tbs electronics OCS 100-20 MPPT Solar Charge Controller Owner’s Manual

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THE POWER OF QUALITY

MPPT Solar Charge Controller

Omnicharge Solar

OCS 100-20 (100V/20A)
OCS 100-30 (100V/30A)
OCS 100-50 (100V/50A)

Owner's manual

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Document name, date and part number

"OCS-20-50 User Manual Rev1endfs", August 2023, xxxxxx

Contents

SAFETY PRECAUTIONS

Thank you for purchasing a TBS Electronics (TBS) Omnicharge Solar MPPT Solar Charge Controller (hereinafter referred to as 'product' or 'solar charger'). Please read this user manual for information about operating the product correctly and safely.

⚠ CAUTION

This user manual is an addition to the installation manual of this product. Please make sure that the installation manual has always been read first, before proceeding with the user manual. The installation manual is included with the charger or can be downloaded from our website at tbs-electronics.nl/downloads.

Keep this user manual and all other included documentation close to the product for future reference. For the most recent manual revision, please check the downloads section of our website.

TECHNOLOGY

2.1 Product features

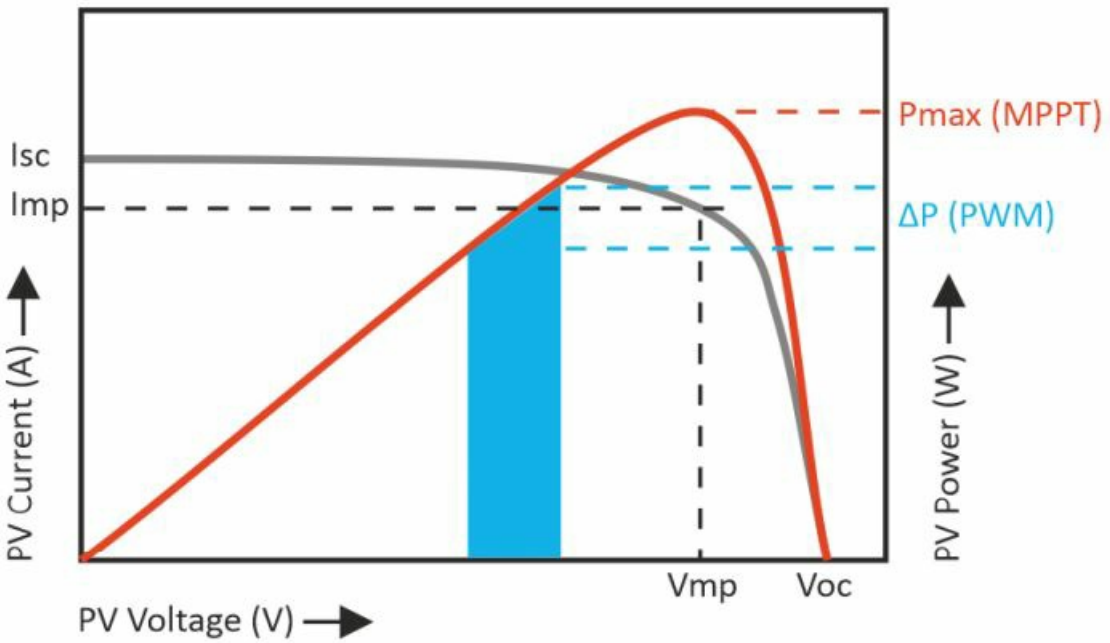
Omnicharge Solar battery chargers are true next generation products and contain the latest highly efficient switch mode power supply technology, as well as a smart digital control system. Please see below a summary of the most important Omnicharge Solar features:

- Fast Maximum Power Point Tracking (MPPT) ensures that you always get the maximum amount of power transferred from the PV panels to your battery. Even under the most difficult circumstances. The MPPT efficiency of an Omnicharge Solar charger can reach up to 99%.
- Highly efficient switch power supply technology ensures a low waste of power and allows for a fan-less design.
- Smart selectable charge programs for AGM, Gel, Flooded, Lithium and User defined battery types
- Automatic battery voltage detection
- Battery temperature sensor input
- Historical data storage up to 300 days
- Full protection against battery reverse polarity, PV reverse polarity, short circuits, battery open circuit and solar charger over temperature
- Monitoring and configuration via Dashboard Mobile app (iOS and Android)

2.2 MPPT charging

There are essentially two types of charging technologies for solar chargers. These are PWM and MPPT technology. PWM is the most basic one and can be seen as just an automatic switch that connects the PV array directly to the battery as long as charging is needed. This results in a PV voltage that is pulled down to the same level as the battery voltage. And since this voltage level is typically lower than the maximum power point voltage (Vmp) of the PV array, the resulting effective power to charge the battery bank is not optimal.

A solar charger with MPPT technology is more advanced and it is based on a smart high efficiency DC to DC converter that will continuously find the maximum amount of power that is available from the PV array. This is accomplished by varying the input voltage of the charger by controlling the amount of power consumed from the PV array. The main goal is to find the highest result out of the multiplication of battery voltage and charging current (P = V * I). This highest result is called the Maximum Power Point. The image below shows a typical I-V graph of a PV panel. Added in red is a scaled graph representing the generated power (multiplication of I and V) of the same PV panel, including the maximum power point Pmax:



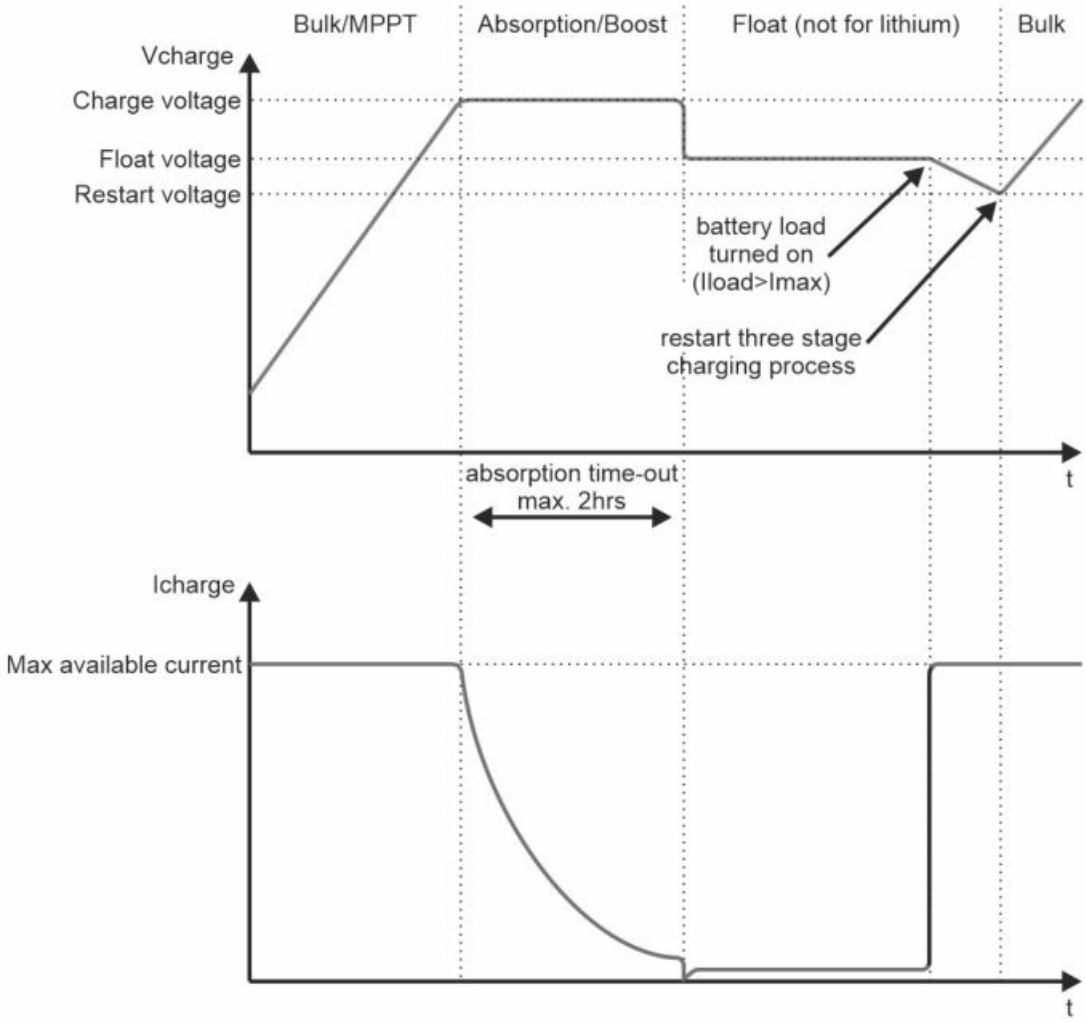
The blue area in the above graph (ΔP) represents the typical operating area of a traditional PWM type solar charge controller. As you can see, Pmax (MPPT) is higher than ΔP (PWM).

The fast and efficient MPPT technology onboard of the Omnicharge Solar products makes sure that the maximum power point is tracked continuously. This is to make sure that it always operates at the maximum power point of the PV array, that may vary continuously against irradiation levels from the sun, partial shading (causing more than one Pmax point) and last but not least PV array temperature.

In general, a well designed MPPT solar charge controller will typically get 15 – 25% more power from your PV array compared to traditional PWM type solar chargers.

2.3 Battery charging explained

Most standard selectable Omnicharge Solar charge programs perform a 3-stage IUoUo charging process comprising of a “Bulk/MPPT” , an “Absorption/Boost”, and a “Float” stage. All of course for as long as there is sufficient sunlight. The image below visualizes the 3-stage charging process:



In the Bulk/MPPT stage the charger delivers full available output current and typically returns approximately 80% of charge back into the battery, once the charge voltage is reached. During this stage the charger runs in MPPT mode, transferring maximum PV power into the battery.

When the Charge voltage has been reached, the Absorption/Boost stage will be entered. In this stage the voltage will be held constant and the current will decline automatically as function of the battery's state of charge. Typically, this stage will return the final 20% of charge to battery. When the absorption time-out of 2 hours (= factory default) has been reached the float stage will be entered. For lithium batteries the charger will remain in the absorption stage as long as there is sufficient solar power available.

Once every 30 days and only if a Flooded (open lead acid type) battery is selected, the Omnicharge Solar charger will automatically perform a mild equalization charge, setting the Absorption/Boost voltage 0.4V @ 12V or 0.8V @ 24V higher than the normal voltage level for a maximum of 2 hours. This process will help minimize the acid stratification and sulfation that typically occurs in all flooded batteries. When you do not wish to have this automatic mild equalize charge performed on your Flooded batteries or wish to alter the equalization voltage level, please create a user defined /custom charge program (see chapter 3.2) and select it to become the standard charge program. By default mild equalization is never performed on AGM, GEL or Lithium batteries.

⚠ CAUTION

During a mild equalize charge, the applied voltage to the battery is higher than the standard charge voltage. Please check if the battery and the connected battery loads can handle this voltage safely.

After the Absorption/Boost stage has been finished and when an AGM, GEL or Flooded battery selected, the

charger will jump to the Float stage. In this stage the battery voltage will be held constant at a safe level for the battery. This will maintain the battery in optimal condition for as long as there is sufficient sunlight. Connected battery loads will be directly powered by the charger up to the charger's maximum output current level. When even more current is drawn, the battery must supply this which results in a declining battery voltage. At a certain battery voltage level (Restart voltage), the charger jumps back to the Bulk/MPPT stage and will execute a complete charge process again.

By default, the Float stage is not enabled when a Lithium battery is selected. When you do need to Float charge your Lithium battery, please create a user defined / custom charge program (see chapter 3.2) and select it to become the standard charge program.

2.4 Temperature compensation

When the optional battery temperature sensor (art# 5055319) is connected to the Omnicharge Solar charger and an AGM, GEL or Flooded battery is selected, it will automatically provide charge voltage compensation against temperature. The charge voltage is compensated by -3mV/°C/cell with +25°C as a 'no compensation' starting point. So for a 12V battery (6 cells) the charge voltage will increase by +18mV/°C below 25°C and decrease by -18mV/°C above 25°C. For a 24V battery (12 cells) this is respectively +36mV/°C and -36mV/°C.

When no battery temperature sensor is connected to the charger, the charge voltages will remain unchanged at the default set 25°C values, independent of ambient temperature.

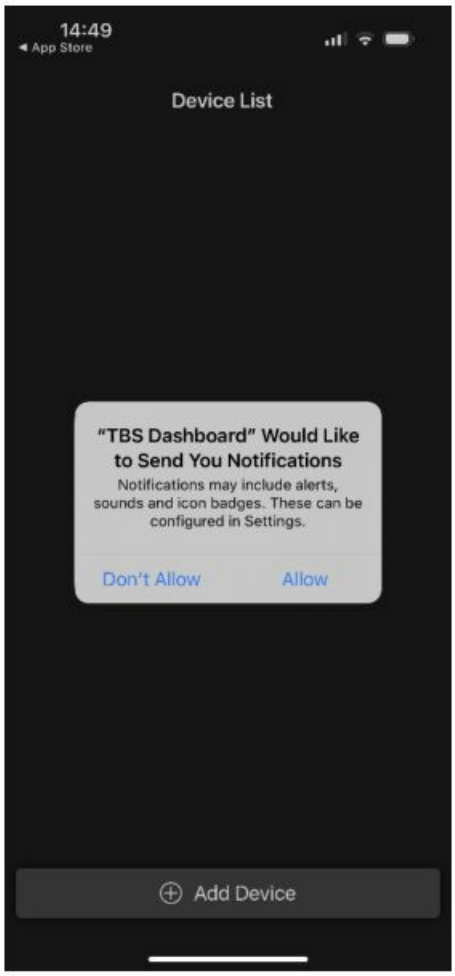
When a Lithium battery is installed and a temperature sensor is connected to the charger, there is no charge voltage compensation as this is typically not allowed for this type of battery.

OMNICHARGE SOLAR SETUP

All information on how to commission the Omnicharge Solar charger, how to interpret the LED indicators on the device and how to select the battery type using the setup button on the device itself, is explained in chapter 3 of the installation manual. This manual is included with the charger or can be downloaded from our website at tbs-electronics.nl/downloads. For a more advanced setup and insight in real time parameter data, please use our Dashboard Mobile app.

3.1 Using the Dashboard Mobile app

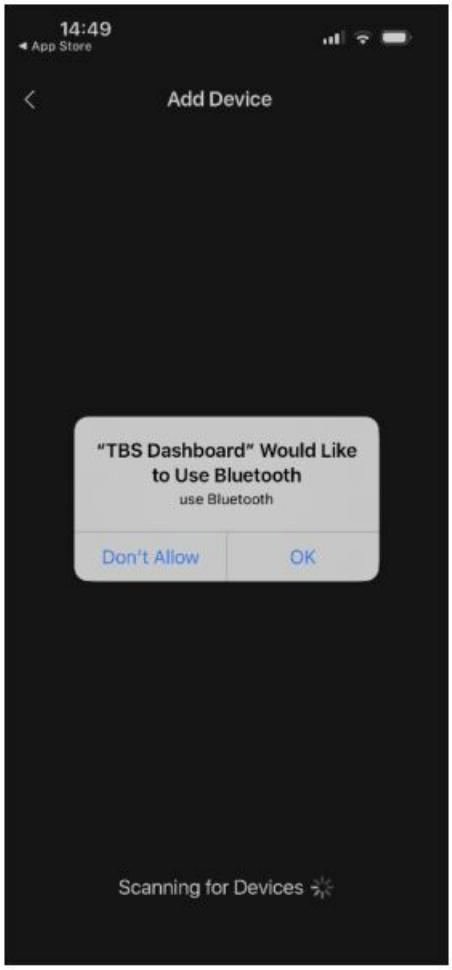
The easiest way to setup your Omnicharge Solar charger is to use the TBS Electronics Dashboard Mobile app. You can find this app in the Apple App Store and Google Play. Besides setting up the charger, this app will also provide you with real time information about the chargers' operation and access to historic data like solar energy yield and maximum power per day. The global operation of the Dashboard Mobile app is explained below using the iOS version. The Android version will however be very similar with only some differences in the system messages when making a Bluetooth connection. For Android, do make sure that you also allow Location Permission and select 'Precise' and 'While using the app' after that. (TBS Dashboard does not locally or externally store any personal, usage or location data)



Once the app is installed and launched you will see the screen as shown on the right.

Please press ‘Allow’ to confirm acceptance of this notifications request.

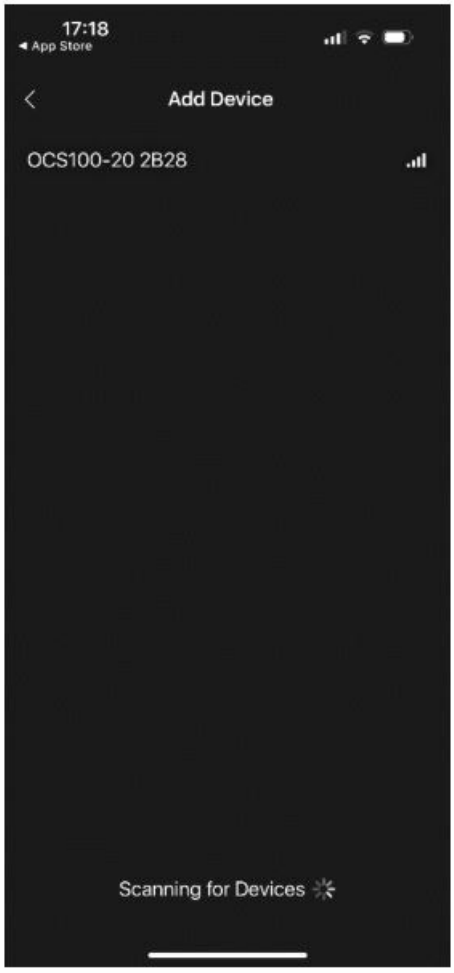
After that, please press the ‘Add Device’ button at the bottom of the screen.



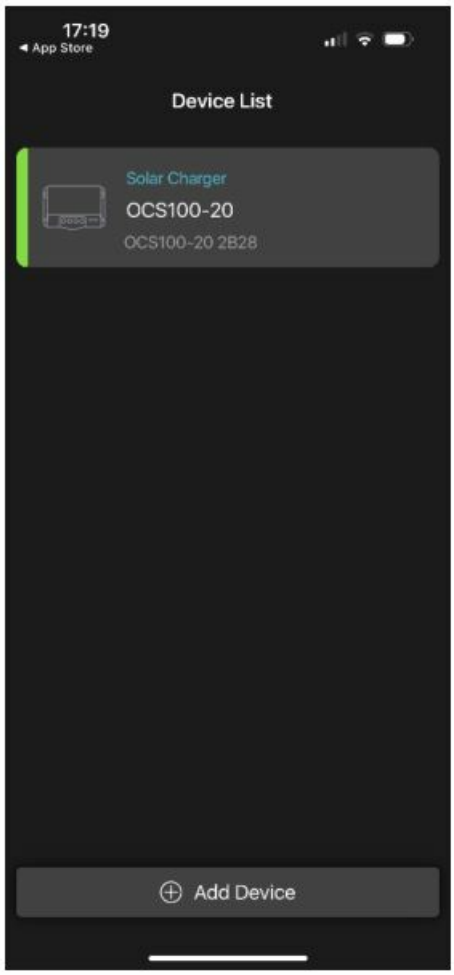
When the app is used for the first time and right after the ‘Add Device’ button is pressed, it will ask for permission to use

Bluetooth on your device. Please press ‘OK’ to proceed so that the app can scan for TBS devices in the neighborhood.

NOTE: Bluetooth in general has a limited range. In open spaces (line of sight) the maximum distance between charger and mobile device can be up to 20 meters. However, in practical circumstances like inside houses, vehicles or boats, several objects such as walls or other equipment can limit this range down to only a few meters. On top of this, it also depends on the Bluetooth hardware inside your mobile device.



After the app has found a TBS Bluetooth device, please press on it to establish a connection.

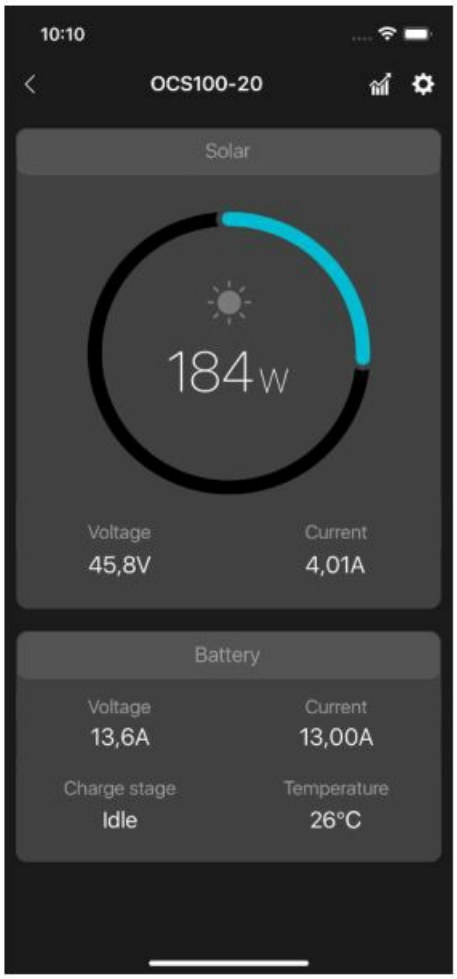


Now the device is shown in the Device List.
The green bar on the left side of the tile indicates that it is successfully connected.
There are three other color states available, being:

- Orange – Device busy connecting
- Red – Connection error
- Dark grey (Off) – No connection

This device tile will always remain in the Device List for future use, even when it is disconnected. So next time you launch the app, you only have to press the device tile and it connects automatically. You can remove it by swiping the tile to the left and press Delete.

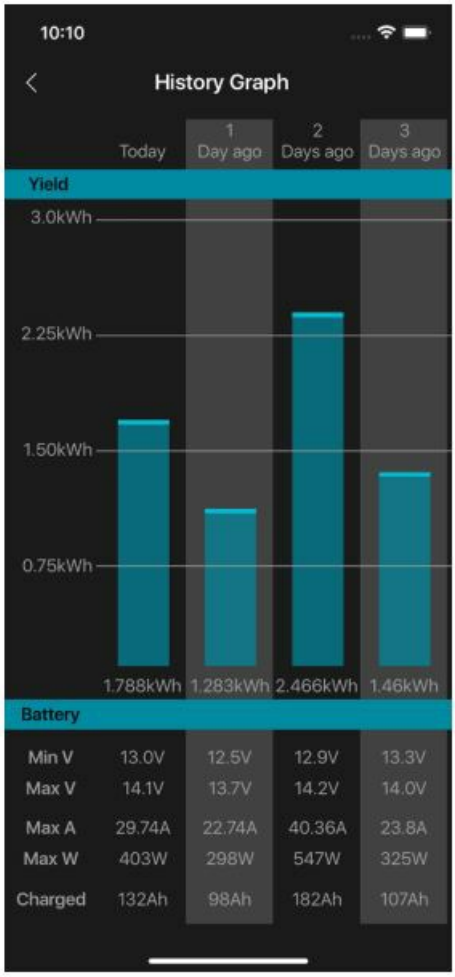
When you press the device tile the app will jump the device’s main screen.



In main screen of the device you can observe all available real time data of the solar panels, the battery and the charging status. Once the sun icon is shown inside the solar power gauge, the charger is active. When the moon and stars icon is shown, the charger is inactive due to a lack of solar light.

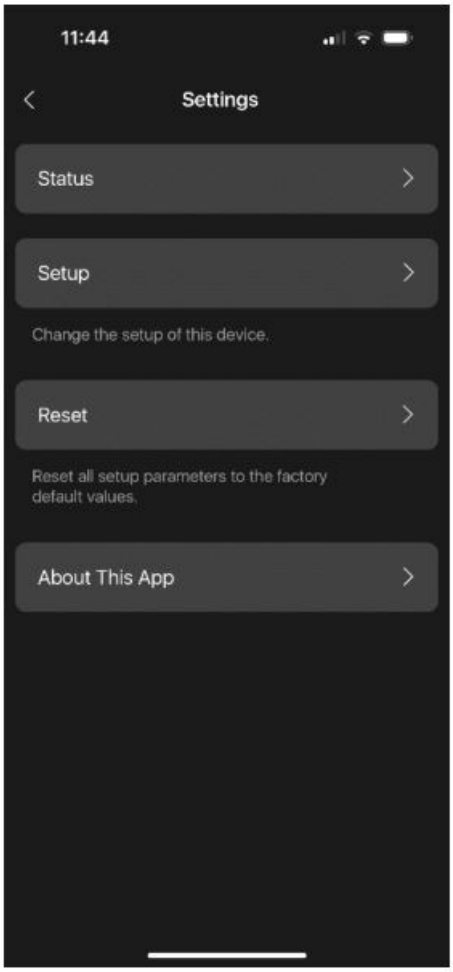
To select a different TBS device (if available), you can press the arrow button on the upper left side of the screen to jump back to the device list screen.

In the upper right corner of this screen there are two buttons for respectively entering the history graph screen or the settings screen.



The history graph screen shows you the solar energy yield of the current day and previous days. Additionally it also indicates the minimum and maximum battery voltages, maximum charge current and charge power and total Amphours charged of each day. You can swipe left to show more days or rotate your device to enter landscape view.

Please note that since the Omnicharge Solar is not equipped with a real time clock, it determines a day length based on solar light input. So the best indications are always given once the current day has completely passed.



In the settings screen you have four options.

The Status button will direct you to a status overview screen showing device name, firmware version, historic data etc.

The Setup button will direct you to the Setup screen.

The Reset button allows you to either perform a full factory reset, or to only clear all history data.

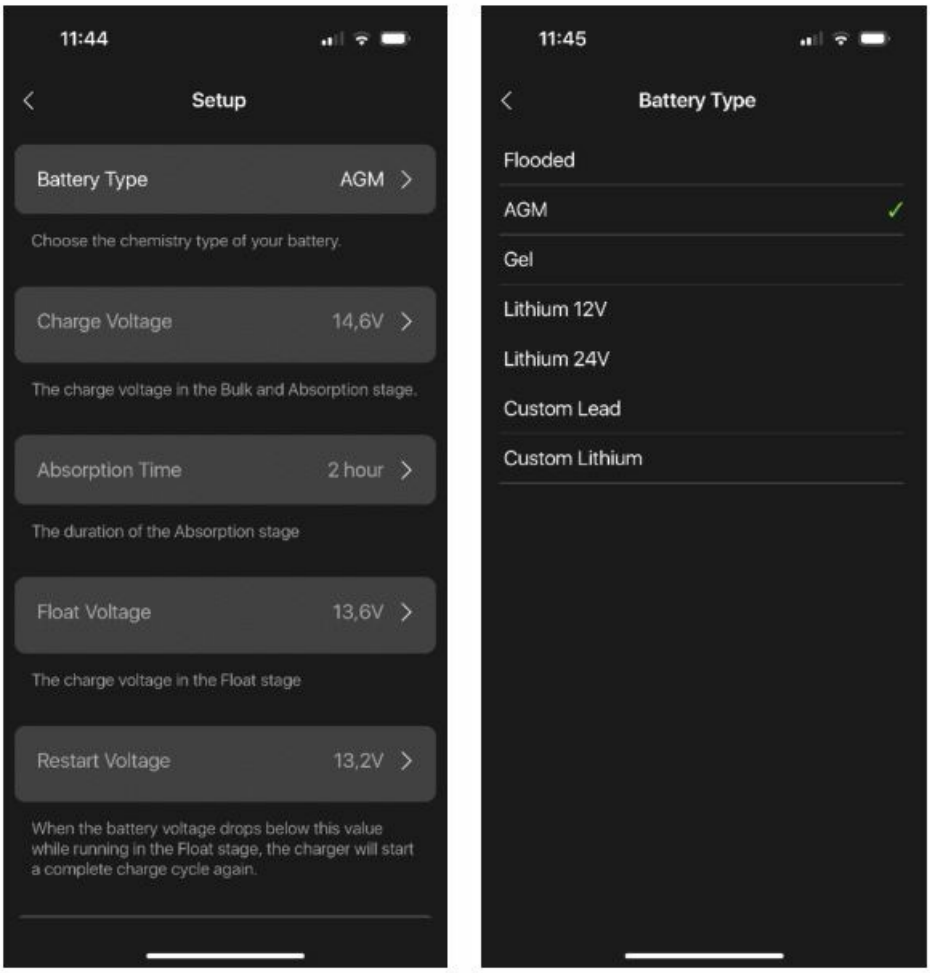
And finally the About this App button, which directs you to a screen with app information, legal stuff and a link to our website.

3.2 Setting up the Omnicharge Solar charger

⚠ CAUTION

Invalid battery type or other parameter settings can cause serious damage to your batteries and/or connected battery loads. Always consult your battery's documentation for the correct charge voltage settings.

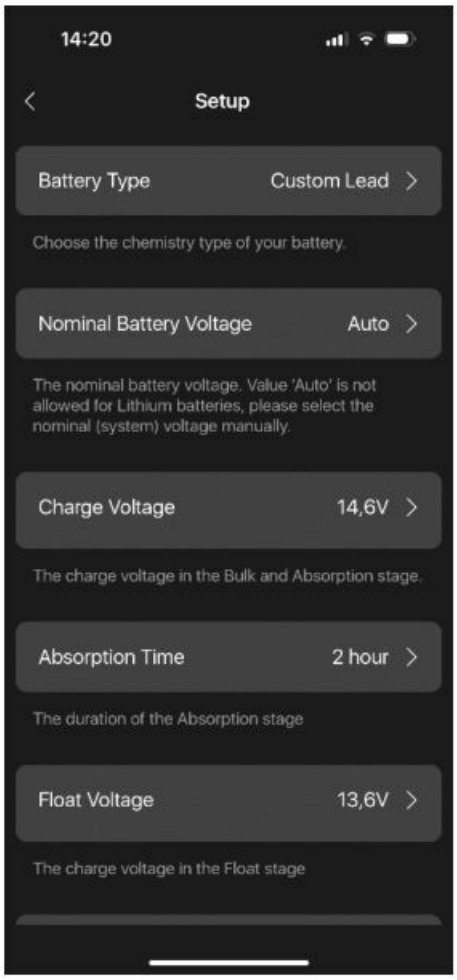
As explained earlier, when you wish to setup the charger in a clearer way or wish to create a charge program with different voltages or other parameters, the Dashboard Mobile app is the way to go.



If from the settings screen you have pressed the Setup button, the first screen on the right will appear. In this screen you can select the desired battery type by pressing the upper button.

When you have selected battery type Flooded, AGM, Gel, Lithium 12V or Lithium 24V and then press the back button, all corresponding settings can be reviewed but not edited. This is because these are the factory default battery types / charge programs. For most applications the standard charge programs will be sufficient.

When the desired battery type has been selected, please press the back button and the app will ask you to save this setting or not. Press ‘Save’ and the charger will be updated.



If any of the standard selectable battery types does not fulfil your requirements, there is a possibility to create your own battery type or charge program.

For this you need to select battery type Custom Lead if you have a lead based battery installed, or Custom Lithium if you have a lithium based battery installed.

Once selected you will see that all available parameters can now be edited. In the app each parameter is explained with text below the button. Please note that only for lead based batteries you can set the Nominal Battery Voltage to Auto. For Lithium based batteries, you must select a nominal voltage manually.

You will also notice that when Custom Lithium is selected, there are a lot less parameters to edit since a float stage and equalization are not possible for Lithium, as well as temperature compensation of the charge voltage. When you do wish to have a float stage for your lithium battery, please see chapter 3.2.1.

When the desired custom battery type has been edited, please press the back button and the app will ask you to save these settings or not. Press ‘Save’ and the charger will be updated.

3.2.1 Creating a lithium charge program with a float stage

As explained above, as standard an Omnicharge Solar charger does not offer a float stage for lithium batteries. If desired however, there is a way to still create a charge program with float for a lithium battery.

For this please select the Custom Lead battery type in the setup screen and use the following parameter settings:

- Battery Type → Custom Lead

- Nominal Battery Voltage → select a voltage manually, do not choose Auto
- Charge Voltage → Enter the desired charge voltage
- Absorption Time → Enter the desired absorption time
- Float Voltage → Enter the desired float voltage
- Restart Voltage → Enter the desired restart voltage
- Auto Equalize Charge → Off
- Equalize Voltage → Enter the same value as Charge Voltage
- Equalize Duration → 10min (do not set to 0min.!)
- Temperature Compensation → Not Compensated
- Undervoltage Alarm On Value → Enter the desired voltage
- Undervoltage Alarm Off Value → Enter the desired voltage
- Undervoltage Alarm Delay Time → Enter the desired time

The parameters indicated in red are very important. Please use exactly these values for correct functionality.

3.3 Overview of factory default charge program parameters

Please see the table below for an overview of the main factory default parameter values of each battery type:

	Battery type[1)]			
Parameter	AGM (SLD)	GEL	Flooded (FLD)	Lithium / LiFePo4 (LI)
Charge Voltage	14.6V	14.2V	14.4V	14.4V
Absorption Time	120 minutes	120 minutes	120 minutes	-
Float Voltage	13.6V	13.4V	13.4V	-
Restart Voltage	13.2V	13.2V	13.2V	13.2V
Auto Equalize Charge	-	-	30 days	-
Equalize Voltage	-	-	14.8V	-
Equalize Duration	-	-	120 minutes	-
Temperature Compensation	-3mV/°C/cell	-3mV/°C/cell	-3mV/°C/cell	-
Overvoltage Alarm	16.0V	16.0V	16.0V	16.0V
Undervoltage Alarm On Value	11.6V	11.6V	11.6V	12.0V
Undervoltage Alarm Off Value	12.4V	12.4V	12.4V	12.4V
Undervoltage Alarm Delay Time	6 seconds	6 seconds	6 seconds	6 seconds

1) Multiply all voltage values by a factor of 2 for 24V systems

TROUBLESHOOTING GUIDELINE

Please see the table below if you experience any problems with the Omnicharge Solar charger and/or the

installation.

Problem	Possible cause	Remedy
Omnicharge Solar charger is not working at all (no LEDs).	Battery and/or solar panel incorrectly connected	Please check if the polarities of the battery or solar panel connection are correct
	Battery fuse blown or solar panel switch turned off	Check any fuses and/or DC switches in the battery and solar panel wiring. Measure the voltage at the battery and solar inputs of the charger for correct values.
	Charger damaged	Please contact your TBS dealer for further assistance
Charger seems to be powered (battery indicator LEDs are on) but does not charge	No solar light	Please make sure that the solar panels are not covered and exposed to sufficient sunlight.
	Incorrectly connected solar panel	Please check solar panel wiring to the charger and make sure that there are no fuses blown or DC switches opened and that the polarity is correct.
	Solar panel voltage too low	Make sure that the solar panels are generating a voltage that is at least 2V higher than the current battery voltage. Check input terminals of the charger.
	Solar panel voltage too high	Please check if the solar panel is not exceeding the maximum input voltage of the charger. If it does, disconnect immediately and revise the installation.
	Battery is full	If the battery is full the charger will stop charging or will greatly reduce the charge current.
	Incorrect battery settings	Check if the Nominal Battery Voltage corresponds to the actual used battery.

Charge current is too low	Insufficient solar power	Make sure that the solar panels are exposed to sufficient sunlight. Check if the solar panel array is sized correctly in terms of power.
	Charger operates too hot	When the charger is too hot, the charge current will be reduced automatically. Please check the charger's mounting location and make sure of sufficient cooling.
Batteries are not fully charged	Battery load current is higher than the charger's output current	If you wish to fully charge the battery, please reduce the DC loads connected to the battery.
	Incorrect battery settings	Check if the Charge Voltage (bulk/absorption) is not set too low for the used battery.
	DC cables too thin	Install larger DC cables. See the DC cable size table in chapter 2.3 of the installation manual.
	Insufficient solar power	Make sure that the solar panels are exposed to sufficient sunlight. Check if the solar panel array is sized correctly in terms of power.
Batteries are overcharged	Nominal Battery Voltage setting too high	Check if the Nominal Battery Voltage corresponds to the actual used battery.
	Battery Charge Voltage setting too high	Please if all battery charge voltages are set correctly (Charge Voltage as well as Float voltage if applicable)
	Equalization issue	Please check if the connected battery is suitable for the equalization stage. In general, only Flooded (open lead) batteries are allowed to be equalized periodically.
	Battery too old or damaged	Replace battery
Unable to connect using Bluetooth	Charger not powered up	Please check if at least one LED is lit on the charger

	Too large distance between charger and mobile device	Make sure that you are in the neighbourhood of the charger. The maximum theoretical distance for Bluetooth is 15-20m. But in practice due to surrounding objects, this distance is much smaller for correct operation.
	Bluetooth not allowed in Dashboard Mobile app	Please make sure that you have allowed Bluetooth connections to be made by Dashboard Mobile. If you did not, please uninstall the app and re-install it or change this in the device's system settings afterwards.
	Bluetooth not enabled on mobile device	Please check the Bluetooth settings of your device

If none of the above remedies will help solving the problem you encounter, it's best to contact your local TBS distributor for further help and/or possible repair of your Omnicharge Solar unit. Do not disassemble the charger yourselves, it is not user serviceable and it will also void your warranty.

TECHNICAL SPECIFICATIONS

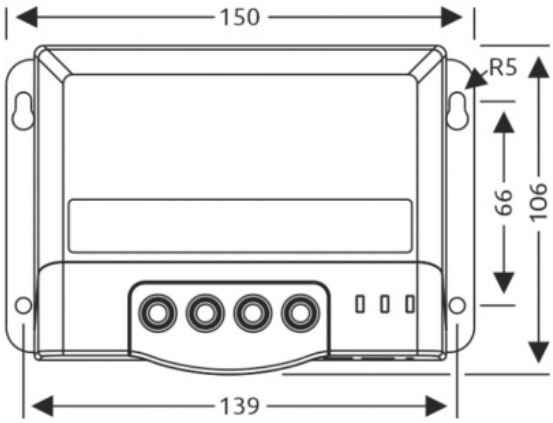
Parameter	OCS 100-20	OCS 100-30	OCS 100-50
System voltage	12Vdc / 24Vdc		
Maximum charge current[1)]	20A	30A	50A
Self consumption	0.12W		
Battery voltage range	9.0 – 32.0Vdc		
Max. PV open circuit voltage	100Vdc		
Max. PV short circuit current	20A	30A	50A
MPPT voltage range	Vbatt + 2 up to 75Vdc		
Max. PV input power 12V	260W	400W	660W
24V	520W	800W	1320W
Charge characteristic	IUoUo, intelligent 3-stage, temp. compensated		
Supported battery types[2)]	Flooded / Gel / AGM / LiFePo4 / Custom (user defined)		
Maximum conversion efficiency	98%		
Maximum MPPT efficiency	99%		
LED indicators	Charge mode, Battery state and Battery type		
Battery temperature sensor	Optional		
Cooling	Natural convection (no fan)		
Protections	Battery and PV reverse polarity, output short circuit and over temperature		
Operating temperature range	-35°C ... +60°C		
Storage temperature range	-40°C ... +80°C		
Communication	Through Dashboard Mobile app (iOS and Android)		
Connections (PV + Battery)	Screw terminals (10mm^2 / 8 AWG)		
Dimensions (HxWxD)	150x106x62mm	150x106x68mm	183x127x70mm
Weight	0.70kg	0.88kg	1.39kg
Protection class	IP32 (mounted in upright position)		
Standards	EMC: 2014/30/EU, Safety: EN62109-1, Functionality EN62509-1 and RoHS: 2011/65/EU		

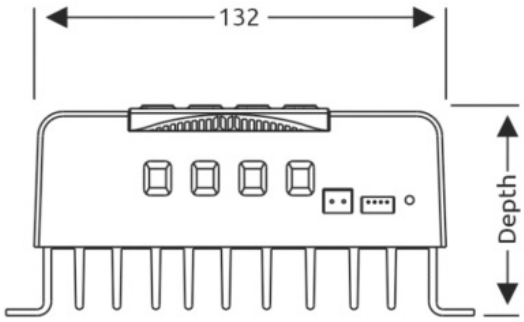
1. Maximum output current tolerance is +/-5%. Automatic output current derating at Tambient > 45°C.
2. Selectable by setup button on solar charger or via Dashboard Mobile app

Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences for the environment and human health.

5.1 Dimension drawings

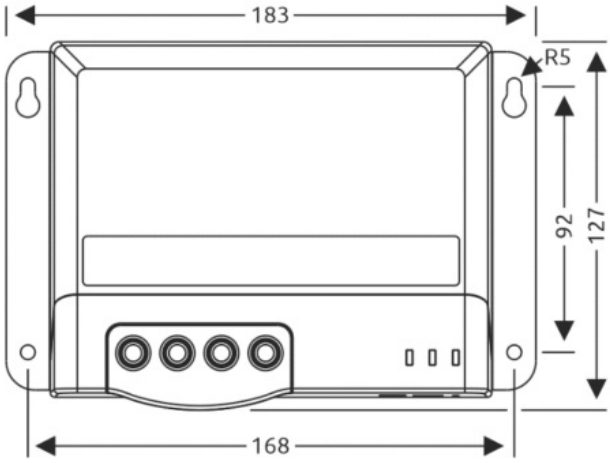
Dimensions OCS 100-20 and 100-30:

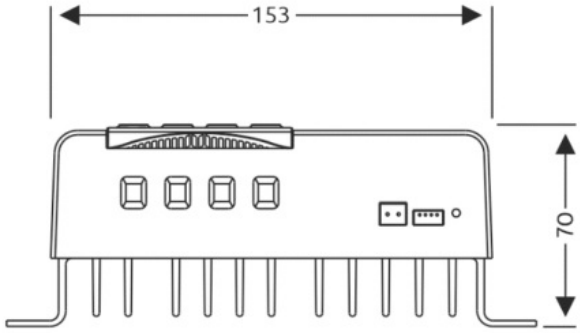




OCS 100-20 depth is 62mm
OCS 100-30 depth is 68mm

Dimensions OCS 100-50:





WARRANTY CONDITIONS

TBS Electronics (TBS) warrants this product to be free from defects in workmanship or materials for 24 months from the date of purchase. During this period TBS will repair the defective product free of charge. TBS is not responsible for any costs of the transport of this product.

This warranty is void if the product has suffered any physical damage or alteration, either internally or externally, and does not cover damage arising from improper use, or from use in an unsuitable environment.

This warranty will not apply where the product has been misused, neglected, improperly installed or repaired by anyone other than TBS. TBS is not responsible for any loss, damage or costs arising from improper use, use in an unsuitable environment, improper installing of the product and product malfunctioning.

Since TBS cannot control the use and installation (according to local regulations) of their products, the customer is always responsible for the actual use of these products. TBS products are not designed for use as critical components in life support devices or systems, that can potentially harm humans and/or the environment. The customer is always responsible when implementing TBS products in these kind of applications. TBS does not accept any responsibility for any violation of patents or other rights of third parties, resulting from the use of the TBS product. TBS keeps the right to change product specifications without previous notice.

Examples of improper use are :

- Too high PV input voltage applied
- Reverse connection of PV or battery polarity

- Connecting wrong batteries (too high battery voltages)
- Mechanical stressed enclosure or internals due to harsh handling or incorrect packaging
- Contact with any liquids or oxidation caused by condensation

DECLARATION OF CONFORMITY

MANUFACTURER : TBS Electronics BV
ADDRESS : De Marowijne 3
1689 AR Zwaag
The Netherlands

Declares that the following products :

PRODUCT TYPE : MPPT Solar Charge Controller
MODELS : OCS 100-20, OCS 100-30 and OCS 100-50

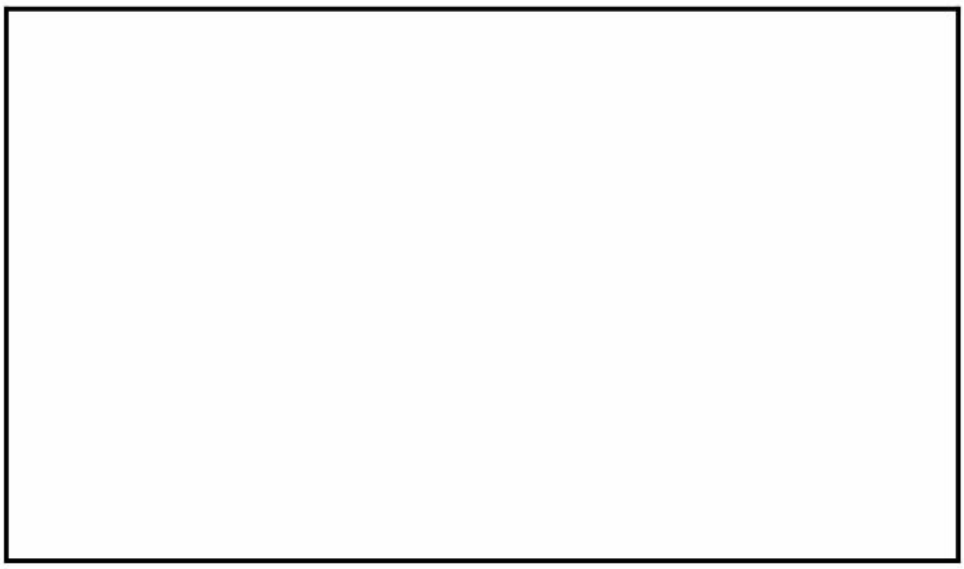
Conforms to the requirements of the following Directives of the European Union :

EMC Directive 2014/30/EU
Low voltage Directive 2014/35/EU
RoHS Directive 2011/65/EU

The above product is in conformity with the following harmonized standards :

EMC : EN61326-1:2021
Safety : EN62109-1:2010 and EN62509:2010

www.tbs-electronics.com



TBS Electronics BV
De Marowijne 3
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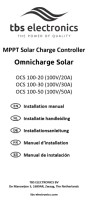
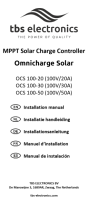
The Netherlands

OCS-20-50 User Manual Rev1endfs

Documents / Resources

	tbs electronics OCS 100-20 MPPT Solar Charge Controller [pdf] Owner's Manual OCS 100-20, OCS 100-30, OCS 100-50, OCS 100-20 100V MPPT Solar Charge Controller, 100V MPPT Solar Charge Controller, MPPT Solar Charge Controller, Solar Charge Controller, Charge Controller
	tbs electronics OCS 100-20 MPPT Solar Charge Controller [pdf] Installation Guide OCS 100-20, OCS 100-30, OCS 100-50, OCS 100-20 MPPT Solar Charge Controller, MPPT Solar Charge Controller, Solar Charge Controller, Charge Controller, Controller
	tbs electronics OCS 100-20 MPPT Solar Charge Controller [pdf] Instruction Manual OCS 100-20, OCS 100-30, OCS 100-50, OCS 100-20 MPPT Solar Charge Controller, MPPT Solar Charge Controller, Solar Charge Controller, Charge Controller, Controller

References

- Downloads | S.Munter Elektrotechniek
- Home - TBS Electronics EN
- Downloads - TBS Electronics NL
- Home - TBS Electronics EN