MPPT Solar Charge Controller

User Manual

Model：IT6415ND

EN

Important Safety Instructions

Please reserve this manual for future review. This manual contains all instructions for safety, installation, and operation for the Maximum Power Point Tracking (MPPT) controller in iTracer6415ND ("the controller" is referred to in this manual).

General Safety Information

- Read all the instructions and warnings carefully in the manual before installation.
- No user-serviceable component exists inside the controller. DO NOT disassemble or attempt to repair the controller.
- Mount the controller indoors. Avoid direct sunlight and high temperatures, and do not install in locations where water can enter the controller.
- Install the controller in well-ventilated places; the controller's heat sink may become very hot during operation.
- Do not install the controller in humid, salt spray, corrosion, greasy, flammable, explosive, dust accumulative, or other severe environments.
- It is suggested to install appropriate external fast-acting fuses/breakers.
- Disconnect all PV array connections and the battery fast-acting fuse/breakers before installation and adjustment.
- Power connections must remain tight to avoid excessive heating from a loose connection.

Contents

1 General Information

1.1 Overview

Appreciate you for choosing our MPPT solar charge controller, iTracer6415ND. Based on the multiphase synchronous rectification technology (MSRT), common negative design, dual-core processor architecture, and advanced MPPT control algorithm, the products own the features of high response speed, high reliability, high industrial standards, etc.

With the MPPT control algorithm, in any situation, products of this series can fast and accurately track out the best maximum power point (MPP) of the PV array. To obtain the maximum solar energy in time, MSRT can guarantee high conversion efficiency in any charging power. It sharply improves the energy efficiency of the solar system. The Modbus communication protocol interface makes it convenient to expand applications and monitor various fields. Like telecommunication base stations, household systems, wilderness monitoring systems, etc.

All-round electronic fault self-test and enhanced electronic protection function could prevent damage to system components from installation errors or system failures.

Features:

- Advanced Maximum Power Point Tracking (MPPT) technology, with no less than 99.5% efficiency.
- High-quality components, perfecting system performance, with a maximum conversion efficiency of 98% and full load efficiency of 97%.
- MSRT, realizing high conversion efficiency in the situation of low charge power.
- Ultra-fast tracking speed and guaranteed tracking efficiency.
- Multiple power point recognizing and tracking accuracy.
- Reliable automatic limit function of maximum PV input power, ensuring no

overload.

- Wide MPP operating voltage range.
- High-speed and high-powered dual-core processor architecture, improving system response speed, optimizing system performance.
- Die-cast aluminum case for heat-dissipating, ensuring excellent heat dissipation characteristics.
- 12/24/36/48VDC auto-identifying system voltage or user-defined working voltage.
- Concise human-computer interactive interface, convenient multiple combination keys, dynamically displaying system operating data and working conditions.
- Multiple load control modes: manual control, light ON/OFF, light on+timer, and time control.
- Support 4 charging options: Sealed, Gel, Flooded, and User.
- Battery temperature compensation function.
- Real-time energy statistics function.
- With RS-485, RS-232 communication bus interface, and Modbus communication protocol, it can meet various communication requirements in different situations.
- Available for PC monitoring and external display unit connecting like MT50 and so on, realizing real-time data checking and parameters setting.

1.2 Characteristics

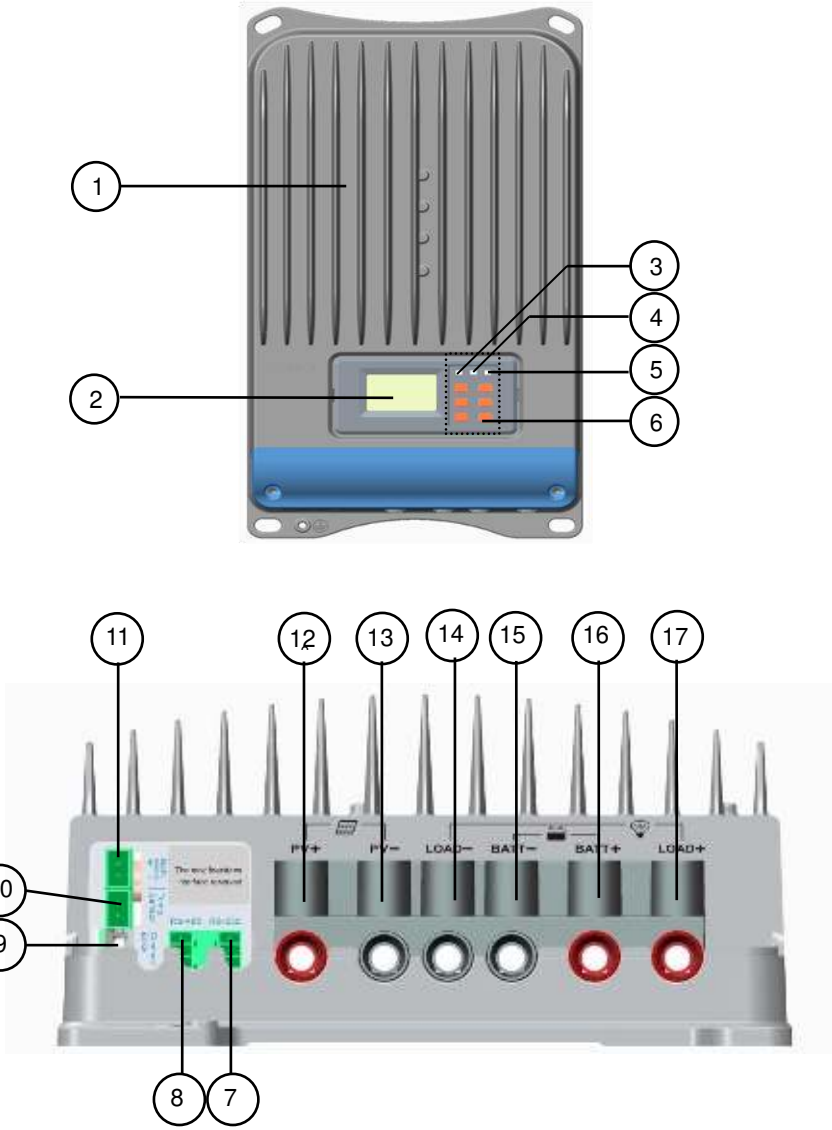


Figure 1-1 Controller Characteristics

Item	Name	Item	Name
1	Heat Sink	10	RTS Port②
2	LCD	11	RBVS Port③
3	Battery LED indicator	12	Solar Positive Terminal(+)
4	Charging LED indicator	13	Solar Negative Terminal(-)④
5	Fault LED indicator	14	Load Negative Terminal(-)
6	Buttons	15	Battery Negative Terminal(-)
7	RS-232 port	16	Battery Positive Terminal(+)
8	RS-485 port①	17	Load Positive Terminal(+)
9	RTC battery (model:CR2032)		

① Monitor controller by PC via RS485 or RS232.

② Connect an RTS (Remote Temperature Sensor) to detect battery temperature remotely.

③ Connect an RBVS (Remote Battery Voltage Sensor) to detect battery voltage accurately.

④ The PV negative, battery negative, and load negative are common.

1.3 Accessories Instructions

1. Remote Temperature Sensor (Model: RTS300R10K5.08A)

The standard cable length is 3m (it can be customized) to acquire battery temperature for undertaking temperature compensation of control parameters. The RTS300R10K5.08A connects to the RTS port (10th) on the controller.

CAUTION	Unplug the RTS, and the battery's temperature will be set to a fixed value of 25℃.

2. USB to RS-485 Converter (Model: CC-USB-RS485-150U-3.81)

The USB to RS-485 converter monitors each controller on the network using Solar Station PC software and updates the firmware. The cable length is 1.5m. The CC-USB-RS485-150U-3.81 connects to the MC1.5-5.08-2L port (8th) on the controller.

3. CD （PC Software）

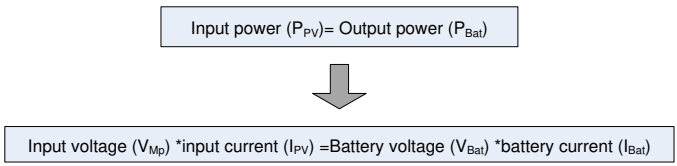
Solar Station PC software is used to monitor each controller on the network

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, adopting the switch charging technology and PWM charging technology, can't charge the battery at the maximum power point. They can't harvest the maximum energy available from the PV array. While the solar charge controller with Maximum Power Point Tracking (MPPT) Technology can lock on the point to harvest the maximum energy and deliver it to the battery.

The MPPT algorithm of our company 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 user adjustment.

As shown in Figures 1-2, the curve is the characteristic curve of the array. The MPPT technology will boost the battery charge current by tracking the MPP. Assuming the conversion efficiency of the solar system is 100%, the following formula is established:



Normally, the V_{Mp} 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 discrepancy between V_{Mp} &V_{Bat}, the greater the discrepancy between I_{PV}& I_{Bat}. The greater the discrepancy between array and battery, the bigger reduction of the conversion efficiency of the system. Thus the controller's conversion efficiency is particularly important in the PV system.

Figure 1-2 is the maximum power point curve, and the shaded area is the charging range of a traditional solar charge controller (PWM Charging Mode). It can diagnose that the MPPT mode can improve the usage of solar energy resources. According to our test, the MPPT controller can raise 20%-30% efficiency compared to the PWM controller. (Value may fluctuate due to the ambient circumstance's influence and energy loss.)

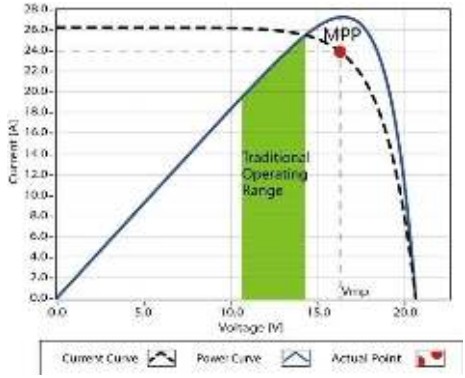


Figure 1-2 Maximum Power Point Curve

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

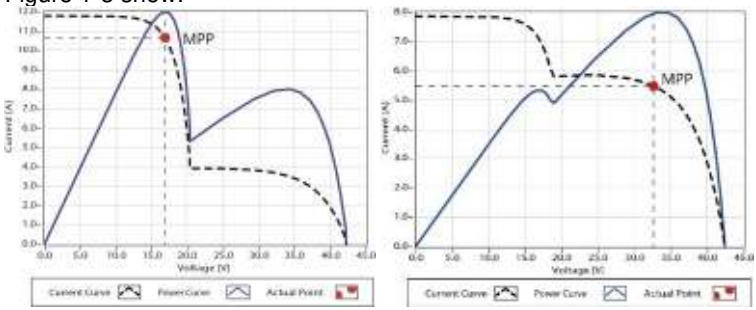


Figure 1-3 Mutil-MPP Curve

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

1.5 Battery Charging Stage

The controller has a three-stage battery charging algorithm (Bulk Charging, Constant Charging, and Float Charging) for rapid, efficient, and safe battery charging.

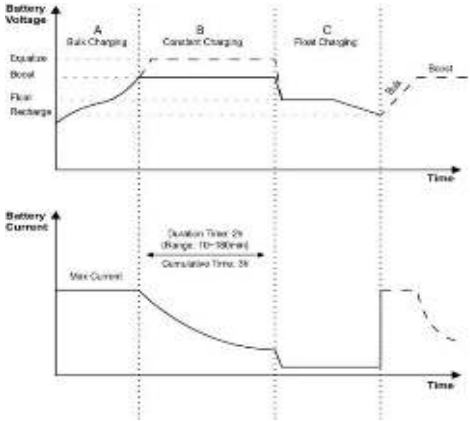


Figure 1-4 Battery changing stage Curve

A) Bulk Charging

In this stage, the battery voltage has not yet reached constant voltage (Equalize or Boost Voltage). The controller operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging).

B) Constant Charging

When the battery voltage reaches the constant voltage setpoint, the controller will start to operate in constant charging mode. This process is no longer MPPT charging. In the meantime, the charging current will drop gradually. The process is not the MPPT charging. Constant charging has two stages, equalize and boost. These two stages are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

- **Boost Charging**

The Boost stage maintains 2 hours in default. Users can adjust the constant time and preset value of boost voltage according to demand.
The stage is used to prevent heating and excessive battery gassing.

- **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 high enough to damage sensitive DC loads. Verify that all load allowable input voltages are 11% greater than the equalizing charging set point voltage. • **Equipment damage!** • Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high an equalizing charge or for too long may cause damage. Please carefully review the specific requirements of the battery used in the system.

Some batteries benefit from equalizing charge regularly, which can stir electrolytes, balance battery voltage, and accomplish chemical reactions. Equalizing charge increases battery voltage, higher than the standard complement voltage, which gasifies the battery electrolyte.
The controller will equalize the battery on the 28th of each month. The constant equalization period is 0~180 minutes. Suppose the equalization isn't accomplished at one-time. In that case, the equalization recharge time will be accumulated until the set time is finished. Equalize and boost charges are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

NOTE:
1) The battery voltage can't be steady in constant voltage due to ambient circumstances or load working. The controller will accumulate and calculate the time of constant voltage working. When the accumulated time reaches 3 hours, the charging mode will turn to Float Charging.

2) If the controller time is not adjusted, the controller will charge the battery in equalized charging mode once a month following the inner time.

C) Float Charging

After the Constant voltage stage, the controller will reduce the charging current to the Float Voltage set point. This stage will have no more chemical reactions, and all the charge current transforms into heat and gas at this time. Then the controller reduces the voltage to the floating stage, charging with a smaller voltage and current. It will reduce the battery's temperature and prevent the

battery's gassing and charging simultaneously. The purpose of the Float stage is to offset the power consumption caused by self-consumption and small loads in the whole system, while maintaining full battery storage capacity.

In the Float charging stage, loads can obtain almost all power from solar panels. If loads exceed the power, the controller can no longer maintain battery voltage in the Float charging stage. Suppose the battery voltage remains below the Recharge Voltage. In that case, the system will leave the Float charging stage and return to the Bulk charging stage.

2 Installation

2.1 General Installation Notes

- Before installation, please read through the instructions to familiarize yourself with the installation steps.
- Do not install the controller in humid, salt spray, corrosion, greasy, flammable, explosive, dust accumulative, or other severe environments.
- Be very careful when installing the batteries, especially flooded lead-acid batteries. Please wear eye protection, and have fresh water available to wash and clean any contact with battery acid.
- Keep the battery away from any metal objects, which may cause a short circuit of the battery.
- Explosive battery gases may come out from the battery during charging, so ensure the ventilation condition is good.
- Gel, Sealed, or Flooded batteries are recommended. For other batteries, 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 produce high heat that can melt wire insulation, burn surrounding materials, or even cause a fire. Ensure tight connections, use cable clamps to secure cables, and prevent them from swaying in mobile applications.
- The battery connection may be wired to one battery or a bank of batteries. The following instructions refer to a singular battery. However, it is implied that the battery connection can be made to either one battery or a group of batteries in a battery bank.

- Multiple models of controllers can be installed in parallel on the same battery bank to achieve a higher charging current. Each controller must have its solar module(s).
- Select the system cables according to 5A/mm^2 or less current density following Article 690 of the National Electrical Code, NFPA 70.

2.2 PV Array Requirements

Serial connection (string) of PV modules

As the core component of the PV system, the controller could be suitable for various types of PV modules and maximize converting solar energy into electrical energy. The series number of PV modules can be calculated according to the open-circuit voltage (Voc) and the maximum power point voltage (Vmpp) of the MPPT controller. The below table is for reference only.

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^2, Module Temperature 25℃, Air Mass1.5.)

2.3 Mounting

WARNING	**Explosive Risk!** Never install the controller with flooded batteries in a sealed enclosure! Do not install the battery in a confined area where battery gas can accumulate.

CAUTION	When mounting the controller, ensure at least 150mm of clearance above and below the controller for proper airflow. If mounted in an enclosure, ensure good ventilation condition of the box.

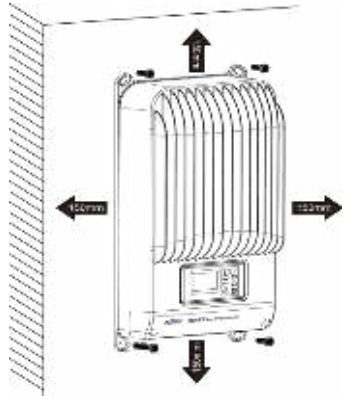
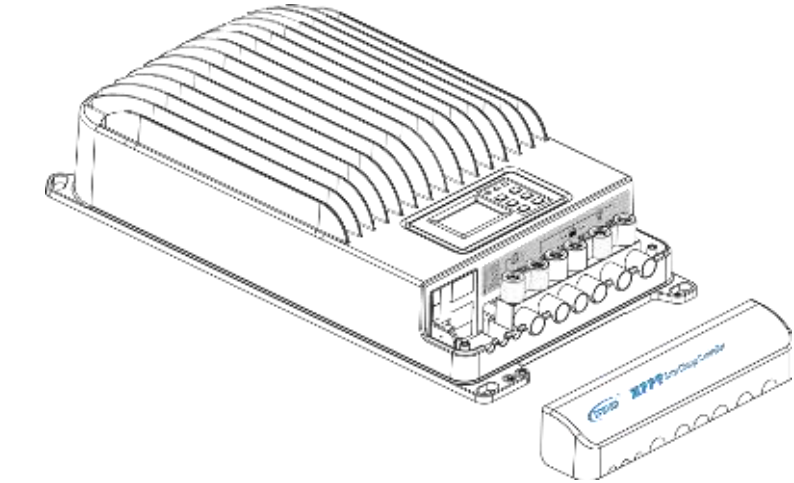


Figure 2-1 Installation Diagram

- 150mm of clearance is required around the controller for proper airflow.
- Secure the controller in place using proper mounting screws.

2.4 Wiring



※Please remove the terminal protective cover before wiring.

CAUTION	• The following connection order is recommended for optimal safety. • Do not entangle all wiring together. Communication cable and power wires should be as far as possible to avoid interfering with the communication signal transmission. • The iTracer-ND controller is a negative ground controller. Any negative PV, load, or battery connection can be earth grounded as required. • For mobile applications, be very certain that all wirings are connected securely. Use cable clamps to prevent cables from swaying when the vehicle is in motion. Unsecured cables create loose and resistive connections, which may lead to excessive heating or fire.

① Remote Temperature Sensor Connection (RTS300R10K5.08A)

WARNING	Equipment Damage! Never place the temperature sensor inside a battery. Both the RTS300R10K5.08A and the battery will be damaged.
	Unplug the RTS, and the battery's temperature will be set to a

CAUTION	fixed value of 25ºC.

The included remote temperature sensor (RTS300R10K5.08A) is recommended for effective temperature compensated charging. Connect the RTS300R10K5.08A to the10th port on the controller (Check Figure 1-1). The cable standard length is 3 meters and could be customized. There is no polarity, so either wire (+ or -) can be connected to either screw terminal. No damage will result if connecting the RTS300R10K5.08A to the remote battery voltage sense port, but the connection will not be recognized.

② Remote Battery Voltage Sensor Connection

CAUTION	• When connecting the Remote Battery Voltage Sensor, please pay attention to '+' and '-' (Check Figure 1-1). • Be careful when installing. Please never plug the voltage sensor wires into the RTS300R10K5.08A terminals (10th Port). It will cause an alarm or damage the controller.

The voltage at the battery terminals on the controller may differ slightly from the real battery voltage due to connection and cable resistance. The remote battery voltage sensor will enable the controller to detect the battery voltage more exactly and avoid voltage deviation. The battery voltage sensor connection is not required to operate the controller, but it is recommended for the best performance.

The voltage sensor wires should be cut into the required length. The wire can range from 0.25 to 1.0 mm^2 (24 to 18 AWG). The maximum size is 3m. Connect the remote battery voltage sensor wires to the 11th port on the controller (Check Figure 1-1). A twin-cord cable is recommended but not required.

Please spot the '+' and '-' when connecting. No damage will result if the polarity is reversed, but the controller can't read a reversed sensor voltage. Plugging the voltage sensor wires into the RTS300R10K5.08A terminals (10th Port) will cause an alarm or damage to the controller.

③ Communicate Connection

WARNING	**Shock Hazard!** There should not be any communication cables and power lines intertwined. Separate them as far as possible to void electric shock.

There are two kinds of communication: RS-232 and RS-485. Please use matching communication cables and make sure the cables are connected firmly during data transmission: the below features are supported by the communication interface:

Monitor each controller on the network using Solar Station PC software; update the firmware.

- **RS-232, RS-485 Connection**

The controller is a standard 3.81-4P port. Check Figure 1-1 for the port location. The RS-232 port is the 7th port, and the RS-485 port is the 8th port on the controller.

④ Power Wires Connection

- **PV Wire Size**

Since the PV array output varies with the PV module size, connection method, or sunlight angle, the minimum wire size can be calculated by the I_{SC} of the PV array. Please refer to the value of I_{SC} in the PV module specification. When the PV modules are connected in series, the I_{SC} equals the PV module's I_{SC}. When the PV modules are connected in parallel, the I_{SC} equals the sum of the PV module's I_{SC}. The I_{SC} of the PV array must not exceed the maximum PV input current. Please refer to the table below:

Model	Max. PV input current	Max. PV wire size
IT6415ND	60A	16mm²/5AWG

NOTE: When the PV modules are connected in series, the open-circuit voltage of the PV array must not exceed 138V (25℃)

- **Battery and Load Wire Size**

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

Model	Rated charge current	Battery wire size	Load wire size
IT6415ND	60A	16mm²/5AWG	16mm²/5AWG

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

WARNING	• **Risk of electric shock!** • Adopt fast-acting fuses or breakers in solar and battery circuits is recommended, and disconnect them before installation. • Exercise caution when handling solar wiring. The solar PV array can produce open-circuit voltages over 150 V in sunlight. Pay more attention to it. • **Risk of explosion or fire!** • Never short circuit battery positive (+) and negative (-) or cables. Pay more attention to it.

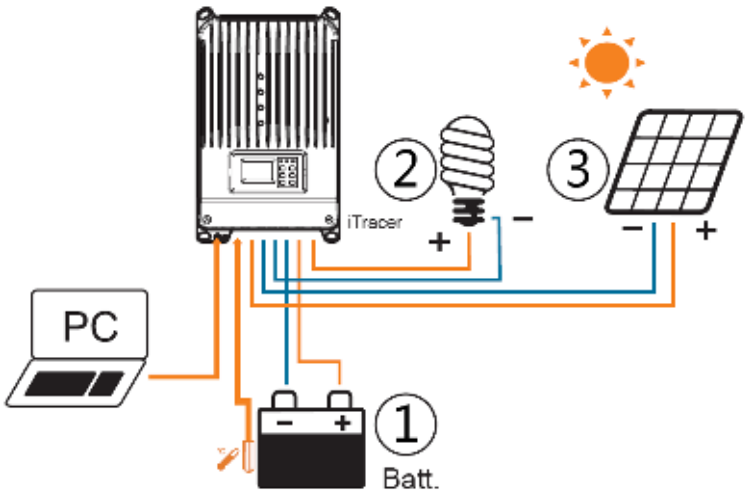


Figure 2-2 Connection Diagram

➢ **Battery Connection**

Connecting a fast-acting fuse in series through battery positive (+) in the circuit and the battery fast-acting fuse must be 1.25 to 2 times the rated current. Disconnect it before installation. Connect battery positive (+) and negative (-) to battery terminals on the controller in figure 1-1. Please pay much attention to '+' and '-.'

➢ **Load Connection**

Connect a breaker in series for the load circuit, and the breaker must be 1.25 to 2 times the rated current. Disconnect it before installation. Connect load positive (+) to the 17th port and negative (-) to the 14th port on the controller in

figure 2-1. Please pay attention to '+"-' and confirm that the cable is connected tightly and correctly.

- **PV Array Connection**

Connect a breaker in series for the solar circuit, and the breaker must be 1.25 to 2 times the rated current. Disconnect it before installation. Connect solar positive (+) and negative (-) to solar terminals on the controller in figure 1-1. Please pay much attention to '+' and '-.'

Solar array short circuit protection and the reversed polarity connection will trigger automatically.

WARNING	The controller will be damaged when the PV array reverses polarity, and the actual operating power of the PV array is 1.5 times greater than the rated charge power!
CAUTION	Load short circuit protection, and the reversed polarity connection will trigger automatically.

2.5 Power ON

WARNING	• Disconnecting the battery will interfere with the load when the controller is charging. • Don't operate the battery reversed polarity test within 10 minutes after power off.
CAUTION	The controller is only powered by the battery, and it will not work when connected to solar input.

- Before switching on, recheck the step of ①～④and make sure all wirings are correct, especially ④connected with battery, load, and PV array.
- Connect the battery fast-acting fuse firstly. Observe if the battery indicator light and startup interface work fine or not (Refer to section 4). Always connect the battery first to allow the controller to recognize the system voltage.
- After the battery works fine with power on, connect the breaker of the PV array. With enough sunlight, the charging LED will blink, and the controller will begin charging.
- If the battery LED error exists or LCD interface alarms, refer to section 5 for troubleshooting. When disconnecting the system, the order is reserved.

3 LED Indication

LED Indication	Color	Indicator	Status
	Green	flash	Charging
	Green	OFF	No charging
	Green	on solid	Normal
	Green	Slowly Flashing	Full
	Green	fast flash	High volt disconnect
	Orange	on solid	Under voltage warning
	Red	on solid	Low voltage disconnect
	Red	flash	Battery over temperature
	Red	OFF	Normal
	Red	flash	Current abnormal Charging overcurrent PV overvoltage Overload load short
 green flashing +  red flashing			System voltage error
 green flashing +  orange flashing			Controller over temperature

4 LCD Display & Operation

Note: The display screen can be viewed clearly when the angle between the end-users horizontal sight and the display screen is within 90°. If the angle exceeds 90°, the information on the display screen cannot be viewed clearly.

4.1 Button operation

Button	Introduction
OK	Enter the corresponding interface Save the data
ESC	Return the main menu in any monitoring interface Cancel the operation
↑ ↓	Move inverse cursor Browse the parameters
+ -	Modify the value Set the period of log

4.2 LCD Display & Operation

- **Rated Info**

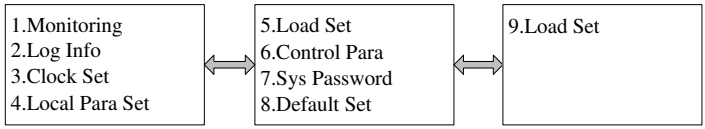
Rated Para	
Rat.Volt	48.0V
Chrg.Cur	60.0A
Disc.Cur	60.0A

Rated information of the controller will be displayed. The monitor interface will be switched after 3 seconds.

➢ **Main Menu**

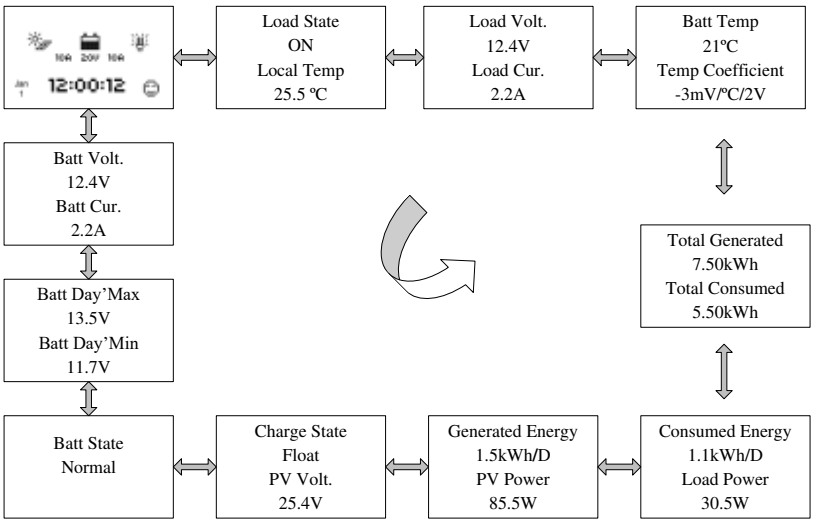
There are nine interfaces for monitoring, as shown in the below picture.

Press the button to move the inverse cursor among nine menus.



➢ **Monitor**

There are 11 interfaces for monitoring, as shown below:



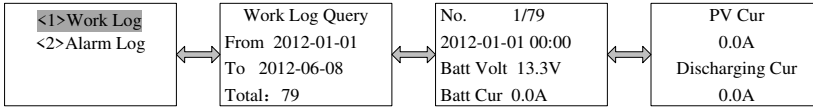
The parameters in the monitoring interface are only for a browse.

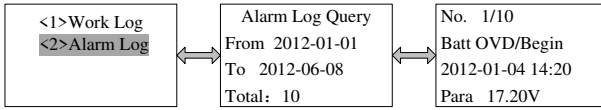
Press the button to browse the parameters interfaces in turns.

There are five battery statuses: Normal, UVW (Under voltage warning voltage), LVD (Low voltage disconnect voltage), Over Voltage, Over Temperature, and four charging stages: no charging, equalized, boost, and float.

➢ **Log Info**

There are two items of log record as shown below.





Work Log and **Alarm Log** could be browsed in this interface, and the operation is as follows:

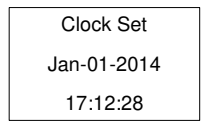
when the item is chosen in inverse, press the OK to enter the **Work Log** or **Alarm Log** interface. Press the OK again to enter the Edit Mode. Use the ↑ or ↓ button to move the cursor between the time parameters and data bit. Use the + - button to modify the value and set the period of log for a browse. Press the OK to enter the corresponding details when the period is set.

Log Number, time, the battery voltage, and the battery current are included in every work log item and are shown in the Work Log interface.

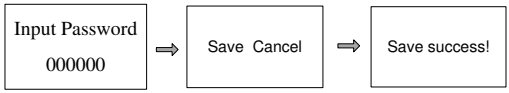
The warning event, start/end time, the fault status, and values are included in every work log item and are shown in the alarm Log interface.

- **Clock Set**

The Clock Set interface is shown as follows:



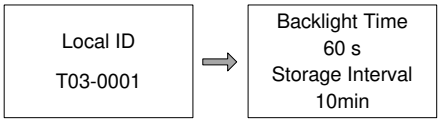
Date and Time can be adjusted in this interface. Press the OK button and input the six-digit user password; then Date and Time can be adjusted. The date format is YYYY-MM-DD; the time format is HH-MM-SS. After completing the set, press the OK button to save or press the ESC button to cancel. "Save success!" will be promoted if adjusted and saved successfully.



NOTE: The log after the current time will be erased when the clock has been adjusted.

- **Device Parameter**

There are two interfaces for device parameters, as shown below:



Before setting the parameters, you should input the user password (see above).

The first interface shows the 4-digit controller's ID in networking. It keeps the ID number unique in the networking, PC software, or other devices that couldn't search it.

The second interface shows the backlight time.

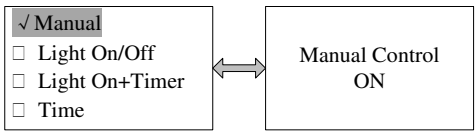
Item	The set range	Default
Backlight Time	1 to 90 seconds	60 seconds
Storage Interval	1 to 30 minutes	10minutes

NOTE: The backlight time "–" means that the backlight is never off.

- **Load Mode**

Load Mode can be set through each menu item respectively.

Manual (default)

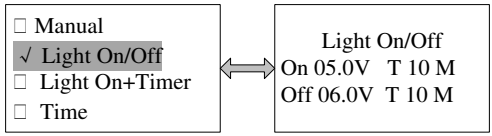


The default load output can be set ON/OFF in this interface. Parameters in the table below:

Parameter	Detail
ON	The load will be turned on automatically after the controller is powered on and stable. The load will keep the ON state

	for 24 hours when the battery power is enough, and the controller works normally.
OFF	The load will be turned off after the controller is powered on and stable. The load needs to be turned on manually. The load will keep the ON state for 24 hours when the battery power is enough, and the controller works normally.

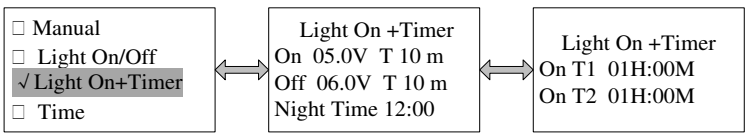
Light On/Off



Load control mode can be set to light control in this interface. Parameters in the table below:

Parameter	Detail
Night Time Threshold Voltage	When the solar voltage goes lower than the Night Time Threshold Voltage (NTTV), the solar controller turns on the load after the time delay. The preset condition: the battery power is enough, and the controller works normally.
Day Time Threshold Voltage	When the solar voltage goes higher than the Day Time Threshold Voltage (DTTV), the solar controller turns off the load after the preset time delay
Delay time	Solar energy determines delay time. If the solar energy meets the action conditions, it will be executed. The range of delay time is 0 to 99 minutes

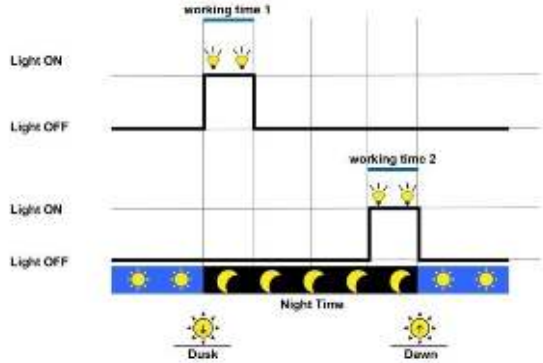
Light On + Timer



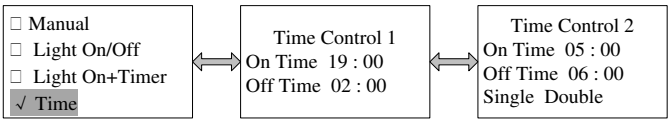
Load control mode can be set to light + timer control in this interface. Parameters in the table below:

Parameter	Detail
Working Time 1	The work time of load in the light mode after dusk
Working Time 2	The work time of load in the light mode before dawn

Night time	The controller calculated the total length of the night by self-learning. The time should be more than 3 hours



Time

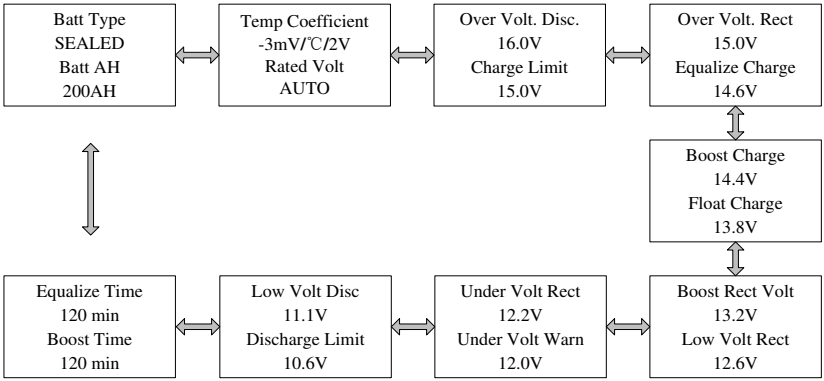


Load control mode can be set to time control in this interface. Parameters in the table below:

Parameter	Detail
Time Control 1	Set the begin and end time 1 of the load output
Time Control 2	Set the begin and end time 2 of the load output
Single	The load output according to time1
Double	The load output according to time1 and time2

- **Control Parameter**

There are nine interfaces for 'Control Parameter' as shown below.



Before setting the parameters, you should input the user password (see above). In setting mode, all the parameters can be modified. And it will immediately take effect after being saved. The detail control parameters are shown below:

Battery Charging Setting

Battery Type	Note
Sealed (Default)	Constant value
GEL	Constant value
Flooded	Constant value
User	Defined by user

Others

Parameter	Default value	Range
Battery capacity	200Ah	1~9999Ah
Temperature compensate coefficient	-3mV/ºC/2V	-9~0 mV/ºC/2V
Rated system voltage	Auto	12/24/36/48VDC Auto

Battery Control Parameters

All coefficient is referred to as 25℃, twice in 24V system rate, triple in 36Vsystem rate, and quadruple in 48Vsystem rate.

Control Voltage parameters	Sealed	Gel	Flooded	User
Over voltage disconnect voltage	16V	16V	16V	9~17V
Charge voltage limit voltage	15V	15V	15V	9~17V
Over voltage reconnect voltage	15V	15V	15V	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 voltage reconnect 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	12V	12V	12V	9~17V
Low voltage disconnect voltage	11.1V	11.1V	11.1V	9~17V
Discharge voltage limit voltage	10.6V	10.6V	10.6V	9~17V
Equalize duration	120min	——	120min	0~180min
Boost duration	120min	120min	120min	10~180min

NOTE：

1) When the battery type is sealed, gel, or flooded, the equalize duration is 0 to180min, and the boost duration is 10 to 180min.

2) The following rules must be observed when modifying the parameter's value in user battery type (factory default value is the same as sealed type)

a. High Volt Disconnect > Charging Limit Voltage ≥ Equalization Voltage ≥ Boost Voltage ≥ Float Voltage > Boost Return Voltage;

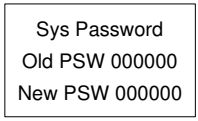
b. High Volt Disconnect > Over Voltage Reconnect;

c. Low Voltage Reconnect > Low Voltage Disconnect ≥ Charging Limit Voltage;

d. Under Voltage Recover > Under Voltage Warning ≥ Charging Limit Voltage;

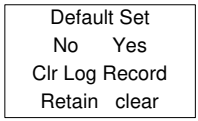
e. Boost Return Voltage > Low Voltage Reconnect;

- **Password**



The factory default password is **"000000".**

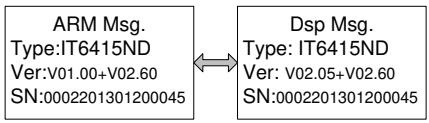
- **Default Set**



Press the OK button to enter to restore the default interface and clear all logs, including work and alarm logs.

NOTE: All parameters will be set to factory default and can't be recovered.

- **Device Message**



The Model, software and hardware version, and SN number are shown in this interface.

5 Protections, Troubleshooting & Maintenance

5.1 Protections

- **PV Over Current**

The controller will limit charge power in rated charge power. An over-sized PV array will not operate at the maximum power point

- **PV Short Circuit**

If the PV array is short-circuited, the controller will stop charging and clear it to resume normal operation.

- **PV Reverse Polarity**

Fully protection against PV reverse polarity, correct the wire connection to resume normal operation.

 **WARNING**	The controller will be damaged when the PV array reverses polarity, and the actual operating power of the PV array is 1.5 times greater than the rated charge power!

- **Battery Reverse Polarity**

Fully protection against reverse battery polarity, correct the wire connection to resume normal operation.

- **Battery Over Voltage**

When the battery voltage reaches the Over Voltage Disconnect Voltage, the controller stops charging the battery to protect the battery from being overcharged.

- **Battery Over Discharge**

When the battery voltage reaches the Low Voltage Disconnect Voltage, the controller stops discharging the battery to protect the battery from being over-discharged.

- **Battery Overheating**

The controller detects the battery temperature through the external temperature sensor. If the battery temperature exceeds 65ºC, the controller will automatically start the overheating protection to stop working and recover

below 50 ºC.

- **Over Load**

The load is switched off when 1.05 times rated current overload happens. The controller will automatically attempt to reconnect the load five times. Suppose overload protection still exists after the controller's 5 times attempts. In that case, the user must reduce the load appliance, press the button, repower the controller, wait for one night-day cycle (night time>3 hours), or press the  button.

- **Load Short Circuit**

The load will be switched off when a load short circuit (≥4 times rated current) happens. The controller will automatically reconnect the load five times. Suppose short circuit protection still exists after the controller's 5 times attempts. In that case, the user must clear the short circuit, restart the controller, wait for one night-day cycle (night time>3 hours), or press the  button.

- **Damaged Remote Temperature Sensor**

Suppose the temperature sensor is short-circuited or damaged. In that case, the controller will charge or discharge at the default temperature of 25℃ to prevent battery damage.

- **Controller Overheating**

If the temperature of the controller heat sinks exceeds 85℃, the controller will automatically start the overheating protection and recover below 75℃.

- **High Voltage Transients**

The PV is protected against small high surge voltage. In lightning-prone areas, additional external suppression is recommended.

CAUTION	Faults will be cleared daily, so the faults that aren't caused by hardware can be solved intelligently.

5.2 Troubleshooting

Faults	Possible reasons	Troubleshooting
Charging LED indicator off during daytime when sunshine falls on	PV array disconnection	Confirm that PV and battery wire connections are correct and tight

solar modules properly		
Battery LED indicator green fast blink and LCD displaying 'OVD'	Battery voltage is larger than over voltage disconnect voltage (OVD)	Check if the battery voltage is too high, and disconnect solar modules.
Fault LED indicator blink, LCD displaying 'Current Err'	Charging current in three phases is unbalanced	Disconnect solar modules and restart the controller; if the fault still exists, please contact the supplier to make maintenance
Fault LED indicator blink, LCD displaying 'Over Volt'	Solar modular output is too high	Check solar component parameters matching; the controller will disconnect the input if the voltage is over 150V and will Recovery below 145V
Fault LED indicator blink, LCD displaying 'Over Temp'	Heat sinks operational temperature is quite high to 85 ºC or above	The controller will automatically stop working. When the temperature is below 75 ºC, the controller will resume working
Cannot connect to the controller via RS-485 or RS-232	RS-485 serial baud rate setting error or serial-USB adapter incorrect configuration	Check serial baud rate is set to 115200bps or not and choose the right COM port; If using a serial-USB adapter, verify that the adapter software is installed and a serial COM port has been mapped
Fault LED indicator blink, LCD displaying 'Over Load' or 'Short circuit'	Over load① or Short circuit	Please reduce the number of electric equipment or carefully check the loads' connection.

① When 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 nominal value, the controller will automatically turn off loads in the 50s, 30s,10s and 2s respectively.

5.3 Maintenance

The following inspections and maintenance tasks are recommended at least twice yearly for best controller performance.

- Make sure the controller is firmly installed in a clean and dry ambient.
- 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 by serious solarization, frictional wear, dryness, insects or rats, etc. Repair or replace some wires if necessary.
- Tighten all the terminals. Inspect for loose, broken, or burnt wire connections.
- Check and confirm that LED or LCD is consistent with the required. Pay attention to any troubleshooting or error indication. Take necessary corrective action.
- Confirm that all the system components are ground connected tightly and correctly.
- Confirm that all the terminals have no corrosion, insulation damage, high temperature, or burnt/discolored sign. Tighten terminal screws to the suggested torque.
- Check for dirt, nesting insects, and corrosion. If so, clear up 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 other equipment.

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

6 PC Software

The controller can be connected to a common PC monitoring software by supporting a USB communication cable developed by the EPEVER company. Monitoring software can remote single or more controllers to modify the parameters and others in the PV system management (username: administrator, password: 111111 as default). See the specific instructions related software user guide. Software interfaces are shown below:

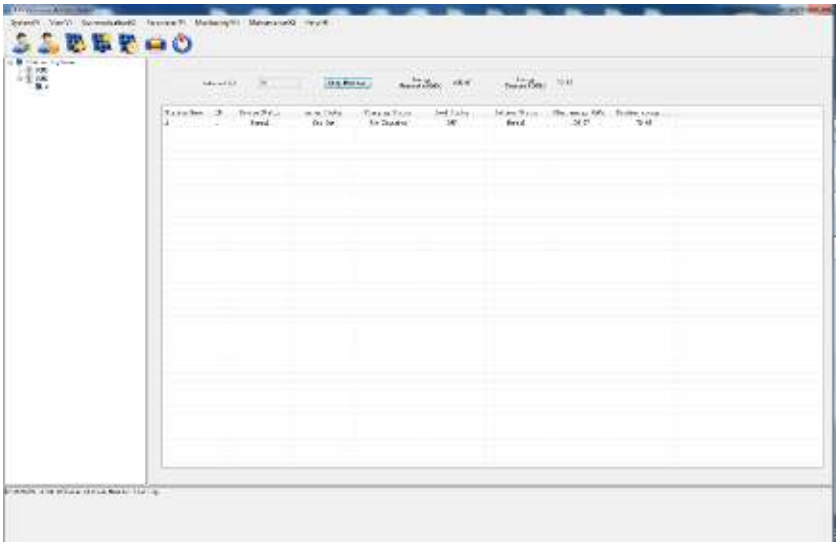


Figure6-1 Globe Monitoring

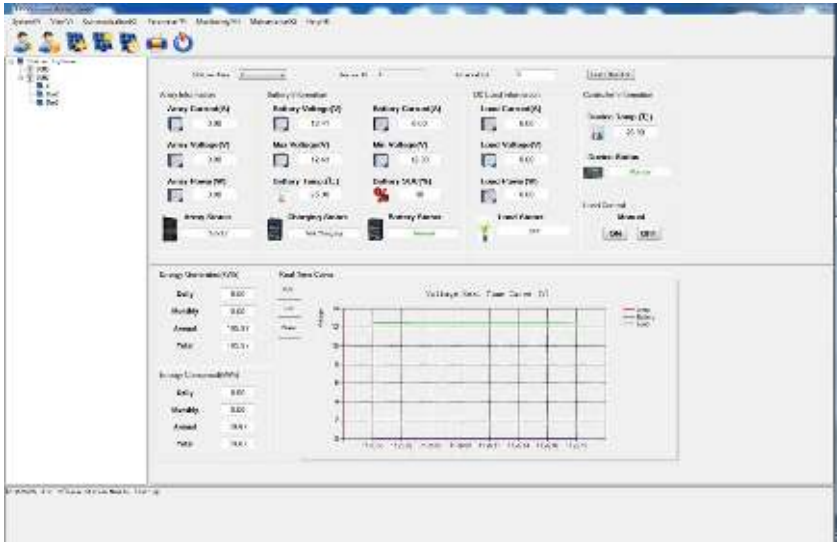


Figure6-2 Real-Time Monitoring

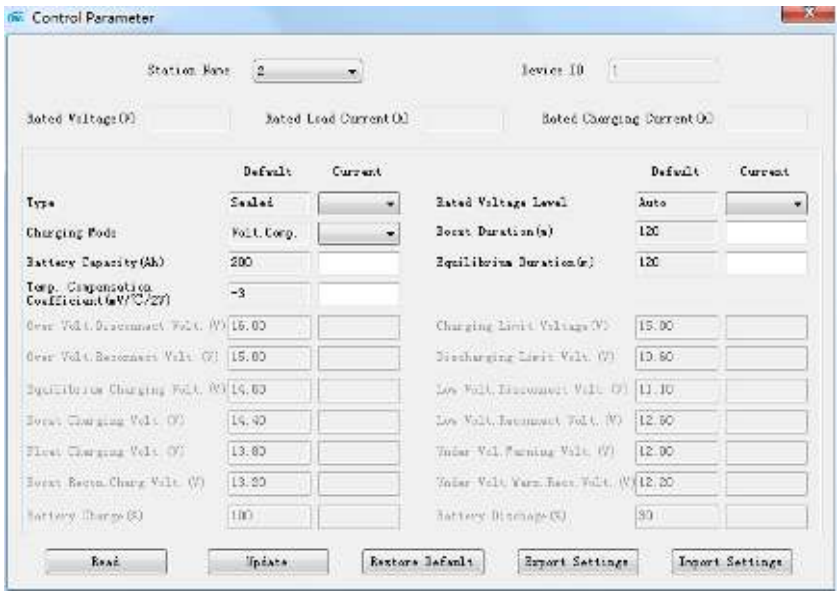


Figure6-3 Control Parameter

7 Specifications

Item	IT6415ND
Electrical Parameters	
Nominal System Voltage	12/24/36/48VDC
Nominal Battery Current	60A
Battery Input Voltage Range	8V～68V
Max. PV open circuit voltage	150V (at minimum operating environment temperature) 138V (at 25℃ environment temperature)
MPP Voltage Range	Battery voltage+2V～108V①
Maximum Input Power	800W/12V;1600W/24V 2400W/36V;3200W/48V
Self-Consumption	1.4W～2.6W
Discharge Circuit Voltage Drop	≤0.3V
Grounding	Common Negative
Environmental Parameters	
LCD temperature range	-20℃ ~ +70℃
Ambient temperature range②	-25℃ ~ +50℃
Storage temperature range	-30℃ ~ +85℃
Humidity range	≤95%, N.C.
Enclosure	IP20
Altitude	< 5000 m (Derating to operate according to IEC60146 at a height exceeding 1000 m)
Mechanical Parameters	
Dimension (L x W x H)	440 x 231 x 110mm
Mounting hole size	Φ10
Terminal size	2AWG(35mm^2)
Net Weight	5.9kg

① Max. PV open circuit voltage must never exceed 138V under 25℃ conditions.

② Please operate the controller at permitted ambient temperature. If over permissible range, derating the capacity in service.

8 Disclaimer

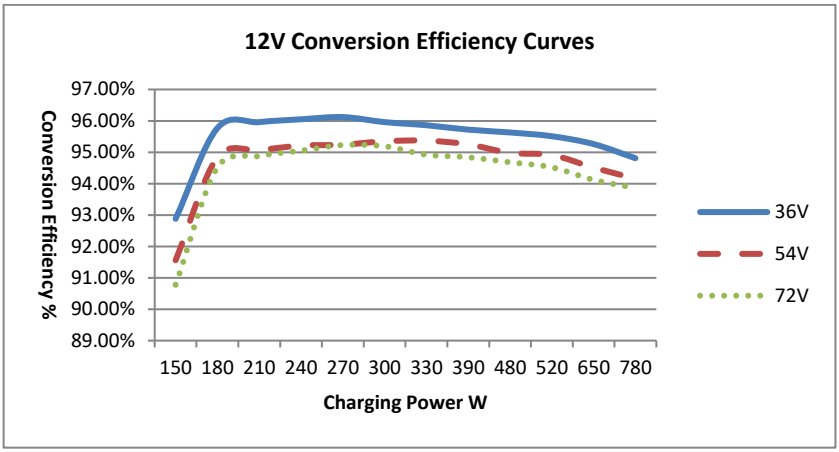
- Damage from improper use or use in an unsuitable environment.
- PV or load current, voltage, or power exceeds the rated value of the controller.
- Disassembly or attempted repair the controller without permission.
- The controller is damaged due to natural elements such as lighting.
- The controller is damaged during transportation and shipment.

Annex I Conversion Efficiency Curves

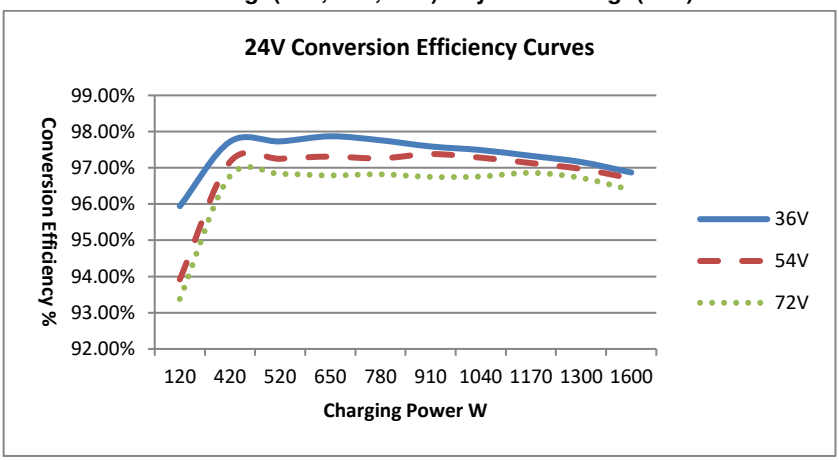
Illumination Intensity: 1000W/m² **Temperature: 25℃**

Test model: IT6415ND

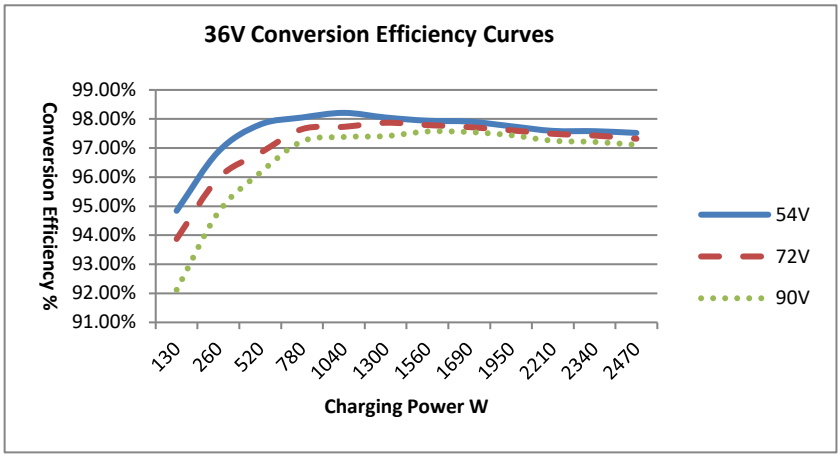
1. Solar MPPT Voltage(36V,54V, 72V) / System Voltage(12V)



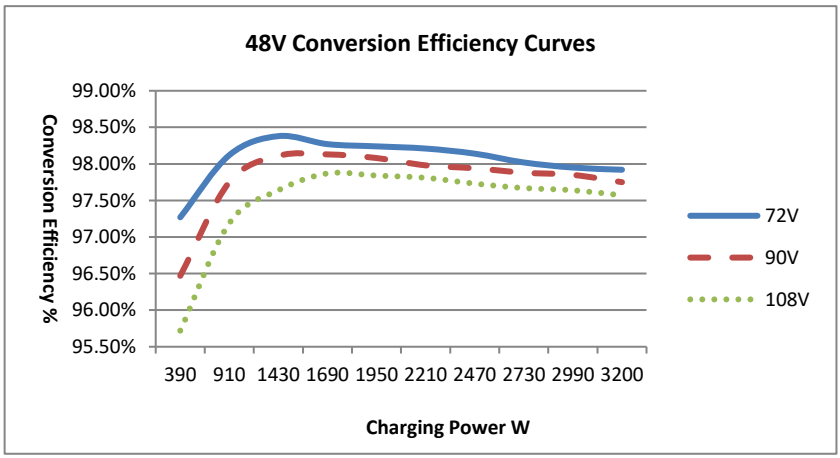
2. Solar MPPT Voltage(36V, 54V, 72V) / System Voltage(24V)



3. **Solar MPPT Voltage(54V, 72V, 90V) / System Voltage(36V)**

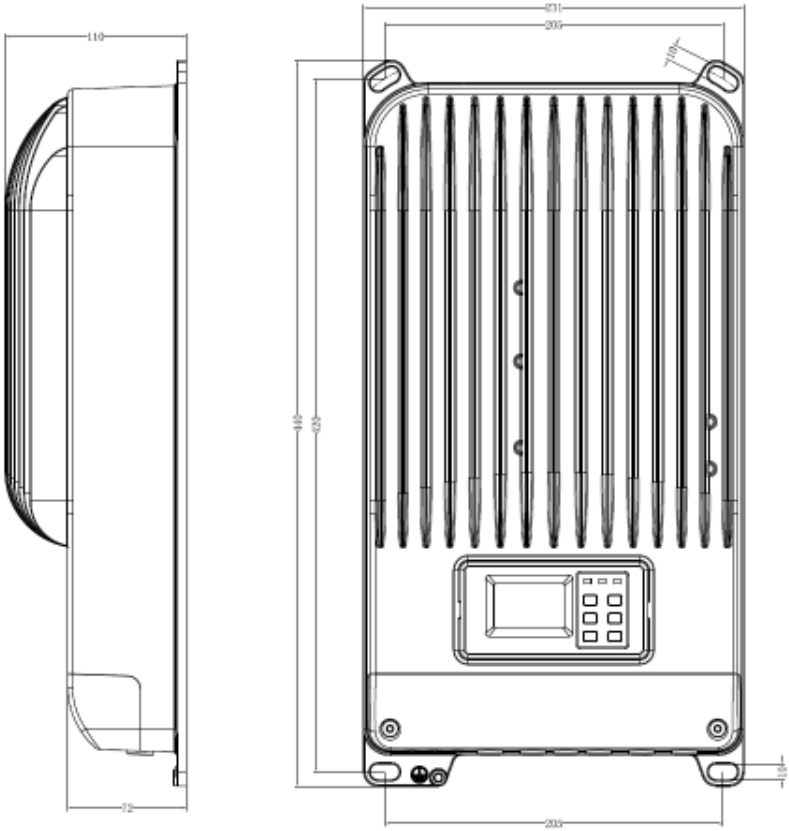


4. **Solar MPPT Voltage(72V, 90V, 108V) / System Voltage(48V)**



Annex II Dimensions

IT6415ND Dimensions (Unit: mm)



Any changes without prior notice! **Version number: V4.3**

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