

# MPPT Solar Charge Controller

## Tracer A series



Tracer A series adopts common positive design and advanced MPPT control algorithm. The products can track the MPP point fast and accurately in any situation which will improve energy efficiency and obtain the maximum solar energy.



### Model

- Tracer4210A 40A, 12/24V auto work

### Features :

- Advanced MPPT technology
- High tracking efficiency no less than 99.5%
- Peak conversion efficiency of 98%
- Ultra-fast tracking speed
- Accurately recognizing and tracking of multiple power point
- Multi-function LCD displays system information intuitively
- User programmable for battery types, load control etc.
- 3-Stage charge with PWM output
- Common positive grounding design
- RS485 port with industrial standard MODBUS open architecture
- Fully programmable function via PC software or remote meter

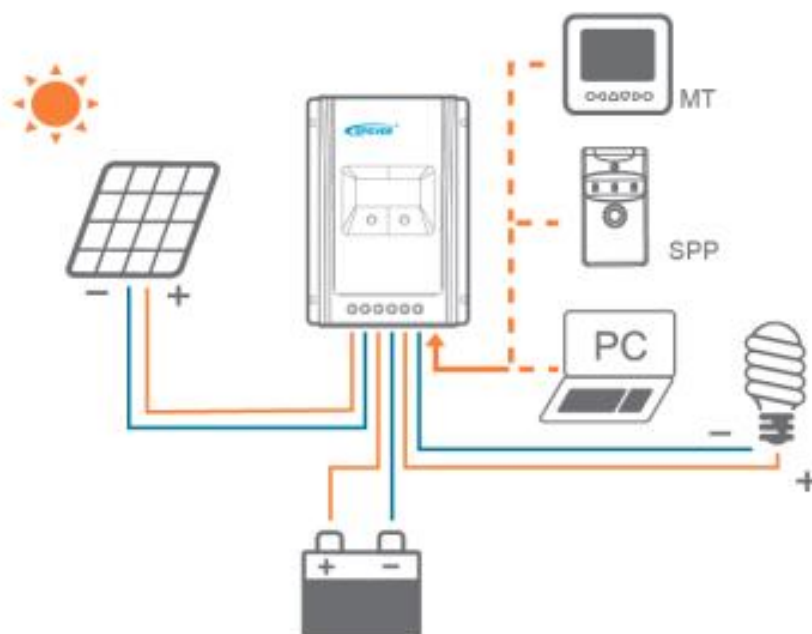


### Electronic protections:

- PV reverse polarity protection
- PV over current alarm protection
- Battery over discharge protection
- Load short circuit protection
- Overheating protection
- PV short circuit protection
- Battery overcharge protection
- Battery reverse polarity protection
- Load overload protection

### Load Set:

- Manual Control (ON/OFF)
- Light ON + Timer
- Light ON/OFF (Default)
- Time Control



### Setting Operation:

There are two methods that can modify load mode and control parameter through infrared interface:

1. Remote meter, MT50
2. Super Parameter Programmer, SPP-02  
This method can realize one-key setting operation which is suitable for bulk quantity products setting or applied in the projects.
3. PC monitoring setting software "Solar Station Monitor"

# ***Tracer AN series***

***—MPPT Solar Charge Controller***

## **User Manual**



# 1 General Information

## 1.1 Overview

Tracer AN series controller, based on multiphase synchronous rectification technology (MSRT) and advanced MPPT control algorithm, with dual-core processor architecture and common negative design, has the features of high response speed, high reliability, and high industrial standard. MSRT can guarantee very high conversion efficiency in any charge power, which sharply improves the energy efficiency of solar system; Advanced MPPT control algorithm minimize the maximum power point loss rate and loss time, to ensure the tracking efficiency, corresponding speed as well as high conversion efficiency under high or low power, so that in any situation, Tracer AN products can rapidly track the maximum power point(MPP) of PV array to obtain the maximum energy of the panel. The limitation function of the charging power and current, and automatic power reduction function fully ensure the stability when works with oversize PV modules and operate under high temperature environment.

With the adaptive three-stage charging mode based on digital control circuit, Tracer AN series controllers can effectively prolong the life-cycle of battery and significantly improve the system performance. The load, utility or generator auto-control relays make it easy to compose the hybrid power system. All-around electronic protections, including overcharging, over discharging, and PV reverse polarity protection, effectively ensure the safer and more reliable operation of the solar system for a longer service time. The isolated RS485 interface with standard MODBUS communication protocol and 5V power supply makes it easy for customer to expand the application, it support up to 8 charging in parallel to expand system and meet with different monitoring requirements, so that can be widely used for various applications, e.g. solar RV, household system and field monitoring, etc.

### Features:

- CE certification(LVD EN/IEC62109,EMC EN61000-6-1/3)
- High quality & low failure rate components of ST and Infineon to ensure the product's life
- Advanced MPPT technology & ultra-fast tracking speed, with tracking efficiency no less than 99.5%
- Maximum DC/DC transfer efficiency is as high as 98.6%\*, full load efficiency is up to 98%\*
- Advanced MPPT control algorithm will minimize the MPP loss rate and loss time
- The accuracy of the recognition and tracking at the highest point of multiple-peaks MPP
- The wider range of MPP operating voltage.
- Auto control system to limit the charging power & current go over the rated value.
- Support 4 charging options: Sealed, Gel, Flooded and User.
- Battery temperature compensation function
- Real-time energy recording and statistical function
- Automatic over-temperature power reduction function
- Hundred percent full load operation in working environment temperature range within charging & discharging
- Support up to 8 units in parallel to expand system



- Load relay control external load switch signal to realize diversified load work modes
- The first and the second disconnection of load control, contain two relay's contact.
- Auto-control of utility and generator relay design
- Utility or generator auto-control relays make it easy to compose the hybrid power system
- The remote temperature and the voltage sensor design will collect accurate data of battery temperature and voltage
- Isolated RS485 with 5VDC/200mA to protect output for no power devices with MODBUS protocol
- To monitor or set the parameters by using the phone Apps or PC software.

★Tracer10415AN@48V system

## 1.2 Characteristics

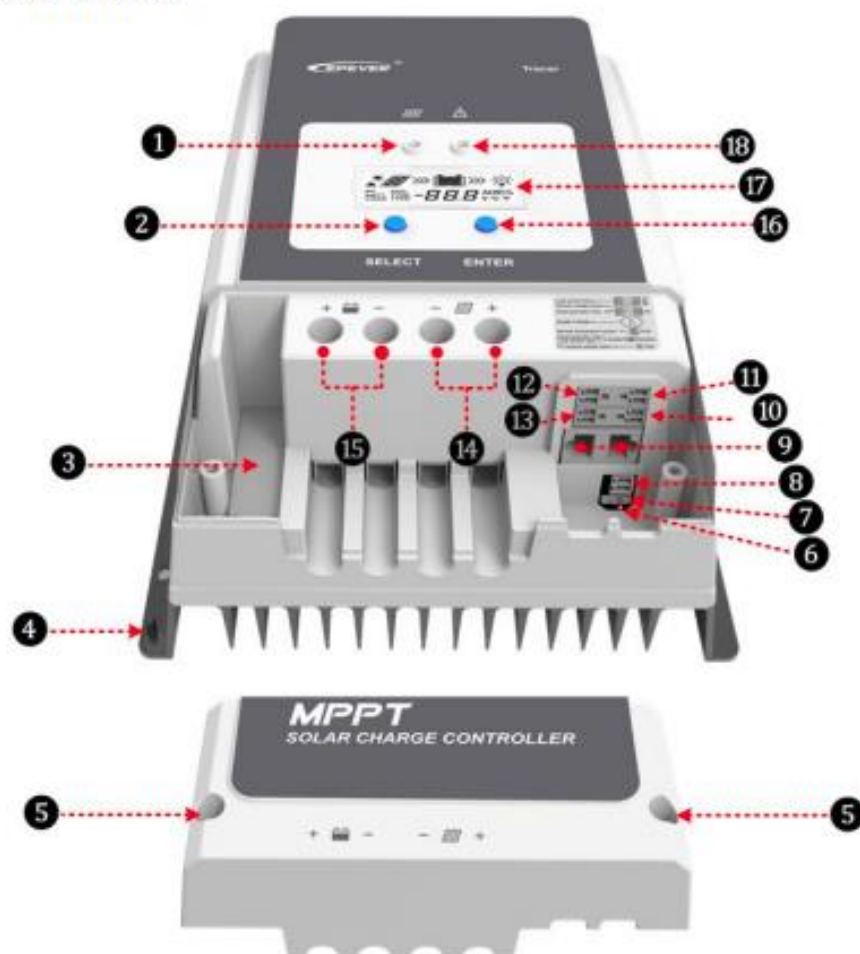



Figure 1 Characteristics

① -Charging LED indicator	⑩ - Utility/Generator relay ON
② -SELECT button	⑪ - RBVS Port <sup>(3)</sup>
③ -Fuse	⑫ -Load control relay <sup>(4)</sup>
④ -Grounding Terminal	⑬ - Utility/Generator relay OFF
⑤ -Cover screw holes M4	⑭ -PV Terminals <sup>(5)</sup>

6 -PV reverse polarity alarm indicator	15 -Battery Terminals <sup>(5)</sup>
7 - Generator and load relay enable <sup>(1)</sup>	16 -ENTER button
8 - RTS Port <sup>(2)</sup>	17 -LCD
9 - RS485 port(5VDC/200mA)	18 -Fault LED indicator

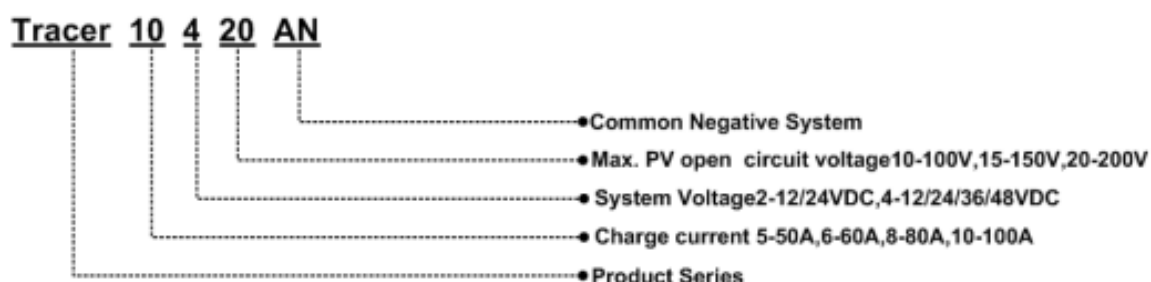
- (1) Enabled  Disabled Generator and load relay enabled when the switch is ON; Generator and load delay is disabled when the switch is OFF.
- (2) Connect for a RTS (Remote Temperature Sensor) to remotely detect battery temperature, sample distance less than 20m.

**CAUTION:** If the temperature sensor is short-circuited or damaged, the controller will charge or discharge at the default temperature setting of 25 °C.




- (3) Connect for RBVS (Remote Battery Voltage Sensor) to detect accurate battery voltage, sample distance less than 20m.
- (4) Low Voltage Disconnect Voltage( $V_{LVD}$ ) make the relay turn off;  
Low Voltage Reconnect Voltage( $V_{LVR}$ ) make the relay turn on.
- (5) Common negative design, with the same terminal of the PV and battery.

### 1.3 Designations of Controller Models

Example:



### 1.4 Accessories (Included)

Item	Accessory	Model	Number	Picture
1	Local Temperature Sensor	RT-MF58R47K3.81A (2P-3.81mm)	1Pcs	
2	Battery Voltage Sensor Terminal	2P-3.81mm	1Pcs	
3	Load control delay Terminal	2P-3.81mm	1Pcs	
4	Diesel generator relay Terminal	2P-3.5mm	2Pcs	

**WARNING:** The Battery Voltage Sensor Terminal and Load Control Delay Terminal should not mix, otherwise the controller may be damaged.

## 2 Installation

### 2.1 General Installation Notes

- Before installation, please read through the entire installation instructions to get familiar with the installation steps.
- Be very careful when installing the batteries, especially flooded lead-acid battery. Please wear eye protection, and have fresh water available to wash and clean if any contact with battery acid.
- Keep the battery away from any metal objects, which may cause short circuit of the battery.
- Explosive battery gases may come out from the battery during charging, so make sure ventilation condition is good.
- Lead-acid battery are recommended, other kinds please refer to the battery manufacturer.
- Ventilation is highly recommended if mounted in an enclosure. Never install the controller in a sealed enclosure with flooded batteries! Battery fumes from vented batteries will corrode and destroy the controller circuits.
- Loose power connections and corroded wires may result in high heat that can melt wire insulation, burning surrounding materials, or even causing fire. Ensure tight connections and use cable clamps to secure cables and prevent them from swaying in mobile applications.
- Battery connection may be wired to one battery or a bank of batteries. The following instructions refer to a singular 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.
- Multiple same models of controllers can be installed in parallel on the same battery bank to achieve higher charging current. Each controller must have its own solar module(s).
- Select the system cables according to  $5A/mm^2$  or less current density in accordance with Article 690 of the National Electrical Code, NFPA 70.

### 2.2 PV Array Requirements

#### (1)Serial connection (string) of PV modules

As the core component of PV system, Controller could be suitable for various types of PV modules and maximize converting solar energy into electrical energy. According to the open circuit voltage ( $V_{oc}$ ) and the maximum power point voltage ( $V_{mpp}$ ) of the MPPT controller, the series number of different types PV modules can be calculated. The below table is for reference only.

#### Tracer5210/6210AN:

System voltage	36cell $V_{oc} < 23V$		48cell $V_{oc} < 31V$		54cell $V_{oc} < 34V$		60cell $V_{oc} < 38V$	
	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

**NOTE:** The above parameter values are calculated under standard test conditions (STC (Standard Test Condition): Irradiance 1000W/m<sup>2</sup>, Module Temperature 25℃, Air Mass1.5.)

**Tracer5415/6415/8415/10415AN:**

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	6	3	4	2	4	2	3	2
48V	6	5	4	3	4	3	3	3

System voltage	72cell Voc<46V		96cell 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:** The above parameter values are calculated under standard test conditions (STC (Standard Test Condition): Irradiance 1000W/m<sup>2</sup>, Module Temperature 25℃, Air Mass1.5.)

**Tracer5420/6420/8420/10420AN:**

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	3	1	2	1	2	1
24V	6	3	4	2	4	2	3	2
48V	8	5	5	4	5	3	4	3

System voltage	72cell Voc<46V		96cell Voc<62V		Thin-Film Module Voc>80V
	MAX.	Best	MAX.	Best	
12V	2	1	1	1	1
24V	3	2	2	1	1
48V	4	3	2	2	2

**NOTE:** The above parameter values are calculated under standard test conditions (STC (Standard Test Condition): Irradiance 1000W/m<sup>2</sup>, Module Temperature 25℃, Air Mass1.5.)

**(2) PV array maximum power**

The MPPT controller has the function of current/power-limiting, that is, during the charging process, when the charging current or power exceeds the rated charging current or power, the controller will automatically limit the charging current or power to the rated charging current or power, which can effectively protect the charging parts of controller, and prevent damages to the controller due to the connection of some over-specification PV modules. The actual operation of PV array is as follows:



**Condition 1:**

Actual charging power of PV array  $\leq$  Rated charging power of controller

**Condition 2:**

Actual charging current of PV array  $\leq$  Rated charging current of 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 PV array.



**WARNING:** When the power of PV module is greater than the rated charging power, and the maximum open-circuit voltage of PV array is more than 100V(Tracer\*\*10AN)/150V(Tracer\*\*15AN)/200V(Tracer\*\*20N) (at the lowest environmental temperature), the controller may be damaged.

**Condition 3:**

Actual charging power of PV array  $>$  Rated charging power of controller

**Condition 4:**

Actual charging current of PV array  $>$  Rated charging current of controller

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



**WARNING:** When the power of PV module is greater than the rated charging power, and the maximum open-circuit voltage of PV array is more than 100V(Tracer\*\*10AN)/150V(Tracer\*\*15AN)/200V(Tracer\*\*20N) (at the lowest environmental temperature), the controller may be damaged.

According to "Peak Sun Hours diagram", if the power of PV array exceeds the rated charging power of controller, then the charging time as per the rated power will be prolonged, so that more energy can be obtained for charging the battery. However, in the practical application, the maximum power of PV array shall not be greater than 1.5 x the rated charging power of controller. If the maximum power of PV array exceeds the rated charging power of controller too much, it will not only cause the waste of PV modules, but also increase the open-circuit voltage of PV array due to the influence of environmental temperature, which may increase the probability of damage to the controller rise. Therefore, it is very important to configure the system reasonably. For the recommended maximum power of PV array for this controller, please refer to the table below:

Item	Rated Charge Current	Rated Charge Power	Max. PV Power	Max. PV Open Circuit
Tracer5210AN	50A	625W/12V 1250W/24V	937.5W/12V 1875W/24V	100V <sup>①</sup>
Tracer6210AN	60A	750W/12V 1500W/24V	1125W/12V 2250W/24V	92V <sup>②</sup>
Tracer5415AN	50A	625W/12V 1250W/24V 1875W/36V 2500W/48V	937.5W/12V 1875W/24V 2812.5W/36V 3750W/48V	150V <sup>①</sup>
Tracer6415AN	60A	750W/12V 1500W/24V 2250W/36V 3000W/48V	1125W/12V 2250W/24V 3375W/36V 4500W/48V	138V <sup>②</sup>