GermanSolar Asia Co., Ltd. **Off-grid Panel**

Polycrystalline | GSAP6-110/115/120/125W

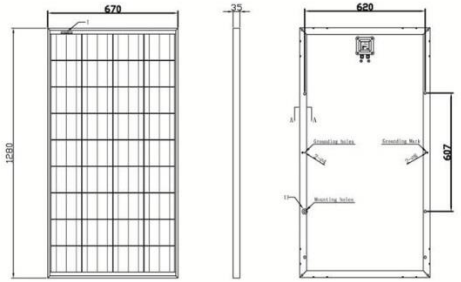
- Flash-data for every panel.
- Positive output sorting.
- Tight power tolerance±3%.
- Individual testing and surveying, quality assurance by permanent production control incl. EL-test.
- UV stabilized, aesthetically pleasing black anodized frame.
- Supported by major mounting structure manufacturers
- Chamfered frame–resulting in improved water drainage.
- The production facility and process comply with IEC standard 61215, 61730 and UL1703.

DESCRIPTION

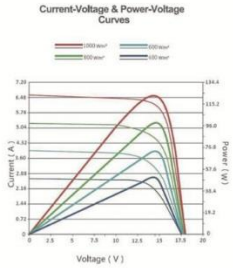
Item		Module Type			
		GSAP6-110W	GSAP6-115W	GSAP6-120W	GSAP6-125W
Maximum power	Pmax(W)	110W	115W	120W	125W
Tolerance	(%)	±3	±3	±3	±3
Open Ciruit Voltage	Voc(V)	21.7	21.96	22	22.2
Short Circuit Current	Isc(A)	6.55	6.67	7.12	7.18
Maximum Power Voltage	Vmpp(V)	18.04	18.3	18.2	18.5
Maximum Power Current	Impp(A)	6.08	6.30	6.60	6.75
Module Efficiency	(%)	12.8	13.4	14	14.6
Solar Cell Efficiency	(%)	14.6	15.3	16.2	16.6
Cell Type	(mm)	156X156(Poly-Crystalline Silicon)			
Number of Cells	(Pcs)	36			
Maximum System Voltage	(V)	DC600			
Temp.Coeff.of Voc	(%/K)	-0.343			
Temp.Coeff.of Isc	(%/K)	0.075			
Temp.Coeff.of Pmax	(%/K)	-0.44			
Operating Temperature	(°C)	-40to85			
Nominal Operating Cell Tempera	(°C)	47±2			
Max.Series Fuse	(A)	10			
Insulation	(MΩ)	50			
Wind Bearing	(Pa)	≤5400			
Pressure Bearing	(Pa)	≤2400			
STC(Stand Test Conditions)		1000W/m² AM=1.525°C			
Weight	(kg)	11			

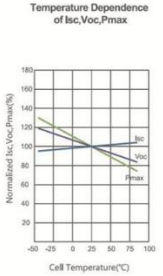
Polycrystalline | GSAP6-110/115/120/125W

PHYSICAL CHARACTERISTICS Unit: mm



ELECTRICAL CHARACTERISTICS





LAMPIRAN 2

EPEVER
EPSOLAR TECHNOLOGY

Tracer AN series
MPPT Solar Charge Controller

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

www.epsolarpv.com

Technical specifications

Model	Tracer5210AN	Tracer6210AN	Tracer5415AN	Tracer6415AN	Tracer8415AN
Nominal System Voltage	12/24VDC or Auto		12/24/36/48VDC or Auto		
Battery Input Voltage Range	8V～32V		8V～68V		
Battery Type	Sealed(Default)/Gel/Flooded/User				
Battery fuse	80A/58V				150A/58V
Rated charge current	50A	60A	50A	60A	80A
Rated charge Power	625W/12V 1250W/24V	750W/12V 1500W/24V	625W/12V 1250W/24V 1875W/36V 2500W/48V	750W/12V 1500W/24V 2250W/36V 3000W/48V	1000W/12V 2000W/24V 3000W/36V 4000W/48V
Max. PV open circuit voltage	100V① 92V②		150V① 138V②		
MPP Voltage Range	(Battery Voltage+2V) ～72V③		(Battery Voltage +2V) ～108V③		
Tracking efficiency	≥99.5%				
Max. conversion efficiency	98.0%	98.0%	98.3%	98.6%	98.5%
Full load efficiency	97.0%	97.0%	97.8%	98.0%	98.0%
Temperature compensate coefficient	－3mV/℃/2V(Default)				
Self-consumption	98mA/12V;60mA/24V;50mA/36V;46mA/48V				
Grounding	Common negative grounding				
Relay	Rated Value:5A/30VDC; Max. Value:0.5A/60VDC				
RS485 interface	RS485(RJ45)				
LCD backlight time	Default:60S,Range:0～999S(0S:the backlight is ON all the time)				

Model	Tracer10415AN	Tracer5420AN	Tracer6420AN	Tracer8420AN	Tracer10420AN
Nominal System Voltage	12/24/36/48VDC or Auto				
Battery Input Voltage Range	8V～68V				
Battery Type	Sealed(Default)/Gel/Flooded/User				
Battery fuse	150A/58V	80A/58V		150A/58V	
Rated charge current	100A	50A	60A	80A	100A
Rated charge Power	1250W/12V 2500W/24V 3750W/36V 5000W/48V	625W/12V 1250W/24V 1875W/36V 2500W/48V	750W/12V 1500W/24V 2250W/36V 3000W/48V	1000W/12V 2000W/24V 3000W/36V 4000W/48V	1250W/12V 2500W/24V 3750W/36V 5000W/48V
Max. PV open circuit voltage	150V① 138V②	200V① 180V②			
MPP Voltage Range	(Battery Voltage +2V) ～108V③	(Battery Voltage+2V) ～144V③			
Tracking efficiency	≥99.5%				
Max. conversion efficiency	98.6%	98.3%	98.1%	98.5%	98.5%
Full load efficiency	98.0%	97.1%	97.5%	97.5%	97.6%
Temperature compensate coefficient	－3mV/℃/2V(Default)				
Self-consumption	98mA/12V;60mA/24V;50mA/36V;46mA/48V				
Grounding	Common negative grounding				
Relay	Rated Value:5A/30VDC; Max. Value:0.5A/60VDC				
RS485 interface	RS485(RJ45)				
LCD backlight time	Default:60S,Range:0～999S(0S:the backlight is ON all the time)				

①At minimum operating environment temperature ②At 25℃ environment temperature

③The maximum PV open circuit voltage must never exceed 138V or 180V at 25℃ environment temperature

Model	Tracer5210AN Tracer6210AN	Tracer5415AN Tracer5420AN	Tracer6415AN Tracer6420AN	Tracer8415AN Tracer8420AN	Tracer10415AN Tracer10420AN
Electrical Parameters					
Ambient temperature range	-25℃～+60℃(Derate above 45℃)				
LCD temperature range	-20℃～+70℃				
Storage temperature range	-30℃～+85℃				
Relative humidity range	5% to 95% (N.C.)				
Enclosure	IP20				
Pollution degree	PD2				

Model	Tracer5210/5415/5420AN	Tracer6210/6415/6420AN	Tracer8415/8420AN	Tracer10415/10420AN
Mechanical				
Dimension	261×216×119mm	340×236×119mm	394×240×134mm	394×242×143mm
Mounting dimension	180×204mm	260×224mm	300×228mm	300×230mm
Mounting hole size	Φ7			
Terminal	6AWG/16mm^2	2AWG/35mm^2	2AWG/35mm^2	2AWG/35mm^2
Recommended cable	6AWG/16mm^2	6AWG/16mm^2	4AWG/25mm^2	2AWG/35mm^2
Weight	3.5kg	4.5kg	6.1kg	7.4kg

BLDG#18, CO.PARK, NO.8 HEYING ROAD, CHANGPING DISTRICT, BEIJING, CHINA
010-82894112 010-82894882 www.epsolarpv.com info@epsolarpv.com

LAMPIRAN 3

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Gel and AGM Batteries

www.victronenergy.com

AGM Battery
12V 90Ah

GEL OPzV 2V cell

1. VRLA technology
VRLA stands for Valve Regulated Lead Acid, which means that the batteries are sealed. Gas will escape through the safety valves only in case of overcharging or cell failure.
VRLA batteries are maintenance free for life.

2. Sealed (VRLA) AGM Batteries
AGM stands for Absorbent Glass Mat. In these batteries the electrolyte is absorbed into a glass-fibre mat between the plates by capillary action. As explained in our book 'Energy Unlimited', AGM batteries are more suitable for short-time delivery of high currents than gel batteries.

3. Sealed (VRLA) Gel Batteries
Here the electrolyte is immobilized as gel. Gel batteries in general have a longer service life and better cycle capacity than AGM batteries.

4. Low Self-Discharge
Because of the use of lead calcium grids and high purity materials, Victron VRLA batteries can be stored during long periods of time without recharge. The rate of self-discharge is less than 2% per month at 20°C. The self-discharge doubles for every increase in temperature by 10°C.
Victron VRLA batteries can therefore be stored for up to a year without recharging, if kept under cool conditions.

5. Exceptional Deep Discharge Recovery
Victron VRLA batteries have exceptional discharge recovery, even after deep or prolonged discharge.
Nevertheless repeatedly deep and prolonged discharge has a very negative effect on the service life of all lead acid batteries, Victron batteries are no exception.

6. Battery Discharging Characteristics
The rated capacity of Victron AGM and Gel Deep Cycle batteries refers to 20 hour discharge, in other words: a discharge current of 0,05 C.
The rated capacity of Victron Tubular Plate Long Life batteries refers to 10 hours discharge.
The effective capacity decreases with increasing discharge current (see table 1). Please note that the capacity reduction will be even faster in case of a constant power load, such as an inverter.

Discharg time (constant current)	End Voltage V	AGM 'Deep Cycle' %	Gel 'Deep Cycle' %	Gel 'Long Life' %
20 hours	10,8	100	100	112
10 hours	10,8	92	87	100
5 hours	10,8	85	80	94
3 hours	10,8	78	73	79
1 hour	9,6	65	61	63
30 min.	9,6	55	51	45
15 min.	9,6	42	38	29
10 min.	9,6	38	34	21
5 min.	9,6	27	24	
5 seconds		8 C	7 C	

Table 1: Effective capacity as a function of discharge time (the lowest row gives the maximum allowable 5 seconds discharge current)

Our AGM deep cycle batteries have excellent high current performance and are therefore recommended for high current applications such as engine starting. Due to their construction, Gel batteries have a lower effective capacity at high discharge currents. On the other hand, Gel batteries have a longer service life, both under float and cycling conditions.

7. Effect of temperature on service life
High temperature has a very negative effect on service life. The service life of Victron batteries as a function of temperature is shown in table 2.

Average Temperature	AGM 'Deep Cycle' years	Gel 'Deep Cycle' years	Gel 'Long Life' years
20°C / 68°F	7 - 10	12	20
30°C / 86°F	4	6	10
40°C / 104°F	2	3	5

Table 2: Design service life of Victron batteries under float service

8. Effect of temperature on capacity

As is shown by the graph below, capacity reduces sharply at low temperatures.

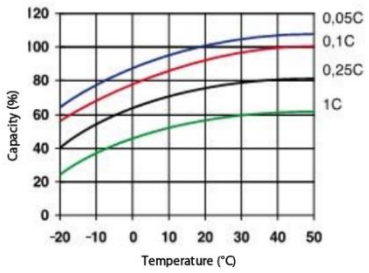

Fig. 1: Effect of temperature on capacity

9. Cycle life of Victron batteries

Batteries age due to discharging and recharging. The number of cycles depends on the depth of discharge, as is shown in figure 2.

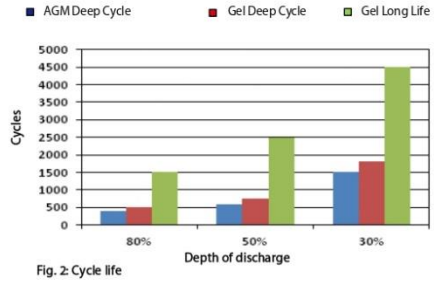

Fig. 2: Cycle life

10. Battery charging in case of cycle use: the 3-step charge curve

The most common charge curve used to charge VRLA batteries in case of cyclic use is the 3-step charge curve, whereby a constant current phase (the bulk phase) is followed by two constant voltage phases (absorption and float), see fig. 3.

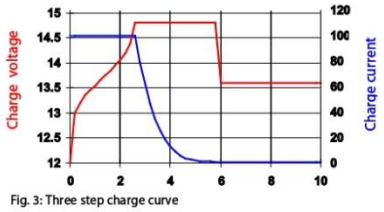

Fig. 3: Three step charge curve

During the absorption phase the charge voltage is kept at a relatively high level in order to fully recharge the battery within reasonable time. The third and last phase is the float phase: the voltage is lowered to standby level, sufficient to compensate for self-discharge.

Disadvantages of the traditional 3-step charge curve:

- During the bulk phase the current is kept at a constant and often high level, even after the gassing voltage (14,34V for a 12V battery) has been exceeded. This can lead to excessive gas pressure in the battery. Some gas will escape through the safety valves, reducing service life.
- Thereafter the absorption voltage is applied during a fixed period of time, irrespective of how deep the battery has been discharged previously. A full absorption period after a shallow discharge will overcharge the battery, again reducing service life (a.o. due to accelerated corrosion of the positive plates).
- Research has shown that battery life can be increased by decreasing float voltage to an even lower level when the battery is not in use.

11. Battery charging: longer battery life with Victron 4-step adaptive charging

Victron developed the adaptive charge curve. The 4-step adaptive chare curve is the result of years of research and testing.

The Victron four-step adaptive charge curve solves the 3 main problems of the 3-step curve:

- Battery Safe Mode
  In order to prevent excessive gassing, Victron has invented the 'Battery Safe Mode'. The Battery Safe Mode will limit the rate of voltage increase once the gassing voltage has been reached. Research has shown that this will reduce internal gassing to a safe level.
- Variable absorption time
  Based on the duration of the bulk stage, the charger calculates how long the absorption time should be in order to fully charge the battery. If the bulk time is short, this means the battery was already charged and the resulting absorption time will also be short, whereas a longer bulk time will also result in a longer absorption time.
- Storage mode
  After completion of the absorption period the battery should be fully charged, and the voltage is lowered to the float or standby level. If no discharge occurs during the next 24 hours, the voltage is reduced even further and the battery goes into storage mode. The lower storage voltage reduces corrosion of the positive plates.
  Once every week the charge voltage is increased to the absorption level for a short period to compensate for self-discharge (Battery Refresh mode).

12. Battery charging in case of standby use: constant voltage float charging

When a battery is not frequently deeply discharged, a 2-step charge curve can be used. During the first phase the battery is charged with a limited current (the bulk phase). Once a pre-set voltage has been reached the battery is kept at that voltage (the float phase).
This charge method is used for starter batteries in vehicles and in uninterruptible power supplies (UPS).

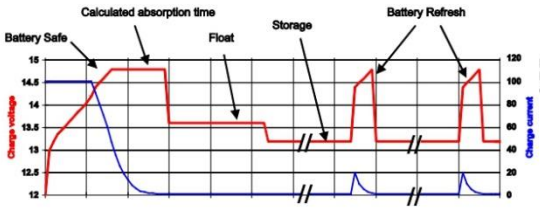

Figure 3: Four-step adaptive charge curve

Fig. 4: Four-step adaptive charge curve

13. Optimum charge voltage of Victron VRLA batteries

The recommended charge voltage settings for a 12V battery are shown in table 3.

14. Effect of temperature on charging voltage

The charge voltage should be reduced with increased temperature. Temperature compensation is required when the temperature of the battery is expected to be less than 10°C / 50°F or more than 30°C / 85°F during long periods of time.
The recommended temperature compensation for Victron VRLA batteries is -4 mV / Cell (-24 mV /°C for a 12V battery).
The centre point for temperature compensation is 25°C / 70°F.

15. Charge current

The charge current should preferably not exceed 0,2C (20A for a 100Ah battery).The temperature of a battery will increase by more than 10°C if the charge current exceeds 0,2C. Therefore temperature compensation is required if the charge current exceeds 0,2C.

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	Float Service (V)	Cycle service Normal (V)	Cycle service Fastest recharge (V)
Victron AGM 'Deep Cycle'			
Absorption		14,2 - 14,6	14,6 - 14,9
Float	13,5 - 13,8	13,5 - 13,8	13,5 - 13,8
Storage	13,2 - 13,5	13,2 - 13,5	13,2 - 13,5
Victron Gel 'Deep Cycle'			
Absorption		14,1 - 14,4	
Float	13,5 - 13,8	13,5 - 13,8	
Storage	13,2 - 13,5	13,2 - 13,5	
Victron Gel 'Long Life'			
Absorption		14,0 - 14,2	
Float	13,5 - 13,8	13,5 - 13,8	
Storage	13,2 - 13,5	13,2 - 13,5	

Table 3: Recommended charge voltage

12 Volt Deep Cycle AGM							General Specification
Article number	Ah	V	l x w x h mm	Weight kg	CCA @0°F	RES CAP @80°F	Technology: flat plate AGM Terminals: copper
BAT406225084	240	6	320x176x247	31	700	270	Rated capacity: 20 hr. discharge at 25°C Float design life: 7-10 years at 20°C Cycle design life: 400 cycles at 80% discharge 600 cycles at 50% discharge 1500 cycles at 30% discharge
BAT212070084	8	12	151x65x101	2,5			
BAT212120084	14	12	151x98x101	4,1			
BAT212200084	22	12	181x77x167	5,8			
BAT412350084	38	12	197x165x170	12,5			
BAT412550084	60	12	229x138x227	20	280	80	
BAT412600084	66	12	258x166x235	24	300	90	
BAT412800084	90	12	350x167x183	27	400	130	
BAT412101084	110	12	330x171x220	32	500	170	
BAT412121084	130	12	410x176x227	38	550	200	
BAT412151084	165	12	485x172x240	47	600	220	
BAT412201084	220	12	522x238x240	65	650	250	

12 Volt Deep Cycle GEL							General Specification
Article number	Ah	V	l x w x h mm	Weight kg	CCA @0°F	RES CAP @80°F	Technology: flat plate GEL Terminals: copper
BAT412550104	60	12	229x138x227	20	250	70	Rated capacity: 20 hr. discharge at 25°C Float design life: 12 years at 20°C Cycle design life: 500 cycles at 80% discharge 750 cycles at 50% discharge 1800 cycles at 30% discharge
BAT412600100	66	12	258x166x235	24	270	80	
BAT412800104	90	12	350x167x183	26	360	120	
BAT412101104	110	12	330x171x220	33	450	150	
BAT412121104	130	12	410x176x227	38	500	180	
BAT412151104	165	12	485x172x240	48	550	200	
BAT412201104	220	12	522x238x240	66	600	220	
BAT412126101	265	12	520x268x223	75	650	250	

2 Volt Long Life GEL					General Specification
Article number	Ah	V	l x b x h mm	Weight kg	Technology: tubular plate GEL Terminals: copper
BAT702601260	600	2	145x206x688	49	Rated capacity: 10 hr. discharge at 25°C Float design life: 20 years at 20°C Cycle design life: 1500 cycles at 80% discharge 2500 cycles at 50% discharge 4500 cycles at 30% discharge
BAT702801260	800	2	210x191x688	65	
BAT702102260	1000	2	210x233x690	80	
BAT702122260	1200	2	210x275x690	93	
BAT702152260	1500	2	210x275x840	115	
BAT702202260	2000	2	215x400x815	155	
BAT702252260	2500	2	215x490x815	200	
BAT702302260	3000	2	215x580x815	235	

Other capacities and terminal types: at request

Victron Energy B.V. | De Paal 35 | 1351 JG Almere | The Netherlands
General phone: +31 (0)36 535 97 00 | Fax: +31 (0)36 535 97 40
E-mail: sales@victronenergy.com | **www.victronenergy.com**

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LAMPIRAN 4

YIY®

Electrical Specifications											
	Model	1.0KW	1.5KW	2.0KW	3.0KW	4.0KW	5.0KW	6.0KW	8.0KW	10.0KW	12.0KW
Inverter Output	Continuous Output Power	1.0KW	1.5KW	2.0KW	3.0KW	4.0KW	5.0KW	6.0KW	8.0KW	10.0KW	12.0KW
	Surge Rating(20s)	3.0KW	4.5KW	6.0KW	9.0KW	12.0KW	15.0KW	18.0KW	24.0KW	30.0KW	36.0KW
	Output Waveform	Pure Sine wave/Same as input(Bypass Mode)									
	Nominal Efficiency	>88%(Peak)									
	Line Mode Efficiency	>95%									
	Power Factor	0.9-1.0									
	Nominal Output Voltage rms	100-110-120Vac / 220-230-240Vac									
	Output Voltage Regulation	±10% RMS									
	Output Frequency	50Hz ± 0.3Hz/60Hz ± 0.3Hz									
	Short Circuit Protection	Yes(1sec after fault)									
	Typical transfer Time	10ms(Max)									
	THD	< 10%									
DC Input	Nominal Input Voltage	12.0Vdc (*2 for 24Vdc, *4 for 48Vdc)									
	Minimum Start Voltage	10.0Vdc									
	Low Battery Alarm	10.5Vdc / 11.0Vdc									
	Low Battery Trip	10.0Vdc / 10.5Vdc									
	High Voltage Alarm	16.0Vdc									
	Low Battery voltage recover	15.5Vdc									
	Idle Consumption-Search Mode	< 25 W when Power Saver On									
Charger	Output Voltage	Depends on battery type									
	Charger Breaker Rating	10A	15A	20A	20A	20A	30A	30A	40A	40A	40A
	Max Charge Power Rate	1/3 Rating Power									
	Battery Initial Voltage for Start Up	10-15.7V for 12V(*2 for 24V, *4 for 48V)									
	Over Charge Protection Shutdown	15.7V for 12V (*2 for 24V, *4 for 48V)									
	Remote Control	Yes(Optional)									
Bypass & Protection	Input Voltage Waveform	Sine wave (Grid or Generator)									
	Nominal Voltage	110Vac			120Vac		220Vac		230Vac		
	Max Input AC Voltage	150VAC For 120Vac LV Mode;300VAC For 230Vac HV Mode;									
	Nominal Input Frequency	50Hz or 60Hz (Auto detect)									
	Low Freq Trip	47±0.3Hz for 50Hz, 57±0.3Hz for 60Hz									
	High Freq Trip	55±0.3Hz for 50Hz, 65±0.3Hz for 60Hz									
	Overload protection(SMPS load)	Circuit breaker									
	Output Short circuit protection	Circuit breaker									
	Bypass breaker rating	10A	15A	20A	30A	40A	40A	40A	50A	63A	63A
	Transfer switch rating	30amp for UL & TUV				40amp for UL			80amp for UL		
	Bypass without battery connected	Yes (Optional)									
	Max bypass current	30amp				40amp			80amp		
Solar Charger(Optional)	Rated Voltage	12Vdc / 24Vdc / 48Vdc									
	Solar Input Voltage Range	15-30Vdc / 30-55Vdc / 55-100Vdc									
	Rated Charge Current	40 ~ 60A									
	Rated Output Current	15A									
	Self Consumption	< 10mA									
	Bulk Charge	14.5V(default)				(*2 for 24Vdc, *4 for 48Vdc)					
	Floating Charge	13.5V(default)									
	Equalization Charge	14.0V(default)									
	Over Charge Disconnection	14.8V									
	Over Charge Recovery	13.6V									
	Over Discharge Disconnection	10.8 V(default)									
	Over Discharge Reconnection	12.3V									
	Temperature Compensation	-13.2mV/°C									
	Ambient Temperature	0 ~ 40°C(Full load) 40 ~ 60°C(Derating)									
Mechanical Spec	Mounting	Wall Mount									
	Inverter Dimensions(L*W*H)	388*415*200mm				488*415*200mm			588*415*200mm		
	Inverter Weight(Solar Chg)KG	21+2.5	22+2.5	23+2.5	27+2.5	38+2.5	48+2.5	49+2.5	60+2.5	66+2.5	70+2.5
	Shipping Dimensions(L*W*H)	550*520*310mm				650*520*310mm			750*520*310mm		
	Shipping Weight(Solar Chg)KG	23+2.5	24+2.5	25+2.5	29+2.5	40+2.5	50+2.5	51+2.5	62+2.5	68+2.5	72+2.5
	Display	Status LEDs / Status LEDs+LCD									
	Standard Warranty	1 Year (Optional)									