Win-K series

MPPT Solar Controller

12/24V, 15/20/30/40A

User Manual

User Manual_Win-K series_OK
CE, RoHS, ISO9001:2015
Subject to change without notice!

Dear Clients,

Thanks for selecting the Win-K series solar controller.

Please take the time to read this user manual, this will help you to make full use of many advantages the controller can provide your solar system. This manual gives important recommendations for installing and using and so on. Read it carefully in your own interest and pay attention to the safety recommendations in it please.

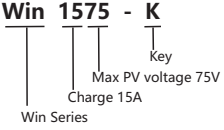
1,Overview and naming rules

The new generation of Win-K series controllers is a product developed according to the latest technical standards and represents the latest level of industrial technology development.

1.1 Outstanding features

- Innovative Max Power Point Tracking(MPPT) technology, tracking efficiency >99.9%
- Full digital technology, high charge conversion efficiency up to 98%
- 12/24V automatic recognition
- Liquid, Gel, AGM and Lithium battery for selection
- The separate ports for remote temperature sensor, make battery temperature compensation more accurate
- Four stages charge way: MPPT, boost, equalization, float
- Automatic over-temperature power reduction function
- Dual automatic restriction function when exceeding rated charging power and charging current
- IOS and Android APP version for Bluetooth communication(selectable)
- Common negative design
- LED segments displays,make battery selection easy.
- Perfect EMC & thermal design
- Full automatic electronic protect function

1.2 Product naming rules



2, Safety instructions and waiver of liability

2.1 Safety Instructions

The following symbols are used throughout this manual to indicate potentially dangerous conditions or mark important safety instructions. Please take care when meeting these symbols.

WARNING: Indicates a potentially dangerous condition. Use extreme caution when performing this task.

CAUTION: Indicates a critical procedure for safe and proper operation of the controller.

CAUTION:
1)There are no user serviceable parts inside the controller. Do not disassemble or attempt to repair the controller.
2)Keep the children away from batteries and the charge controller.

2.2 Liability Exclusion

The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

3, MPPT profile

3.1 MPPT profile

The full name of the MPPT is maximum power point tracking. It is an advanced charging way which could detect the real-time power of the solar Modulel and the maximum point of the I-V curve that make the highest battery charging efficiency.

3.2 Current Boost

Under most conditions, MPPT technology will "boost" the solar charge current.

MPPT Charging: Power Into the controller **(Pmax)**=Power out of the controller **(Pout)**

Iin x Vmp= Iout x Vout

* **Assuming 100% efficiency. Actually, the losses in wiring and conversion exist.**

If the solar module's maximum power voltage (Vmp) is greater than the battery voltage, it follows that the battery current must be proportionally greater than the solar input current so that input and output power are balanced. The greater the difference between the Vmp and battery voltage, the greater the current boost. Current boost can be substantial in systems where the solar array is of a higher nominal voltage than the battery as described in the next section

3.3 An Advantage Over Traditional Controllers

Traditional controllers connect the solar module directly to the battery when recharging. This requires that the solar module operate in a voltage range that is usually below the module's Vmp. In a 12 Volt system for example, the battery voltage may range from 11-15 Vdc, but the module's Vmp is typically around 16 or 17V.

Because traditional controllers do not always operate at the Vmp of the solar array, energy is wasted that could otherwise be used to charge the battery and power system loads. The greater the difference between battery voltage and the Vmp of the module, the more energy is wasted.

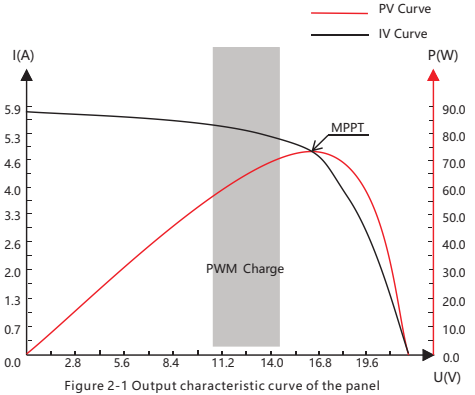


Figure 2-1 Output characteristic curve of the panel

Contrast with the traditional PWM controller, MPPT controller could play a maximum power of the solar panel so that a larger charging current could be supplied. Generally speaking, the MPPT controller's energy utilization efficiency is 15%~20% higher than PWM controller.

3.4 MPPT-Four Chargeing Stage

Battery type: AGM/GEL/LIQ.

As shown in Figure 2-2, the lead-acid battery is charged in the following stages: MPPT charge, constant voltage charge (Equalization charge/Boost charge/Float charge).

The constant voltage charging stage is divided into three stages: Equalization charge, Boost charge and Float charge:

■ **MPPT Charge**

When the battery voltage does not reach the target constant voltage value, the controller will carry out MPPT charging. When the battery voltage reaches the constant voltage value, the MPPT charging will automatically exit and enter the constant voltage charging (Equalization charge/Boost charge/Float charge).

■ **Boost Charge**

When the battery has recharged to the Boost voltage setpoint, the controller will charge at a constant voltage, and the charging current will gradually decrease over time. This process will be maintained for 120 minutes before switching to a floating charge.

■ **Equalization Charge**

Certain types of batteries benefit from periodic equalizing charge, which can stir the electrolyte, balance battery voltage and complete chemical reaction. Equalizing charge increases the battery voltage, higher than the standard complement voltage, which gasifies the battery electrolyte.

WARNING: Risk of explosion!
Equalizing flooded battery can produce explosive gases, so well ventilation of battery box is necessary.

■ **Float Charge**

After the Boost voltage stage, the controller will reduce the battery voltage to Float voltage setpoint. When the battery is fully recharged, there will be no more chemical reactions and all the charge current transmits 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 temperature of battery and prevent the gassing, also charging the battery slightly at the same time. The purpose of 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 Float stage, loads can continue to draw power from the battery. In the event that the system load(s) exceed the solar charge current, the controller will no longer be able to maintain the battery at the Float setpoint. Should the battery voltage remains below the boost reconnect charging voltage, the controller will exit Float stage and return to Bulk charging.

3.5 Lithium battery charging mode

Battery types are available in four and eight series lithium iron phosphate.

As shown in Figure 2-3, the lithium battery charging stage includes: MPPT charging/constant voltage charging.

■ **MPPT charging stage:** When the battery voltage has not reached the overcharge protection voltage, the controller will charge MPPT. When the battery voltage reaches the overcharge protection voltage, the MPPT charging will automatically exit and enter the constant voltage charging.

■ **Constant voltage charging stage:** the lithium battery is in the constant voltage charging stage, when the battery voltage reaches the overcharge protection voltage, the controller will carry out constant voltage charging, and the charging current will gradually decline over time, this process will remain for 60 minutes, and then stop charging, and re-enter the next charging cycle when the battery voltage reaches the overcharge recovery voltage.

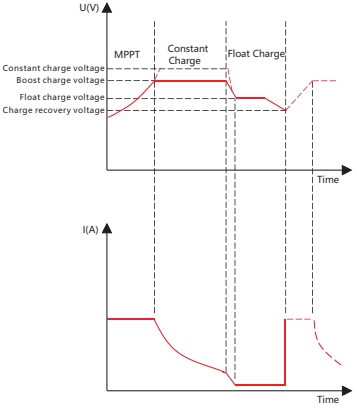


Figure 2-2 Lead-acid battery charging curve

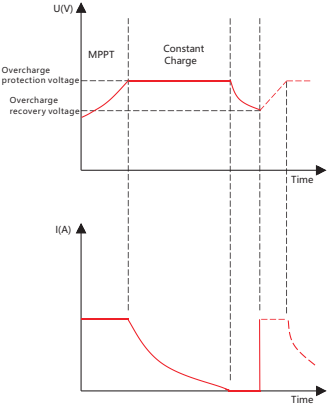
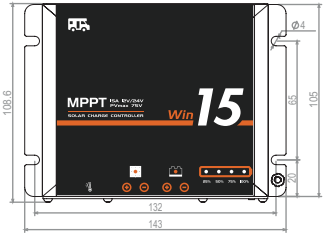


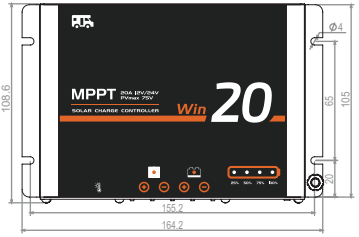
Figure 2-3 Lithium battery charging curve

4,Dimensions

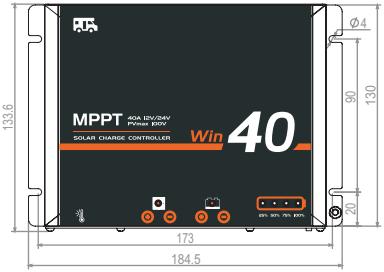
Unit: mm



Win1575-K



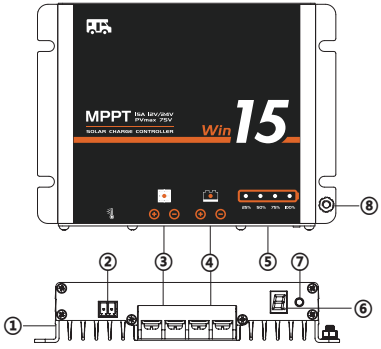
Win2075-K



Win30100/40100-K

5,Structure & Accessory

5.1 Structure&Characteristics



①Aluminum case
—dissipate controller heat, Internal protection.
②Temperature Sensor Port
—Collect temperature information. Temperature compensation.
③Solar module terminals
—Connected solar modules.
④Battery Terminals
—Connect the battery.
⑤LED Display
—Display the status of the controller.
⑥LED segments displays
—Display battery type.
⑦Button
—Set battery type.
⑧Ground terminal
—Ground.

5.2 Remote Temperature Sensor(Accessory)

The controller is shipped with a temperature sensor of length 80mm. If you need a longer remote temperature sensor, you need to purchase separately.

The remote temperature sensor can measure the temperature at the battery and use this data for very accurate temperature compensation. The standard length of the remote temperature sensor cable is 3m (length can be customized). The temperature sensor connected via interface ②.

1. Connection is independent of polarity.
2. If the external temperature sensor is not connected or damaged, The controller charges at 25 ° C by default.
3. If the controller and battery are not located in the same room then an external temperature sensor for measuring the battery temperature must be installed.

6,Installation

Please read all instructions and precautions in the manual before installing.

6.1 Installation Notes

(1)The solar charge controller may only be used in PV systems in accordance with this user manual and the specifications of other modules manufacturers. No energy source other than a solar generator may be connected to the solar charge controller.

(2)Batteries store a large amount of energy, never short circuit a battery under all circumstances. We strongly recommend connecting a fuse directly to the battery to avoid any short circuit at the battery wiring.

(3)Batteries can produce flammable gases. Avoid making sparks, using fire or any naked flame. Make sure that the battery room is ventilated.

(4)Avoid touching or short circuiting wires or terminals. Be aware that the voltages on special terminals or wires can be as much as twice the battery voltage. Use isolated tools, stand on dry ground, and keep your hands dry.

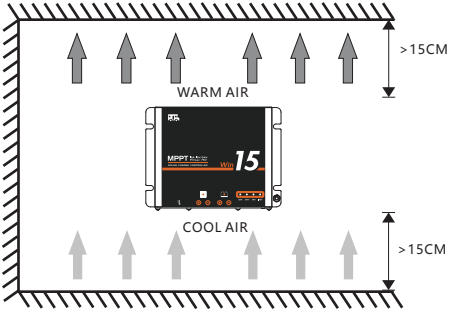
(5)Keep children away from batteries and controllers.

6.2 Mounting Location Requirements

Do not subject the solar charge controller to direct sunshine or other sources of heat. Protect the solar charge controller from dirt and moisture. Mount upright on the wall on a non-flammable substrate. Maintain a minimum clearance of 15cm below and around the device to ensure unhindered air circulation. Mount the solar charge controller as close as possible to the batteries.

Mark the position of the solar charge controller fastening holes on the wall, drill 4 holes and insert dowels, fasten the solar charge controller to the wall with the cable openings facing downwards.

Take win1575-k for example:



6.3 Wiring Specifications

Wiring and installation methods must comply with national and local electrical specifications.

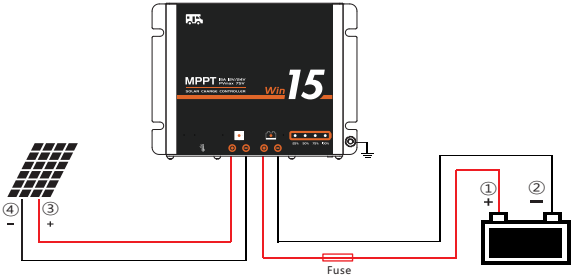
The wiring specifications of the solar, battery must be selected according to rated currents, and see the following table for wiring specifications:

Rated charging current	Solar wire diameter(mm²/AWG)	Battery wire diameter(mm²/AWG)
20A	5/10	5/10

The wire size is only for reference. If there is a long distance between the PV array and the controller or between the controller and the battery, larger wires can be used to reduce the voltage drop and improve performance.

6.4 Connection

We strongly recommend connecting a fuse directly to the battery to protect any short circuit at the battery wiring. Solar PV modules create current whenever light strikes them. The current created varies with the light intensity, but even in the case of low levels of light, full voltage is given by the modules. So, protect the solar modules from incident light during installation. Never touch uninsulated cable ends, use only insulated tools, and make sure that the wire diameter is in accordance with the expected currents of solar charge controller. Connections must always be made in the sequence described below.



WARNING: Risk of electric shock! Operation caution during connection. The solar PV array can produce open-circuit voltages in excess of 100V when in sunlight. Pay more attention to it.

WARNING: Risk of explosion! Once the battery's positive and negative terminals or leads that connect to the two terminals get short-circuited, a fire or explosion will occur. Always be careful in operation.

1st step: Connect the battery:

Connect the battery connection cable with the correct polarity to the solar charge controller (with the battery symbol). If the system is 12V, please make sure that the battery voltage is within 5V~15.5V, else if the system is 24V, the battery voltage should between 20V~31V.

2nd step: Connect the solar module:

Ensure that the solar module is protected from incident light. Ensure that the solar module does not exceed the maximum permissible input current. Connect the solar module connection cable to the correct polarity to the solar charge controller (with the solar module symbol).

3th step: Final work:

Tighten all cables connected to the controller and remove all the debris around the controller (leaving a space of approx. 15 cm).

6.5 Grounding

The system is equipped with ground studs, please ground the ground nut, do not ground other positions.

For common-negative system, such as motorhome, it is recommended to use a common-negative controller, but if in the common-negative system, some common-positive equipment are used, and the positive electrode is grounded, the controller may be damaged.

7,Bluetooth

7.1 Bluetooth Communication

Bluetooth communication has the following characteristics:
1.Support Android and iOS mobile phone APP(Solar life BT for Android,Solar life for iOS).
2.Realize wireless monitoring function of solar controller.
3.Use high performance, ultra-low power consumption Bluetooth dedicated chip.
4.Adopt Bluetooth 4.2 and BLE technology.
5.communication distance up to 10m.

Refer to Bluetooth APP instructions for detailed operation of mobile APP.

6.2 Battery Type

The controller applies to Liquid, Gel, AGM and Lithium battery, the factory default setting is suitable for Gel battery.

6.2.1 Liquid, GEL, AGM

When choosing Liquid, GEL or AGM for battery type, the parameters of boost, equalization and float charging voltage can be set by mobile phone APP. The range of parameters is as follows. The following voltage parameters are 25℃ /12V system parameters, 24V system automatically multiplied by 2.

①Liquid, GEL(The battery of GEL has no equalization charging function) :

Charging stage	Boost	Equalization	Float
Charging voltage range	14.0~14.8V	14.0~15.0V	13.0~14.5V
Default charging voltage	14.5V	14.8V	13.7V

②AGM :

Charging stage	Boost	Equalization	Float
Charging voltage range	14.0~14.8V	14.0~15.0V	13.0~14.5V
Default charging voltage	14.4V	14.7V	13.6V

Low voltage disconnect and low voltage reconnect can also be set by Bluetooth app of mobile phone.
Low voltage disconnect(LVD) setting range: 10.8-11.8V/21.6-23.6V(default: 11.2/22.4V)
Low voltage reconnect(LVR) setting range: 11.4~12.8V/22.8~25.6V(default: 12.0/24.0V)

6.2.2 Lithium

③ Parameters setting

When choosing lithium battery type, the charge target voltage, charge recovery voltage, low voltage disconnect and low voltage reconnect of lithium battery can be set by mobile phone APP, the setting range is as follow.
Charge target voltage(CVT) setting range: 10.0-32.0V (default: 14.4/28.8V)
Charge recovery voltage(CVR) setting range: 9.2-31.8V (default: 14.0/28.0V)
Low voltage disconnect(LVD) setting range: 9.0-30.0V (default: 11.0/22.0V)
Low voltage reconnect(LVR) setting range: 9.6-31.0V (default: 12.0/24.0V)

② 0℃ Charging

"0℃ Charging" function is only applicable for lithium battery, it can be set to "Yes", "Slow" or "No". When the controller detects that the ambient temperature is higher than 0℃, the charging function is normal. when the ambient temperature is low than 0℃, if the "0℃ Charging" is set to "Yes", the charging function is normal, else if the "0℃ Charging" is set to "slow", the max charging current is 20% of the rated current, else if the "0℃ Charging" is set to "No", the controller does not charge the battery.
The user can select the appropriate charging method.

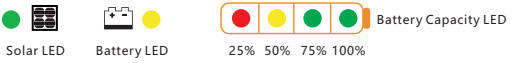
The low voltage reconnect(LVR) should be higher than the low voltage disconnect (LVD) at least 0.6/1.2V, if you want to improve LVD, you should first improve LVR.

(Charge recovery voltage+1.5V)≥Lithium Charge target voltage≥(Charge recovery voltage+0.2V)
Mobile App does not support parameters beyond this range.

Warning: The required accuracy of BMS shall be at least 0.2V. If the deviation is higher than 0.2V, the manufacturer will assume no liability for any system malfunction caused by this.

8, LED indications, Protections and Maintenance

8.1 LED Display



LED	Status	Function
Solar LED (Red)	On	Solar panel is correctly connected, but not charged
	Fast Flash(0.1s on/0.1s off)	MPPT charging
	Flash(0.5s on/0.5s off)	Equal or Boost charging
	Slow Flash(0.5s on/2s off)	Float charging
	Off	Night
	Super slow flash(2s on/2s off)	PV overvoltage
Battery LED (Blue)	On	Battery is normal
	Flash(0.2s on/0.2s off)	Over temperature
Battery Capacity LED (Red, Yellow, Green, Green)	25% LED Flash(0.2s on/0.2s off, Red)	Low voltage protection
	100% LED Flash(0.2s on/0.2s off, Green)	Over voltage protection
	25% LED On(Red)	Battery capacity < 25%
	50% LED On(Yellow)	25% < Battery capacity < 50%
	75% LED On(Green)	50% < Battery capacity < 90%
	100% LED On(Green)	Battery capacity > 90%

8.2 LED segments displays and button

8.2.1 Button setting mode:

Long press to enter the setting, the digital tube is flashing, then click to select the battery type, then long press to save and exit. After the setting is successful, all indicators flash three times at the same time.

Note: The LED segments displaywill be off after no operation for 30 seconds, the button will wake up, and the display will start from the first interface.

8.2.2 Digital tube display

Display	Battery type	Boost votage	Float voltage	Overvoltage protection	Low voltage
1	AGM	14.4V	13.6V	15.8/31.3V	11.2/22.4V
2	GEL	14.5V	13.7V	15.8/31.3V	11.2/22.4V
3	LIQ	14.5V	13.7V	15.8/31.3V	11.2/22.4V
4	LiFePO4*4S	14.4V	——	14.6V	11.0V
5	LiFePO4*8S	28.8V	——	29.0V	22.0V

Note:
1. When the Bluetooth setting parameter is inconsistent with the digital tube parameter, the digital tube displays 0;
2. Bluetooth APP can customize parameters.

Note: The letters are shown as below:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
S	T	U	V	W	X	Y	Z	0	1	2	3	4	5	6	7	8	9

8.3 Faults & Alarms

Fault	Reason	Troubleshooting
High voltage at battery terminal	Battery voltage is too high	Check if other sources overcharge the battery. If not, controller is damaged.
Can't recognize bluetooth	Communication failure	Reconnect after disconnecting the battery for about 1 minute and reconnect the Bluetooth device.
Can't recognize system voltage	Battery voltage is abnormal at start-up	Charge or discharge the battery so that the battery voltage is within the normal operating range (5~15.5V or 20~31V).
Full sunlight shines on the solar panel, and the charging icon is not bright	PV panel fault or reverse connection	Check panels and connection wires.
Full sunlight shines on the solar panel, and the charging icon flashes super slowly	The solar open circuit voltage exceeds the rated maximum open circuit voltage of the controller	Check the solar panel and replace the appropriate solar circuit board so that the solar voltage is within the normal working range of the controller

8.4 Protection

- **Charging power limit function**

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

- **PV Short Circuit**
  When the PV is not charged, a short circuit occurs at the solar end, which will not damage the controller.
  ※ Warning: Do not short circuit the PV during the charging process, otherwise it will damage the controller.
- **PV Reverse Polarity**
  Fully protection against PV reverse polarity, no damage to the controller. Correct the connection to start normal operation.
- **Battery Reverse Polarity**
  Fully protection against battery reverse polarity, no damage to the controller. Correct the connection to start normal operation.(Polarity reversal is prohibited for lithium batteries)
- **Battery Over voltage**
  If there are other energy sources to charge the battery, when the battery voltage exceeds 15.8 / 31.3V, the controller will stop charging to protect the battery from overcharging damage.(Lithium battery is the target voltage +0.2V)
- **Battery Over discharge**
  When battery voltage drops to the setting voltage point of low voltage disconnect ,it enters the low voltage protection state to prevent the battery from being damaged due to excessive discharge.
- **Over Temperature Protection**
  The controller detects the internal temperature through internal sensor, when the temperature exceeds the setting value, the charging current will lower down followed by the decrease of temperature, so as to control the controller's temperature rise, when the internal temperature exceeds the setting over temperature protection threshold, the controller stops working and restores after the temperature is lowered.
- **Damaged Remote Temperature Sensor**
  If the external temperature sensor is damaged or not connected, the controller charges the battery at 25 ° C by default to prevent overcharge from damaging the battery.

8.5 Maintenance

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

- Make sure no block on air-flow around the controller. Clear up any dirt and fragments on radiator.
- Check all the naked wires to make sure insulation is not damaged. Repair or replace some wires if necessary.
- Tighten all the terminals. Inspect for loose, broken, or burnt wire connections.
- Pay attention to any troubleshooting or error indication .Take corrective action if necessary.
- Confirm that all the system components are ground connected tightly and correctly.
- Confirm that all the terminals have no corrosion, insulation damaged, 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.

WARNING: Risk of electric shock!
Make sure that all the power is turned off before above operations, and then follow the corresponding inspections and operations.

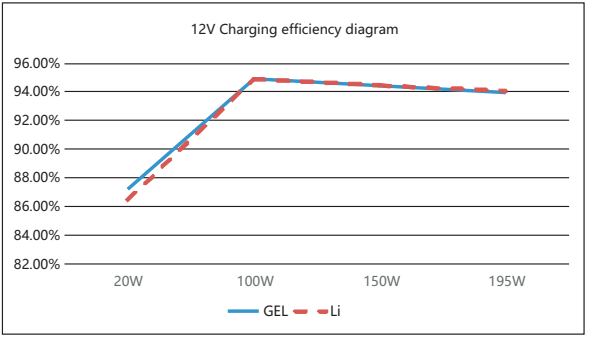
9, Technical Data

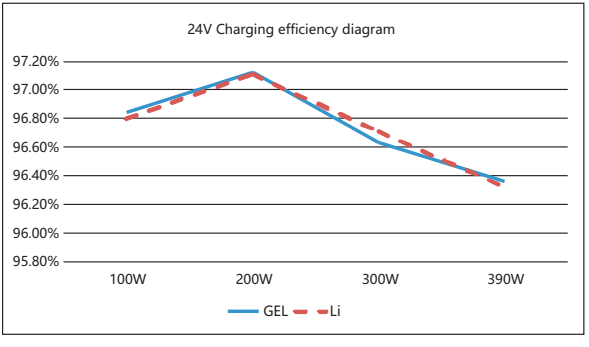
	Item	Win1575-K	Win2075-K
Battery Parameters	Battery type	Gel, AGM, Liquid, Lithium(default: Gel)	
	System voltage	12V/24V automatical recognization	
	Max charging current	15A	20A
	MPPT charging voltage	<14.5/29.0V@25℃	
	Boost voltage	14.0~14.8V/28.0~29.6V(default:14.5/29.0V@25℃)	
	Equalization voltage	14.0~15.0V/28.0~30.0V(default:14.8/29.6V@25℃)(Liquid,AGM)	
	Float voltage	13.0~14.5V/26.0~29.0V(default:13.7/27.4V@25℃)	
	Low voltage disconnect	10.8~11.8V/21.6~23.6V(default:11.2/22.4V)	
	Low voltage reconnect	11.4~12.8V/22.8~25.6V(default:12.0/24.0V)	
	Battery high voltage protection voltage	15.8/31.3V(Liquid,GEL,AGM)	
	Max volt on bat. terminal	35V	
	Temperature compensation	-4.17mV/K per cell (Boost, Equalization), -3.33mV/K per cell (Float)	
	Charging target voltage	10.0 ~32.0V(Lithium,default:14.4/28.8V)	
	Charging recovery voltage	9.2 ~31.8V(Lithium,default:14.0/28.0V)	
	Low voltage disconnect	9.0 ~30.0V(Lithium,default:11.0/22.0V)	
	Low voltage reconnect	9.6 ~31.0V(Lithium,default:12.0/24.0V)	
Panel Parameters	Max voltage on PV(-20℃)	75V	
	Max voltage on PV(25℃)	70V	
	Max input power	200W/400W	260W/520W
System Parameters	Max tracking efficiency	>99.9%	
	Max conversion efficiency	98%	
	Dimensions	108.6*143*28.1mm	108.6*164.2*31.5mm
	Weight	534g	719g
	Communication	BLE(Selectable)	
	Grounding	Negative grounding	
	Power terminals	10AWG(5mm²)	
	Ambient temperature	-20~+55℃	
	Ambient humidity	0~100%RH	
	Storage temperature	-40~+80℃	
	Protection degree	IP54	
	Max Altitude	4000m	

	Item	Win30100-K	Win40100-K
Battery Parameters	Battery type	Gel, AGM, Liquid, Lithium(default: Gel)	
	System voltage	12V/24V automatical recognization	
	Max charging current	30A	40A
	MPPT charging voltage	<14.5/29.0V@25℃	
	Boost voltage	14.0~14.8V/28.0~29.6V(default:14.5/29.0V@25℃)	
	Equalization voltage	14.0~15.0V/28.0~30.0V(default:14.8/29.6V@25℃)(Liquid,AGM)	
	Float voltage	13.0~14.5V/26.0~29.0V(default:13.7/27.4V@25℃)	
	Low voltage disconnect	10.8~11.8V/21.6~23.6V(default:11.2/22.4V)	
	Low voltage reconnect	11.4~12.8V/22.8~25.6V(default:12.0/24.0V)	
	Battery high voltage protection voltage	15.8/31.3V(Liquid,GEL,AGM)	
	Max volt on bat. terminal	35V	
	Temperature compensation	-4.17mV/K per cell (Boost, Equalization), -3.33mV/K per cell (Float)	
	Charging target voltage	10.0 ~32.0V(Lithium,default:14.4/28.8V)	
	Charging recovery voltage	9.2 ~31.8V(Lithium,default:14.0/28.0V)	
	Low voltage disconnect	9.0 ~30.0V(Lithium,default:11.0/22.0V)	
	Low voltage reconnect	9.6 ~31.0V(Lithium,default:12.0/24.0V)	
Panel Parameters	Max voltage on PV(-20℃)	100V	
	Max voltage on PV(25℃)	90V	
	Max input power	400W/800W	520W/1040W
System Parameters	Max conversion efficiency	97%	
	Dimensions	133.6*184.5*39.5mm	
	Weight	1330g	
	Communication	BLE(Selectable)	
	Grounding	Negative grounding	
	Power terminals	10AWG(5mm²)	
	Ambient temperature	-20~+55℃	
	Ambient humidity	0~100%RH	
	Storage temperature	-40~+80℃	
	Protection degree	IP54	
	Max Altitude	4000m	

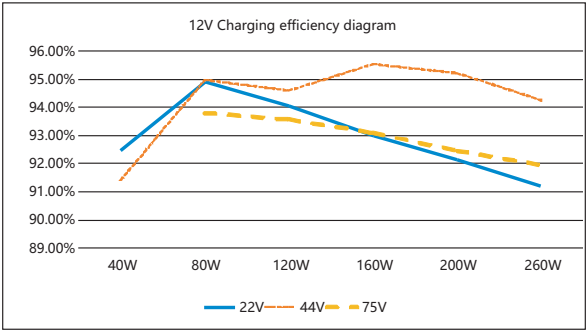
10, Charging efficiency diagram

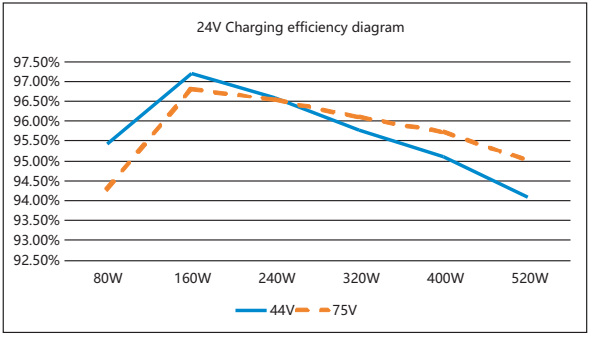
Product model：Win1575-K

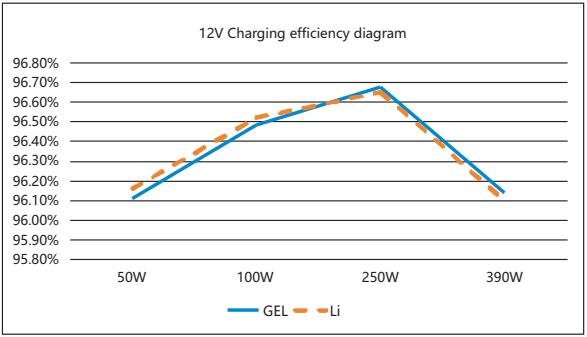


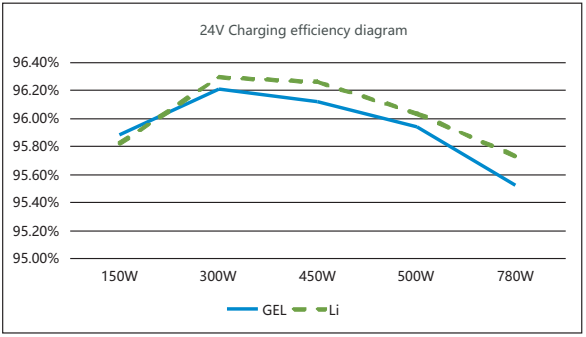


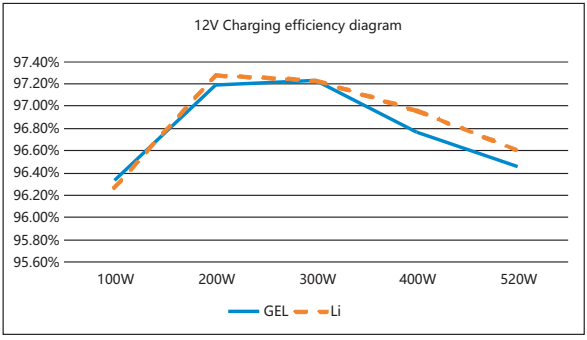
产品型号：Win2075-K

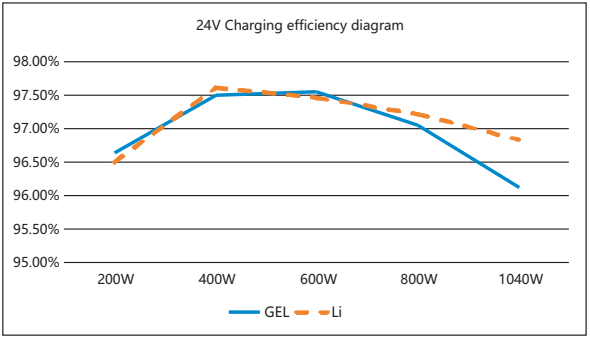





12V Charging efficiency diagram
96.80%
96.70%
96.60%
96.50%
96.40%
96.30%
96.20%
96.10%
96.00%
95.90%
95.80%
50W
100W
250W
390W
GEL
Li


24V Charging efficiency diagram
96.40%
96.20%
96.00%
95.80%
95.60%
95.40%
95.20%
95.00%
150W
300W
450W
500W
780W
GEL
Li


12V Charging efficiency diagram
97.40%
97.20%
97.00%
96.80%
96.60%
96.40%
96.20%
96.00%
95.80%
95.60%
100W
200W
300W
400W
520W
GEL
Li


24V Charging efficiency diagram
98.00%
97.50%
97.00%
96.50%
96.00%
95.50%
95.00%
200W
400W
600W
800W
1040W
GEL
Li