- The operating mode can be set for each output (`On`/`Off`/`Function`).
- An individual disconnection threshold and reconnection hysteresis value for deep discharge protection of the battery can be set for each output.
- When a control function is switched off its setting is retained.
- The switching time and thresholds of the control functions can be individually set for each output.
- The control functions for an output are logically ORed. This means,
  - each control function can switch on the output independently of the other control functions,
  - the output is not switched off until *all* control functions have switched it off.
- The deep discharge protection has priority over the control functions.
  - If the deep discharge protection disconnection threshold is reached then the output is switched off regardless of the state of the control functions.
  - The control functions remain ineffective until the reconnection hysteresis value is reached.

9.2 Operation

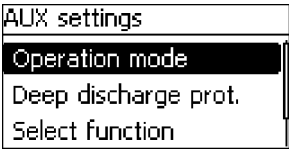
Topics

Setting the operating mode

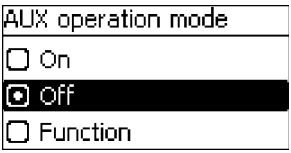
✓ *'Main menu ➔ Settings AUX 1/2/3'*



1. Select an output in the `Settings AUX 1/2/3` menu (Fig. left).



2. Press `SET`. The menu for setting the output appears, `Operation mode` is selected (Fig. left).



3. Press `SET`. The option fields for setting the operating mode are displayed.

NOTICE

The AUX 1/2/3 outputs are disabled in the default factory settings (Operation mode = `Off`).

4. Press ∆, ∇ to change the selection.

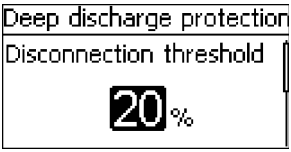
   `On`: The output is switched on.

   `Off`: The output is switched off.

   `Function`: The control functions automatically switch the output.
5. Press `SET`. The selected operation mode is switched on.
6. Press `ESC` to leave the page.

Configuring the deep discharge protection

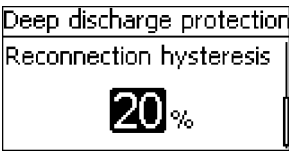
✓ *'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Deep discharge protection'*



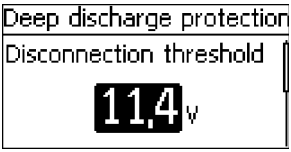
1. Press `SET`. The disconnection threshold is displayed (Fig. left).
2. Use ∆, ∇ to set the disconnection threshold and confirm with `SET`.

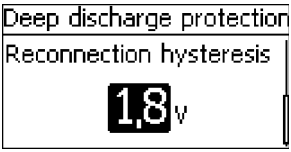
NOTICE

The parameter is set as an SOC value in % or a battery voltage value, depending on the configured control mode and the configured battery type. A value of ≥ 30 % is recommended.



3. Press ∇. The reconnection hysteresis is shown.

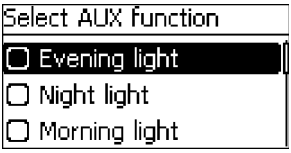




4. Press SET, then use Δ, ∇ to set the reconnection hysteresis and confirm with SET.
5. Press ESC to leave the page.

Switch control functions individually on and off

✓ *'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*



1. Press Δ, ∇ to switch the control functions on and off (Fig. left).

NOTICE

The switched-on control functions only take effect in the Function operation mode.

2. Press ESC to leave the page.

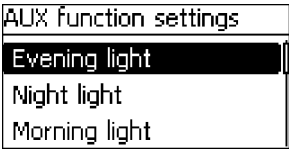
Setting control functions

NOTICE

Setting of the control functions is described below using Evening light and Timer 1 as examples. The other control functions are configured in the same manner.

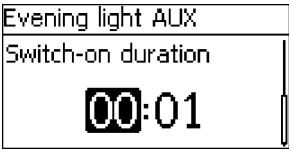
Setting the evening light

✓ *'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings'*



1. Press Δ, ∇ as required to select Evening light (Fig. left).

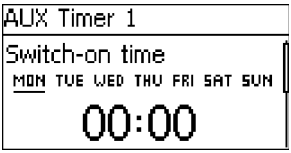
2. Press SET. The Switch-on delay dialogue appears (Fig. left).
3. Press SET, use Δ, ∇ to set the switch-on delay hours and confirm with SET.
4. Press ∇. The minutes are selected.
5. Press SET use Δ, ∇ to set the minutes and confirm with SET.



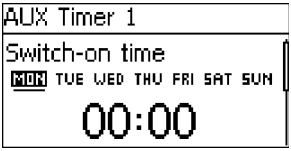
6. Press ∇. The `Switch-on duration` dialogue appears.
7. Press `SET`, repeat steps 3 to 5 for the switch-on duration.
8. Press `ESC`. The `AUX function settings` menu appears

Setting Timer1

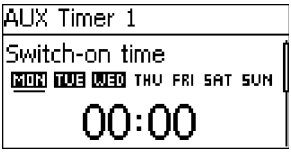
✓ *'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings'*



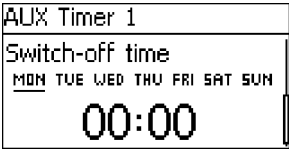
1. Press ∇ until `Timer 1` is selected.
2. Press `SET`. The `Switch-on time` dialogue appears and the selected day is underlined (Fig. left: Monday is underlined and switched off).
3. If necessary, press Δ, ∇ to select a different day.



4. Press `SET`. The state of the selected day changes (Fig. left: Monday is switched on).
5. Press Δ, ∇ to select another day as required.
6. Repeat steps 4 to 5 until all days are switched on for which the switch-on time is to apply.
7. Press ∇ (several times if necessary) until the hour of the switch-on time is selected (Fig. left).



8. Press `SET`, then use Δ, ∇ to set the hour and confirm with `SET`.
9. Press ∇. The minutes are selected.
10. Press `SET`, then use Δ, ∇ to set the minutes and confirm with `SET`.
11. Press ∇. The `Switch-off time` dialogue appears (Fig. left).



12. Set the day and time of the switch-off time in the same manner as described in steps 3 to 10.
13. Setting of the `Evening light` and `Timer 1` control functions is now finished. Press `ESC` to leave the page.

9.3 Functionality

! NOTICE!

With all brightness-based control functions, the required brightness information is obtained from the solar module.

9.3.1 Deep discharge protection

The deep discharge protection switches the output on and off independently of the control functions.

Switching behaviour

The deep discharge protection switches the output off when the switch-off threshold is reached and switches it on again when the battery charge state is the switch-on difference greater than the switch-off threshold.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Deep discharge prot.'*

9.3.2 Evening light function

The evening light function switches the output on and off based on the brightness and time. The reference point is the time of dusk. The evening light function is suitable for loads that are operated a certain time after nightfall, e.g. lighting, heating.

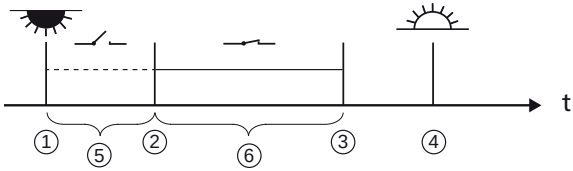
Switching behaviour

- The output remains switched on during the switch-on duration ⑥ (Fig. below) but the switch-on is delayed by the switch-on delay ⑤.
- When dawn is detected the output is switched off, even if the switch-on duration has not expired.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Evening light'*



① Dusk
② Switch-on time
③ Switch-off time
④ Dawn
⑤ *'Switch-on delay'*
⑥ *'Switch-on duration'*

9.3.3 Night light function

The night light function switches the output on and off based on the brightness and time. The reference points are the times of dusk and dawn. The night light function is suitable for loads that are only operated at night, e.g. emergency lighting.

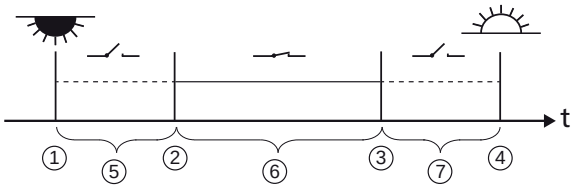
Switching behaviour

The output is switched on at the switch-on delay ⑤ (Fig. below) after dusk and switched off at the switch-off delay ⑦ before dawn.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Night light'*



① Dusk
② Switch-on time
③ Switch-off time
④ Dawn
⑤ *'Switch-on delay'*
⑥ Switch-on duration
⑦ *'Switch-off delay'*

9.3.4 Morning light function

The morning light function switches the output on and off based on the brightness and time. The reference point is the time of dawn. The morning light function is suitable for loads that are operated a certain time before dawn, e.g. heating, feeding system, bus-stop lighting.

Switching behaviour

- The output remains switched on during the switch-on duration ⑤ (Fig. below) and is switched off by the switch-off duration ⑥ before dawn.
- When dawn is detected the output is switched off, even if the switch-on duration has not expired.

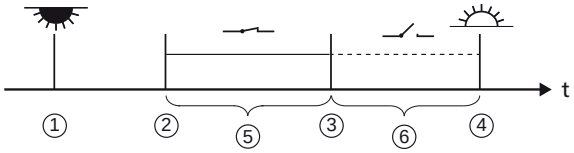
! NOTICE!

The daylight function relates to the time of dawn, but the resulting switching time lies before dawn, i.e. in the past. For this reason, the controller must have performed at least one night-day changeover before the daylight function can be executed. After this, the controller continuously adjusts the time of dawn to suit any changes (weather, annual changes to the length of the day, disconnection/covering of the solar module).

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Morning light'*



① Dusk
② Switch-on time
③ Switch-off time
④ Dawn
⑤ *'Switch-on duration'*
⑥ *'Switch-off delay'*

9.3.5 Excess energy control

The excess energy control switches the output on as long as the battery has a high state of charge [1)]. The excess energy control is suitable for non time-critical loads that can be specifically switched on when a surplus of energy is available, e.g. electric water heating, pumping station for filling an elevated water tank.

[1)] Value in volts with voltage control and in percent with SOC control.

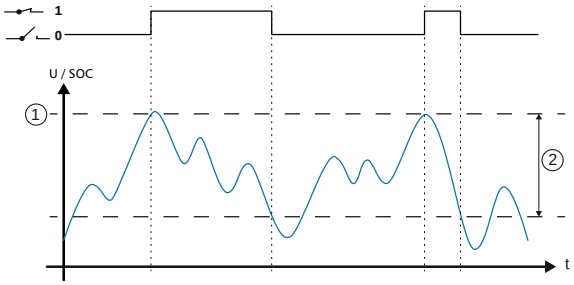
Switching behaviour

The output is switched on when the starting threshold is reached ① (Fig. below) and is switched off when the charge state is less than the starting threshold minus the hysteresis value ②.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Excess energy control'*



① *'Starting threshold'*
② *'Hysteresis'*

9.3.6 Generator control

The generator control switches the output on as long as the battery has a low state of charge [1]. The generator control is suitable for a generator that is switched on when the battery is at a low state of charge.

[1] Value in volts with voltage control and in percent with SOC control.

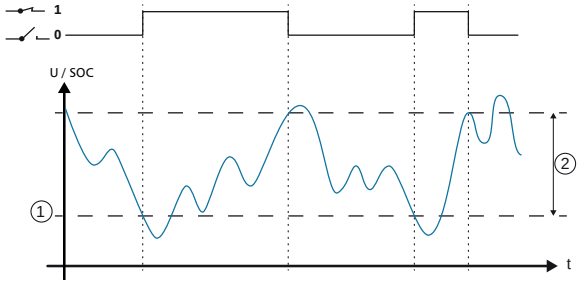
Switching behaviour

The output is switched on when the charge state falls below the starting threshold ① (Fig. below) and is switched off when the charge state reaches the starting threshold plus the hysteresis value ②.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Excess energy control'*



① *'Starting threshold'*
② *'Hysteresis'*

9.3.7 Timer 1 to 4

The timers can be used to switch the outputs on and off at specific times in a weekly cycle. The switch-on and switch-off times for each weekday can be separately defined for each timer.

Switching behaviour

The weekdays for the on and off switching times are set independently; which means that the duration of an on or off time can stretch over several days.

Operation

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Select function'*

✓*'Main menu ➔ Settings AUX 1/2/3 ➔ <Output> ➔ Function settings ➔ Timer 1/..2/..3/..4'*

10 Troubleshooting

1. *Chapter 10.1 'Factory settings' on page 111*
2. *Chapter 10.2 'Event messages' on page 111*
3. *Chapter 10.3 'Errors without event messages' on page 118*

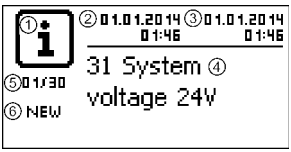
10.1 Factory settings

▶For information on the factory setting function, see *Chapter 8.12 'Factory settings' on page 99*.

✓*'Main menu* ➔ *System settings* ➔ *Factory reset '*

10.2 Event messages

10.2.1 Indicator on the display



① Symbol for the type of event message: Information, Warning, Error.
② Date/time when the event occurred.
③ Date/time at which the cause of the event message was eliminated (date/time), or ACTIVE if the cause of the event message is still present.
④ Message text with error number.
⑤ Counter: Number of the displayed event message / Total number of event messages; max. number of all event messages = 30
⑥ NEW indicates that the event messages has not yet been confirmed.

10.2.2 Function

Errors detected by the controller are indicated via event messages. Warning and Error events cause the display to blink red. The list of event messages in *Chapter 10.2.4 'List of event messages' on page 112* contains information on troubleshooting and fault correction.

Information event type (symbol ⓘ): A state or error exists that does not impair the functioning of the device.

Warning event type (symbol ⚠): An error exists that restricts or falsely executes the device functions.

Error event type (symbol ⊗): A serious error has occurred, due to which the correct functioning of the device cannot be guaranteed.

New event messages are displayed immediately. The messages disappear after they have been confirmed or their cause(s) have been corrected. The presence of messages whose cause has been corrected but have not yet been confirmed is indicated in the status display information bar (symbol ✉).

If an already confirmed error recurs then it is displayed again.

10.2.3 Operation

Confirming event messages

✓ A new event message is displayed with the comment NEW.

Press ESC/Δ, ∇. The event message is confirmed.

Displaying event messages

✓*'Main menu ➔ Event log'*

Press Δ, ∇ to page through the event messages.

Clearing the event log

NOTICE!

All event messages are cleared.

✓*'Main menu ➔ System settings ➔ Clear event log'*

1. Press SET. Fig. 16 appears.
2. Press SET for 1 s to clear the event log.

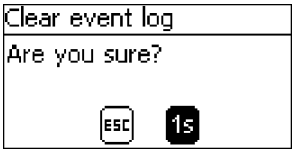


Fig. 16: Clear event log dialogue

10.2.4 List of event messages

DANGER!

When correcting errors, observe the safety instructions in *Chapter 4.1 'Safety instructions' on page 23*.

Event message			Cause	Remedy
Type	No.	Text		
Error	2, 19, 20	Internal error	Internal system error	Switch the device off and then on again. Contact the Steca Service department if the error persists.
Warning	26	Undefined system voltage	The automatically detected system voltage cannot be matched to any of the voltages 12 V/ 24 V/ 48 V.	Take the following measures: 1. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again. If using both string inputs then switch off both DC load circuit breakers. 2. Determine the rated voltage of the system. 3. Check the following points: – Is the manually set system voltage the same as the actual rated voltage of the system? Correct if necessary! – Does the battery voltage lie within the range of the rated voltage of the system? If necessary, charge the battery with an external charger.
Info	29	RTC not set	The time and date are not set.	Set the time and date.

Event message			Cause	Remedy
Type	**No.**	**Text**		
Info	31	`System voltage xx V`	The controller has recognised the system voltage *xx V* (battery voltage).	The message is displayed after the battery has been connected. The message is displayed after changing the battery parameters. Check the following points: ■ Check that the charging parameters are correct for the battery being used. Correct if necessary! ■ Does the recognised system voltage correspond to the actual nominal voltage range of the battery? If necessary, adjust the system voltage via the Expert menu. **Notice:** ■ For the lead-acid and lead-gel/AGM battery types, the limits and base values of the charging parameters and the deep discharge protection, generator control, and excess energy control functions are determined based on the detected system voltage. ■ For the Li-Ion or NiCd battery types in the MPPT 6000-M, the limits and base values of the charging parameters and the deep discharge protection, generator control, and excess energy control functions are determined based on the configured number of cells and cell voltage. ■ In a master/slave system using the StecaLink bus, the MPPT 6000-M functioning as the master transmits the system voltage to the MPPT 6000-S member devices. This value is used even when the slave devices have possibly detected a different system voltage.

Event message			Cause	Remedy
Type	No.	Text		
Warning	33	MinMax out of range	Invalid parameter setting detected. The setting lies outside the range defined for the device. Max./Min. errors can occur when the setting ranges of the master and slave differ due to different software versions. The error is triggered when transferring settings from the master to the slave if the setting from the master lies outside the valid setting range for the slave. This error can also occur when different parameter files have been used for updating the devices (M/S).	Execute the Factory reset function. Notify the Service department if the error persists and perform a software update if necessary.
Warning	45	Ext. temp. sense open	An open-circuit exists in the external temperature sensor cable.	Check the following points: ■ External temperature sensor cable correctly connected to the controller? ■ Cable open-circuit? ■ External temperature sensor damaged?
Warning	46	Ext. temp. sense short	A short-circuit exists in the external temperature sensor cable.	Check the following points: ■ External temperature sensor cable correctly connected to the controller? ■ Short circuit in connecting cable? ■ External temperature sensor damaged?
Warning	53	NTC ambient open	Failure of the device-internal temperature measuring position used for determining the ambient temperature of the battery.	Switch off the temperature compensation (Expert menu). Contact the Steca Service department.
Warning	54	NTC ambient short	Failure of the device-internal temperature measuring position used for determining the ambient temperature of the battery.	Switch off the temperature compensation (Expert menu). Contact the Steca Service department.

Event message			Cause	Remedy
Type	No.	Text		
Warning	55	Bat. sense open	The line compensation has been manually switched on but the controller has not detected a battery voltage.	Check the following points: ■ Battery voltage sensor cable correctly connected? ■ Open-circuit in sensor cable? ■ Sensor cable fuse/breaker blown/triggered?
Warning	56	Bat. sense wrong polarity	The battery voltage sensor cable has been connected with the incorrect polarity.	Connect the battery voltage sensor cable with the correct polarity.
Warning	57	Ext. Bat. sense short	A short-circuit exists in the battery voltage sensor cable.	Check the following points: ■ Battery voltage sensor cable correctly connected? ■ Short-circuit in sensor cable?
Warning	58	PV 1 wrong polarity	The module at connection M1 is connected with the wrong polarity.	Take the following measures: 1. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again. With 2 solar modules, switch off both DC load circuit breakers. 2. Disconnect module 1. 3. Check the polarity. 4. Connect module 1 with the correct polarity.
Warning	59	PV 2 wrong polarity	The module at connection M2 is connected with the wrong polarity.	Take the following measures: 1. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again. With 2 solar modules, switch off both DC load circuit breakers. 2. Disconnect module 2. 3. Check the polarity. 4. Connect module 2 with the correct polarity.
Error	70	PV 1 voltage too high	The module voltage at connection M1 (solar module 1) is too high.	Check the installation and design.
Error	71	PV 2 voltage too high	The module voltage at connection M2 (solar module 2) is too high.	Check the installation and design.

Event message			Cause	Remedy
Type	No.	Text		
Warning	79	PA HS400 communication failed	The MPPT 6000-M can no longer access one or more previously recognised PA HS400 devices. The connection to the PA HS400 might have been interrupted.	Check the StecaLink bus cables. Check the address setting at the PA HS400, restart the PA HS400 if necessary. Check the StecaLink bus termination and plug in a termination plug if necessary.
Warning	79	79 MPPT slave communication failed	The MPPT 6000-M can no longer access one or more previously recognised MPPT 6000-S devices. The connection might have been interrupted.	Check the StecaLink bus cables. Check the address setting at the MPPT 6000-S, restart the MPPT 6000-S if necessary. Check the StecaLink bus termination and plug in a termination plug if necessary.
Warning	79	79 Tarom 4545 communication failed	The MPPT 6000-M can no longer access one or more previously recognised Tarom 4545 devices. The connection to the Tarom 4545 might have been interrupted.	Check the StecaLink bus cables. Check the address setting at the Tarom 4545, restart the Tarom 4545 if necessary. Check the StecaLink bus termination and plug in a termination plug if necessary.
Warning	84	Check voltage settings	The automatically detected system voltage does not agree with the manually set system voltage.	Take the following measures: 1. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again. With 2 solar modules, switch off both DC load circuit breakers. 2. Determine the rated voltage of the system. 3. Check the following points: – Is the manually set system voltage the same as the actual rated voltage of the system? Correct if necessary! – Does the battery voltage lie within the range of the rated voltage of the system? If necessary, charge the battery with an external charger.

Event message			Cause	Remedy
Type	No.	Text		
Info	-	Gateway active	Gateway function active on the StecaLink bus.	A StecaLink communication device is directly accessing the power unit data. If this function was not intentionally triggered then disconnect the device from the StecaLink bus, switch it off and on and then reconnect it to the bus.
Info	-	No SD card	MicroSD not present or not recognised.	Correctly insert the SD card. Format the SD card with a FAT16 file system, check for correct functioning of the SD card on a PC.
Info	-	SD card full	No more parameter/data files can be stored on the microSD card.	Create free space on the SD card by deleting old files or insert a new empty SD card. Format the SD card with the FAT16 file system.
Info	-	Settings incompatible	Incompatible settings are present, the contents of the Master.ini parameter file are not compatible with the valid setting ranges of the device.	Save the parameter file of the device onto the microSD card.
Info	-	File not found	Master.ini parameter file could not be found on the microSD card. The parameter file could not be loaded.	Save the parameter file on the SD card again.

10.3 Errors without event messages

The causes of the following errors cannot be controlled by the device. Therefore the device does not display an event message when one of these errors occurs.

Error	Possible cause	Solution
No display.	Battery voltage too low.	Pre-charge the battery.
	External fuse/circuit breaker for the battery has blown/triggered.	Replace the external battery fuse for the battery or reset the circuit breaker.
	Battery is not connected.	1. Unclamp all connections.
	Battery is defective.	2. Connect a (new) battery with the correct polarity. 3. Reconnect the solar module and loads.

Error	Possible cause	Solution
	The LCD is mechanically defective.	Contact your installer. The device must be replaced.
Display readability temporarily impaired.	Ambient temperature lies outside the permissible range. This can cause discolouration of the display or noticeably sluggish display response times.	Ensure a permissible ambient temperature according to the technical data.
	Poor contrast setting.	Adjust the contrast setting.
Load(s) controlled via AUX 1/2/3 cannot be operated or can only be briefly operated.	The deep-discharge protection has switched off the load(s) via an AUX output as a result of excessively low battery voltage.	Charge the battery.
Battery is not being charged.	Solar module not connected.	Connect the solar module.
	Short circuit at solar module connection.	Rectify short circuit.
	Incorrect solar module voltage.	Use a solar module of a suitable voltage. **Notice** The module voltage must be a factor of 1.15 times larger than the current battery voltage in order to charge the battery.
	Solar module defective.	Replace the solar module.
	System consumption higher than the recharging rate.	Reduce consumption.
	Battery fully charged.	Charge controller stops charging.
	The device is not switched on.	Switch on the device via *'Main menu ➔ Device On/Off'*.
	The AUX IO control switches charging off.	Check the settings and use of the AUX IO function.
The charging power, charging current and battery voltage remain low, despite good solar irradiation and correct installation of the solar module and battery.	Controller possibly defective.	Contact your installer.
Battery voltage very low.	■ Battery excessively discharged by loads (deep-discharge protection not installed). ■ Battery is defective.	■ Charge the battery with an external charger. ■ Replace the battery.

Error	Possible cause	Solution
Battery voltage is significantly greater than the nominal system voltage.	Additional charging sources in the system may be causing an excessively high voltage.	Check the external charging devices and adjust if necessary.
	Controller possibly defective.	Contact your installer.

11 Maintenance, dismounting and disposal

Topics

11.1 Maintenance of the controller

The controller is basically maintenance-free. Despite this, it is a good idea to regularly check that the cooling ribs on the rear side of the device are free of dust. Clean the inverter when necessary as described below.

CAUTION!

Danger of damage to components

- Do not allow cleaning agents or objects to enter the inside of the controller from the front.
- Do not use especially the following cleaning agents:
  - solvent-based cleaning agents,
  - disinfectants and/or
  - coarse, abrasive or sharp-edged cleaning agents.

11.1.1 Removing dust

Dust should be removed using compressed air (max. 2 bar).

11.1.2 Removing heavy soiling

DANGER!

Risk of death by electrocution!

- Switch off the solar module and battery before cleaning, as described in *Chapter 11.3 'Dismounting the controller' on page 122*.
- Use cleaning agents only with a slightly damp cloth.

Remove heavy soiling with a slightly damp cloth (use clear water). If necessary, use a 2 % hard soap solution instead of water. After cleaning, remove any soap residue using a slightly damp cloth.

11.2 System maintenance

We recommend checking all system components at least once a year, according to the manufacturer's specifications. The following maintenance work is generally recommended:

- Check the cable strain relief.
- Check that all cable connections are secure.

DANGER!

Risk of death by electrocution. Only technical professionals are permitted to remove the terminal cover.

– Tighten screws if necessary.
– Check all contacts for signs of corrosion.
– Check the acid levels in the battery according to the manufacturer's specifications.

11.3 Dismounting the controller

DANGER!

Risk of death by electrocution. Only technical professionals may perform the work described in this section. Observe the safety notices in *Chapter 4.1 'Safety instructions' on page 23*.

WARNING!

Danger from hot surfaces. Allow the heatsink on the rear of the device to cool down before touching.

Switch all cables free of voltage and remove the terminal cover.

1. Switch off the DC load circuit breaker (solar module) and secure it against being switched on again. With 2 solar modules, switch off both DC load circuit breakers.
2. Switch off the external battery fuse: Remove the fuse insert from the fuse holder (safety fuse) or switch off the DC line circuit breaker and secure it against being switched on again.
3. Remove the terminal cover.

Disconnect the solar module from the controller

Disconnect module cables "M1−"/"M1+" and if present "M2−"/"M2+" from the controller and insulate the cable ends.

Disconnect the battery from the controller

Disconnect the battery cables "B−" and "B+" from the controller and insulate the cable ends.

Disconnect the PE cable from the controller

Disconnect the PE cable from the controller.

Finish dismounting

1. If present, disconnect any remaining components from the controller.
   - Battery voltage sensor cable: First disconnect the cable from the battery and then from the controller.
   - External battery temperature sensor: Disconnecting this from the controller only is sufficient.
2. Remove the controller from the mounting surface.

11.4 Disposal of the controller

Do not dispose of the device in the normal household waste! Dispose of the device at the collection point provided for this in your country or send the device at the end of its service life to Steca customer service with a note stating "For disposal".

The device packaging consists of recyclable materials.

12 Technical data

Topics

12.1 Controller

NOTICE!

The respective values for system voltages of 12 V, 24 V, 36 V, 48 V and 60 V are separated with a "/" character in the following text.

Technical data at 25 °C / 77 °F

Characterisation of the operating behaviour	MPPT 6000-M/MPPT 6000-S
Supply voltage for operation (battery voltage)	
Minimum	9.5 VDC
Maximum	80.0 VDC
System voltage range	12 V/24 V/48 V (automatic detection)
	36 V/60 V (manually set)
System voltage setting	
Factory setting	Automatic
Setting range	Automatic/12 V/24 V/36 V/48 V/60 V
String connection	
Factory setting	Separated
Setting range	Separated/Parallel
Total rated output	900 W/1800 W/3600 W; [at battery voltages of 15 V, 30 V, 60 V]

Characterisation of the operating behaviour	MPPT 6000-M/MPPT 6000-S
Dynamic MPP efficiency	99.8 %
Max. DC/DC efficiency	99.4 % (UBatt=48 V; UIn=70 V;P=0.65*Pnom)
Own consumption	In operation: 2 W; Standby: < 1 W

DC input side	
Max. input voltage [1)]	150 V/180 V [4)]
Module current [1)]	2 x 30 A/1 x 60 A [4)]
MPP voltage/string	> 1.15 x U bat to 180 V [4)]
Open circuit solar module/string voltage	180 V/200 V (at minimum operating temperature) [4)]

DC output side	
Max. charging current	60 A

Charge parameters	
Battery capacity	
Factory setting	100 Ah
Setting range	30 Ah … 50,000 Ah
System current limit	(MPPT 6000-M only)
Factory setting	Off | 1605.0 A
Setting range	Off/On | 5.0 A … 1605.0 A
Maximum device current	
Factory setting	60.0 A
Setting range	5.0 A … 60.0 A
Battery type	
Factory setting:	Lead acid
Setting range	Lead acid/Lead Gel/AGM (MPPT 6000-M and MPPT 6000-S) Li-Ion/NiCd (MPPT 6000-M only)

Lead acid/Lead Gel/AGM settings	
Float charge completion of charging voltage for battery type: Lead acid/Lead Gel/AGM	
Factory setting	14.1 VDC/28.2 VDC/42.3 VDC/56.4 VDC/70.5 VDC
Setting range	12.6 VDC ... 14.4 VDC/25.2 VDC ... 28.8 VDC/ 37.8 VDC ... 43.2 VDC/50.4 VDC ... 57.6 VDC/ 63.0 VDC ... 72.0 VDC
Boost charge switch-on threshold for battery type: Lead acid/Lead Gel/AGM	SOC (MPPT 6000-M only) | Voltage control
Factory setting	70 % | 12.7 V/25.4 V/38.1 V/50.8 V/63.5 V
Setting range	40 % ... 70 % | 11.4 VDC ... 12.7 VDC/22.8 VDC ... 25.4 VDC/34.2 VDC ... 38.1 VDC/45.6 VDC ... 50.8 VDC/57.0 VDC ... 63.5 VDC
Boost charge completion of charging voltage for battery type: Lead acid/Lead Gel/AGM	
Factory setting	14.4 VDC/28.8 VDC/43.2 VDC/57.6 VDC/ 72.0 VDC
Setting range	13.2 VDC ... 15.6 VDC/26.4 VDC ... 31.2 VDC/ 39.6 VDC ... 46.8 VDC/52.8 VDC ... 62.4 VDC/ 66.0 VDC ... 78.0 VDC
Boost charge duration for battery type: Lead acid/Lead Gel/AGM	
Factory setting	120 min
Setting range	0 min ... 300 min
Equalise charging switch-on threshold for battery type: Lead acid/Lead Gel/AGM	SOC (MPPT 6000-M only) | Voltage control
Factory setting	40 % | 12.2 V/24.4 V/36.6 V/48.8 V/61.0 V
Setting range	10 % ... 60 % | 10.8 VDC ... 12.6 VDC/21.6 VDC ... 25.2 VDC/32.4 VDC ... 37.8 VDC/43.2 VDC ... 50.4 VDC/54.0 VDC ... 63.0 VDC
Equalise charging completion of charging voltage for battery type: Lead acid	
Factory setting	15.0 VDC/30.0 VDC/45.0 VDC/60.0 VDC/75.0 VDC
Setting range	13.8 VDC ... 15.9 VDC/27.6 VDC ... 31.8 VDC/ 41.4 VDC ... 47.7 VDC/55.2 VDC ... 63.6 VDC/ 69.0 VDC ... 79.5 VDC
Duration of equalise charging for battery type: Lead acid	
Factory setting	240 min

Lead acid/Lead Gel/AGM settings	
Setting range	0 min ... 300 min
Equalisation cycle for battery type: Lead acid	
Factory setting	On | 30 days
Setting range	On/Off | 1 … 185 days
Control mode for battery type: Lead acid/Lead Gel/AGM	(MPPT 6000-M only, MPPT 6000-S permanently set to voltage control)
Factory setting	SOC
Setting range	SOC/Voltage control
Temperature compensation for battery type: Lead acid/Lead Gel/AGM	
Factory setting	On| Internal | -4.0 mV/cell/K/cell
Setting range	On/Off | internal/external | -8.0 … 0.0 mV/cell/K/cell
IUIA charge mode for battery type: Lead acid/Lead Gel/AGM	(MPPT 6000-M only)
Factory setting	Off | Cycle: 6 months
Setting range	On/Off | Cycle: 1 … 6 months
Cable compensation	
Factory setting	Off
Setting range	On/Off

Li-Ion battery settings	(MPPT 6000-M only)
Number of cells	
Factory setting	7 cells
Setting range	2 … 20 cells
Cell voltage	
Factory setting	3.7 V/cell
Setting range	1.5 V/cell… 6.0 V/cell
Charge cut-off voltage	
Factory setting	4.20 V/cell
Setting range	2.00 V/cell… 7.00 V/cell
Charge activation	

Li-Ion battery settings	(MPPT 6000-M only)
Factory setting	4.00 V/cell
Setting range	1.50 V/cell… 7.00 V/cell
Charge duration	
Factory setting	60 min
Setting range	30 min … 120 min
Temperature range	
Factory setting	Min: 0 °C | Max. 60 °C
Setting range	Min: -20 °C … +10 °C | Max : +40 °C … +80 °C
Battery temperature sensor	
Factory setting	Internal
Setting range	Internal/External
Cable compensation	
Factory setting	Off
Setting range	On/Off

NiCd battery settings	(MPPT 6000-M only)
Upper charge voltage U1	
Factory setting	1.50 V/cell
Setting range	1.35 V/cell… 1.80 V/cell
Limit for charge volt. U1	
Factory setting	1.65 V/cell
Setting range	1.5 V/cell… 2.0 V/cell
Lower DOD limit	
Factory setting	0.05
Setting range	0.00 … 0.20
U1 factor per DOD	
Factory setting	5 mV
Setting range	0 mV … 20 mV
Temp. factor U1 (>0 °C)	
Factory setting	0.0 mV/cell/K/cell
Setting range	-6.0 mV/cell/K/cell … 0.0 mV/cell/K/cell

NiCd battery settings	(MPPT 6000-M only)
Temp. factor U1 (>0 °C)	
Factory setting	-2.5 mV/cell/K/cell
Setting range	-6.0 mV/cell/K/cell … 0.0 mV/cell/K/cell
Fixed DOD value	
Factory setting	0.00
Setting range	0.00 … 1.00
U1 tolerance for timer	
Factory setting	50 mV
Setting range	0 mV … 100 mV
Charging time U1	
Factory setting	50 min
Setting range	0 min … 600 min
DOD level charge reset	
Factory setting	0.02
Setting range	0.00 … 0.10
Lower charge voltage U2	
Factory setting	1.50 V/cell
Setting range	1.35 V/cell… 1.60 V/cell
Temp. factor U2 (>0 °C)	
Factory setting	0.0 mV/cell/K/cell
Setting range	-6.0 mV/cell/K/cell … 0.0 mV/cell/K/cell
Temp. factor U2 (<0 °C)	
Factory setting	-2.5 mV/cell/K/cell
Setting range	-6.0 mV/cell/K/cell … 0.0 mV/cell/K/cell
Number of NiCd cells	
Factory setting	7 cells
Setting range	6 … 50 cells
U2 U1 switch	
Factory setting	1.0 V/cell
Setting range	1.0 V/cell… 1.8 V/cell

NiCd battery settings	(MPPT 6000-M only)
Temperature compensation for battery type: NiCd	
Factory setting	On | Internal
Setting range	On/Off | Internal/External
Cable compensation	
Factory setting	Off
Setting range	On/Off

Configurable auxiliary contacts AUX 1–3	(MPPT 6000-M only)
Contact	Normally open contact (NO), potential-free, 100 x 10^3 switching operations
Plug	2-pin Phoenix Contact RM3.81, Type: MC 1.5/2-ST-3.81; (fine strand) 0.14 mm^2 -1.5 mm^2 - AWG 28 - 16
Switchable voltage for resistive loads	30 VDC@1.0 A/60 VDC@0.3 A
Operating mode AUX 1…3	
Factory setting	Off
Setting range	Off/On/Function
Deep-discharge protection disconnection threshold for battery type: Lead acid/Lead Gel/AGM	SOC | Voltage control
Factory setting	20 % | 11.4 VDC/22.8 VDC/34.2 VDC/45.6 VDC/ 57.0 VDC
Setting range	10 % ... 70 % | 9.6 VDC … 12.6 VDC/19.2 VDC … 25.2 VDC/28.8 VDC … 37.8 VDC/38.4 VDC … 50.4 VDC/48.0 VDC … 63.0 VDC
Reconnection hysteresis for battery type: Lead acid/Lead Gel/AGM	SOC | Voltage control
Factory setting	20 % | 1.8 VDC/3.6 VDC/5.4 VDC/7.2 VDC/9.0 VDC
Setting range	5 % … 70 % | 0.2 VDC ... 3.0 VDC/0.5 VDC … 6.0 VDC/0.7 VDC … 9.0 VDC/1.0 VDC … 12.0 VDC/1.2 VDC … 15 VDC
Deep-discharge protection disconnection threshold for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	3.2 V/ cell [22.4 VDC with number of cells = 7]
Setting range	0.5 V/cell… 6.0 V/cell

Configurable auxiliary contacts AUX 1–3	(MPPT 6000-M only)
Reconnection hysteresis for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.5 V/cell [3.5 VDC with number of cells = 7]
Setting range	0.1 VDC … 1.1 V/cell
Deep-discharge protection disconnection threshold for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	1.157 V/cell [8.1 VDC with number of cells = 7]
Setting range	1.0 V/cell… 1.4 V/cell
Reconnection hysteresis for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.057 V/cell [0.4 VDC with number of cells = 7]
Setting range	0.1 VDC … 0.5 V/cell
Generator control starting threshold for battery type: Lead acid/Lead Gel/AGM	SOC | Voltage control
Factory setting	50 % | 12.0 VDC/24.0 VDC/36.0 VDC/48.0 VDC/ 60.0 VDC
Setting range	10 % … 90 % | 9.6 VDC … 13.8 VDC/19.2 VDC … 27.6 VDC/28.8 VDC … 41.4 VDC/38.4 VDC … 55.2 VDC/48.0 VDC … 69.0 VDC
Generator control hysteresis for battery type: Lead acid/Lead Gel/AGM	SOC | Voltage control
Factory setting	10 % | 1.5 VDC/3.0 VDC/4.5 VDC/6.0 VDC/7.5 VDC
Setting range	5 % … 90 % | 0.3 VDC … 3.0 VDC/0.6 VDC … 6.0 VDC/0.9 VDC … 9.0 VDC/1.2 VDC … 12.0 VDC/1.5 VDC … 15.0 VDC
Generator control starting threshold for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	3.7 V/cell [25.9 VDC with number of cells = 7]
Setting range	0.5 V/cell… 6.0 V/cell
Generator control hysteresis for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.3 V/cell [2.1 VDC with number of cells = 7]
Setting range	0.1 VDC … 1.5 V/cell

Configurable auxiliary contacts AUX 1–3	(MPPT 6000-M only)
Generator control starting threshold for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	1.2 V/cell [8.4 VDC with number of cells = 7]
Setting range	1.0 V/cell… 1.7 V/cell
Generator control hysteresis for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.057 V/cell [0.4 VDC with number of cells = 7]
Setting range	0.1 VDC … 0.5 V/cell
Excess energy control starting threshold for battery type: Lead acid, Lead Gel/AGM	SOC | Voltage control
Factory setting	90 % | 13.8 VDC/27.6 VDC/41.4 VDC/55.2 VDC/ 69.0 VDC
Setting range	30 % … 100 % | 12.0 VDC … 15.6 VDC/24.0 VDC … 31.2 VDC/36.0 VDC … 46.8 VDC/48.0 VDC … 62.4 VDC/60.0 VDC … 78.0 VDC
Excess energy control hysteresis for battery type: Lead acid, Lead Gel/AGM	SOC | Voltage control
Factory setting	10 % | 0.9 VDC/1.8 VDC/2.7 VDC/3.6 VDC/4.5 VDC
Setting range	5 % … 70 % | 0.3 VDC … 3.0 VDC/0.5 VDC … 6.0 VDC/0.8 VDC … 9.0 VDC/1.0 VDC … 12.0 VDC/1.3 VDC … 15.0 VDC
Excess energy control starting threshold for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	4.1 V/cell [28.7 VDC with number of cells = 7]
Setting range	0.5 V/cell… 7.0 V/cell
Excess energy control hysteresis for battery type: Li-Ion	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.3 V/cell [2.1 VDC with number of cells = 7]
Setting range	0.1 VDC … 1.5 V/cell
Excess energy control starting threshold for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	1.6 V/cell [11.2 VDC with number of cells = 7]
Setting range	1.0 V/cell… 1.7 V/cell

Configurable auxiliary contacts AUX 1–3	(MPPT 6000-M only)
Excess energy control hysteresis for battery type: NiCd	Value range depends on the number of cells. Setting as total battery voltage.
Factory setting	0.057 V/cell [0.4 VDC with number of cells = 7]
Setting range	0.1 VDC … 0.5 V/cell
Timer 1–4	
Factory setting	Day: none | Switch-off time 00:00 | Switch-on time 00:00
Setting range	Day: MON … SUN | Switch-on time 00:00 … 23:59 | Switch-off time 00:00 … 23:59
Evening light	
Factory setting	Switch-on delay 00:00 | Switch-on duration 00:01
Setting range	Switch-on delay 00:00 … 12:00 | Switch-on duration 00:00 … 16:00
Night light	
Factory setting	Switch-on delay 00:00 | Switch-off delay 00:00
Setting range	Switch-on delay 00:00 … 12:00 | Switch-off delay 00:00 … 16:00
Morning light	
Factory setting	Switch-on duration 00:01 | Switch-off duration 00:00
Setting range	Switch-on duration 00:00 … 16:00 | Switch-off delay 00:00 … 12:00

AUX IO	(MPPT 6000-M only)
Plug	3-pin Phoenix Contact RM3.81, Type: MC 1.5/3-ST-3.81; (fine strand) 0.14 mm^2 -1.5 mm^2 - AWG 28 - 16
Permissible external signal voltage	5.0 VDC … 24 VDC
Current consumption from external signal voltage	0.5 mA … 3.0 mA
Required external normally-open contact rating	Min. 15.0 VDC; max. 5.0 mA
Mode AUX IO	
Factory setting	Ext. switch on
Setting range	Ext. voltage on | Ext. voltage off | Ext. switch on | Ext. switch off

SD card	(MPPT 6000-M only)
Type	MicroSD, microSDHC; max. 8 GB
Formatting	FAT 16, FAT 32
Data logger	
Factory setting	Off
Setting range	On/Off
Data format	*.csv
Directory structure	:\\LOG\YYYY\MM\DD*.csv
Parameters	
Functions	Load/Save
File name	Master.ini
Directory structure	:\\SETTINGS\Master.ini

UART	(MPPT 6000-M only)
RS-232 interface	
Factory setting	On
Setting range	On/Off
Plug	3-pin Phoenix Contact RM3.81, Type: MC 1.5/3-ST-3.81; (fine strand) 0.14 mm^2 -1.5 mm^2 - AWG 28 - 16
Signal levels	+5V/0V/-5V
Parameters	Baud: 4800, Bits: 8 , Parity: n, Stop bits: 1
Output interval	60 s, +/- 1 s

Device control	
Device On/Off	(MPPT 6000-M only)
Factory setting	Off
Setting range	Off/On/Remote
Device On/Off	(MPPT 6000-S only)
Factory setting	Off
Setting range	Off/On/Redundancy

Internal data logger	
Energy input recording	Last 18h | 30 Days | 12 Months | 20 Years | Total
Energy output recording (MPPT 6000-M only)	Last 18h | 30 Days | 12 Months | 20 Years | Total
Recording of max./min. values	Minimum battery voltage | 30 days
	Maximum battery voltage | 30 days
	Maximum device charge current | 30 days
	Maximum device PV 1 voltage| 30 days
	Maximum device PV 2 voltage| 30 days
Internal event log	
Scope of event log	30 messages

System	
Language	
Factory setting	English
Setting range	English/German/French/Italian/Spanish/ Portuguese [2)]
Time and date	
RTC data retention	4 days
Time setting	00:00 … 23:59 | 01:00 AM … 12:59 PM
Date setting	01.01.2010 … 31.12.2079
Time format setting	12 h | 24 h
Date format setting	YYYY-MM-TT | TT.MM.YYYY | MM/TT/YYYY
Display settings	
Contrast	
Factory setting	50 %
Setting range	0 % to 100%
Backlighting	
Factory setting	Automatic
Setting range	Off | Automatic | Power mode
StecaLink slave address	
Factory setting	1

System	
Setting range	1 … 99
Acoustic alarm	
Factory setting	On
Setting range	On/Off

System information	
Product name	MPPT 6000 (MPPT 6000-M)
	MPPT 6000 (MPPT 6000-S)
Serial number	Steca part number (6 digits), Steca RM number (8 digits), consecutive number (4 digits)
PU version	
APP	Software version of the application
FBL	Software version of the bootloader
BFAPI	Software version of the memory module
HW	Hardware version of the power unit
SYS version	
BFAPI	Software version of the memory module
FBL	Software version of the bootloader
APP	Software version of the application
PAR	Version of the parameter file
HW	Hardware version of the control unit
StecaLink slave address	
Factory setting	1
Operating instructions	Z01 [3)]

Application conditions	
Ambient temperature	-25 °C ... +50 °C
Derating	From >65 °C internal
Fan	Internal, temperature controlled
Degree of protection	IP 31

Equipment and design	
Connection terminals "M1+/-"; "M2+/-"; "B+/-"; "PE"	35 mm^2/AWG 2
Dimensions (X x Y x Z)	295 x 335 x 125 mm
Weight	6.3 kg
Display	
Type	S/W graphical display with backlighting
Resolution	128 x 64 pixels

Accessories	
PA TS-S	
Type	5 kOhm +/- 2 % NTC
Cable length	2.8 m cable
Plug	2-pin Phoenix Contact RM3.81, Type: MC 1.5/2-ST-3.81
Termination plug	RJ45, 120 Ohm
Battery voltage sensor cable connection	
Plug	2-pin Phoenix Contact RM3.81, Type: MC 1.5/2-ST-3.81

Recommended external battery fuse per PPT	
Fuse rating	63 A DC, slow-blow
Recommended external fuse for battery voltage sensor cable	
Fuse rating	E.g. 0.75 mm^2, 1 A; select a fuse rating appropriate for the wire cross-section used.

[1] Solar module performance data is temperature-dependent. Note the following regarding the maximum input voltage when selecting the solar module: At temperatures <25 °C the open-circuit module voltage is higher than the value specified on the type plate.

[2] The scope of language versions may vary with the software version and device variant.

[3] Subject to change without notice.

[4] From software version PU-APP 1.2.0. onwards.

! NOTICE!

Technical data that varies from the above is given on a device label. Subject to change without notice.

12.2 Connection cable

Notice

The cable cross-section can be calculated using the following formula:

$A = 0.0175 \times L \times P/(f_k \times U^2)$

A = Cable cross-section in mm^2

0.0175 = Specific electrical resistance of copper [Ohms x mm^2/m]

L = Cable length (plus wire + minus wire) in m

P = Power conducted by the cable, in W

f_k= Power loss factor (generally 1.5 %) = 0.015

U = Voltage, in V

12 V system Total MPPT power max. 900 W

		Power per PV string connection at MPPT 6000-M/-S			
		100 W		200 W	
		Total cable length ("M+" and "M−") in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	30 V	10 mm^2 AWG 7	2.5 mm^2 AWG 13	16 mm^2 AWG 5	6 mm^2 AWG 10
	50 V	4 mm^2 AWG 11	1.5 mm^2 AWG 15	6 mm^2 AWG 10	2.5 mm^2 AWG 13
	80 V	1.5 mm^2 AWG 15	1.5 mm^2 AWG 15	1.5 mm^2 AWG 15	1.5 mm^2 AWG 15

12 V system Total MPPT power max. 900 W

		Power per PV string connection at MPPT 6000-M/-S			
		300 W		450 W	
		Total cable length (M+ and M−) in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	30 V	25 mm^2 AWG 3	10 mm^2 AWG 7	35 mm^2 AWG 2	16 mm^2 AWG 5
	50 V	10 mm^2 AWG 7	4 mm^2 AWG 11	16 mm^2 AWG 5	4 mm^2 AWG 11
	80 V	4 mm^2 AWG 11	1.5 mm^2 AWG 15	6 mm^2 AWG 10	1.5 mm^2 AWG 15

24 V system Total MPPT power max. 1800 W

		Power per PV string connection at MPPT 6000-M/-S			
		500 W		600 W	
		Total cable length ("M+" and "M−") in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	50 V	16 ^{2}mm AWG 5	6 mm^2 AWG 10	16 mm^2 AWG 5	6 mm^2 AWG 10
	80 V	6 mm^2 AWG 10	2.5 mm^2 AWG 13	6 mm^2 AWG 10	2.5 mm^2 AWG 13
	100 V	4 mm^2 AWG 11	1.5 mm^2 AWG 15	6 mm^2 AWG 10	1.5 mm^2 AWG 15
	120 V	2.5 mm^2 AWG 13	1.5 mm^2 AWG 15	4 mm^2 AWG 11	1.5 mm^2 AWG 15

24 V system Total MPPT power max. 1800 W

		Power per PV string connection at MPPT 6000-M/-S			
		700 W		900 W	
		Total cable length ("M+" and "M−") in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	50 V	25 mm^2 AWG 3	10 mm^2 AWG 7	25 mm^2 AWG 3	10 mm^2 AWG 7
	80 V	10 mm^2 AWG 7	4 mm^2 AWG 11	10 mm^2 AWG 7	4 mm^2 AWG 11
	100 V	6 mm^2 AWG 10	2.5 mm^2 AWG 13	6 mm^2 AWG 10	2.5 mm^2 AWG 13
	120 V	4 mm^2 AWG 11	1.5 mm^2 AWG 15	6 mm^2 AWG 10	2.5 mm^2 AWG 13

48 V system Total MPPT power max. 3600 W

		Power per PV string connection at MPPT 6000-M/-S			
		1000 W		1250 W	
		Total cable length ("M+" and "M−") in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	80 V	10 mm² AWG 7	4 mm² AWG 11	16 mm² AWG 5	6 mm² AWG 10
	100 V	10 mm² AWG 7	2.5 mm² AWG 13	10 mm² AWG 7	4 mm² AWG 11
	120 V	6 mm² AWG 10	2.5 mm² AWG 13	6 mm² AWG 10	2.5 mm² AWG 13
	140 V	4 mm² AWG 11	1.5 mm² AWG 15	4 mm² AWG 11	1.5 mm² AWG 15
	160 V	4 mm² AWG 11	1.5 mm² AWG 15	4 mm² AWG 11	1.5 mm² AWG 15

48 V system Total MPPT power max. 3600 W

		Power per PV string connection at MPPT 6000-M/-S			
		1500 W		1800 W	
		Total cable length ("M+" and "M−") in m, Loss: <= 1.5 %; Insulation: 85 °C			
		2 x 30 m	2 x 10 m	2 x 30 m	2 x 10 m
MPP voltage	80 V	16 mm² AWG 5	6 mm² AWG 10	25 mm² AWG 3	10 mm² AWG 7
	100 V	16 mm² AWG 5	4 mm² AWG 11	16 mm² AWG 5	4 mm² AWG 11
	120 V	10 mm² AWG 7	2.5 mm² AWG 13	10 mm² AWG 7	4 mm² AWG 11
	140 V	4 mm² AWG 11	1.5 mm² AWG 15	6 mm² AWG 10	2.5 mm² AWG 13
	160 V	6 mm² AWG 10	1.5 mm² AWG 15	6 mm² AWG 10	2.5 mm² AWG 13

Battery cables

		MPPT 6000-M/-S power					
		900 W		1800 W		3600 W	
		Total cable length ("B+" und "B−") in m, insulation: 85 °C					
		Power loss <2 % (17 W)		Power loss <1 % (17 W)		Power loss <0.5 % (17 W)	
		2 x 3 m	2 x 2 m	2 x 3 m	2 x 2 m	2 x 3 m	2 x 2 m
Battery voltage	12 V	35 mm^2 AWG 2	25 mm^2 AWG 3				
	24 V	10 mm^2 AWG 7	6 mm^2 AWG 10	35 mm^2 AWG 2	25 mm^2 AWG 3		
	48 V	2.5 mm^2 AWG 13	1.5 mm^2 AWG 15	10 mm^2 AWG 7	6 mm^2 AWG 10	35 mm^2 AWG 2	25 mm^2 AWG 3

WARNING!

Contact your dealer for information on the recommended cable cross section if you require longer cable lengths for the solar module, battery and loads than specified for the recommended cables in the table above!

12.3 UART/RS-232 interface protocol (MPPT 6000-M only)

12.3.1 Settings

Signal/Information	Value	Units	Action
RS232 bits per second	4800	Baud	Fixed value, not configurable.
RS232 data bits	8	bit	8 bit data; fixed value, not configurable.
RS232 parity	None		Fixed value, not configurable.
RS232 stop bits	1		Fixed value, not configurable.
RS232 flow control	None		Fixed value, not configurable.

Signal/Information	Value	Units	Action
RS232 transmission interval	60 ±1	s	■ The data is output at a non-configurable fixed interval of 60 s. ■ No external data transfer request.
RS232 data output			■ Data is output in a fixed, non-configurable sequence. ■ The units are not specified, e.g. V, A, °C, Ah. ■ The values are sent as ASCII characters. ■ The decimal point is denoted with a full-stop. A maximum of 1decimal character is displayed. ■ A semicolon { ; } is output as the separating character between values. ■ If a value is not available then {#} is output. A CR + LF sequence is output at the end of the data transmission.

12.3.2 UART/RS-232

Signal/Information	Value	Units	Action
RS-232 Data info 1	Version number		1, compatible with MPPT and Tarom 4545
RS-232 Data info 2	Date		YYYY/MM/DD
RS-232 Data info 3	Time		hh:mm, 24h format
RS-232 Data info 4	Battery voltage	V	■ Battery voltage at terminals "B+"/"B−" or ■ Voltage ext. bat. sense, if connected
RS-232 Data info 5	PV voltage 1	V	Voltage at module connection M1
RS-232 Data info 6	PV voltage 2	V	Voltage at module connection M2
RS-232 Data info 7	SOC	%	■ SOC value ■ "#" with the voltage control setting
RS-232 Data info 8	Result of capacity test	Ah	■ Result of the executed capacity test ■ "#" if no value is present

Signal/Information	Value	Units	Action
RS-232 Data info 9	Total charge/ discharge current of battery	A	■ Current information according to the sources selected in the member list in *'Menu ➔ Settings ➔ Battery ➔ Control mode ➔ '* ■ Currents of the selected sources are added according to their prefix ■ Charge current is displayed as positive ("+") ■ Discharge current is displayed as negative ("−")
RS-232 Data info 10	PV1 current	A	Current at module connection M1
RS-232 Data info 11	PV2 current	A	Current at module connection M2
RS-232 Data info 12	Module current	A	"#" – Information not present in MPPT 6000-M and MPPT 6000-S
RS-232 Data info 13	Total charge current of battery		Total of the selected energy input sources
RS-232 Data info 14	Load current	A	"#" – Information not present in MPPT 6000-M and MPPT 6000-S
RS-232 Data info 15	Total discharge current of battery	A	Total of the selected energy output sources
RS-232 Data info 16	Temperature	°C	■ Temperature of the internal sensor or ■ Temperature of the external battery temperature sensor, if connected
RS-232 Data info 17	Error		Error state: 0-No errors, 1-Information, 2-Warning, 3-Error
RS-232 Data info 18	Charging mode		■ "#" If the device is OFF or during the battery capacity test ■ Charge mode identifier, F,B,E,L,A,I
RS-232 Data info 19	AUX 1		Switching state of AUX 1 relay 0-OFF, 1-ON
RS-232 Data info 20	AUX 2		Switching state of AUX 2 relay 0-OFF, 1-ON
RS-232 Data info 21	AUX 3		Switching state of AUX 3 relay 0-OFF, 1-ON
RS-232 Data info 22	Energy input 24 h	Ah	Ah meter of the energy input members total during the period from 00:00 to 23:59

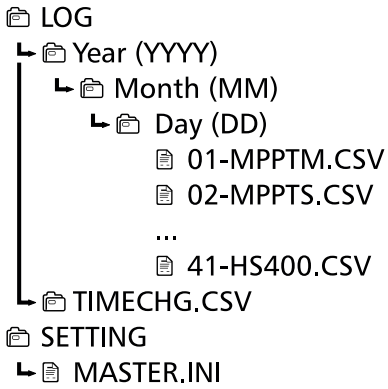
Signal/Information	Value	Units	Action
RS-232 Data info 23	Energy input/total	Ah	Ah meter of the energy input members total since initial commissioning
RS-232 Data info 24	Energy output 24 h	Ah	Ah meter of the energy output members total during the period from 00:00 to 23:59
RS-232 Data info 25	Energy output/total	Ah	Ah meter of the energy output members total since initial commissioning
RS-232 Data info 26	Derating	Ah	0- Derating not active, 1- Derating active
RS-232 Data info 27	Checksum		A CRC16 checksum is generated. Name: *'CRC-16-CCITT/openUART'* Width: 16 Direction: right shift Polynomial: 0x8408 CCITT reversed, 2 bytes long, stored as high-byte, low-byte. The CRC is calculated with semicolons and without CR+LF.
RS-232 Data info 28	End of data		CR + LF

12.4 Recording data on an SD card (MPPT 6000-M only)

When data logging is activated, separate data logging files are created for each of the following StecaLink member devices:

- MPPT 6000-M
- MPPT 6000-S
- PA HS400

The data files are stored in a predefined directors structure.



File name structure of the data files

'StecaLink bus address' + *'-'* + *'Device name'* + *'.CSV'*

Example: 40-HS400.CSV or 08-MPPTS.CSV

12.4.1 MPPT 6000-M data file

Header data in the created CSV file

Manufacturer	Device name	Serial number
Steca Elektronik GmbH	MPPT 6000	20-digit serial number ■ Steca part number (6 digits) ■ Coded month/year of production (2-digits) ■ Steca RM number (8 digits) ■ Consecutive number (4 digits)

Content of data file for MPPT 6000-M

Information/column	Value
Date	DD/MM/YYYY, according to the configured date format.
Time	hh:mm:ss, according to the configured time format.
SOC[%]	■ SOC value ■ '-' with the voltage control setting.
Kaptest[Ah]	■ Result of the executed capacity test. ■ '-' if no value is present.
Vbat[V]	Battery voltage at terminals B+/B−.
Ibat_M[A]	MPPT charge current; battery charging current of the MPPT 6000-M power unit.
Vbat.sense[V]	■ Ext. Bat. Sense, if connected. ■ '-' if no value is present.
VPV1_M[V]	Voltage at module connection M1.
VPV2_M[V]	Voltage at module connection M2.
PVpower_M[W]	■ Total PV module power at the MPPT 6000-M. ■ Total of PV1power and PV2power. ■ '0' if no PV1power_M and PV2power_M.
PV1power_M[W]	■ Power at module input M1. ■ '-' if no value is present.
PV2power_M[W]	■ Power at module input M2. ■ '-' if no value is present.
Ophours[h]	Number of operating hours since initial commissioning of the device.

Information/column	Value
Ibat_total[A]SOC	■ Current information according to the sources selected in the member list in *'Menu ➔ Settings ➔ Battery ➔ Control mode ➔ .'* ■ The currents of the selected sources are added according to their prefix. ■ Charge current is displayed as positive ('+') ■ Discharge current is displayed as negative ('–')
Icharge_total[A]	Total of the selected energy input sources.
Iload_total[A]	Total of the selected energy output sources.
BatPower_total[W]	Total charge/discharge power according to the sources selected in the member list in *'Menu ➔ Settings ➔ Battery ➔ Control mode ➔ .'*
BatTemp[°C]	■ Value of the external battery temperature sensor, if connected. ■ '-' if no value is present.
ChargeMode	■ *'OFF'* if the device is OFF or during the battery capacity test. ■ Charge mode identifier: F,B,E,L,A,I.
ErrorState	Error state: 0-No errors, 1-Information, 2-Warning, 3-Error.
ErrorNr	■ Error code ■ "-" if no value is present.
StateAux1	Switching state of AUX 1 relay 0 OFF, 1 ON
StateAux2	Switching state of AUX 2 relay 0 OFF, 1 ON
StateAux3	Switching state of AUX 3 relay 0 OFF, 1 ON
IntTemp1[°C]	Internal device temperature string 1.
IntTemp2[°C]	Internal device temperature string 2.
Derating	0 - Derating not active, 1- Derating active.
Ah_in_24h_M[Ah]	Ah meter of the energy loaded through the MPPT 6000-M during the period from 00:00 to 23:59.
Ah_in_total_M[Ah]	Ah meter of the total energy loaded through the MPPT 6000-M since initial commissioning.
Ah_in_24h_SYS[Ah]	Ah meter of the energy input members total during the period from 00:00 to 23:59.
Ah_in_total_SYS[Ah]	Ah meter of the energy input members total since initial commissioning.
Ah_out_24h_SYS[Ah]	Ah meter of the energy output members total during the period from 00:00 to 23:59.

Information/column	Value
Ah_out_total_SYS[Ah]	Ah meter of the energy output members total since initial commissioning.
Day_night	Day/Night status 0-Night, 1-Day
Status_AUXIO	Status of remote control via AUX IO ■ "-" when remote control is not activated. ■ 0 - Charging via remote control activated. ■ 1 - Charging via remote control deactivated.

12.4.2 TIMECHG data file

Changing the date and time settings of the MPPT 6000-M affects the data logging.

Changes to the date and time settings are recorded in a special data file in order to document these changes.

Changes are only documented in the TIMECHG.CSV data file when the SD card data logging is activated.

Contents of TIMECHG.CSV

Date before the change	Time before the change	->	Date after the change	Time after the change
DD/MM/YYYY	hh:mm:ss		DD/MM/YYYY	hh:mm:ss

12.4.3 PA HS400 data file

Header data in the created CSV file

StecaLink slave address	Device name	Serial number
40 – 49	HS400	18-digit serial number ■ Steca part number (6 digits), ■ Steca RM number (8 digits), consecutive number (4 digits).

Contents of the CSV data file

Information/column	Value
Date	DD/MM/YYYY, according to the configured date format.
Time	hh:mm, according to the configured time format.
I_integral	Current information of the PA HS400 in A.

Information/column	Value
Position	The current direction of the measuring position assigned to this sensor in the MPPT 6000-M, "-" if no value is present. 1 – Not installed 2 – Charge sensor 3 – Discharge sensor 4 – Charge/Discharge sensor
SOC_relevant	Use of the PA HS400 0 – Only displayed in the status window 1 – SOC member
Number_of_turns	The number of turns configured for this sensor in the MPPT 6000-M.
Reading_inverted	The current direction configured for this sensor in the MPPT 6000-M. 0 – Value not inverted 1 – Value inverted

12.4.4 MPPT 6000-S data file

Header data in the created CSV file

StecaLink address	Device name	Serial number
1 … 99	MPPT 6000	18-digit serial number ■ Steca part number (6 digits) ■ Steca RM number (8 digits) ■ Consecutive number (4 digits)

Contents of the CSV data file

Information/column	Value
Date	DD/MM/YYYY, according to the configured date format.
Time	hh:mm:ss, according to the configured time format.
Vbat[V]	Battery voltage at terminals "B+"/"B-".
Ibat_S[A]	MPPT charge current; battery charging current of the MPPT 6000-S power unit.
Vbat.sense[V]	Ext. Bat. Sense, if connected.
VPV1_S[V]	Voltage at module connection M1.
VPV2_S[V]	Voltage at module connection M2.

PVpower_S[W]	■ Total PV module power at the MPPT 6000-S. ■ Total of PV1power and PV2power. ■ "0" if no PV1power_M and PV2power_M.
PV1power_S[W]	■ Power at module input M1. ■ "-" if no value is present.
PV2power_S[W]	■ Power at module input M2. ■ "-" if no value is present.
Ophours[h]	Number of operating hours since initial commissioning of the device.
BatTemp[°C]	■ Value of the external battery temperature sensor, if connected. ■ "-" if no value is present.
ChargeMode	■ OFF when the device is not charging, e.g. also when controlled by MPPT 6000-M. ■ Charge mode identifier: F,B,E.
ErrorState	Error state: 0-No errors, 1-Information, 2-Warning, 3-Error.
IntTemp1[°C]	Internal device temperature string 1.
IntTemp2[°C]	Internal device temperature string 2.
Derating	0-Derating not active 1-Derating active
Day_night	Day/Night status 0-Night, 1-Day

13 Guarantee conditions, exclusion of liability, contacts, notes

13.1 Guarantee conditions

The Steca guarantee conditions are available in the Internet at:
www.steca.com/pv-off-grid/warranties

13.2 Exclusion of liability

The manufacturer can neither monitor the compliance with this manual nor the conditions and methods during the installation, operation, usage and maintenance of the controller. Improper installation of the system may result in damage to property and, as a result, to bodily injury.

Therefore, the manufacturer assumes no responsibility and liability for loss, damage or costs which result from or are in any way related to incorrect installation, improper operation, incorrect execution of installation work and incorrect usage and maintenance.

Similarly, we assume no responsibility for patent right or other right infringements of third parties caused by usage of this controller. The manufacturer reserves the right to make changes to the product, technical data or installation and operating instructions without prior notice.

13.3 Contact

In the case of complaints or faults, please contact the local dealer from whom you purchased the product. They will help you with any issues you may have.

Dealer:	.....
Street and house number:	.....
City:	.....
	.....
Phone:	.....
Fax:	.....
Email:	.....
Internet:	.....

Stamp

13.4 Notes

Controller

Type:	.....
Serial number:	.....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