MPPT Solar controller

User Manual

Model

Tracer1206AN/Tracer2206AN

Tracer1210AN/Tracer2210AN

Tracer3210AN/Tracer4210AN

EN

Important Safety Instructions

Please reserve this manual for future review.

This manual contains safety, installation, and operation instructions for the Tracer-AN series MPPT solar controller ("controller" referred to in this manual).

- Read all the instructions and warnings carefully in the manual before installation.
- No user-serviceable components inside the controller; please do not disassemble or attempt to repair the controller.
- Mount the controller indoors. Avoid exposure to the components and do not 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.
- We suggest installing appropriate external fuses/breakers.
- Ensure to switch off PV array connections and the battery fuse/breakers before controller installation and adjustment.
- Power connections must remain tight to avoid excessive heating from a loose connection.

Contents

1 General Information

1.1 Overview

Adopting the advanced MPPT control algorithm, Tracer-AN solar controller can minimize the maximum power point loss rate and loss time. It makes this product tracks the PV array's maximum power point and obtains maximum energy under any situation. Compared with the PWM charging method, MPPT solar controllers can increase the energy utilization ratio by 10%-30%. Charging current limit, charging power limit, and high temperature charging automatic power reduction; these functions fully ensure system stability when access to excess PV modules and high temperature running. Increase a professional protection chip for the RS485 port, which further improves the reliability and meets the different application requirements.

Based on a digital control circuit, the Tracer-AN series controller owns a self-adaptive three-stage charging mode. It can effectively prolong the battery lifespan and significantly improve the system's performance. They are equipped with comprehensive electronic protections to ensure the solar system more reliable and more durable. This controller can be widely used for RV, household systems, field monitoring, and many other applications.

Features:

- Advanced MPPT, with efficiency no less than 99.5%
- Ultra-fast tracking speed and guaranteed tracking efficiency
- Advanced MPPT control algorithm to minimize the MPPT loss rate and loss time
- Accurate recognizing and tracking technology of multi-peaks maximum power point
- Maximum DC/DC conversion efficiency of 98%
- Automatic limitation of the charging current and charging power
- Wider MPPT working voltage range
- Support the lead-acid and lithium batteries; voltage parameters can be set on the controller①
- Programmable temperature compensation feature.
- Real-time energy statistics function
- High temperature charging automatic power reduction function
- Multiple load work modes
- High quality and low failure rate components of ST or IR to ensure the service life
- 100% charging and discharging in the environment temperature range

- Standard Modbus communication protocol based on the RS485 communication bus, making the communication distance longer
- A power protection chip, which can provide 5VDC/200mA power and over-current, short-circuit protections, is adopted by the communication interface
- Support monitoring and setting the parameters via the APP or PC software
- Comprehensive electronic protection

① For the BCV, FCV, LVD, and LVR, users can modify them on the local controller when the battery type is "USE."

1.2 Characteristics

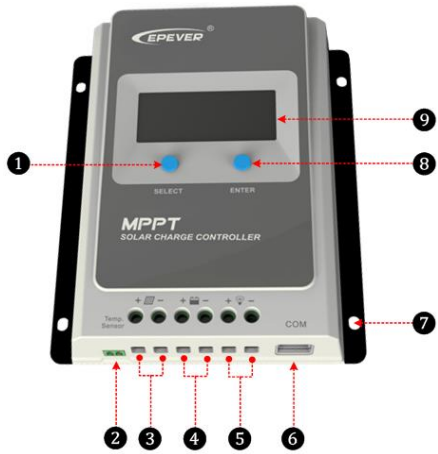
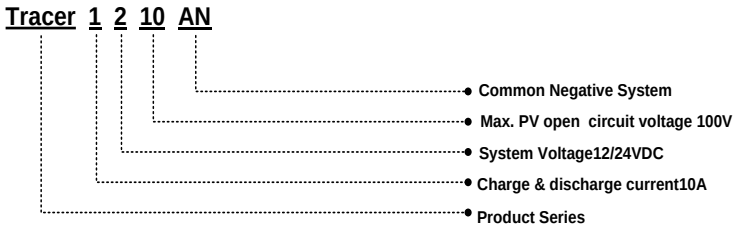


Figure 1-1 Product Characteristics

❶	**SELECT** button	❻	RS485 port
❷	RTS interface	❼	Mounting Hole Φ5mm
❸	PV Terminals	❽	**ENTER** button
❹	Battery terminals	❾	LCD
❺	Load terminals		

★ Suppose the remote temperature sensor is not connected to the controller or damaged. In that case, the controller will charge or discharge the battery at the default temperature setting of 25 ºC (no temperature compensation).

1.3 Naming rules



1.4 Maximum Power Point Tracking Technology

Due to the nonlinear characteristics of the solar array, there is a maximum energy output point (Max Power Point) on its curve. Traditional controllers, equipped with switch charging technology and PWM charging technology, can't charge the battery at the maximum power point and cannot obtain the maximum energy available from the PV array. In contrast, the solar charge controller with Maximum Power Point Tracking (MPPT) Technology can lock the point to obtain the maximum energy and deliver it to the battery.

Our company's MPPT algorithm continuously compares and adjusts the operating points to locate the array's maximum power point. The tracking process is fully automatic and does not need the user's adjustment.

As Figure 1-2, the curve is also the array's characteristic curve; the MPPT technology will 'boost' the battery charge current through tracking the MPP. Assuming 100% conversion efficiency exist in the solar system, the following formula is established:

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 energy conservation, the I_{Bat} is always higher than I_{PV}. The greater the difference between V_{Mpp} &V_{Bat}, the greater the difference between I_{PV}& I_{Bat}. The greater the difference between the array and the battery will also decrease the system conversion efficiency. Therefore, the controller's conversion efficiency is particularly important in the PV system.

Figure 1-2 is the maximum power point curve, whose shaded area is the traditional solar charge controller (PWM Charging Mode). It is known that the MPPT mode can improve solar PV usage.

According to the test, the MPPT controller can raise 20%-30% efficiency compared to the PWM controller. (Specified value may be fluctuant due to the influence of the circumstance and energy loss.)

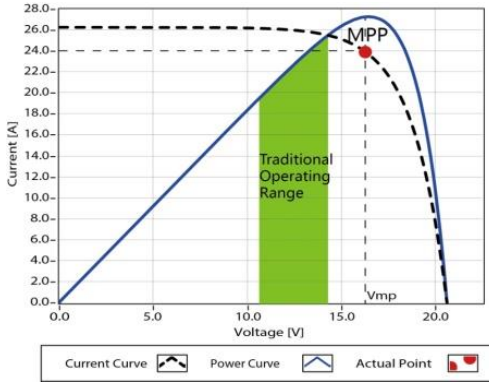


Figure 1-2 Maximum Power Point Tracking Technology

In actual application, as shading from cloud, tree, and snow, the panel may appear Multi-MPP. However, in actuality, there is only one real Maximum Power Point. As the below Figure 1-3 shows:

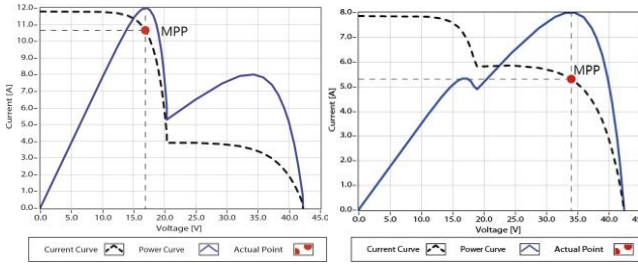


Figure 1-3 Mutil-MPP Curve

Suppose the program works improperly after appearing Multi-MPP. In that case, the system will not work on the real max power point, which may waste most solar energy resources and seriously affect the system's normal operation. The typical MPPT algorithm, designed by our company, can track the real MPP quickly and accurately. It can improve the PV array's utilization rate and avoid resource waste.

1.5 Battery charging stage

The controller has a three-stage battery charging algorithm, including Bulk Charging, Constant Charging, and Float Charging. Through the three-stage charging method, the system can extend the battery's lifespan.

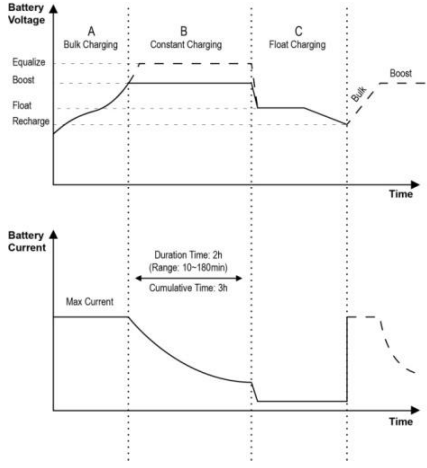


Figure 1-4 Battery charging stage curve

A) Bulk Charging

The battery voltage has not yet reached constant voltage (Equalize or Boost Charging Voltage). The controller operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging). When the battery voltage reaches the constant voltage set point, the controller will start to operate in constant charging mode.

B) Constant Charging

When the battery voltage reaches the constant voltage set point, the controller will start to operate in constant charging mode. The MPPT charging stops during this process, and the charging current will drop gradually at the same time. Constant charging has two stages, namely, equalize charging and boost charging. These two charging processes are not repeated. Among them, equalize charging starts on the 28th of each month.

➢ **Boost Charging**

The default duration of the boost charging stage is generally 2 hours. Customers can also adjust the constant time and preset value according to actual needs. When the duration is equal to the set value, the system will switch to the float charging stage.

➢ **Equalize Charging**

WARNING	Explosive Risk! Equalizing flooded batteries would produce explosive gases, so well ventilation of the battery box is recommended.

CAUTION	• Equipment damage! • Equalization may increase battery voltage to the level that damages sensitive DC loads. Verify that the load's allowable input voltages are greater than the equalizing charging setpoint voltage. • Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high an equalize charging or for too long may cause damage. Please carefully review the specific requirements of the battery used in the system.

Some battery types benefit from equalizing charging, stirring electrolytes, balancing battery voltage, and accomplishing chemical reactions. Equalize charging increases the battery voltage to make it higher than the standard complement voltage, gasifying the battery electrolyte.

If the controller automatically controls the next charge for equalizing charging, the equalizing charging time is 120 minutes. Equalize charge and boost charge are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

CAUTION:	• Due to the installation environment or load work, the system may not stabilize the battery voltage at a constant voltage. The controller will accumulate the time when the battery voltage is equal to the set value. When the accumulative time is equal to 3 hours, the system will automatically switch to float charging. • If the controller time is not adjusted, the controller will equalize charging following the inner time.

C) Float Charging

After the constant charging stage, the controller will reduce the battery voltage to the float charging preset voltage by reducing the charging current. During the floating charge stage, the battery is charged weakly to ensure that the battery is maintained in a fully charged state. In the float charging stage, loads can obtain almost all power from the solar panel. Suppose loads' power exceeds the solar array's power. In that case, the controller will no longer maintain the battery voltage in the float charging stage. When the battery voltage goes lower than the set value of the boost recharge voltage, the system will exit the float charging stage and enter the bulk charging stage again.

2 Installation

2.1 Attentions

- Be careful when installing the batteries. Please wear eye protection when installing the open-type lead-acid battery and rinse with clean water in time for battery acid contact.
- Keep the battery away from any metal objects, which may cause a short circuit of the battery.
- Acid gas may be generated when the battery is charged. Confirm that the surrounding environment is well ventilated.
- Avoid direct sunlight and rain infiltration when installing it outdoor.
- Loose power connectors 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 secure cables with cable clamps to prevent them from swaying in moving applications.
- Only charge the lead-acid and lithium-ion batteries within the control range of this controller.
- The battery connector may be wired to another battery or a bank of batteries. The following instructions refer to a singular battery. Still, 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 5A/mm^2 or less current density.

2.2 Requirements for the PV array

(1) Serial connection (string) of PV modules

As the core component of the solar system, the controller needs to suit various types of PV modules and maximize solar energy conversion into electricity. According to the open-circuit voltage (V_{OC}) and the maximum power point voltage (V_{MPP}) of the MPPT controller, the serial connection of PV modules suitable for different controllers can be calculated. The below table is for reference only.

Tracer1206/2206AN:

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

System voltage	72cell Voc＜ 46V		96cell Voc＜ 62V		Thin-Film module Voc＞ 80V
	Max.	Best	Max.	Best	
12V	1	1	-	-	-

24V	1	1	-	-	-

CAUTION	The above parameters are calculated under the STC (Standard Test Condition)--module temperature 25℃, air mass1.5, irradiance 1000W/m2.)

Tracer1210/2210/3210/4210AN:

System voltage	36cell Voc＜ 23V		48cell Voc＜ 31V		54cell Voc＜ 34V		60cell 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	72cell Voc＜ 46V		96cell Voc＜ 62V		Thin-Film module Voc＞ 80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	2	1	1	1	1

CAUTION	The above parameters are calculated under the STC (Standard Test Condition)--module temperature 25℃, air mass1.5, irradiance 1000W/m2.)

(2) Max. PV Array Power

The MPPT controller has the function of current/power-limiting. Namely, when the charging current or power exceeds the rated value, the controller will automatically reduce the actual charging current or power to the rated value. The function can effectively protect the charging parts of the controller and prevent damages to the controller due to the connection of some over-specification PV modules. The actual PV array running status shows as below:

Condition 1: Actual charging power of the PV array ≤ Rated charging power of the controller

Condition 2: Actual charging current of the PV array ≤ Rated charging current of the controller

When the controller operates under "Condition 1" or "Condition 2", it will carry out the charging as per the actual current or power; at this time, the controller can work at the maximum power point of the PV array.

CAUTION	The controller may be damaged when: 1. The PV module's power is not greater than the rated charging power. 2. The PV array's maximum open-circuit voltage is more than 60(Tracer**06AN)/100V(Tracer**10AN)(at the lowest environmental temperature).

Condition 3: Actual charging power of the PV array＞Rated charging power of the controller

Condition 4: Actual charging current of the PV array＞Rated charging current of the controller

When the controller operates under "Condition 3" or "Condition 4,"，it will carry out the charging as per the rated current or power.

CAUTION	The controller may be damaged when: 1. The PV module's power is greater than the rated charging power. 2. The PV array's maximum open-circuit voltage is more than 60(Tracer**06AN)/100V(Tracer**10AN)(at the lowest environmental temperature).

According to the "Peak Sun Hours diagram," if the PV array's power exceeds the controller's rated charging power, the charging time as per the rated power is prolonged. The controller can obtain more energy. However, in the practical application, the maximum power of the PV array shall be not higher than 1.5 times the rated charging power of the controller. Suppose the maximum power of the PV array exceeds the rated charging power of the controller too much. In that case, it causes the waste of the PV array, and increases the PV array's open-circuit voltage, which may increase the probability of damage to the controller. For the recommended maximum power of the PV array, please refer to the table below:

Model	Rated charge current	Rated charge power	PV array Max. PV power	Max. PV open circuit voltage
Tracer1206AN	10A	130W/12V 260W/24V	195W/12V 390W/24V	46V(At 25℃ operating environment) 60V(lowest environmental temperature)
Tracer2206AN	20A	260W/12V 520W/24V	390W/12V 780W/24V	
Tracer1210AN	10A	130W/12V 260W/24V	195W/12V 390W/24V	92V(At 25℃ operating environment) 100V(lowest environmental temperature)
Tracer2210AN	20A	260W/12V 520W/24V	390W/12V 780W/24V	
Tracer3210AN	30A	390W/12V 780W/24V	580W/12V 1170W/24V	
Tracer4210AN	40A	520W/12V 1040W/24V	780W/12V 1560W/24V	

2.3 Wire size

The wiring and installation methods conform to the national and local electrical code requirements.

➢ **PV wire size**

The PV array's output current varies with its size, connection method, and sunlight angle. The minimum wire size can be calculated by its ISC (short circuit current). Please refer to the ISC value in the PV module's specifications. When the PV modules are connected in series, the total ISC equals any PV module's ISC. When the PV modules are connected in parallel, the total ISC equals the sum of the PV module's ISC. The PV array's ISC must not exceed the controller's maximum PV input current. For max. PV input current and max. PV wire size, please refer to the table as below:

Model	Max. PV input current	Max. PV wire size
Tracer1206AN Tracer1210AN	10A	4mm^2/12AWG
Tracer2206AN Tracer2210AN	20A	6mm^2/10AWG
Tracer3210AN	30A	10mm^2/8AWG
Tracer4210AN	40A	16mm^2/6AWG

CAUTION	When the PV modules are connected in series, the total voltage must not exceed the max. PV open circuit voltage 46V(Tracer**06AN) or 92V(Tracer**10AN) at 25℃ environment temperature.

➢ **Battery and Load Wire Size**

The battery and load wire size conform to the rated current, the reference size as below:

Model	Rated charge current	Rated discharge current	Battery wire size	Load wire size
Tracer1206AN Tracer1210AN	10A	10A	4mm^2/12AWG	4mm^2/12AWG
Tracer2206AN Tracer2210AN	20A	20A	6mm^2/10AWG	6mm^2/10AWG
Tracer3210AN	30A	30A	10mm^2/8AWG	10mm^2/8AWG
Tracer4210AN	40A	40A	16mm^2/6AWG	16mm^2/6AWG

CAUTION	• The wire size is only for reference. Suppose there is a long distance between the PV array and the controller or between the controller and the battery. In that case, larger wires can be used to reduce the voltage drop and improve

	performance. • The recommended wire is selected for the battery according to the conditions that its terminals are not connected to any additional inverter.

2.4 Mounting

WARNING	• Risk of explosion! Never install the controller in a sealed enclose with flooded batteries! Do not install the controller in a confined area where battery gas can accumulate. • Risk of electric shock! When wiring the PV modules, the PV array may generate a high open-circuit voltage. Turn off the breaker or fuse firstly, and be careful when wiring.
CAUTION	The controller requires at least 150mm of clearance above and below for proper airflow. Ventilation is highly recommended if mounted in an enclosure.

Installation procedures:

Step 1: Determine the installation location and heat-dissipation space

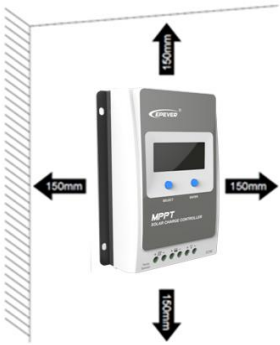


Figure2-1 Mounting

Step 2：Connect the system in the order of battery -- load --PV array following Figure 2-2," Schematic Wiring Diagram," and disconnect the system in the reverse order.

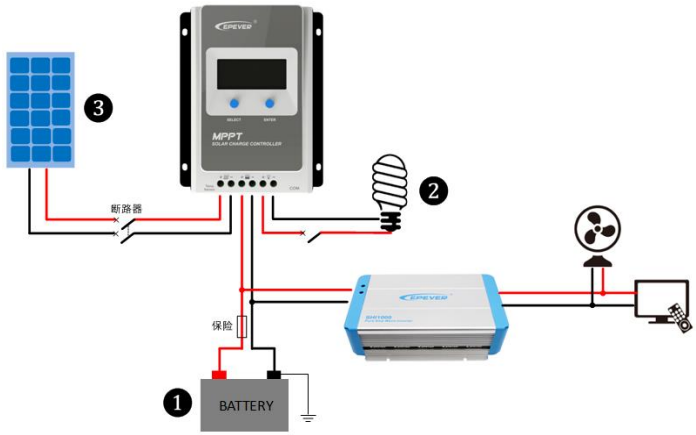


Figure 2-2 Wiring Diagram

CAUTION	• Please do not close the circuit breaker or fuse during the wiring and ensure that the leads of "+" and "-" poles are polarity correctly. • A fuse whose current is 1.25 to 2 times the controller's rated current must be installed on the battery side with a distance from the battery no longer than 150 mm. • If an inverter is to be connected to the system, connect the inverter directly to the battery, not to the load side of the controller.

Step 3：Grounding

Tracer-AN series are common-negative controllers. Negative terminals of the PV array, the battery, and the load can be grounded simultaneously, or any negative terminal is grounded. However, according to the practical application, the negative terminals of the PV array, battery, and load can also be ungrounded. However, the grounding terminal on its shell must be grounded. It shields electromagnetic interference and avoids electric shock to the human body.

CAUTION	For common-negative systems, such as the RV system, it is recommended to use a common-negative controller. If a common-positive controller is used and the positive electrode is grounded in the common-negative system, the controller may be damaged.

Step 4：Connect accessories

- **Connect the temperature sensor**

Included Accessory:

(Model: RT-MF58R47K3.81A)

Optional Accessory:

(Model: RTS300R47K3.81A)

Connect one end of the remote temperature sensor cable to the interface ③ and place the other end close to the battery.

CAUTION	Suppose the remote temperature sensor is not connected to the controller or damaged. In that case, the controller will charge or discharge the battery at the default 25 ºC (no temperature compensation).

- **Connect the accessories for RS485 communication**

Refer to 3.3 "Setting."

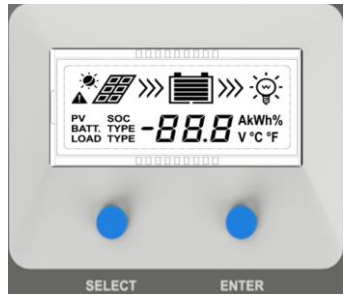
CAUTION	The internal circuit of the RS485 port has no isolation design. It is recommended to connect an RS485 communication isolator to the port before communicating.

Step 5：Power on the controller

Closing the battery fuse will power on the controller. Check the battery indicator status (the controller is operating normally when the indicator is lit green). Close the fuse and circuit breaker of the load and PV array. Then the system will be operating in the preprogrammed mode.

CAUTION	If the controller is not operating properly or the battery indicator shows an abnormality, please refer to 4.2 "Troubleshooting."

3 Operation



3.1 Buttons

Mode	Note
Load ON/OFF	It can turn the load On/Off via the **ENTER** button in manual load mode.
Clear fault	Press the **ENTER** button.
Browsing mode	Press the **SELECT** button.
Setting mode	Press the **ENTER** button and hold on 5s to enter the setting mode. Press the **SELECT** button to set the parameters. Press the **ENTER** button to confirm the setting parameters or no operation for 10s. It will exit the setting interface automatically.

3.2 Interface

1） Status Description

Name	Icon	Status
PV array		Day
		Night
		No charge
		Charging
	PV	PV array's voltage, current, and generate energy
Battery		Battery capacity, In charging

	BATT.	Battery Voltage, Current, Temperature
	BATT. TYPE	Battery type
Load		Load ON
		Load OFF
	LOAD	Current/Consumed energy/Load mode

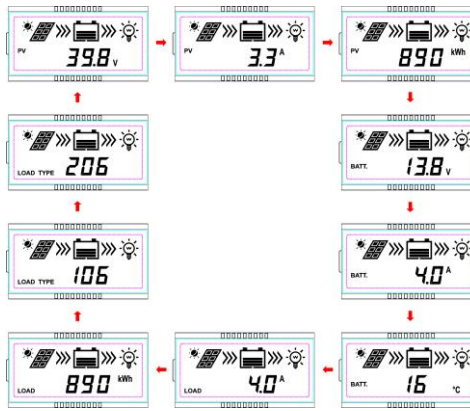
2） Error codes

Status	Icon	Instruction
Battery over-discharged		Battery level shows empty, battery frame blink, fault icon blink
Battery over voltage		Battery level shows full, battery frame blink, fault icon blink
Battery overheating		Battery level shows current value, battery frame blink, fault icon blink
Load failure		Overload①, Load short circuit

① When the load current reaches1.02-1.05 times, 1.05-1.25 times, 1.25-1.35 times, and 1.35-1.5 times more than the rated value, the controller will automatically turn off the loads in 50 seconds, 30 seconds,10 seconds, and 2 seconds respectively.

3） Browse interface

Press the **SELECT** button to cycle display the following interfaces.



3.3 Setting

1) Clear the generated energy

Step 1: Press the **ENTER** button and hold 5s under the PV-generated energy interface, and the value will be flashing.

Step 2: Press the **ENTER** button to clear the generated energy.

2) Switch the battery temperature unit

Press the button and hold 5s under the battery temperature interface.

3) Battery type

① Support battery types

1	**Battery**	Sealed(default)
		Gel
		Flooded
2	**Lithium battery**	LiFePO4(4S/ 8S)
		Li(NiCoMn)O2 (3S/6S/7S)
3	**User**	

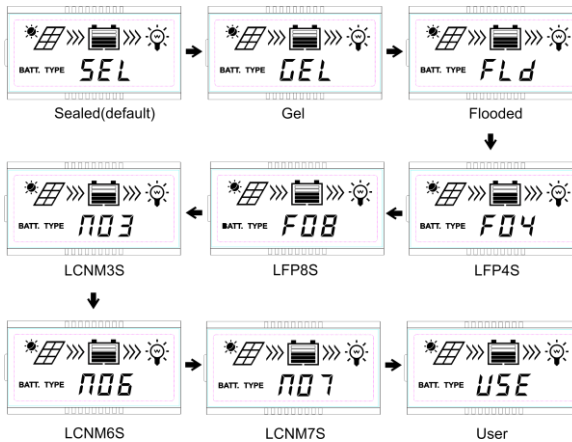
② Set the battery type via the LCD

Operation:

Step1: Press the **SELECT** button to browse the battery voltage interface.

Step2: Press and hold the **ENTER** button until the battery-type interface flashes.

Step3: Press the **SELECT** button to change the battery type, shown as below:

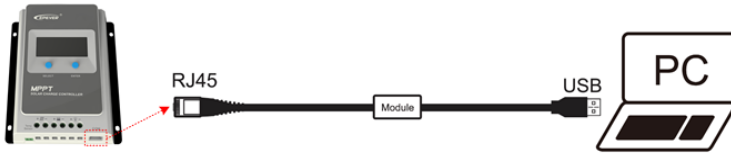


Step4: Press the **ENTER** button to confirm.

③ Set the battery parameters under "USE" battery type

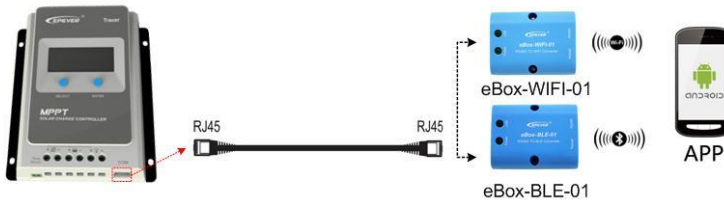
- **Setting the battery parameters by PC software**

Connect the controller's RJ45 interface to the PC's USB interface via a USB to RS485 cable (model: CC-USB-RS485-150U). When selecting the battery type as "USE," set the battery voltage parameters by the PC software. Refer to the cloud platform manual for detail.



- **Setting the battery parameters by APP**

Connect the controller to the WIFI module through a standard network cable or connect to the Bluetooth module by Bluetooth signal. When selecting the battery type as "USE," set the battery voltage parameters by the APP. Refer to the cloud APP manual for details.



- **Setting the battery parameters via the LCD**

Operation:

Step1: Enter the “USE” battery type. For detail operations of entering the “USE” battery type refer to the chapter 3.3 “Setting > ② **Set the battery type via the LCD**.”

Step2: Under the "USE" battery type, the battery parameters that can be set via the LCD are shown in the table below:

Parameters	Default	Range	Operation
SYS★	12VDC	12/24 VDC	1) Under the "USE" battery type, press the **ENTER** button to enter the “SYS” interface. 2) Press the **ENTER** button again to display the current “SYS” value. 3) Press the **SELECT** button to modify the parameter. 4) Press the **ENTER** button to confirm and enter the next parameter.

BCV	14.4V	9~17V	1) Press the **ENTER** button again to display the current voltage value. 2) Press the **SELECT** button to modify the parameter (short press to increase 0.1V, long press to decrease 0.1V). 3) Press the **ENTER** button to confirm and enter the next parameter.
FCV	13.8V	9~17V	
LVR	12.6V	9~17V	
LVD	11.1V	9~17V	
LEN	NO	YES/NO	Press the **SELECT** button to modify the switch status. Note: It exists automatically from the current interface after no operation of more than 10S.

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

Only the above battery parameters can be set on the local controller, and the remaining battery parameters follow the following logic (the voltage level of 12V system is 1, the voltage level of 24V system is 2).

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

④ Battery voltage parameters

- **Measure the parameters in the condition of 12V/25ºC. Please double the values in the 24V**

system.

Battery type / Battery parameters	Sealed	GEL	FLD	User
Over voltage disconnect voltage	16.0V	16.0V	16.0V	9~17V
Charging limit voltage	15.0V	15.0V	15.0V	9~17V
Over voltage reconnect voltage	15.0V	15.0V	15.0V	9~17V
Equalize charging voltage	14.6V	--	14.8V	9~17V
Boost charging voltage	14.4V	14.2V	14.6V	9~17V
Float charging voltage	13.8V	13.8V	13.8V	9~17V
Boost reconnect charging voltage	13.2V	13.2V	13.2V	9~17V
Low voltage reconnect voltage	12.6V	12.6V	12.6V	9~17V
Under voltage warning reconnect voltage	12.2V	12.2V	12.2V	9~17V
Under voltage warning voltage	12.0V	12.0V	12.0V	9~17V
Low voltage disconnect voltage	11.1V	11.1V	11.1V	9~17V
Discharging limit voltage	10.6V	10.6V	10.6V	9~17V
Equalize Duration	120 minutes	--	120 minutes	0～180 minutes
Boost Duration	120 minutes	120 minutes	120 minutes	10～180 minutes

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

- **When the battery type is "USE," the battery voltage parameters follow the following logic:**

A. Over Voltage Disconnect Voltage > Charging Limit Voltage ≥ Equalize 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.

⑤ Lithium Battery voltage parameters

Battery type / Battery parameters	LFP		LNCM			
	LFP4S	LFP8S	LCNM 3S	LCNM 6S	LCNM 7S	User①
Over voltage disconnect voltage	14.8V	29.6 V	12.8 V	25.6 V	29.8 V	9~17V
Charging limit voltage	14.6 V	29.2 V	12.6 V	25.2 V	29.4 V	9~17V
Over voltage reconnect voltage	14.6 V	29.2 V	12.5 V	25.0 V	29.1 V	9~17V
Equalize charging voltage	14.5 V	29.0 V	12.5 V	25.0 V	29.1 V	9~17V
Boost charging voltage	14.5 V	29.0 V	12.5 V	25.0 V	29.1 V	9~17V
Float charging voltage	13.8 V	27.6 V	12.2 V	24.4 V	28.4 V	9~17V
Boost reconnect charging voltage	13.2 V	26.4 V	12.1 V	24.2 V	28.2 V	9~17V
Low voltage reconnect voltage	12.8 V	25.6 V	10.5 V	21.0 V	24.5 V	9~17V
Under voltage warning reconnect voltage	12.2 V	24.4 V	12.2 V	24.4 V	28.4 V	9~17V
Under voltage warning voltage	12.0 V	24.0 V	10.5 V	21.0 V	24.5 V	9~17V
Low voltage disconnect voltage	11.1 V	22.2 V	9.3 V	18.6 V	21.7 V	9~17V
Discharging limit voltage	11.0 V	22.0 V	9.3 V	18.6 V	21.7 V	9~17V

① The battery parameters under the "User" battery type is 9-17V for LFP4S. They should x2 for LFP8S.

- **When the battery type is "USE," the Lithium battery voltage parameters follow the following logic:**

A. Over Voltage Disconnect Voltage>Over Charging Protection Voltage(Protection Circuit Modules(BMS))+0.2V;

B. Over Voltage Disconnect Voltage>Over Voltage Reconnect Voltage＝Charging Limit Voltage ≥ Equalize 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;

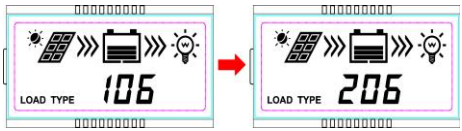
E. Boost Reconnect Charging voltage> Low Voltage Reconnect Voltage;

F. Low Voltage Disconnect Voltage ≥ Over Discharging Protection Voltage (BMS)+0.2V

CAUTION	The required accuracy of BMS is no higher than 0.2V. We will not assume responsibility for the abnormal when the accuracy of BMS is higher than 0.2 v.

4) Load mode setting

When the LCD shows the above interface, operate as follows:



Operation:

Step1: Press the **SELECT** button to browse the load mode interface.

Step2: Press and hold the **ENTER** button until the load mode interface begins to flash.

Step3: Press the **SELECT** button to modify the load mode.

Step4: Press the **ENTER** button to confirm.

① Load mode

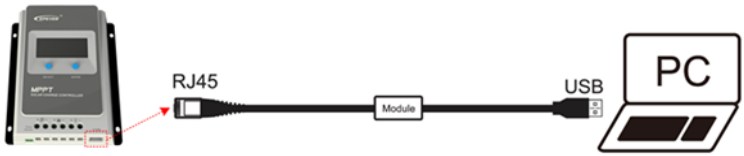
1**	Timer 1	2**	Timer 2
100	Light ON/OFF	**2 n**	Disabled
101	The load will be on for 1 hour since sunset	**201**	The load will be on for 1 hour before sunrise
102	The load will be on for 2 hours since sunset	**202**	The load will be on for 2 hours before sunrise
103 ~113	The load will be on for 3 ~13 hours since sunset	**203 ~213**	The load will be on for 3 ~13 hours before sunrise
114	The load will be on for 14 hours since sunset	**214**	The load will be on for 14 hours before sunrise
115	The load will be on for 15 hours since 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

CAUTION	Please set Light ON/OFF, Test mode, and Manual mode via Timer1. Timer2 will be disabled and display "2 n ".

② **Load mode setting**

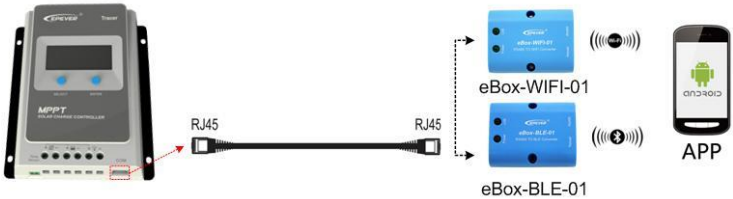
- **Load mode setting by PC software**

Connect the controller's RJ45 interface to the PC's USB interface via a USB to RS485 cable (model: CC-USB-RS485-150U). Set the load mode by the PC software. Refer to the cloud platform manual for detail.



- **Load mode setting by APP**

Connect the controller to the WIFI module through a standard network cable or connect to the Bluetooth module by Bluetooth signal. Set the load mode by the APP. Refer to the cloud APP manual for details.



- **MT50 Setting**

CAUTION	For detailed setting methods, please refer to the instructions or contact after-sales support.

4 Others

4.1 Protections

No.	Protections	Instruction
1	PV Over Current	When the actual PV array's charging current or power is higher than the controller's rated charging current or power, the controller will charge the battery per the rated current or power.
2	PV short-circuit protection	When not in the PV charging state, the controller will not be damaged in the case of short-circuiting in the PV array. **WARNING:** It is forbidden to short-circuit the PV array during charging. Otherwise, the controller may be damaged.
3	PV reverse polarity protection	When the PV array's polarity is reversed, the controller may not be damaged and resume work after the mis-wiring is corrected. **CAUTION:** If the PV array is reversed and its actual power is 1.5 times the controller's rated power, the controller may be damaged.
4	Night reverse charging protection	Avoid the battery from discharging to the PV module at night.
5	Battery reverse protection	When the polarity of the battery is reversed, the controller may not be damaged and resume normal operation after the mis-wiring is corrected. **CAUTION:** Limited to the characteristic of lithium battery, when the PV array connection right and battery connection reversed, the controller will be damaged.
6	Battery over voltage protection	When the battery voltage reaches the over voltage disconnect voltage, the PV array will automatically stop charging the battery to avoid battery damage.
7	Battery over-discharging protection	When the battery voltage is lower than the low voltage disconnect voltage, the battery discharging is automatically stopped.
8	Battery overheating protection	The controller detects the battery temperature through an external temperature sensor. The battery stops working when its temperature goes higher than 65℃ and resumes work when its temperature is below 55℃.
9	Lithium battery low temperature protection	When the temperature detected by the optional 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 be working

		automatically (The LTPT is 0 °C by default and can be set within the range of 10 ~ -40 °C).
10	Load short circuit protection	When a short circuit occurs on the load side (which is 4 times higher than the rated load current), the controller automatically cuts off the output. The output still attempts to resume five times automatically (delay 5 seconds, 10 seconds, 15 seconds, 20 seconds, 25 seconds). Suppose you want the controller to restart the auto-recovery process. In that case, you need to press the Load button, or restart the controller, or experience a night-to-day change (night time ＞3 hours).
11	Overload protection	If the load current exceeds 1.05 times the controller's rating, the controller will cut off the output after a delay. After the overload occurs, the output attempts to resume automatically five times (delay of 5 seconds, 10 seconds, 15 seconds, 20 seconds, 25 seconds). Suppose you want the controller to restart the auto-recovery process. In that case, you need to press the Load button, or restart the controller, or experience a night-to-day change (night time ＞3 hours).
12	Device overheating protection	An internal temperature sensor can detect the internal temperature of the controller. The controller stops working when its internal temperature higher than 85℃and resumes working when its internal temperature is below 75℃.
13	TVS high voltage transients protection	The controller's internal circuitry is designed with Transient Voltage Suppressors (TVS), which can only protect against high-voltage surge pulses with less energy. Suppose the controller is to be used in an area with frequent lightning strikes. In that case, it is recommended to install an external surge arrester.

★ When the controller's internal temperature reaches 81℃, the charging power automatic reduction function is enabled. Temperature increases by 1 ℃, the charging power is reduced by 5%, 10%, 20%, and 40%. If the internal temperature is higher than 85℃, the controller stops charging the battery. When the internal temperature is not more than 75ºC, the controller resumes charging per the rated charging power.

4.2 Troubleshooting

Faults	Faults	Troubleshooting
PV array open-circuit	When there is plenty of direct sunlight on the PV array, the LCD shows	Confirm whether the connection of the PV array is correct and tight.
The battery voltage is lower than 8V.	The wire connection is correct; the controller is not working.	Please check the voltage of the battery (at least 8V voltage to activate the controller).

Battery over voltage	 Battery frame blink,	Check whether the battery voltage is higher than OVD (over voltage disconnect voltage) and disconnect the PV array connection.
Battery over discharged	 Battery frame blink,	① When the battery voltage is restored to or above LVR (low voltage reconnect voltage), the load will recover. ②Take other ways to recharge the battery.
Battery overheating	 Battery frame blink,	While the temperature decline to be below 55 ºC, the controller will resume.
Overload	1. Load off	① Please reduce the number of electric devices. ② Restart the controller or press the button to clear faults.
Load short-circuit	2  Load and fault	① Check carefully loads connection, clear the fault, ② Restart the controller or press the button to clear faults.

① When the load current goes higher than 1.02-1.05 times, 1.05-1.25 times, 1.25-1.35 times, and 1.35-1.5 times the rated value, the controller may automatically turn offloads in 50 seconds, 30 seconds,10 seconds, and 2 seconds respectively.

4.3 Maintenance

The following inspections and maintenance tasks are recommended at least two times per year for good performance.

- Make sure no block on airflow around the controller. Clear up any dirt and fragments on the radiator.
- Check all the naked wires to ensure insulation is not damaged for sun exposure, frictional wear, dryness, insects or rats, etc. Repair or replace some wires if necessary.
- Verify the indicator display is consistent with the actual operation. Pay attention to any troubleshooting or error conditions. Take necessary corrective action.
- Confirm that terminals have no corrosion, insulation damaged, high temperature, burnt/discolored sign, and tighten terminal screws to the suggested torque.
- Clear up dirt, nesting insects, and corrosion in time.
- Check and confirm that the lightning arrester is in good condition. Replace a new one in time to avoid damaging the controller and even other equipment.

 **CAUTION**	Risk of electric shock! Ensure that the power is turned off before the above operations, and then follow the corresponding inspections and operations.

5 Specifications

Electrical Parameters

Parameter	Tracer 1206AN	Tracer 2206AN	Tracer 1210AN	Tracer 2210AN	Tracer 3210AN	Tracer 4210AN
System rated voltage	12/24VDC ① Auto-recognition					
Rated charging current	10A	20A	10A	20A	30A	40A
Rated discharge current	10A	20A	10A	20A	30A	40A
Controller working voltage range	8~32V					
Max. PV open circuit voltage	60V② 46V③		100V② 92V③			
MPPT voltage range	(Battery voltage +2V)～36V		(Battery voltage +2V)～72V			
PV rated charge 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
Self-consumption	≤12mA					
Discharge circuit voltage drop	≤0.23V					
Temperature compensate coefficient④	-3mV/℃/2V (Default)					
Grounding type	Common negative					
RS485 port	5VDC/200mA					
LCD backlight time	Default:60S, Range:0~999S(0 seconds: the backlight is ON all the time)					

① When a lithium battery is used, the system voltage can't be identified automatically.

② At minimum operating environment temperature

③ At 25℃ environment temperature

④ When a lithium battery is used, the temperature compensation coefficient will be 0 and can't be changed.

Environmental parameters

Environment temperature	-25℃~+45℃ (100% loads working)
Storage temperature	-20℃~+70℃
Relative humidity	< 95% (N.C.)
Enclosure	IP30

The controller can full load working in the working environment temperature. When the internal temperature reaches 81℃, the reducing charging power mode is turned on. Refer to P28.

Mechanical parameters

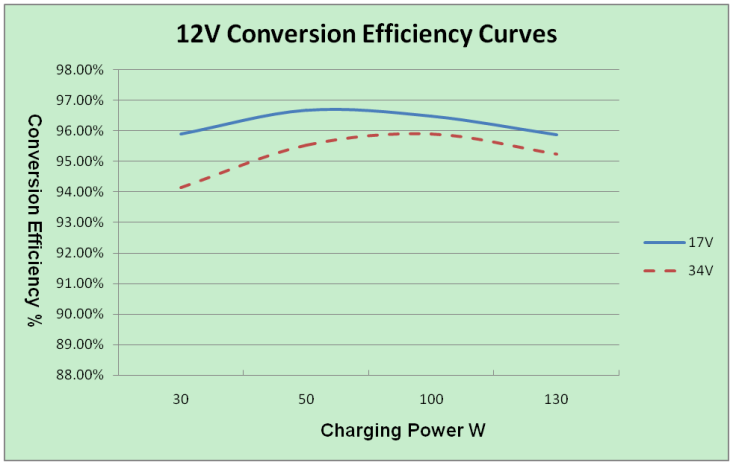
Model	Tracer1206AN Tracer1210AN	Tracer2206AN Tracer2210AN	Tracer3210AN	Tracer4210AN
Dimension	172x139x44mm	220x154x52mm	228x164x55mm	252x180x63mm
Mounting dimension	124x130mm	170x145mm	170x155mm	204x171mm
Mounting hole size	Φ5mm			
Wire size	12AWG(4mm^2)	6AWG(16mm^2)	6AWG(16mm^2)	6AWG(16mm^2)
Recommended cable	12AWG(4mm^2)	10AWG(6mm^2)	8AWG(10mm^2)	6AWG(16mm^2)
Net Weight	0.57kg	0.94kg	1.26kg	1.65kg

Annex I Conversion Efficiency Curves

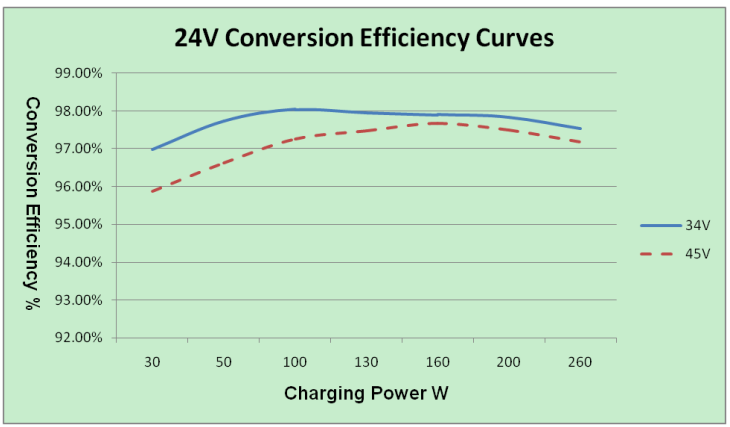
Test condition: Illumination Intensity: 1000W/m^2 Temperature: 25

Model: Tracer1206AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**

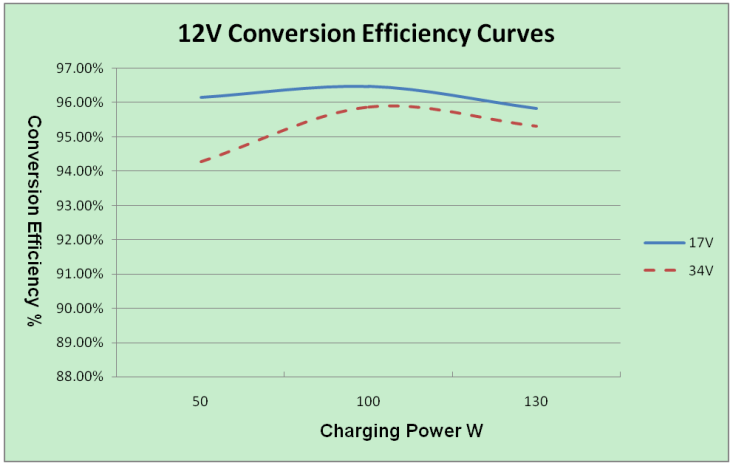


2. **PV array Max. power point voltage(34V, 54V)/system voltage(24V)**

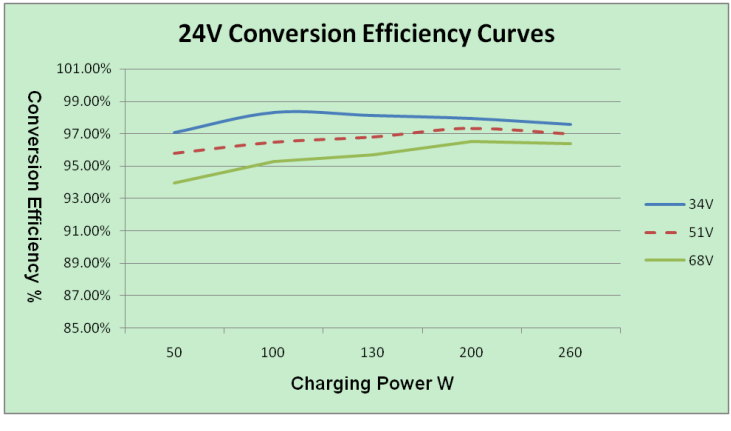


Model: Tracer1210AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**

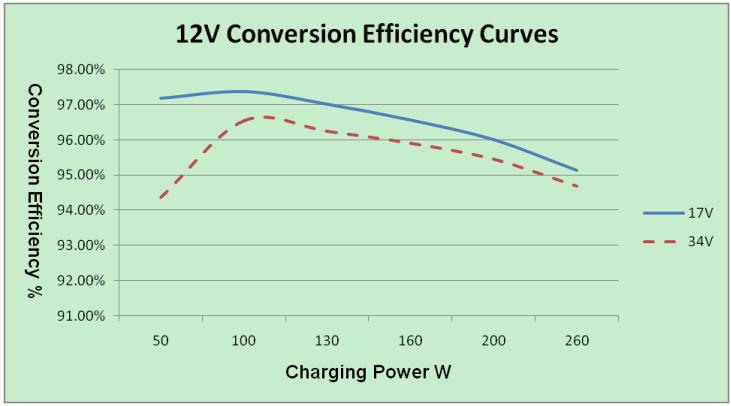


2. **PV array Max. power point voltage(34V)/system voltage(24V)**

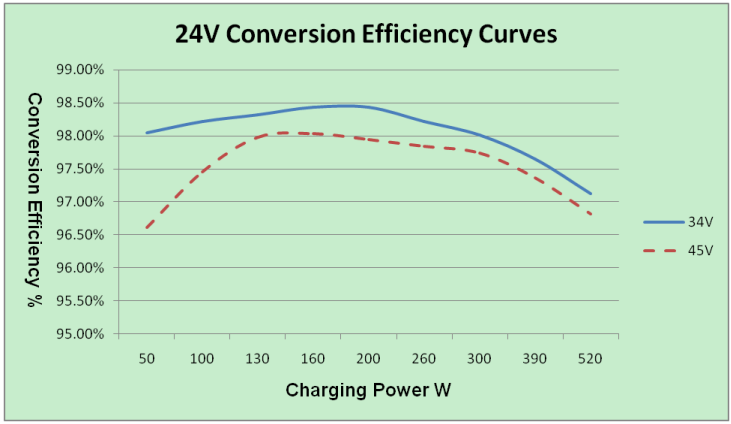


Model: Tracer2206AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**

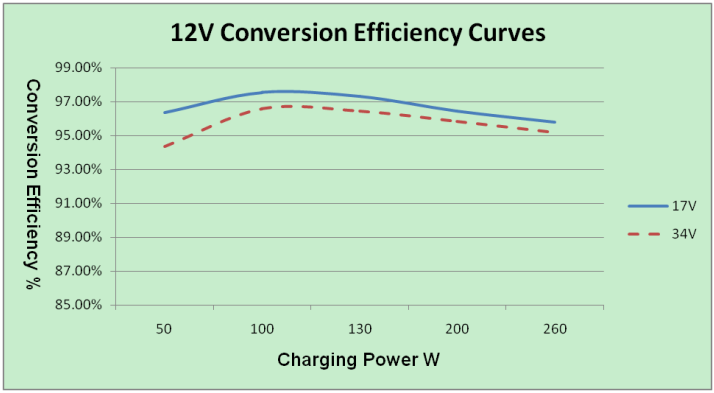


2. **PV array Max. power point voltage(34V, 45V)/system voltage(24V)**

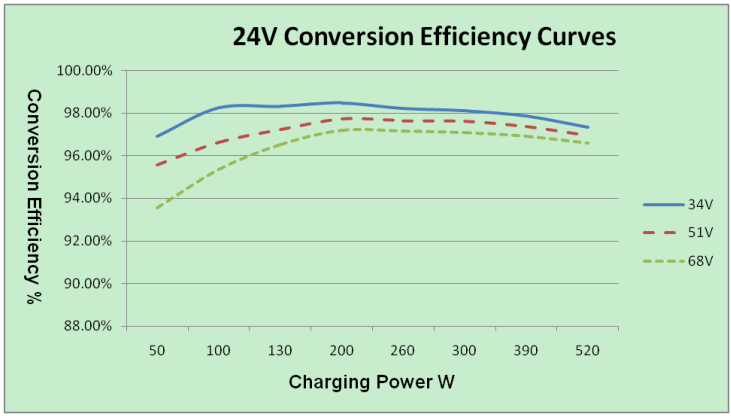


Model: Tracer2210AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**

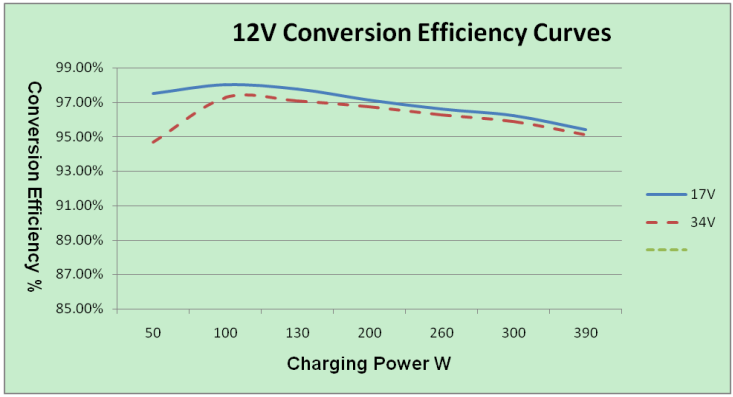


2. **PV array Max. power point voltage(34V, 45V)/system voltage(24V)**

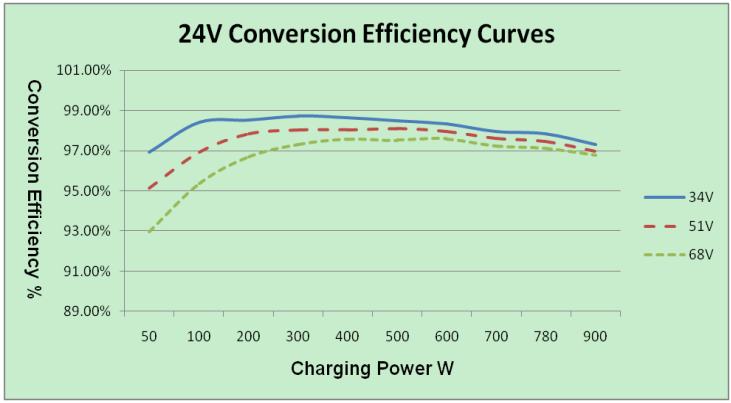


Model: Tracer3210AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**

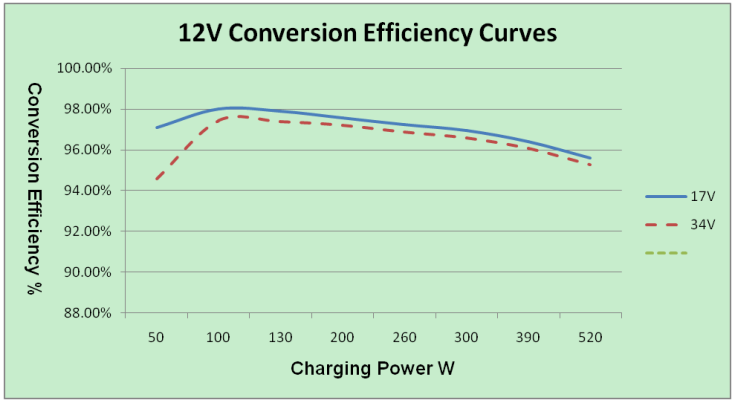


2. **PV array Max. power point voltage(34V, 51V, 68V)/system voltage(24V)**

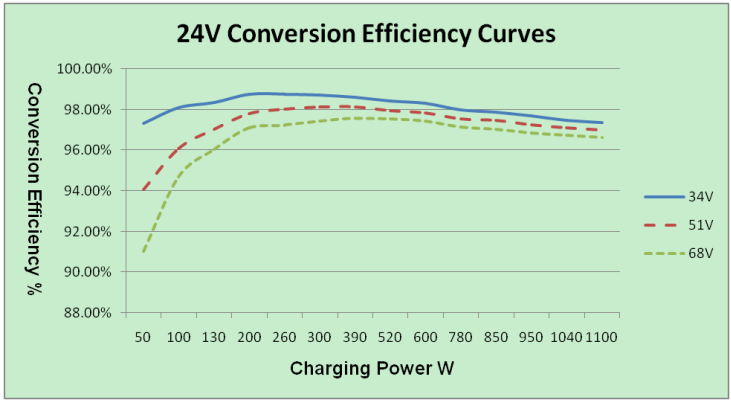


Model: Tracer4210AN

1. **PV array Max. power point voltage(17V, 34V)/system voltage(12V)**



2. **PV array Max. power point voltage(34V, 51V, 68V)/system voltage(24V)**



HUIZHOU EPEVER TECHNOLOGY CO., LTD.

Beijing Tel: +86-10-82894896/82894112

Huizhou Tel: +86-752-3889706

E-mail:info@epsolarpv.com

Website: www.epsolarpv.com

www.epever.com