Photonic Universe

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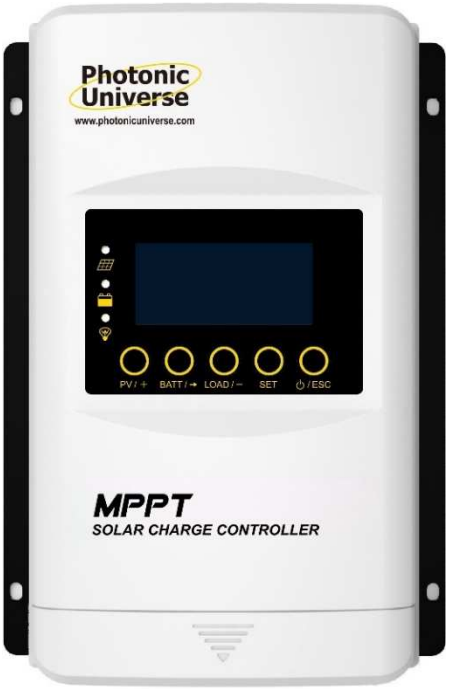
MPPT Solar Charge Controller

XTR Series (10A/20A/30A/40A 12V/24V/48V)

INSTRUCTION MANUAL



Models:

XTR1206N/2206N/1210N/2210N /3210N/4210N/3215N/4215N/ 3415N/4415N

Important Safety Instructions

This manual contains all safety, installation, and operation instructions for the XTR series Maximum Power Point Tracking (MPPT) solar charge controllers.

Safety instructions for installation

- Read all the instructions and warnings carefully in the manual before installation.
- There are no user-serviceable components inside the controller. Do not disassemble or attempt to repair the controller.
- Mount the controller indoors. Do not allow the components to be exposed to water or allow water to enter the controller.
- Install the controller in a well-ventilated place. The controller's heat sink may become very hot during operation.
- It is recommended to install appropriate external fast-acting fuses/breakers.
- Disconnect all PV array connections and the fast-acting fuses/breakers before installing or adjusting the controller.
- Power connections must remain tight to avoid excessive heating from a loose connection.

WARNING Do not install the controller in humid, high salt spray, corrosion, greasy, flammable, explosive, dust accumulative, or other severe environments.

Other safety instructions

- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
  (1) This device may not cause harmful interference, and
  (2) This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
- However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - ✓ Reduce the length of the solar and battery cables
  - ✓ Shield the solar and battery cables
  - ✓ Reorient or relocate the receiving antenna.
  - ✓ Increase the separation between the equipment and receiver.
  - ✓ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
  - ✓ Consult the dealer or an experienced radio/TV technician for help.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Contents

1 General Information

1.1 Overview

Thank you for choosing the Photonic Universe *XTR* series MPPT solar charge controller. This product features a new highly stable and efficient system architecture. It also includes a built-in Bluetooth module, allowing installers and users to easily read and adjust parameters via the mobile app.

The controller adopts an advanced MPPT control algorithm, improving the maximum power point (MPP) tracking and acting speed. By minimizing the MPP loss rate and time, the controller can track the MPP quickly to obtain the maximum energy under any conditions.

There is also a new function for independent voltage regulation, meaning the battery terminals of the controller can be connected to loads directly even when there is no battery. The controller is compatible with various types of lithium batteries. Its low self-consumption design significantly reduces the static power consumption and extends system standby time.

The charging power/current limit, and the automatic reduction of charging power under high temperature conditions ensure system stability when controllers are used with a large amount of solar power or in a high temperature environment.

The IP33 ingress protection and isolated RS485 com port design improve the controller's reliability and increase the versatility of the controller for use in various applications.

The XTRxxxxN series uses a three-stage charging algorithm, which effectively prolongs the battery's lifespan and improves performance. Comprehensive electronic protections, such as overcharge, over-discharge, PV and battery reverse polarity, etc., ensure the solar system is more reliable and durable. This controller can be widely used in solar systems for RVs, boats and marine, household systems, monitoring, industrial and commercial applications, and more.

Features:

- High-quality and low failure rate components of ST or IR to ensure a long service life.
- Advanced MPPT technology & ultra-fast-tracking speed, tracking efficiency up to 99.5%
- Maximum DC/DC transfer efficiency reaching 98.5%; full load efficiency up to 97.2%[1]
- Advanced MPPT control algorithm minimizes the loss rate and loss time.
- Accurate recognition and tracking of multi-peak maximum power point.
- Wider MPP (maximum power point) running voltage to optimize PV utilisation.
- Supports multiple battery types including lithium batteries.
- Equipped with a stable self-activation function for lithium batteries.
- Allows setting the battery voltage parameters on the LCD.
- Battery temperature compensation.
- Limits the charging power and charging current to no higher than the rated value.
- Real-time energy statistics function.
- Charging power is automatically reduced for over-temperature.
- Built-in Bluetooth enables adjusting settings through a mobile app.
- RS485 communication interface with optional Bluetooth or Wi-Fi modules for remote monitoring.
- Parameters can be set via PC software, app, or remote meter.
- Constant voltage output function[2].
- Comprehensive electronic protections.
- Multiple load work modes.
- Dustproof and waterproof design with an IP33 enclosure[3].
- Low self-consumption, less than 10mA[4].
- Operation at full load without reducing charging power in the working temperature range.

1. Only for the XTR4415N @48V.

2. To enable the constant voltage output function, ensure the input power is consistently higher than the output power. If the input power is lower than the output power, the controller will switch between ON and OFF states intermittently due to the under-voltage protection.
3. 3-protection against solid objects: protected against solid objects over 2.5mm. 3-protected against sprays to 60°from the vertical.
4. After disabling the COM port, the self-consumption is lower than 10mA.

1.2 Product Features

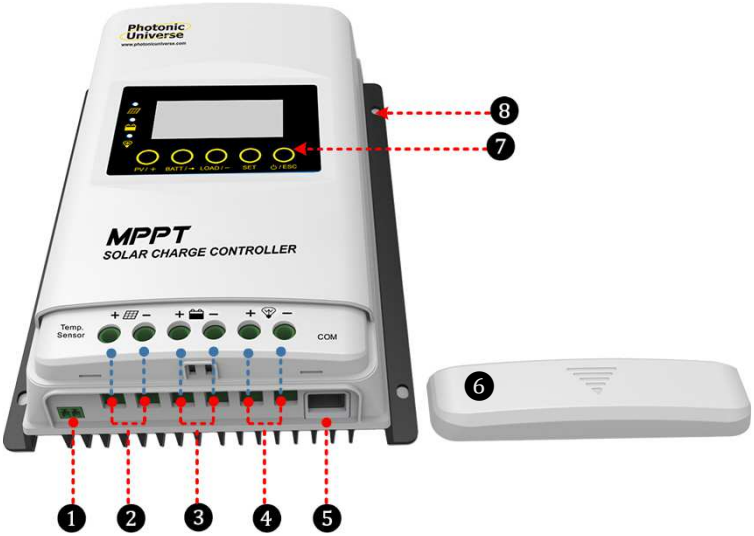


Figure 1.1 XTRxxxxN Series Product Features

Item	Name	Item	Name
❶	RTS port*	❺	RS485 communication port
❷	PV terminals	❻	Terminal protection cover
❸	Battery terminals	❼	Display units
❹	Load terminals	❽	Mounting hole Φ5mm

**If the temperature sensor is short-circuited or damaged, the controller will charge or discharge according to the set parameters at 25 ºC, without any temperature compensation.*

1.3 Maximum Power Point Tracking Technology

Due to the nonlinear output of a solar panel or solar array, there is a maximum energy point (Max Power Point, or MPP) on the output curve at which the solar panel achieves its highest efficiency. Traditional solar charge controllers with switch charging PWM technology cannot track this highest efficiency point of a solar panel, so most of the time they work with reduced efficiency and do not extract the full energy available from the solar panel. In contrast, this solar charge controller uses Maximum Power Point Tracking (MPPT) technology which can lock on to the highest efficiency point of a solar panel to extract the maximum energy and deliver it to the battery.

The MPPT algorithm continuously compares and adjusts various points on the output curve of a solar panel to locate the MPP (highest efficiency) point. This tracking process is fully automated and does not require user involvement.

As per Figure 1.2, MPPT technology will 'boost' the battery charging current (amps) by tracking the MPP. Assuming 100% conversion efficiency of the solar system, the battery current will increase in line with the following formula:

Input power (P_{PV})= Output power (P_{Bat})

Input voltage (V_{Mpp}) *input current (I_{PV}) =Battery voltage (V_{Bat}) *battery current (I_{Bat})

Normally, the V_{Mpp} is always higher than V_{Bat}. Due to the principle of conservation of energy, the I_{Bat} is always higher than I_{PV}. The greater the discrepancy between V_{Mpp} & $V_{Bat,}$ the greater the discrepancy between I_{PV} & I_{Bat}. The greater the discrepancy between the solar and battery voltage, the bigger the reduction of conversion efficiency of a standard controller. Thus, by using this MPPT solar charge controller, the efficiency of the PV system can be significantly improved.

Figure 1.2 shows the maximum power point curve of a solar panel. The shaded area is the charging range of a standard PWM controller. The MPPT technology of this controller can shift the point on the curve to the higher current, and raise the efficiency by 20%-30% (on average) compared to a standard PWM controller.

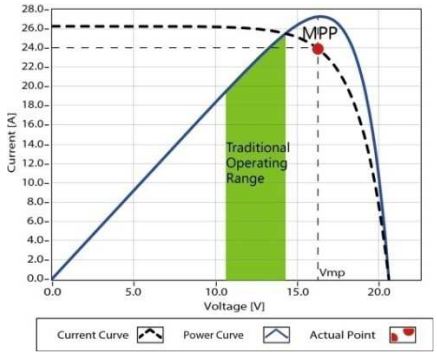


Figure 1.2 Maximum Power Point Curve

In practice, due to shading from clouds, trees, snow etc., a solar panel may have multiple MPP points, but there is only really one true Maximum Power Point (see Figure 1.3 for examples):

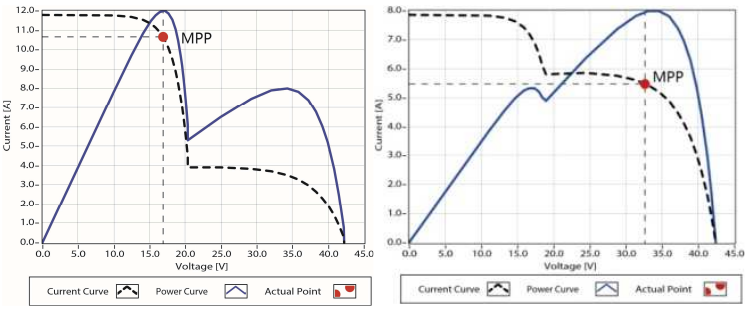


Figure 1.3 Curves with multiple MPP points

Some MPPT solar charge controllers are unable to accurately track multiple MPP points. As a result, they lock on to an incorrect point and work with reduced efficiency. This solar charge controller features special MPPT technology that can handle multiple MPP points and track the true MPP point quickly and accurately, improving system efficiency and avoiding energy wastage.

2 Installation Instructions

2.1 General Installation Notes

- Before you begin installation, please read through the entire installation instructions to familiarise yourself with the installation steps.
- Be very careful when working with batteries, especially flooded lead-acid batteries. Wear eye protection and have fresh water available to wash with in case of any contact with battery acid.
- Keep the battery away from any metal objects which may cause a short circuit of the battery terminals.
- Explosive battery gases may be released from the battery during charging, therefore sufficient ventilation is required. Never install the controller in a sealed enclosure with flooded batteries. Battery gases from flooded batteries may cause corrosion and destroy the controller circuits.
- This controller has programs for Gel, Sealed, Flooded lead acid and Lithium batteries. It also supports User defined batteries with custom charging voltages. To choose the correct battery programme for your battery (including User defined) please refer to the battery specifications, supplier or manufacturer.
- Loose power connections and corroded wires may result in high heat that can melt wire insulation, burn surrounding materials, or even cause a fire. Ensure tight connections and use cable clamps to secure cables and prevent them from unnecessary movement.
- Battery connecting cables may be wired to one battery or a bank of batteries. This user manual always refers to a single battery, but it is implied that the battery connection can be made to either one battery or a group of batteries in a battery bank.
- Select the system cables according to a 5A/mm^2 or less current density.
- Follow all appropriate regulations, national guidelines and industry standards. The installation should be carried out by professionals with the appropriate qualifications and experience.

2.2 PV Array Requirements

➢ **Serial connection (string) of PV modules**

As a core component of a PV system, a controller should be suitable for various types of PV modules and be able to maximise solar energy conversion. The maximum number of PV modules which can be connected in series and fed into this solar charge controller can be calculated according to the open circuit voltage (V_{oc}) of the PV module and the maximum power point voltage (V_{Mpp}) of the controller. The following tables are provided for general guidance only; always refer to the exact parameters of your modules to ensure they are within the allowed range.

NOTE: The below parameter values are calculated under Standard Test Conditions (STC): irradiance 1000W/m^2, Module Temperature 25°C, Air Mass 1.5.

XTR1206/2206N

System voltage	36 cells Voc＜ 23V		48 cells Voc＜ 31V		54 cells Voc＜ 34V		60 cells Voc＜ 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	2	2	1	1	1	1	1	1
24V	2	2	-	-	-	-	-	-

System voltage	72 cells Voc＜ 46V		96 cells Voc＜ 62V		Thin-Film Module Voc＞80V
	Max.	Best	Max.	Best	
12V	1	1	-	-	-
24V	1	1	-	-	-

XTR1210/2210/3210/4210N

System voltage	36 cells Voc< 23V		48 cells Voc< 31V		54 cells Voc< 34V		60 cells Voc< 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	4	2	2	1	2	1	2	1
24V	4	3	2	2	2	2	2	2

System voltage	72 cells Voc< 46V		96 cells Voc< 62V		Thin-Film Module Voc>80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	2	1	1	1	1

XTR3215/4215N

System voltage	36 cells Voc< 23V		48 cells Voc< 31V		54 cells Voc< 34V		60 cells Voc< 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	4	2	2	1	2	1	2	1
24V	6	3	4	2	4	2	3	2

System voltage	72 cells Voc< 46V		96 cells Voc< 62V		Thin-Film Module Voc>80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	3	2	2	1	1

XTR3415/4415N

System voltage	36 cells Voc< 23V		48 cells Voc< 31V		54 cells Voc< 34V		60 cells Voc< 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	4	2	2	1	2	1	2	1
24V	6	3	4	2	4	2	3	2
48V	6	5	4	3	4	3	3	3

System voltage	72 cells Voc< 46V		96 cells Voc< 62V		Thin-Film Module Voc>80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	3	2	2	1	1
48V	3	2	2	2	1

NOTE: If there is a choice between parallel and series connection of solar panels in your system, and the open circuit voltage from the series connection is within 10% of the maximum open circuit voltage threshold of the controller, it is recommended to connect PV modules in parallel, to lower the input PV voltage to the controller. This would reduce the risk of controller being damaged from the PV voltage accidentally going over the maximum threshold (such as in low ambient temperatures).

WARNING: If the maximum open circuit voltage of the PV array is more than 46V (XTRxx06N), 92V (XTRxx10N) or 138V (XTRxx15N) at 25°C, the controller may be damaged.

When configuring a solar PV array, remember that in all cases the **maximum power point voltage (Vmpp) of the array should be greater than the battery charging voltage** to enable charging. For example, it will not be possible to charge a 24V battery from a single 36-cell solar panel which delivers 18V at the maximum power point.

2.3 Wire Size

The wiring and installation methods must conform to all national and local requirements.

➢ **PV Cable Size**

Since PV array output can vary due to the PV module size, connection method or light exposure, the minimum cable size can be calculated based on the maximum current (*Isc*) of the PV array. Please refer to the value of *Isc* in PV module specification. When the PV modules are connected in series, the *Isc* of the array is equal to *Isc* of each PV module. When the PV modules are connected in parallel, the *Isc* of the array is equal to the sum of *Isc*'s of all PV modules. The *Isc* of the PV array must not exceed the maximum PV input current as per the table below:

NOTE: All PV modules in an array are assumed to be identical.
Isc = short circuit current (amps) Voc = open circuit voltage.

Model	Max. PV input current	PV cable size (mm^2/AWG)
XTR1206/1210N	10A	4/12
XTR2206/2210N	20A	6/10
XTR3210/3215/3415N	30A	10/8
XTR4210/4215/4415N	40A	16/6

➢ **Battery and Load Cable Size**

The battery and load cable size must conform to the rated current. The reference size is as below:

Model	Rated charge current	Rated discharge current	Battery cable size (mm^2/AWG)	Load cable size (mm^2/AWG)
XTR1206/1210N	10A	10A	4/12	4/12
XTR2206/2210N	20A	20A	6/10	6/10
XTR3210/3215/3415N	30A	30A	10/8	10/8
XTR4210/4215/4415N	40A	40A	16/6	16/6

CAUTION

- The cable size in the above tables is only for reference. If there is a long distance between the PV array, the controller, and the battery, thicker cables should be used to reduce the voltage drop and improve performance.
- The recommended battery cable size is for the cable between the controller and the battery only, and not for other devices connected to the battery such as an inverter.

2.4 Mounting and Connections

CAUTION: The controller requires at least 150mm of clearance above and below for proper airflow. Ventilation is required if mounted in an enclosure.

WARNING: Risk of explosion! Never install the controller in a sealed enclosure with flooded batteries! Do not install in a confined area where battery gases can accumulate.

WARNING: Risk of electric shock! Exercise caution when handling solar wiring. The solar PV array can produce high voltages when in sunlight, which could be dangerous. Disconnect the breaker or isolator switch when working on PV cables and use gloves and insulated tools.

The controller shall be installed in a place with sufficient airflow through the controller heat sink and a minimum clearance of 150mm from the upper and lower edges of the controller to ensure proper thermal convection. See Figure 2.1: Mounting.

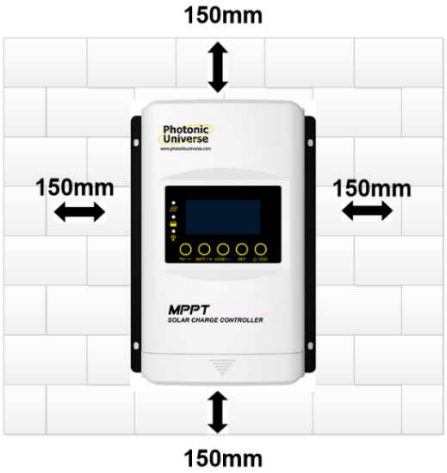


Figure 2.1 Mounting

Battery Mode

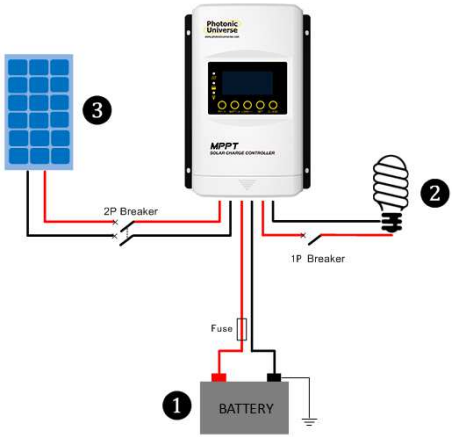


Figure 2.2 Battery mode diagram

CAUTION

- The optimal length of the battery cable is within 3m.
- If your system has an inverter, in this Battery mode you should connect the inverter to your battery directly. Never connect the inverter to the load terminals.

1) Connect components to the charge controller in the sequence 1-2-3 as shown on the diagram above and pay particular attention to the polarity (“+” and “-”) ensuring this is correct. When disconnecting the system, the disconnection order must be reversed to the order of connection (3-2-1).
2) After the battery power has been supplied to the controller, check that the LCD display is on. If it is not on, please refer to chapter 5 for troubleshooting. Always connect the battery first to allow the controller to recognise the system voltage (12V or 24V), unless it is pre-set.
3) A fast-acting battery fuse with 1.25 – 2.0 times controller rating should be installed as close to the battery as possible. The recommended distance is within 150mm of the battery terminal.
4) This solar charge controller has a **negative common ground** design (which means that internally the negative terminals of the solar panel, battery and load are linked). Therefore, any negative terminal of the controller (solar, load or battery) can be grounded if required. However, you should in any case ground the case of the controller. It shields the controller from the outside electromagnetic interference and reduces the risk of electric shock.

CAUTION: Do not ground any positive terminals of the controller to avoid the risk of damage.

5) Install a lightning arrester if the controller is used in areas with frequent lightning strikes.

No-battery Mode *(for bright direct sunlight and clear sky only)*

When there is no battery, the XTR controller can be directly connected to a small (low power) inverter. The inverter must be connected to the battery terminals of the controller. The system must meet the following conditions:

1) The system voltage must be pre-set in the controller settings to match the inverter input voltage
2) The inverter should be a high-frequency type
3) The controller must have sufficient PV power connected. The PV input power into the controller must be greater than the result of the formula: *load output power / (inverter conversion efficiency * controller conversion efficiency)*

CAUTION: The No-battery mode will only work in a location with bright direct sunlight and clear sky, when the PV power substantially exceeds the power drawn by the inverter. This mode is not recommended for locations with unstable weather, as any clouds can quickly cause system instability and an automatic low voltage shutdown of the inverter.

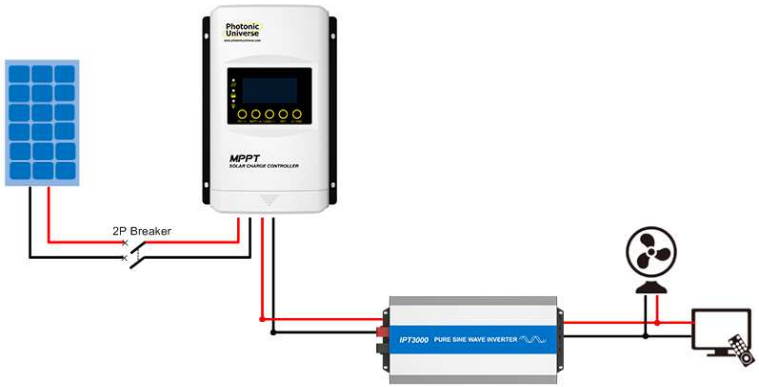


Figure 2.3 No-battery mode diagram

2.5 Instructions for Accessories

1) Connect a temperature sensor to the port (1) of the controller:

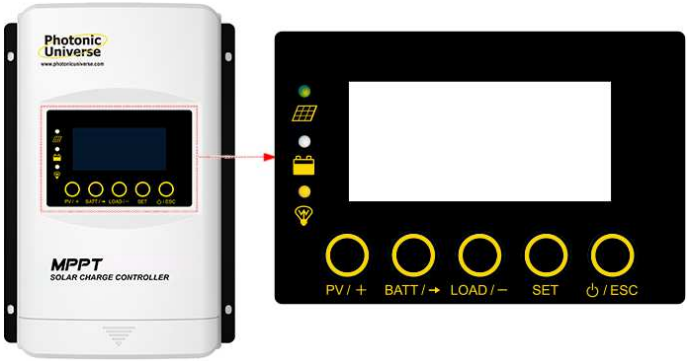

Standard temperature sensor


Optional remote temperature sensor with 3m cable (product code **TEMP_VS**)

If a temperature sensor is not connected, the controller will assume a default temperature 25ºC.
2) (for 20A-40A controllers) use an optional Photonic Universe surface mounted (**CB** series) or recess mounted (**CBR** series) DC circuit breaker with overcurrent protection instead of a battery fuse (30A, 40A, 50A and 60A breakers are available):

3) Connect an optional Remote meter with 5m cable (product code **MT52**). The meter displays system information and allows parameter setting and self-diagnostics (see Annex II for details).
4) Connect an optional USB to RJ45 adapter with 1.5m cable (product code **PTR-USB**) to link the controller to a PC for monitoring and programming using *Solar Station* software (see Annex II for details).
5) Use an optional Wi-Fi module (product code **EBOX-WIFI**) to allow the controller to connect to a local Wi-Fi network. You can then access the controller remotely from your mobile phone or tablet using the free mobile app for remote monitoring and parameter setting (see Annex II for details).

3 Operation



3.1 LED Indicators

Indicator	Colour	Status	Instruction
	Green	On Solid	PV charges the battery with a low current
	Green	OFF	1. No sunlight 2. Connection error 3. Low PV voltage
	Green	Slowly flashing (1/sec)	Normal charging
	Green	Fast flashing (4/sec)	PV Over voltage
	Green	On Solid	Normal
	Green	Slowly flashing (1/sec)	Full
	Green	Fast flashing (4/sec)	Overvoltage
	Orange	On Solid	Under voltage
	Red	On Solid	Over discharge
	Red	Slowly flashing (1Hz)	Battery Overheating Lithium battery Low Temperature[1]
	Yellow	On Solid	Load On
	Yellow	OFF	Load Off
PV & BATT LED fast flashing			Controller Overheating / System voltage error[2]

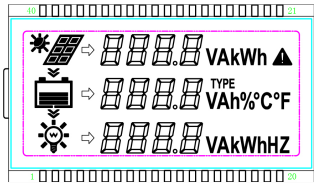
1. When a Lead-acid battery type is used, the controller does not have low-temperature protection.

2. When a Lithium battery is used, the system voltage cannot be identified automatically.

3.2 Buttons

PV / +	Press the button	PV browsing interface
		Setting data +
	Press the button and hold 5s	Setting the LCD cycle time, enabling or disabling the COM port
BATT / →	Press the button	BATT browsing interface
		Cursor displacement during setting
	Press the button and hold 5s	Setting the battery type, battery capacity level, and temperature unit.
LOAD / –	Press the button	Controller load browsing interface
		Setting data
	Press the button and hold 5s	Setting the load working mode
SET	Press the button	Enter setting interface
		Switch the setting interface to the browsing interface
		Confirm the setting parameter
⏻ / ESC	Press the button	Exit the setting interface

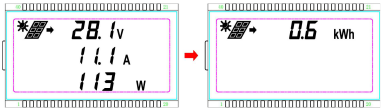
3.3 Display



Note: The display screen can be viewed clearly when the angle between the end-user's horizontal sight and the display screen is within 90°. If the angle exceeds 90°, the information on the display screen may not be seen clearly.

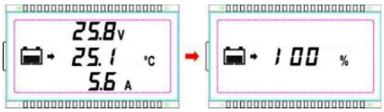
Icon	Information	Icon	Information	Icon	Information
	Day		Not charging		Not discharging
	Night		Charging		Discharging

1) PV parameters



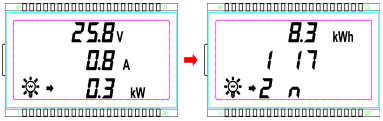
Display: Voltage / Current / Power / Generated energy

2) Battery parameters



Display: Voltage / Current / Temperature / Battery capacity level

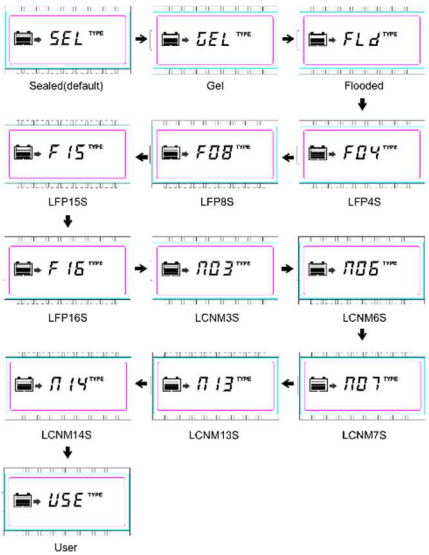
3) Load parameters



Display: Voltage / Current / Power / Consumed energy / Load working mode-Timer1 / Load working mode-Timer2

3.4 Setting parameters

1) Battery type



Note: If the controller supports 48V battery voltage, the battery type will display LiFePO4 F15/ F16 and Li(NiCoMn)O2 N13/ N14.

Operation:

Step 1: Press the “BATT” button to browse the battery parameters on the initial interface. Then, press the “SET” button to enter the battery parameters setting interface.

Step 2: Long-press the “BATT” button to enter the battery-type interface.

Step 3: Press the “PV / +” or “LOAD / -” button to select the battery type.

Step 4: Press the “SET” button to confirm.

Step 5: Continue to press the “SET” button twice or wait for 10s of no-operation to automatically go back to the battery parameters setting interface.

CAUTION

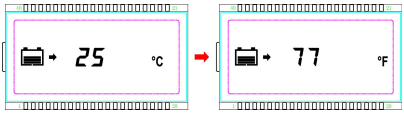
Please refer to chapter 4.1 for the battery control voltage setting when the battery type is USER.

2) Battery capacity

Operation:

Step 1: Press the “BATT” button to browse the battery parameters on the initial interface. Then, press the “SET” button to enter the battery parameters setting interface.
Step 2: Long-press the “BATT” button to enter the battery-type interface.
Step 3: Press the “SET” button to jump to the battery capacity interface.
Step 4: Press the “PV / +” or “LOAD / -” button to set the battery capacity.
Step 5: Press the “SET” button to confirm.

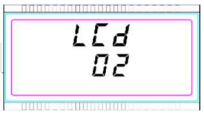
3) Temperature units



Operation:

Step 1: Press the “BATT” button to browse the battery parameters on the initial interface. Then, press the “SET” button to enter the battery parameters setting interface.
Step 2: Long-press the “BATT” button to enter the battery-type interface.
Step 3: Press the “SET” button twice to jump to the temperature unit's interface.
Step 4: Press the “PV / +” or “LOAD / -” button to set the temperature units.
Step 5: Press the “SET” button to confirm.

4) LCD cycle time



NOTE: The LCD cycle default time is 2s, and the setting time range is 0～20s.

Operation:

Step 1: Press the “PV / +” button to browse the PV parameters on the initial interface. Then, press the “SET” button to enter the PV parameters setting interface.
Step 2: Long-press the “PV / +” button to enter the LCD cycle time interface. The cycle time will flash.
Step 3: Press the “PV / +” or “LOAD / -” button to set the LCD cycle time.
Step 4: Press the “SET” button to confirm.

5) Clear the energy counter (of the generated power)

Operation:

Step 1: Press the “PV / +” button to browse the PV parameters on the initial interface. Then, press the “SET” button to enter the PV parameters setting interface.

Step 2: Long-press the “PV / +” button to enter the LCD cycle time interface. The cycle time will flash.

Step 3: Hold the “PV / +” button and the “LOAD / -” button for 5 seconds to clear the energy counter.

Note: Return to the PV parameters interface to confirm whether the generated power (kWh) is zero.

6) Enable the RS485 com port

The RS485 com port supports 5V output and communication functions when enabled. When disabled, it has no output or communication functions, but the controller's own power consumption is reduced.

Operation:

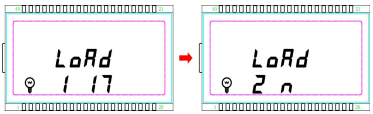
Step 1: Press the “PV / +” button to browse the PV parameters on the initial interface. Then, press the “SET” button to enter the PV parameters setting interface.

Step 2: Long-press the “PV / +” button to enter the LCD cycle time interface. Then, press the “SET” button to switch to the CON interface.

Step 3: Press the “PV / +” or “LOAD / -” button to enable (EN) or disable (DIS) the RS485 com port.

Step 4: Press the “SET” button to confirm.

7) Load mode selection



Operation:

Step 1: Press the “LOAD / -” button to browse the load parameters on the initial interface. Then, press the “SET” button to enter the load parameters setting interface.

Step 2: Long-press the “LOAD / -” button to enter the load mode interface.

Step 3: Press the “PV / +” or “LOAD / -” button to change the load mode.

Step 4: Press the “SET” button to confirm.

NOTE: Please refer to chapter 4.2 for the load modes.

4 Parameters Setting

4.1 Battery parameters

4.1.1 Supported Battery Types

1	**Lead acid battery**	Sealed (default)
		Gel
		Flooded
2	**Lithium battery**	LiFePO4 (4S/8S/15S/16S)
		Li(NiCoMn)O2 (3S/6S/7S/13S/14S)
3	**User defined**	

Note: If the controller supports 48V system voltage, the battery type will display LiFePO4 F15/F16 and Li(NiCoMn)O2 N13/N14.

4.1.2 Local setting

WARNING

When the default battery type is selected, the battery voltage parameters cannot be modified. To change these parameters, select the "USE" type.

Step 1: Choose the "USE" battery type. Detailed operations for choosing the "USE" battery type are shown in the following table.

Content	Operation steps
Choose the "USE" battery type	1) Press the "BATT" button to browse the battery parameters. Press the "SET" button to enter the battery parameters setting interface, and long-press the "BATT" button to enter the battery type interface. 2) Press the "PV / +" or "LOAD / -" button to select the "USE" battery type, and then press the "SET" button to confirm. 3) Press the "SET" button again or wait for 10s of no operation to automatically go back to the battery parameters setting interface.

Step 2: Set the battery parameters on the local device.

Long-press the "BATT" button to enter the battery type interface again from the battery parameters setting interface. If needed, press the "PV / +" or "LOAD / -" button to select the battery type "USE" interface. Under the "USE" interface, the battery parameters that can be locally set are shown in the table below:

Parameters	Default	Range	Operation steps
System voltage level (SYS)*	12VDC	12/ 24/ 36/ 48VDC or "0" (auto detect)	a) Under the "USE" battery type, press the "SET" button to enter the "SYS" interface. b) Press the "SET" button again to display the current "SYS" value. c) Press the "PV / +" or "LOAD / -" button to modify the parameter. d) Press the "SET" button to confirm and enter the next parameter.
Boost charging voltage (BCV)	14.4V	9~17V	a) Press the "SET" button again to display the current voltage value. b) Press the "PV / +" or "LOAD / -" button to modify the parameter (press the "PV / +" button to increase the value by 0.1V, press the "LOAD / -" button to decrease the value by 0.1V). c) Press the "SET" button to confirm and enter the next parameter.
Float charging voltage (FCV)	13.8V	9~17V	
Low voltage reconnect voltage (LVR)	12.6V	9~17V	
Low voltage disconnect voltage (LVD)	11.1V	9~17V	
Lithium battery low temperature protection enabled (LEN)	NO	YES/NO	Protects the lithium battery from charging / discharging in low temperatures (default cut-off threshold 0°C; it can be changed via an app, remote meter or PC software). Press the "PV / +" or "LOAD / -" button to modify the protection status. Press "SET" button to confirm.

Note: The controller will exit from the current interface after the period of inactivity longer than 10s**.**

**The SYS value can only be modified under the non-lithium "USE" type. The SYS value can be modified if the battery type is Sealed, Gel, or Flooded before entering the "USE" type. The SYS value cannot be modified if it is a lithium battery type before entering the "USE" type.*

For the no-battery application, the SYS value must be set to the nominal input voltage of the inverter or another load / device connected to the battery terminals of the controller. Never use the controller in a no-battery application with SYS = 0 (auto detect).

The above battery parameters can be set locally on the controller screen. Any changes to these parameters automatically affect the values for other remaining battery parameters (settable via an app, remote meter or PC software) which by default are calculated using the following formulas:

Battery type / Battery parameters	Sealed/Gel/Flooded User	LiFePO4 User	Li(NiCoMn)O2 User
Over voltage disconnect voltage	BCV + 1.4V * *voltage multiple*	BCV + 0.3V * *voltage multiple*	BCV + 0.3V * *voltage multiple*
Charging limit voltage	BCV + 0.6V * *voltage multiple*	BCV + 0.1V * *voltage multiple*	BCV + 0.1V * *voltage multiple*
Over voltage reconnect voltage	BCV + 0.6V * *voltage multiple*	BCV + 0.1V * *voltage multiple*	Boost charging voltage
Equalize charging voltage	BCV + 0.2V * *voltage multiple*	Boost charging voltage	Boost charging voltage
Boost reconnect charging voltage	FCV - 0.6V * *voltage multiple*	FCV - 0.6V * *voltage multiple*	FCV - 0.1V * *voltage multiple*
Under voltage warning reconnect voltage	UVW + 0.2V * *voltage multiple*	UVW + 0.2V * *voltage multiple*	UVW + 1.7V * *voltage multiple*
Under voltage warning voltage	LVD + 0.9V * *voltage multiple*	LVD + 0.9V * *voltage multiple*	LVD + 1.2V * *voltage multiple*
Discharging limit voltage	LVD - 0.5V * *voltage multiple*	LVD - 0.1V * *voltage multiple*	LVD - 0.1V * *voltage multiple*

The term "voltage multiple" of the 12V system = 1, of the 24V system = 2, of the 36V = 3, and of the 48V = 4

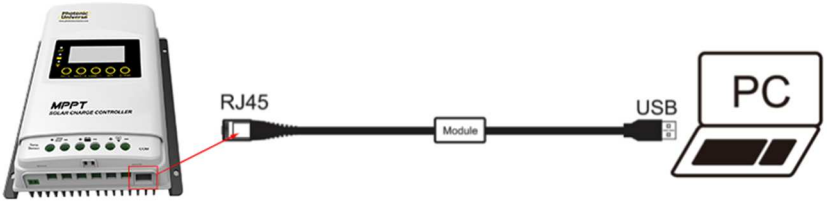
4.1.3 Remote setting

1) Setting the battery parameters by an app via built-in Bluetooth

Download the mobile app to your phone or tablet (check the product listing, datasheet or contact the supplier for the most up-to-date app) and connect to the built-in Bluetooth of the controller from the app. Change the voltage parameters on the controller by the app after setting the battery type to "USE".

2) Setting the battery parameters by PC software

Download the free PC software *Solar Station*. Connect the controller's RJ45 port to the PC's USB port via a USB to RS485 cable (product code **PTR-USB**). When the battery type has been set to "USE," the charging parameters can be set in *Solar Station* software.



3) Setting the battery parameters by an app via an external Wi-Fi module

Connect an optional Wi-Fi dongle (product code **EBOX-WIFI**) to the RS485 communication port of the controller. The charging parameters can be set using the mobile app after setting the battery type to "USE". This option also allows remote monitoring. Refer to the EBOX-WIFI manual for details.

4) Setting the battery parameters by a remote meter

Connect a remote meter (product code **MT52**) to the RJ45 port of the controller. The charging parameters can be set using the MT52 display after setting the battery type to "USE". Refer to the MT52 user manual for details.

The following list of controller parameters below can be viewed and set by using one of the above methods:

Lead-acid battery voltage parameters

Parameters in below table are provided for a 12V system at 25ºC. Please double the values for 24V systems and multiply the values by 4 for 48V systems.

Battery parameters \ Battery type	Sealed	GEL	Flooded	User Defined
Over voltage disconnect voltage	16.0V	16.0V	16.0V	9~17V
Charging limit voltage	15.0V	15.0V	15.0V	9~15.5V

Over voltage reconnect voltage	15.0V	15.0V	15.0V	9~15.5V
Equalise charging voltage	14.6V	——	14.8V	9~15.5V
Boost charging voltage	14.4V	14.2V	14.6V	9~15.5V
Float charging voltage	13.8V	13.8V	13.8V	9~15.5V
Boost reconnect charging voltage	13.2V	13.2V	13.2V	9~15.5V
Low voltage reconnect voltage	12.6V	12.6V	12.6V	9~15.5V
Under voltage warning reconnect voltage	12.2V	12.2V	12.2V	9~15.5V
Under voltage warning voltage	12.0V	12.0V	12.0V	9~15.5V
Low voltage disconnect voltage	11.1V	11.1V	11.1V	9~15.5V
Discharging limit voltage	10.6V	10.6V	10.6V	9~15.5V
Equalise Duration	120 minutes	——	120 minutes	0~180 minutes
Boost Duration	120 minutes	120 minutes	120 minutes	10~180 minutes

When the battery type is "USE," the lead-acid battery voltage parameters must meet these conditions:

A. Over Voltage Disconnect Voltage > Charging Limit Voltage ≥ Equalise Charging Voltage ≥ Boost Charging Voltage ≥ Float Charging Voltage > Boost Reconnect Charging Voltage.
B. Over Voltage Disconnect Voltage > Over Voltage Reconnect Voltage.
C. Low Voltage Reconnect Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage.
D. Under Voltage Warning Reconnect Voltage > Under Voltage Warning Voltage ≥ Discharging Limit Voltage.
E. Boost Reconnect Charging voltage > Low Voltage Reconnect Voltage.
F.

Lithium battery voltage parameters

Battery type / Battery parameters	LFP			
	LFP4S	**User Defined**	**LFP8S**	**User Defined**
Over voltage disconnect voltage	14.8V	9~17 V	29.6 V	18~34V
Charging limit voltage	14.6 V	9~15.5 V	29.2 V	18~31V
Over voltage reconnect voltage	14.6 V	9~15.5 V	29.2 V	18~31V
Equalise charging voltage	14.5 V	9~15.5 V	29.0 V	18~31V
Boost charging voltage	14.5 V	9~15.5 V	29.0 V	18~31V
Float charging voltage	13.8 V	9~15.5 V	27.6 V	18~31V
Boost reconnect charging voltage	13.2 V	9~15.5 V	26.4 V	18~31V
Low voltage reconnect voltage	12.8 V	9~15.5 V	25.6 V	18~31V

Under voltage warning reconnect voltage	12.2 V	9~15.5 V	24.4 V	18~31V
Under voltage warning voltage	12.0 V	9~15.5 V	24.0 V	18~31V
Low voltage disconnect voltage	11.1 V	9~15.5 V	22.2 V	18~31V
Discharging limit voltage	11.0 V	9~15.5 V	22.0 V	18~31V

Note: The LFP4S is for 12V batteries, and the LFP8S is for 24V batteries.

Battery type / Battery parameters	LFP		
	LFP15S	LFP16S	User Defined
Over voltage disconnect voltage	55.5V	59.2V	36~68V
Charging limit voltage	54.7V	58.4V	36~62V
Over voltage reconnect voltage	54.7V	58.4V	36~62V
Equalise charging voltage	54.3V	58.0V	36~62V
Boost charging voltage	54.3V	58.0V	36~62V
Float charging voltage	51.7V	55.2V	36~62V
Boost reconnect charging voltage	49.5V	52.8V	36~62V
Low voltage reconnect voltage	48.0V	51.2V	36~62V
Under voltage warning reconnect voltage	45.7V	48.8V	36~62V
Under voltage warning voltage	45.0V	48.0V	36~62V
Low voltage disconnect voltage	41.6V	44.4V	36~62V
Discharging limit voltage	41.2V	44.0V	36~62V

Note: The LFP15S and LFP16S are for 48V batteries.

Battery type / Battery parameters	LNCM				
	LNCM3S	User Defined	LNCM6S	LNCM7S	User Defined
Over voltage disconnect voltage	12.8 V	9~17 V	25.6 V	29.8 V	18~34V
Charging limit voltage	12.6 V	9~15.5 V	25.2 V	29.4 V	18~31V
Over voltage reconnect voltage	12.5 V	9~15.5 V	25.0 V	29.1 V	18~31V
Equalise charging voltage	12.5 V	9~15.5 V	25.0 V	29.1 V	18~31V
Boost charging voltage	12.5 V	9~15.5 V	25.0 V	29.1 V	18~31V

Float charging voltage	12.2 V	9~15.5 V	24.4 V	28.4 V	18~31V
Boost reconnect charging voltage	12.1 V	9~15.5 V	24.2 V	28.2 V	18~31V
Low voltage reconnect voltage	10.5 V	9~15.5 V	21.0 V	24.5 V	18~31V
Under voltage warning reconnect voltage	12.2 V	9~15.5 V	24.4 V	28.4 V	18~31V
Under voltage warning voltage	10.5 V	9~15.5 V	21.0 V	24.5 V	18~31V
Low voltage disconnect voltage	9.3 V	9~15.5 V	18.6 V	21.7 V	18~31V
Discharging limit voltage	9.3 V	9~15.5 V	18.6 V	21.7 V	18~31V

Note: The LNCM3S is for 12V batteries, the LNCM6S and LNCM7S are for 24V batteries.

Battery type / Battery parameters	LNCM		
	LNCM13S	LNCM14S	User Defined
Over voltage disconnect voltage	55.4V	59.7V	36~68V
Charging limit voltage	54.6V	58.8V	36~62V
Over voltage reconnect voltage	54.1V	58.3V	36~62V
Equalise charging voltage	54.1V	58.3V	36~62V
Boost charging voltage	54.1V	58.3V	36~62V
Float charging voltage	52.8V	56.9V	36~62V
Boost reconnect charging voltage	52.4V	56.4V	36~62V
Low voltage reconnect voltage	45.5V	49.0V	36~62V
Under voltage warning reconnect voltage	52.8V	56.9V	36~62V
Under voltage warning voltage	45.5V	49.0V	36~62V
Low voltage disconnect voltage	40.3V	43.4V	36~62V
Discharging limit voltage	40.3V	43.4V	36~62V

Note: The LNCM13S and LNCM14S are for 48V batteries.

When the battery type is "USE", the Lithium battery voltage parameters must meet these conditions:

A. Over Voltage Disconnect Voltage > Over Charging Protection Voltage (of battery BMS) + 0.2V;
B. Over Voltage Disconnect Voltage > Over Voltage Reconnect Voltage = Charging Limit Voltage ≥

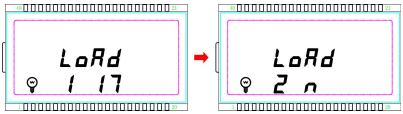
Equalise Charging Voltage = Boost Charging Voltage ≥ Float Charging Voltage > Boost Reconnect Charging Voltage;

C. Low Voltage Reconnect Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage.
D. Under Voltage Warning Reconnect Voltage > Under Voltage Warning Voltage ≥ Discharging Limit Voltage;
E. Boost Reconnect Charging voltage > Low Voltage Reconnect Voltage;
F. Low Voltage Disconnect Voltage ≥ Over Discharging Protection Voltage (of battery BMS) + 0.2V

CAUTION The required level of accuracy of BMS charging voltages must not be more than 0.2V.

4.2 Load modes

4.2.1 Local setting



When the LCD shows the above interface, the load settings can be changed as follows:

Step1: Press the “LOAD / -” button to browse the load parameters on the initial interface, and then press the “SET” button to enter the load parameters setting interface.

Step 2: Long-press the “LOAD / -” button to enter the load mode interface.

Step 3: Press the “PV / +” or “LOAD / -” button to change the load mode.

Step 4: Press the “SET” button to confirm.

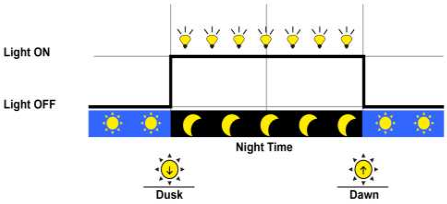
1) Load mode

1**	Timer 1	2**	Timer 2
100	Light ON/OFF	**2 n**	Disabled
101	The load will be on for 1 hour after sunset	**201**	The load will be on for 1 hour before sunrise
102	The load will be on for 2 hours after sunset	**202**	The load will be on for 2 hours before sunrise
103 ～ 113	The load will be on for 3～13 hours after sunset	**203 ～ 213**	The load will be on for 3～13 hours before sunrise
114	The load will be on for 14 hours after sunset	**214**	The load will be on for 14 hours before sunrise
115	The load will be on for 15 hours after sunset	**215**	The load will be on for 15 hours before sunrise
116	Test mode	**2 n**	Disabled
117	Manual mode (Default load ON)	**2 n**	Disabled
118	Always ON mode (The load always maintains the output state, and this mode is suitable for loads that require 24-hour power supply)		

CAUTION When selecting the load mode as the Light ON/OFF mode, Test mode, and Manual mode, only Timer 1 can be set, and Timer 2 is disabled and will display "2 n".

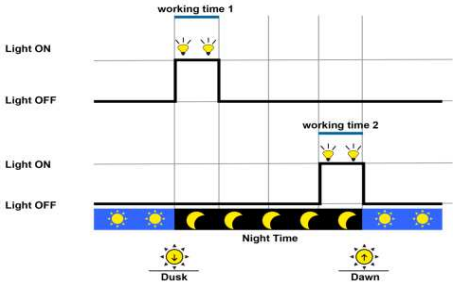
Light ON/OFF

The Light ON/OFF setting (100) of Timer 1 works as follows:



Light ON + Timer

The Light ON + Timer setting of Timer 1 (101-115) and Timer 2 (201-215) works as follows:



Manual Control (default)

In the Manual Control mode, the load can be turned ON and OFF by pressing the “LOAD / -” button.

4.2.2 Remote setting

All of the load settings available via the LCD screen of the controller can also be set or changed via the built-in Bluetooth or RS485 port of the controller through the app, remote meter or PC software. For detailed connection diagrams please refer to chapter 4.1.3 Remote Setting.

In the Manual Control mode, in addition to the “LOAD / -“ button control to turn the load ON and OFF, the controller can also receive remote commands from the app, remote meter or the PC software to turn the load ON and OFF.

The following additional load working mode is available with the remote connection only (the app, remote meter or the PC software):

Time Control

The load ON/OFF function is controlled by the timer settings to turn the load ON and OFF at specific preset times of the day. In this mode the controller will use the real-time clock for load control.

This function is only available remotely and is not available via the LCD screen of the controller.

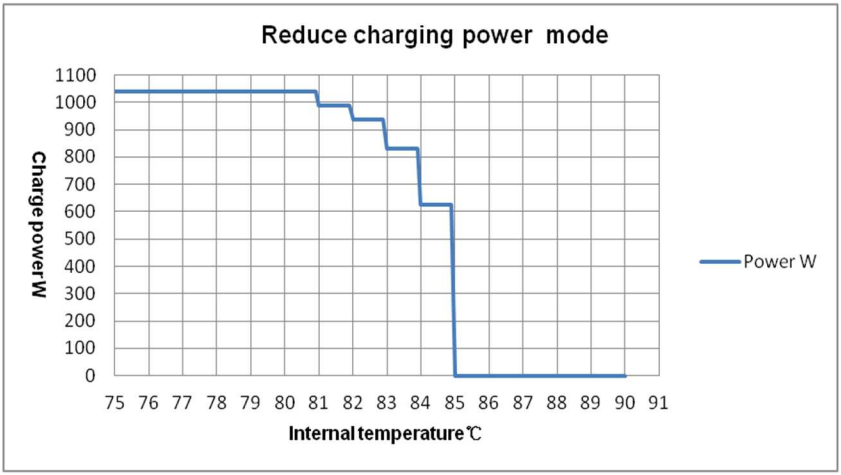
5 Protection, Troubleshooting and Maintenance

5.1 Protection

Protections	Instructions
PV over current/ over power	When the charging current or power of the PV array exceeds the controller's rated current or power, it will be charged at the rated current or power. ⚠ **WARNING: The PV input open-circuit voltage cannot be higher than the "maximum PV open-circuit voltage." Otherwise, the controller will be damaged.**
PV short circuit (only when not charging)	When not charging from PV, the controller will not be damaged from short-circuiting in the PV array. ⚠ **WARNING: Do not short-circuit the PV array during charging as this may damage the controller.**
PV reverse polarity	If the PV array is connected to the controller with the wrong polarity, the controller is protected from damage. ⚠ **CAUTION: If the PV power is over 1.5 times the rated charge power of the controller, reverse polarity connection will damage the controller.**
Night reverse flow	Prevents the battery from discharging to the PV array at night.
Battery reverse polarity (only when PV is disconnected)	When there is no PV connected, the battery can be connected with reverse polarity. If the battery is connected to the controller with reverse polarity, please disconnect the battery and reconnect with the correct polarity immediately. ⚠ **WARNING: The controller will be damaged if the battery is connected to the controller with reverse polarity when the PV is connected.**
Battery over voltage	When the battery voltage exceeds the Over Voltage Disconnect Voltage, the controller will stop charging the battery to protect the battery from being overcharged.
Battery over discharge	When the battery voltage is lower than the Low Voltage Disconnect Voltage, the controller will stop discharging to protect the battery from being over-discharged.
Battery over-heating	The controller can detect the battery temperature through an external temperature sensor. The controller stops charging when the temperature exceeds 65°C and will not resume charging until the temperature drops to below 55°C.
Lithium battery low temperature	When the temperature detected by the temperature sensor is lower than the Low Temperature Protection Threshold (LTPT), the controller will stop charging and discharging automatically. When the detected temperature is higher than the LTPT, the controller will work normally. The LTPT is 0°C by default and can be set from -40°C to +10°C via the app, remote meter or in PC software.
Load short circuit	When the load is short-circuited (the current is ≥ 4 times the rated controller load current), the controller will automatically cut off the output. It will try to reconnect the load output automatically 5 times (with a delay of 5s, 10s, 15s, 20s, 25s). If the short circuit repeats, the controller must be reset by pressing the "LOAD / -" button, restarting the controller, or waiting for one night-day cycle (night time > 3 hours).
Overload	If an overload is detected (the current is ≥ 1.02 times the rated load current), the controller will automatically cut off the output. If the next five load reconnect attempts are unsuccessful (with a delay of 5s, 10s, 15s, 20s, 25s), the controller must be reset by pressing the "LOAD / -" button, restarting the controller, or waiting for one night-day cycle (night time > 3 hours).
Controller over-heating*	The controller can monitor its internal temperature using a built-in temperature sensor. The controller stops working when its internal temperature exceeds 85°C and resumes work when its temperature is below 75°C.
TVS high voltage transients	The internal circuitry of the controller is designed with Transient Voltage Suppressors (TVS), which can only protect against high-voltage surge pulses with small power. If the controller is used in an area with frequent lightning strikes, it is recommended to install an external surge arrester.

** When the internal temperature reaches 81℃, the reduced charging power mode is turned on. It reduces the charging power by 5%, 10%, 20% and, 40% with every increase of 1℃. If the internal temperature exceeds 85℃, the controller will stop charging. When the temperature declines to below 75℃, the controller will resume working.*

For example, for an XTR4215N controller in a 24V system:



5.2 Troubleshooting

Faults	Possible reasons	Troubleshooting
Charging LED indicator is off during the daytime when the PV modules are in bright direct sunlight.	PV array is not connected, or connected with the wrong polarity	Confirm that PV input is securely wired into the PV terminals of the controller with the correct polarity.
The battery is connected, but the controller is not recognising it / not working	Battery voltage at the controller terminals is lower than 8V	Check the voltage at the battery terminals of the controller. At least 8V is needed to start the controller.
	Blown fuse or circuit breaker between the controller and the battery.	Check the fuse and the circuit breaker and it case if it blown / open, disconnect the PV and idenfity the cause of the issue.
Green charging indicator is flashing fast. Battery level shows full, battery frame and fault icon are blinking.	Battery over voltage	Check if the battery voltage is higher than OVD (over voltage disconnect voltage), and disconnect the PV input.
Red charging indicator is ON solid. Battery level is empty, battery frame and fault icon are blinking.	Battery over-discharged	Charge the battery. When its voltage exceeds LVR (low voltage reconnect voltage), the load output will reconnect.

Red battery indicator is flashing slowly.  Battery frame and fault icon are blinking.	Battery overheating	The controller will automatically turn the system off. When the temperature drops to below 55ºC, normal operation will resume.
PV and BATT indicators are flashing fast.	Controller overheating	When the internal temperature of the controller exceeds 85°C, the controller will automatically cut off the input and output circuits. The controller will start working again when the temperature drops back below 75°C
	System voltage error	1. Check whether the battery voltage matches the system voltage level set on the controller. **Note:** The fault can be ignored for the no-battery application if the voltage of the inverter matches the system voltage set in the controller. The alarm will disappear after 3 minutes or when the “LOAD / -” button is pressed.
1. The load has no output. 2. LCD blinks “E001.” 3. Load and fault icons blink. 	Load short circuit	1. Carefully check the load connection, identify and remove the fault. 2. Restart the controller. 3. Press the “LOAD / -” button or wait for one night-day cycle (night time > 3 hours).
1. The load has no output. 2. LCD blinks “E002.” 3. Load and fault icons blink. 	Load overload*	1. Reduce the size of the loads connected to the load terminals. 2. Restart the controller. 3. Press the “LOAD / -” button or wait for one night-day cycle (night time > 3 hours).

* In case of overload, when the actual load current exceeds the rated load curent, the load will be cut off after the following delay:

The actual load current as a factor of the rated load current	1.02-1.15	1.15-1.25	1.25-1.35	1.35-1.50
Delay time of the load cut off	50s	30s	10s	2s

5.3 Maintenance

To ensure the controller is properly maintained please do the following at least twice a year:

- Check that the controller is firmly installed in a clean and dry environment.
- Make sure there is nothing blocking the airflow to the controller. Clear any dirt or debris on the heat sink.
- Check all the wires for signs of damage from sun exposure, frictional wear, dryness, insects, or rats, etc. Replace any damaged wires.

- Tighten all the terminals. Inspect for loose, broken, or burnt connections at the terminals.
- Check the display and LED indicators of the controller to ensure they are working as expected. Pay attention to any troubleshooting or error indication.
- Check and confirm that any fuses or lightning arresters installed with the controller are in good working condition.

WARNING

Risk of electric shock!
Ensure all the power is turned off before performing the steps above.

6 Technical Specifications

Item	XTR1206N	XTR2206N	XTR1210N	XTR2210N	XTR3210N	XTR4210N
Electrical Parameters						
Rated Battery Voltage	12V/24V DC auto[1]					
Rated Charging Current	10A	20A	10A	20A	30A	40A
Rated Discharging Current	10A	20A	10A	20A	30A	40A
Battery Voltage Range	8 ~ 31V					
PV Maximum Open-circuit Voltage	46V (at 25°C environment temperature) 60V (at minimum operating environment temperature)		92V (at 25°C environment temperature) 100V (at minimum operating environment temperature)			
MPPT Voltage Range	(Battery voltage + 2V) ~ 36V		(Battery voltage + 2V) ~ 72V			
Rated Charging Power	130W / 12V 260W / 24V	260W / 12V 520W / 24V	130W / 12V 260W / 24V	260W / 12V 520W / 24V	390W / 12V 780W / 24V	520W / 12V 1040W / 24V
Maximum Conversion Efficiency	97.9%	98.3%	98.2%	98.3%	98.6%	98.6%
Maximum Load Efficiency	97.0%	96.7%	96.2%	96.4%	96.6%	96.5%
Standby current (COM port enabled)	≤ 10mA (12V) ≤ 7mA (24V)	≤ 10mA (12V) ≤ 7mA (24V)	≤ 15mA (12V) ≤ 9mA (24V)	≤ 15mA (12V) ≤ 9mA (24V)	≤ 15mA (12V) ≤ 9mA (24V)	≤ 15mA (12V) ≤ 9mA (24V)
Standby current (COM port disabled)	≤ 8mA (12V) ≤ 5mA (24V)	≤ 8mA (12V) ≤ 5mA (24V)	≤ 8mA (12V) ≤ 6mA (24V)	≤ 8mA (12V) ≤ 6mA (24V)	≤ 8mA (12V) ≤ 5mA (24V)	≤ 8mA (12V) ≤ 5mA (24V)
Load Circuit Voltage Drop	≤ 0.23V					
Temperature Compensation[2]	-3mV/°C/2V (Default)					

Grounding Type	Common negative					
RS485 Port	5VDC / 200mA (RJ45)					
LCD Backlight Time	Default: 60S, Range: 0 ~ 999S (0S: the backlight is ON all the time)					
Mechanical Parameters						
Dimension (L x W x H)	175 × 143 × 48 mm	217 × 158 × 56.5 mm	175 × 143 × 48 mm	217 × 158 × 56.5 mm	230 × 165 × 63 mm	255 × 185 × 67.8 mm
Mounting Size (L x W)	120 × 134 mm	160 × 149 mm	120 × 134 mm	160 × 149 mm	173 × 156 mm	200 × 176 mm
Mounting Hole Size	Φ5mm	Φ5mm	Φ5mm	Φ5mm	Φ5mm	Φ5mm
Terminal	4 mm^2 (12 AWG)	16 mm^2 (6 AWG)	4 mm^2 (12 AWG)	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)
Recommended Battery Cable Size	4 mm^2 (12 AWG)	6 mm^2 (10 AWG)	4 mm^2 (12 AWG)	6 mm^2 (10 AWG)	10 mm^2 (8 AWG)	16 mm^2 (6 AWG)
Net Weight	0.58kg	0.97kg	0.59kg	0.97kg	1.30kg	1.72kg

1. When a lithium battery is used, the system voltage cannot be identified automatically.
2. When a lithium battery is used, the temperature compensation coefficient must be "0" and cannot be changed.

Item	**XTR3215N**	**XTR4215N**	**XTR3415N**	**XTR4415N**
Electrical Parameters				
Rated Battery Voltage	12V / 24V DC auto[1]		12V / 24V / 36V / 48V DC auto[1]	
Rated Charging Current	30A	40A	30A	40A
Rated Discharging Current	30A	40A	30A	40A
Battery Voltage Range	8 ~ 31V	8 ~ 31V	8 ~ 62V	8 ~ 62V
PV Maximum Open-circuit Voltage	138V (at 25°C environment temperature) 150V (at minimum operating environment temperature)			
MPPT Voltage Range	(Battery voltage + 2V) ~ 108V			
Rated Charging Power	390W / 12V 780W / 24V	520W / 12V 1040W / 24V	390W / 12V 780W / 24V 1170W / 36V 1560W / 48V	520W / 12V 1040W / 24V 1560W / 36V 2080W / 48V
Maximum Conversion Efficiency	97.6%	97.9%	98.1%	98.5%
Maximum Load Efficiency	95.1%	95.4%	96.9%	97.2%
Standby current (COM port enabled)	≤ 15mA (12V) ≤ 9mA (24V)	≤ 15mA (12V) ≤ 9mA (24V)	≤ 14mA (12V) ≤ 9mA (24V) ≤ 8mA (36V) ≤ 7mA (48V)	≤ 14mA (12V) ≤ 9mA (24V) ≤ 8mA (36V) ≤ 7mA (48V)

Standby current (COM port disabled)	≤ 8mA (12V) ≤ 5mA (24V)	≤ 8mA (12V) ≤ 5mA (24V)	≤ 8mA (12V) ≤ 5mA (24V) ≤ 5mA (36V) ≤ 5mA (48V)	≤ 8mA (12V) ≤ 5mA (24V) ≤ 5mA (36V) ≤ 5mA (48V)
Load Circuit Voltage Drop	≤ 0.23V			
Temperature Compensation[2]	-3mV/°C/2V (Default)			
Grounding Type	Common negative			
RS485 Port	5VDC / 200mA (RJ45)			
LCD Backlight Time	Default: 60S, Range: 0 ~ 999S (0S: the backlight is ON all the time)			
Mechanical Parameters				
Dimension (L x W x H)	255 × 185 × 67.8 mm	255 × 187 × 75.7 mm	255 × 187 × 75.7 mm	255 × 189 × 83.2 mm
Mounting Size (L x W)	200 × 176 mm	200 × 178 mm	200 × 178 mm	200 × 180 mm
Mounting Hole Size	Φ5mm	Φ5mm	Φ5mm	Φ5mm
Terminal	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)
Recommended Battery Cable Size	10 mm^2 (8 AWG)	16 mm^2 (6 AWG)	10 mm^2 (8 AWG)	16 mm^2 (6 AWG)
Net Weight	1.66kg	2.08kg	2.16kg	2.60kg

1. When a lithium battery is used, the system voltage cannot be identified automatically.
2. When a lithium battery is used, the temperature compensation coefficient must be "0" and cannot be changed.

Environmental Parameters

Item	XTR1206/2206/1210/2210/3210/4210N	XTR3215/4215/3415/4415N
Working Temperature Range[1]	-25°C ~ +50°C	-25°C ~ +45°C
Storage Temperature Range	-20°C ~ +70°C	
Relative Humidity	≤ 95%, N.C.	
Enclosure	IP33 (3-protection against solid objects: protected against solids objects over 2.5mm. 3-protected against sprays to 60°from the vertical.	
Pollution Degree	PD2	

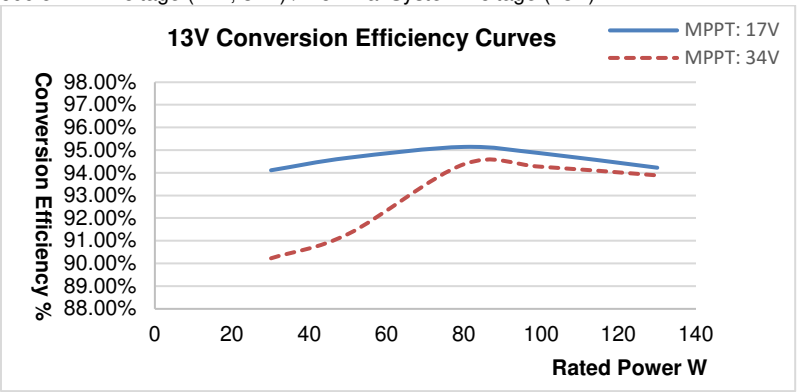
1. The controller is rated at full power in the working temperature range. When the internal temperature reaches 81°C, the reduced charging power mode is turned on. Please refer to chapter 5.1 Protection.

Annex I: Conversion Efficiency Curves

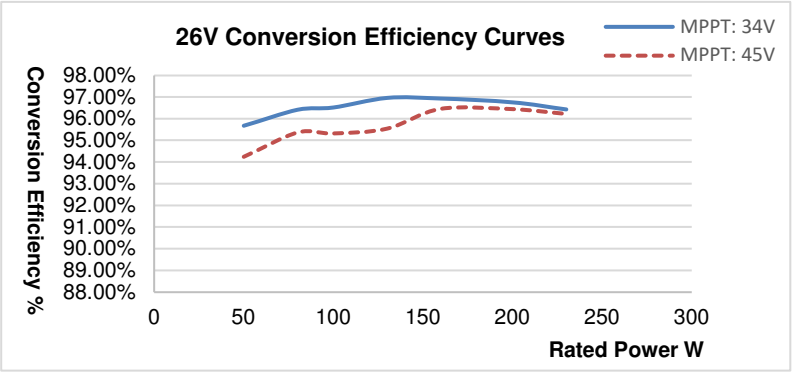
Illumination Intensity: 1000W/m^2 Temperature: 25ºC

Model: XTR1206N

1.Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

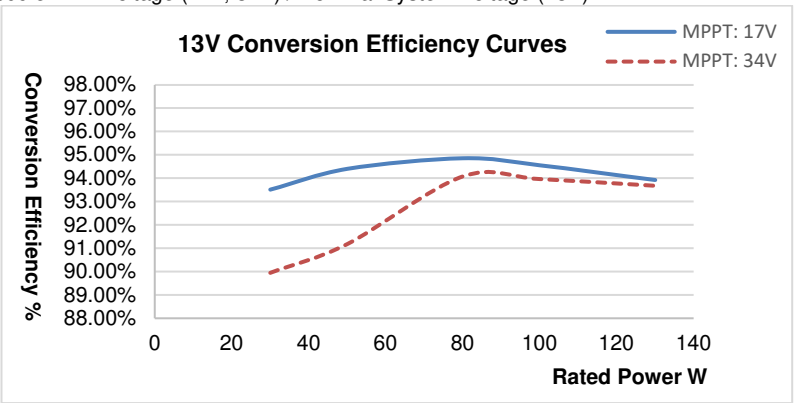


2. Solar Module MPP Voltage (34V, 45V) / Nominal System Voltage (26V)

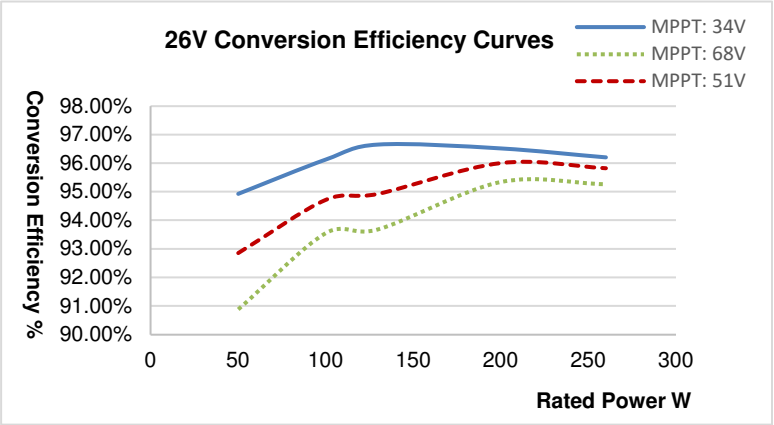


Model: XTR1210N

1. Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

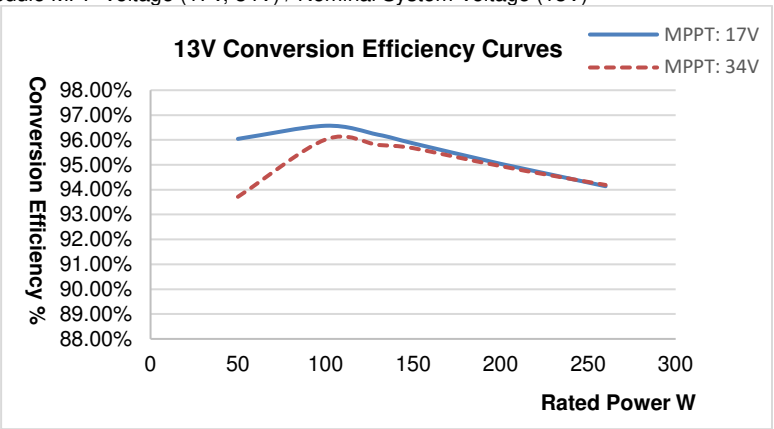


2. Solar Module MPP Voltage (34V, 51V, 68V) / Nominal System Voltage (26V)

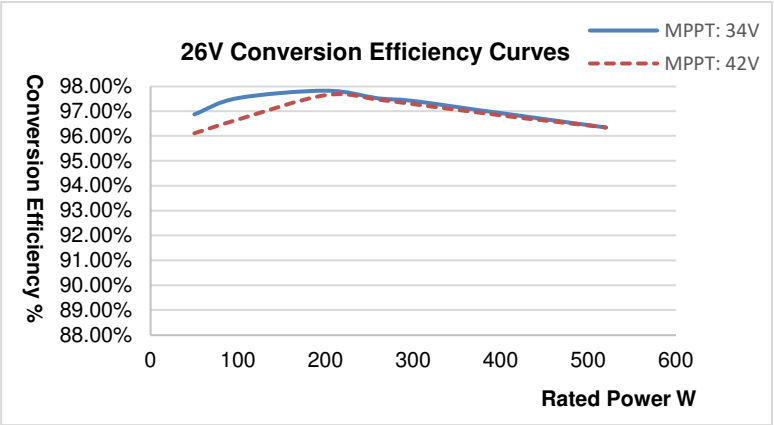


Model: XTR2206N

1. Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

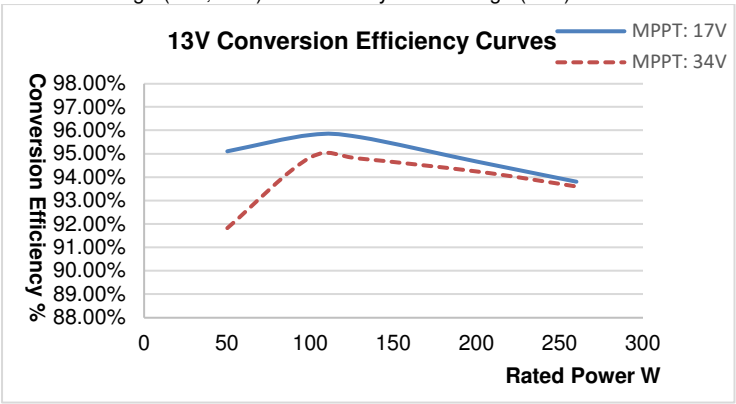


2. Solar Module MPP Voltage (34V, 42V) / Nominal System Voltage (26V)

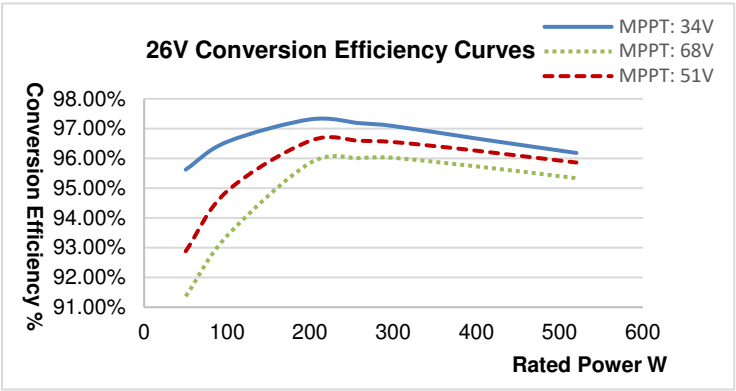


Model: XTR2210N

1. Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

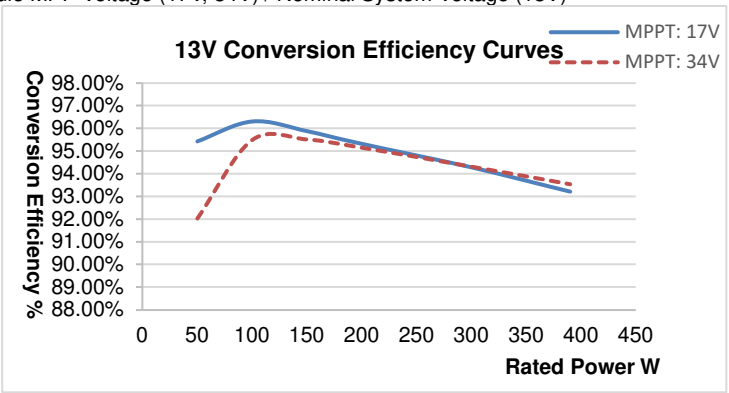


2. Solar Module MPP Voltage (34V, 51V, 68V) / Nominal System Voltage (26V)

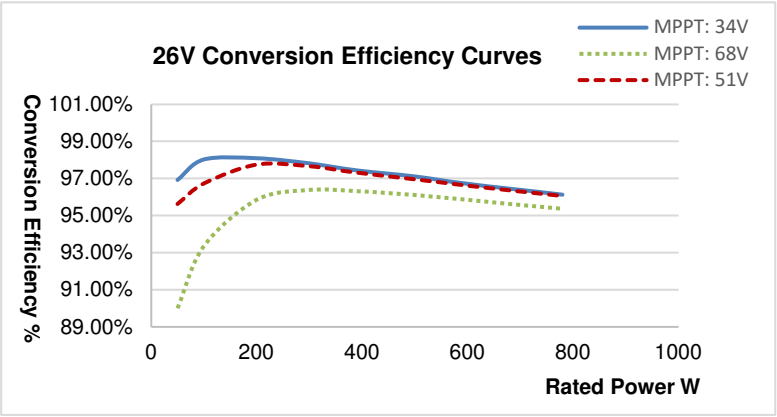


Model: XTR3210N

1. Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

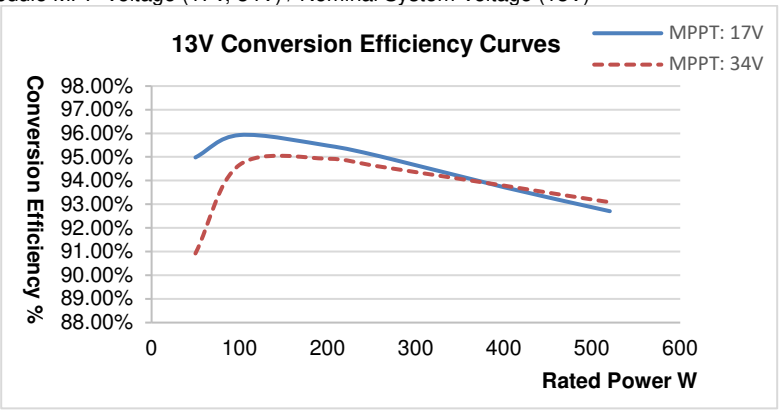


2. Solar Module MPP Voltage (34V, 51V, 68V) / Nominal System Voltage (26V)

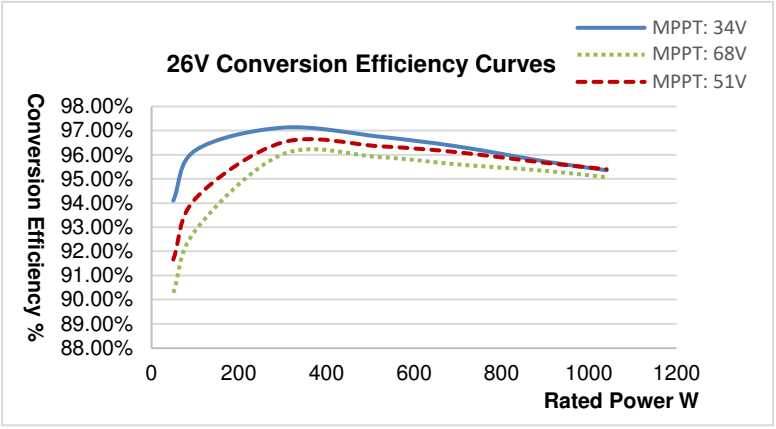


Model: XTR4210N

1. Solar Module MPP Voltage (17V, 34V) / Nominal System Voltage (13V)

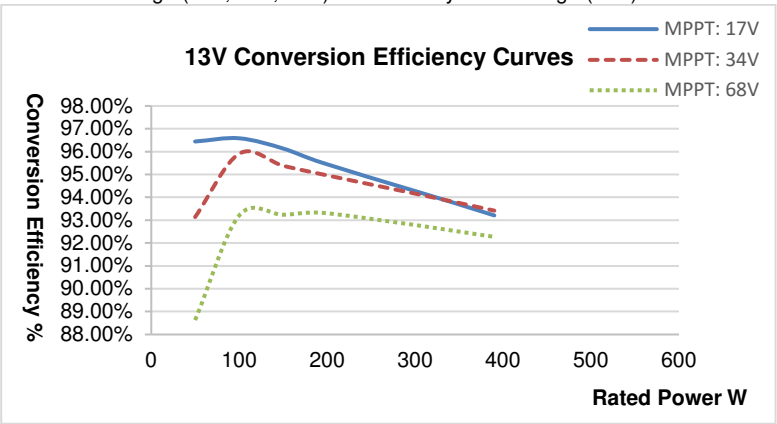


2. Solar Module MPP Voltage (34V, 51V, 68V) / Nominal System Voltage (26V)

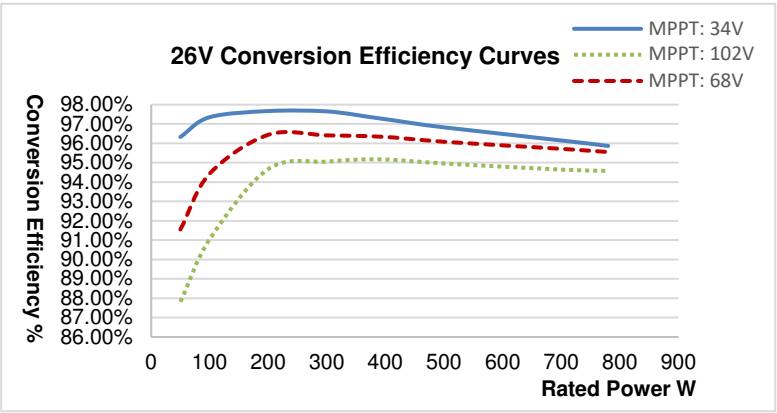


Model: XTR3215N

1. Solar Module MPP Voltage (17V, 34V, 68V) / Nominal System Voltage (13V)

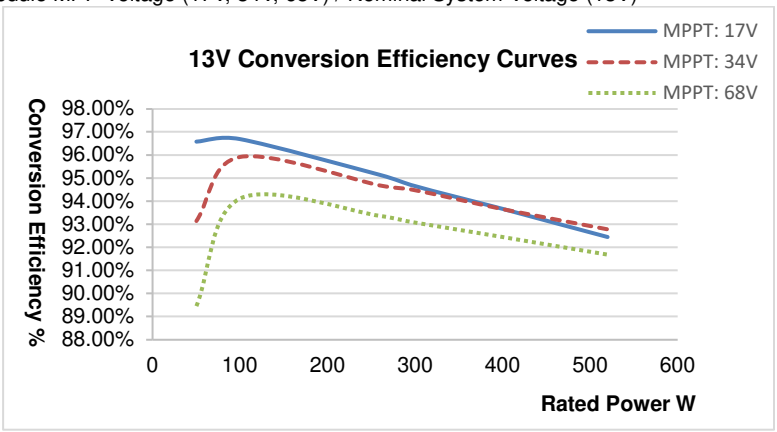


2. Solar Module MPP Voltage (34V, 68V, 102V) / Nominal System Voltage (26V)

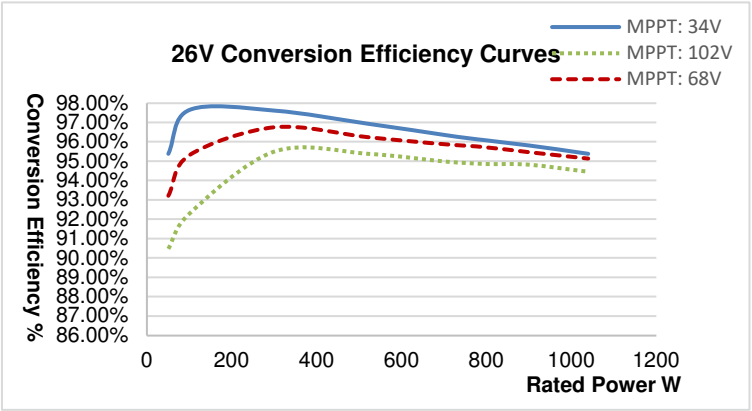


Model: XTR4215N

1. Solar Module MPP Voltage (17V, 34V, 68V) / Nominal System Voltage (13V)

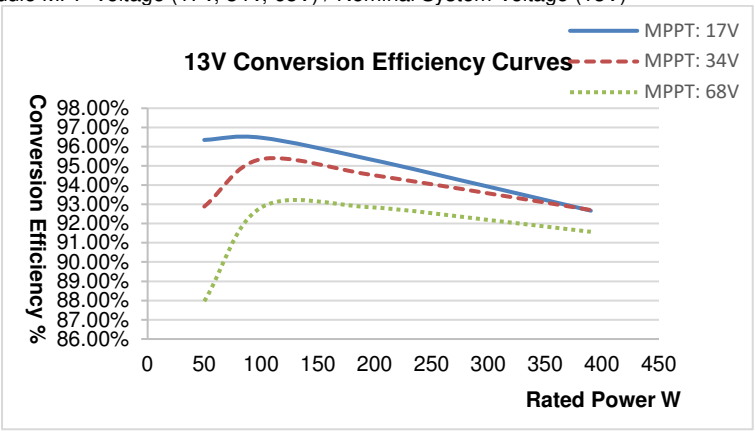


2. Solar Module MPP Voltage (34V, 68V, 102V) / Nominal System Voltage (26V)

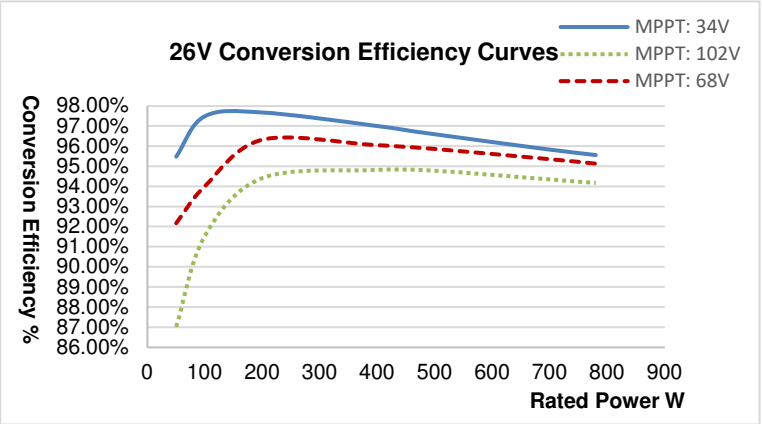


Model: XTR3415N

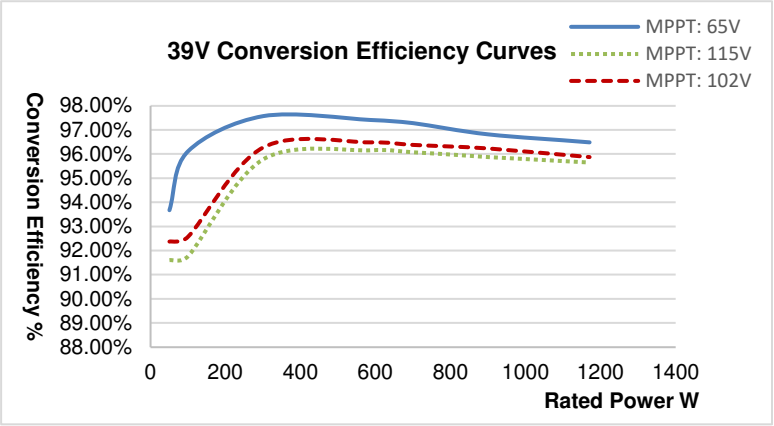
1. Solar Module MPP Voltage (17V, 34V, 68V) / Nominal System Voltage (13V)



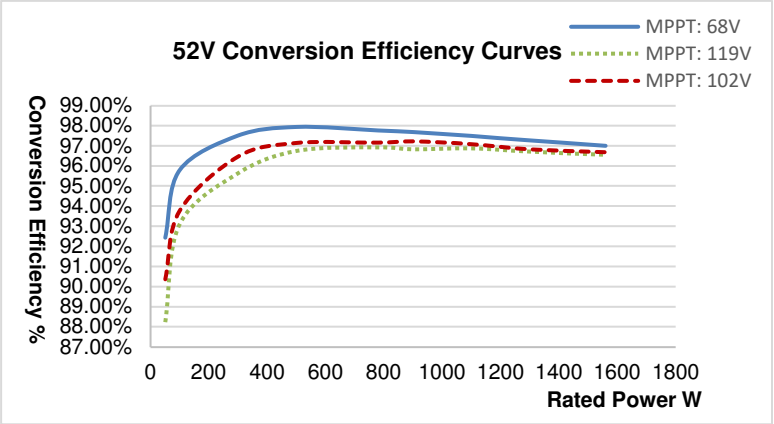
2. Solar Module MPP Voltage (34V, 68V, 102V) / Nominal System Voltage (26V)



3. Solar Module MPP Voltage (65V, 102V, 115V) / Nominal System Voltage (39V)

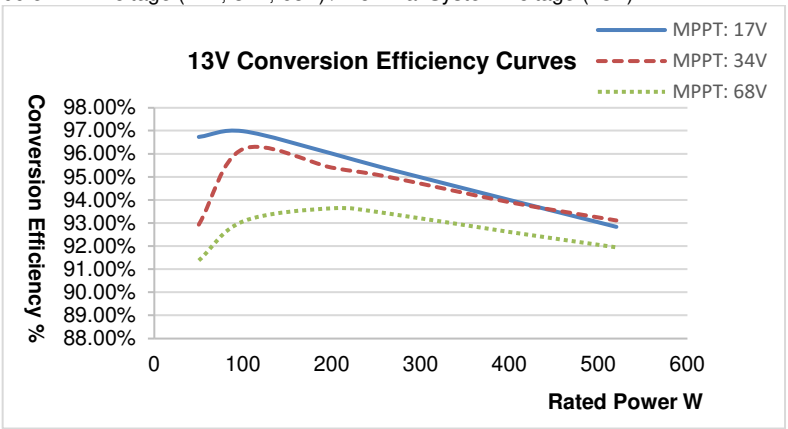


4. Solar Module MPP Voltage (68V, 102V, 119V) / Nominal System Voltage (52V)

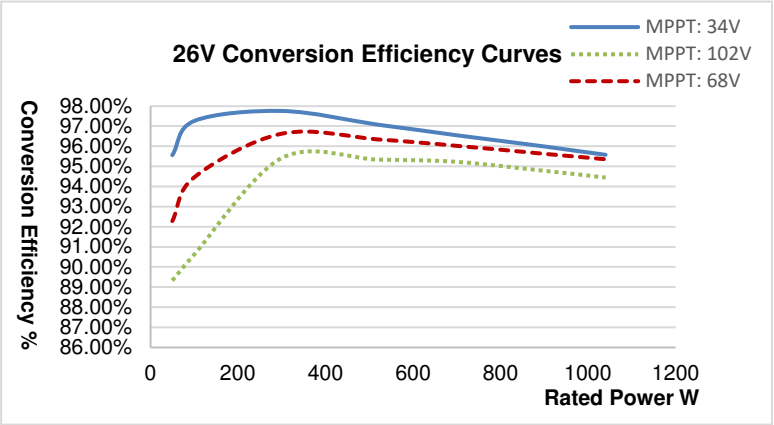


Model: XTR4415N

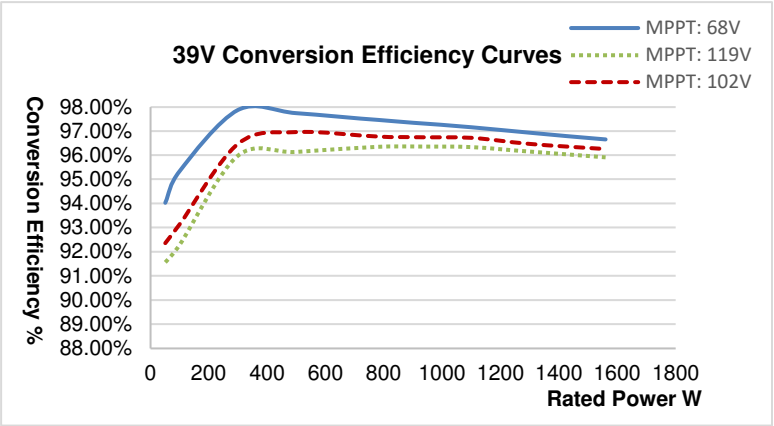
1. Solar Module MPP Voltage (17V, 34V, 68V) / Nominal System Voltage (13V)



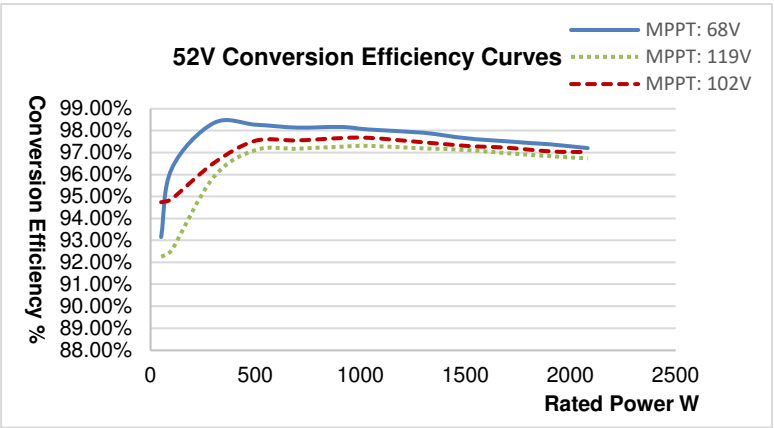
2. Solar Module MPP Voltage (34V, 68V, 102V) / Nominal System Voltage (26V)



3. Solar Module MPP Voltage (65V, 102V, 115V) / Nominal System Voltage (39V)



4. Solar Module MPP Voltage (68V, 102V, 119V) / Nominal System Voltage (52V)



Annex II: Optional Accessories

Remote meter MT52

Your Photonic Universe *XTR* series solar charge controller has a socket for connecting a remote LCD meter MT52 (purchased separately). This meter can display charging parameters such as battery and solar panel voltage, current (amps), power (watts), accumulated energy and the state of charge of your battery. It also allows adjustment of various charging parameters listed in chapter 4 Parameters Setting of this manual.

Wi-Fi communication module and the app

The module **EBOX-WIFI** plugs into the RJ45 socket of your Photonic Universe *XTR* solar charge controller. It allows the controller to connect to a local Wi-Fi network. You can then access the controller remotely from your mobile phone or tablet using the free mobile app for remote monitoring and adjustment of parameters, including battery type, voltages, load parameters and other settings. Please refer to the controller listing or datasheet or contact your supplier for the most up-to-date app.

RJ45 to USB converter PTR-USB

Your Photonic Universe *XTR* solar charge controller has an RJ45 port for connecting to a PC using an optional RJ45 to USB converter with 1.5m cable (product code **PTR-USB**). This converter allows using the PC software *Solar Station* for monitoring and programming the parameters of the controller.

If you would like to buy any of the above accessories for your solar charge controller, please visit our online shop
www.PhotonicUniverse.com

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