



**SOLAR MPPT SMU  
CHARGE CONTROLLER**

**MULTI VOLTAGE RANGE  
12V/24V SELF SETTING**

**MODEL: SURYA-50**



**USER MANUAL**

**Vers.7.7**

## ASHAPOWERSOLAR MPPT CHARGE CONTROLLER SURYA-50 Vers.7.7

Thank you for purchasing ASHAPOWER® SURYA-50 7.7 MPPT charge controller. It is a multi voltage range device with unique features. The same device can be used for charging 1 battery (12V) to a battery bank of 2x12V (24V) in series. The device automatically detects and configures itself to the connected battery bank. The high Voc range (open circuit voltage) of the device makes it easier to group the PV panels conveniently. The maximum power point tracking (MPPT) technology of the charge controller optimizes the maximum power production from the connected PV panel array.

### SALIENT FEATURES

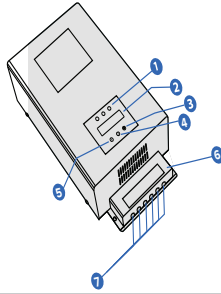
- ▲ Compatible for 12V/24V battery bank
- ▲ Auto-detection and self setting of battery bank
- ▲ True 4 stage smart charging for prolonged battery life (Bulk-Absorption-Float-Equalization)
- ▲ Programmable Initial limited ampere battery charging facility
- ▲ Ultra-fast & efficient power point tracking (98.9%)
- ▲ dsPIC33EP family micro controller based devices
- ▲ PV panel reverse polarity protection
- ▲ Automatic disconnection of PV panels at night
- ▲ Over voltage and overload protection from PV panels
- ▲ Protection for battery against hardware failures
- ▲ 16 menu user programmable function settings and inbuilt settings keys
- ▲ Grid power control to the connected inverter (SMU-Solar Management Unit)
- ▲ Forced grid to solar shifting facility
- ▲ Multifunction status display

### SPECIFICATIONS

<b>Max. Applicable PV Panel Load &amp; Open Circuit Voltage (Voc) at different battery banks</b>	<b>12V /1000Wp / 100V Voc 24V /1600Wp / 140V Voc</b>
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Nominal Battery Voltage	12V/24V (Self Setting)
Maximum Charging Current (Rated Output)	50Amps
Battery charging stages	Bulk-Absorption-Float-Equalization
Maximum Tracking Efficiency	98.9%
Standby Power Consumption	<1.5W
Humidity	0 to 90% RH (No dew)
Operating temperature	-20 degree to 65 degree C
Storage temperature	-30 degree to 80 degree C
Overload Protection From PV Panel	YES
Over Charge Protection	YES
Panel Reverse Polarity Protection	YES
Battery Reverse Polarity Protection	Optional
Dimensions – L x W x H (cm)	32x15x11
Net Weight (Kgs) / Gross Weight (Kgs)	2.6Kgs/3.1Kgs
Connector	Input/Output Terminal block
Display	2 x 16 LCDisplay

**KNOW YOUR DEVICE**  
SURYA-50 Vers.7.7



1	LED INDICATORS
2	2x16 LCD DISPLAY
3	SETTINGS BUTTON (●) ENTER
4	SETTINGS BUTTON (▼) OFF
5	SETTINGS BUTTON (▲) ON
6	TERMINAL COVER
7	IN/OUT POWER TERMINALS

LED INDICATOR	ON	OFF	BLINKING
<b>BLUE</b> SOLAR / GRID POWER STATUS	Load is on SOLAR power (On battery power)	Load is on GRID power (Applicable only if grid power is connected to the inverter through the charge controller)	Battery LOW warning indication to disconnect heavy loads
<b>GREEN</b> SOLAR PANEL VOLTAGE PRESENCE	PV Panel voltage is higher than battery bank voltage	PV Panel voltage is lower than battery bank voltage OR PV panel connection is not ready	-
<b>RED</b> SOLAR CHARGING STATUS	Solar charging current is above 2 amps	Solar charging current is below 2 amps (charging is still going on in low amps)	Fast blinking indicates BULK charging Slow blinking indicates ABSORPTION charging Steady LED indicates FLOAT charging

## INSTALLATION & OPERATION

**1) PV Panel Grouping:** Group the PV panel array using standard Solar MC4 connectors and parallel connectors as to the recommended grouping example chart provided. Good quality weather proof solar DC cables must be used (4sq,6sq,10sq).

**2) Battery Bank Setup:** If more than one battery is used, Connect the batteries with 16sq.mm/10 sq.mm interlinking cables and tight them well. Check each battery separately for specific gravity, same terminal volt and good backup. Do not use old and new batteries together, either in parallel or in series.

**3) MPPT Charge controller installation:** Mount the MPPT charge controller vertically on the wall using the wall mounting clamp provided.

✗ Avoid mounting on wet walls.

✗ Avoid exposure to rain, dusty area, direct sun light or in area having high temperature.

✔ Use 10Sq.mm standard electric cables below 1.5 metre length as battery wires, red colour for positive connection and black for negative. Remove the connection terminal cover of the charger. Connect the battery wires with correct polarity to the desired battery bank. (Reverse polarity will spoil the device) Three LED Indicators and cooling fan of the device starts functioning for 5 seconds and goes off. MPPT Charge controller starts scanning the connected battery bank voltage and automatically configures itself to that particular volt. Display shows the voltage of the connected battery bank and maximum applicable range of PV panel Voc limit for the connected battery bank. When the charger is connected on deeply discharged battery banks it will configure to low level battery voltage and results malfunction of the device.

**Ensure the displayed battery bank voltage and connected battery bank voltage is same when the charge controller is powered ON.**

continued....

Connect the cables from PV panels to the solar positive and negative terminals of the charge controller. If the PV panel voltage and polarity is correct green LED indicator on the front panel glows on. When the detected PV panel voltage is higher than the connected battery bank voltage red LED indicator glows on indicating battery charging.

When the PV panel voltage goes below the battery bank voltage the green LED indicator goes off. When the device detects more than 2Amp charging current to the battery, charging LED (RED) glows on.

If the current is less than 2Amp the Red LED goes off, but charging continuous in low amp till the solar power availability.

When the connected battery voltage reaches GRID to SOLAR preset voltage (default 14.2V) the Blue LED on the front panel glows ON indicating the battery is nearly full charge and ready to use the connected load either directly from the battery or through a connected inverter.

#### **Automatic Grid power/ Solar Power Changeover function using MPPT charge controller (Converting a Home Inverter to a Smart Solar Inverter - Solar Management Unit - SMU )**

Remove the connected grid phase input wire from the the inverter and connect to the 'PHASE IN' terminal of the charge controller. Connect another wire from the 'PHASE OUT' terminal of the charger to the input phase connector of the inverter.

#### **Automatic Solar to Grid / Grid to Solar changeover function**

In default mode MPPT charge controller is in AUTO BYPASS "ON" mode.

If it is in "OFF" mode press and hold (A) ON button on the front panel for 2 seconds to turn it ON.

#### **What happens if Auto Bypass Mode is in "ON" mode**

- ✓ Charger disconnects grid power to connected inverter when the battery volt goes above GRID to SOLAR preset voltage. (default 14.2V per battery). Display shows INV MODE ON , AUTO BYPASS ON and LOAD ON SOLAR indicator LED on the front panel (blue) glows on.
  - ✓ Charger connects grid power to the connected inverter when the battery volt goes below SOLAR to GRID preset voltage. (default 11.5V per battery). Display shows INV MODE OFF, AUTO BYPASS ON and LOAD ON SOLAR indicator LED on the front panel (blue) goes off.
- To turn "OFF" automatic bypass function of the charger press and hold (v) OFF button on the front panel for 2 seconds.

#### **What happens if Auto Bypass function is in "OFF" mode**

- ✓ Charger reconnects grid power to the connected inverter. Displays shows INV MODE OFF, AUTO BYPASS MODE OFF. In this mode inverter will be always on grid power.

#### **What is the Forced Grid to Solar Shifting feature.**

This feature helps the customers using the charge controller as SMU. (solar management unit - converting a normal inverter to solar inverter) When connected battery voltage is at low level (after sunset or in dim sun light) a sudden heavy load on connected inverter drops the battery voltage below the preset solar to grid changeover volt and the charge controller shifts the connected inverter load to grid power. It will only be shifted back to solar mode automatically the very next day when battery is fully charged. If the battery terminal voltage is above the solar to grid preset voltage (default 11.5v) the inverter load can be shifted back to solar mode again by pressing and holding (●) ENTER button for 3 seconds.

#### **Multifunction display status**

- E-TODAY** : Indicates everyday total solar energy production from the MPPT charge controller in units.  
:This value disappears overnight and is added to total energy production in Units on the next day.
- UNITS** :Total solar energy produced from the solar charge controller in units from the day of installation.  
This value resets when goes over 999 units or when battery power to MPPT is disconnected.
- BAT VOLT** :Indicates terminal voltage status of the connected battery bank.
- SPV AMP** :Indicates available PVpanel input current (Amp) from the connected solar panels.
- SPV VOLT** :Indicates available PV panel input voltage from the connected solar panels.
- WATTS** : Indicates currently available solar power in watts from the connected solar panels.
- CHG AMP** :Indicates current flow (Amp) from the charge controller to the battery and connected load in live.

#### **How MPPT charge controller drives the connected Inverter (SMU)**

Charge controller is provided with a relay inside to connect and disconnect grid power to inverter monitoring the terminal volt of the battery. When the battery terminal volt rises up to 14.2V (adjustable) charger disconnects grid power to the inverter and the load on it starts running on battery power (solar power). When the solar charging current stops load will be working from the battery bank and the battery voltage goes down. When it reaches 11.5V (adjustable) the device reconnects AC mains (grid power) to inverter and the blue LED goes off. Blinking of blue LED indicates low battery bank voltage. ie. below 11.7 V (adjustable) giving warning indication to remove heavy load on inverter.

## EXAMPLES FOR GROUPING OF PV PANELS SURYA-50 Vers.7.7

**Note: For maximum MPPT performance we recommend Voc of at least double the battery bank voltage. When grouping PV Panels in series maximum Voc must be under the specified limit for each battery bank as mentioned below.**

Battery Bank Volt	Max.PV Panel Voltage Range (Voc)	PV Panels used in Watts	Max.PV Panels Applicable in Watts
12V	100V	45 Voc (445W PANEL) X 2 PANEL IN SERIES = 90 Voc = 890W	1000W
24V	140V	45 Voc (445W PANEL) X 3 PANEL IN SERIES = 135 Voc =1335W	1600W

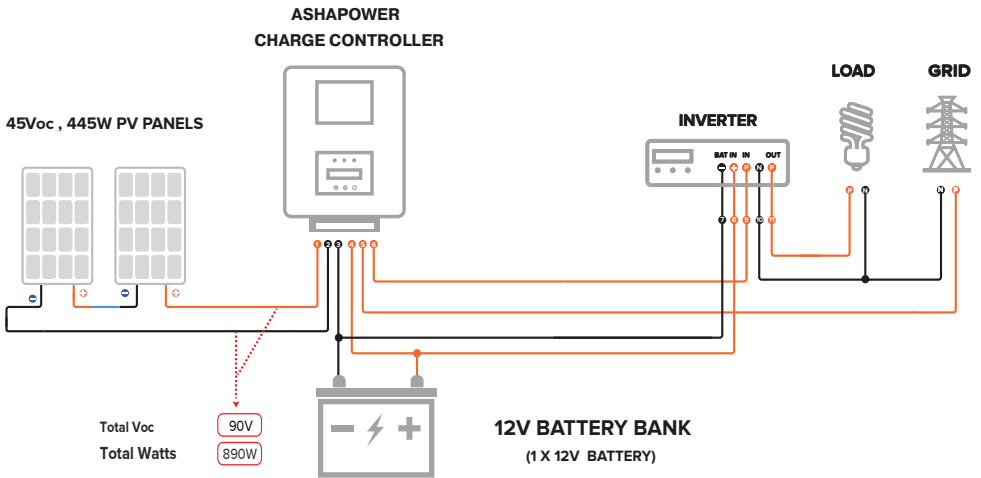
### IMPORTANT SAFETY PRECAUTIONS

#### Lead Acid Batteries Produce Hydrogen Gas Which is Highly Flammable

- 1) Never use a flame or any kind of spark producing device near fully charged batteries as it may cause an explosion of the batteries and fire hazard (eg: Checking battery water level under a candle flame, spark from metal cutter or spark from loose contact of battery connecting wires).
- 2) Maintenance of the batteries and pv panel array at regular intervals make the solar power system trouble free and fresh.
- 3) Solar panels should be grouped in such a way that the maximum Open Circuit Voltage (Voc) of the panels connected in series should not exceed the Maximum PV panel voltage recommended for each Battery Banks.
- 4) Safety precautions must be taken while grouping and connecting PV panels to the charge controller with high Voc input. (500 Volt DC current from the PV panel is highly dangerous. Never touch the terminals without safety gloves).
- 5) Extreme care should be taken while connecting High voltage solar power systems.
- 6) Earthing and wiring of high power solar system must be done under the supervision of a qualified electrical engineer.
- 7) Never connect the PV panel connection to the battery input or the connection of the batteries to the PV input.
- 8) Never connect any of the grid line to any of the **DC (PV or Battery)** connection terminals.
- 9) The installation and use must comply with the local safety instructions and standards in force.
- 10) We disclaim all responsibility and liability for damage, costs or losses resulting from an installation that does not comply with the instructions, a faulty operation or inadequate maintenance.
- 11) The use of the charger is in any case under the responsibility of the customer.
- 12) This equipment is neither designed nor guaranteed to installations used for vital medical care nor any other critical installation entailing potential risks of damage to people or to the environment.

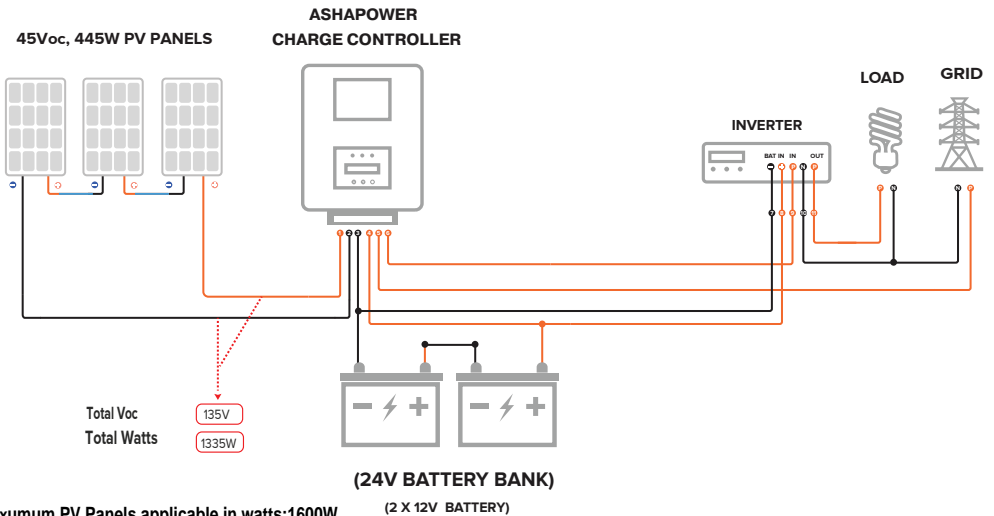
EXAMPLES OF CONNECTION DIAGRAMS

900W-12V OFF GRID SOLAR POWER PLANT



Maximum PV Panels applicable in watts:1000W  
Max PV Voc Range 100V

1335W-24V OFF GRID SOLAR POWER PLANT



Maximum PV Panels applicable in watts:1600W  
Max PV Voc Range 140V

## TROUBLE SHOOTING

ERROR CODE	DESCRIPTION	SOLUTION
EV	PV PANEL VOLTAGE ERROR	PV PANEL VOLTAGE IS NOT IN THE SPECIFIED LIMIT. CHECK FOR PV PANEL GROUPING. REFER PV PANEL GROUPING MANUAL PROVIDED.
EB	BATTERY BANK VOLTAGE ERROR	CONNECTED BATTERY BANK VOLTAGE IS NOT IN THE SPECIFIED LIMIT. CHECK FOR DEFECTIVE BATTERIES LOOSE CONNECTION OF JUMPER WIRES AND NUMBER OF BATTERIES.
ET	HIGH TEMPERATURE	CONNECTED PV PANEL CAPACITY (WATTS) IS NOT IN THE SPECIFIED LIMIT OR CHECK FOR THE FUNCTION OF THE COOLING FAN.
EM	HARDWARE ERROR	LIGHTNING MAY CAUSE HARDWARE FAILURE. IF CONTINUOUS BEEP SOUND AND ERROR MESSAGE EM IS SEEN, CHECK FOR LOOSE CONTACT OF BATTERY CONNECTORS OR FAULTY BATTERIES.DISCONNECT AND RECONNECT THE BATTERY WIRES FROM THE DEVICE. IF THE PROBLEM PERSISTS CONTACT THE INSTALLER FOR SERVICE ASSISTANCE.  IF MPPT IS MOUNTED ON A WET WALL, EARTH LEAKAGE MAY CAUSE ISSUES. UN MOUNT THE DEVICE AND ISOLATE IT FROM THE WALL BY MOUNTING ON A WOODEN OR PVC BOARD.

## IMPORTANT NOTE FOR ACTIVATION OF INITIAL LIMITED AMPERE BATTERY CHARGING AND EQUALIZATION CHARGING

### 1. What is initial limited ampere battery charging in MPPT charge controller ?

Maximum recommended charging current for a solar C10 lead acid battery is up to 20% of its Ah.

Batteries used in solar power system is often discharged below 11.5V every day. So it is recommended to start initial charging with limited ampere instead of charging with maximum capacity of the charge controller.

**Eg:** Maximum recommended charging current for a 12V,150Ah lead acid solar battery is 30 Amp. If such a battery is connected to MPPT charger delivering above 30 amps, the excess ampere entering the battery can be controlled in the initial charging stage by activating initial limited ampere battery charging feature. On activating this feature charger delivers only 20% of the connected battery Ah. ie.30 amps to the battery.

**Four options are given to control the initial charging limit. In default the charge controller is set in option "0" without any ampere limiting in charging.**

#### Option 1. Ampere Limiting based on grid to solar load shifting voltage

In this mode battery charging ampere is limited in the initial charging stage up to the preset limit of grid to solar load shifting voltage.(eg.If grid to solar load shifting voltage is set to 14.2V charge controller limits the charging current up to this voltage at the rate of 20% of the Ah of the connected battery.There after the entire current is shared between the connected inverter load and battery charging.

#### Option 2. Ampere limiting based on bulk charging voltage

In this mode also, battery charging ampere is limited in the initial charging stage and the limiting is stopped when bulk charging stops. There after the entire current is shared between the connected inverter load and battery charging.

#### Option 3. Daily bulk charging with limited ampere

If the battery is still in float charging mode in the morning, the charge controller will not limit the charging current and the entire ampere will enter the battery.So it is recommended to set the option 3 to start daily bulk charging with limited amps.

#### Option 4. Daily bulk charging without ampere limiting

For daily bulk charging without ampere limitation select option 4

MPPT charge controllers are sun light dependent devices and they can't deliver high ampere in the morning. They start to charge the batteries in low ampere early in the morning. As the terminal volt of the battery increases, charge controller shifts the connected inverter load to solar power mode and the current is shared between connected load and for battery charging.Hence the activation of limited ampere charging is not necessary in low ampere charge controllers connected with high Ah batteries.

eg: If the charge controller delivers more than 30amp current in starting stage and the connected battery is below 150Ah it is recommended to activate limited ampere charging option.

## 2. What is Equalization charging in MPPT charge controller

When a lead acid battery is left in discharged state for extended periods of time, non-removable sulphate crystals are formed on the surface of battery plates that reduce the charging and discharging capacity of the battery. Equalization charging is an over charging process of lead-acid batteries above their recommended charging voltage, to remove sulfation and bring all cells of the battery to similar levels by increasing the voltage to 2.50V/cell or 10 percent higher than the recommended charging voltage. Equalization charging also equalize acid stratification, a condition where acid concentration is greater at the bottom of stationary batteries than at the top level. Battery experts recommend periodic equalization charging to keep the batteries healthy (once in every three month).

### **SMF, VRLA, AGM, GEL Batteries.**

**SMF** (sealed maintenance free), **SLA** (Sealed lead acid) and **VRLA** (Valve regulated lead acid) batteries are same. Its 2 types of cells are (**AGM** (Absorbed glass mat) and **GEL** cells. They are maintenance free batteries which do not require regular water filling, its composition of electrodes and electrolyte is same as flooded lead acid batteries. These batteries do not need to be kept upright as the electrolyte is in the form of gel or paste).

**Un-attended equalization charging of old battery is risky as there is chance for over heating of battery plates, overflowing of electrolyte and damaging of batteries.**

Remove all loads from the batteries before starting equalization charging. Fill all the battery cells with distilled water in the required level. It is better to remove all the lids of the batteries before starting equalization charging as the batteries will begin gassing and bubbling vigorously at the peak stage of boost charging. Ensure the batteries are installed in a good ventilated area. Even a spark from a metal cutter, loose contact of battery wires may cause fire hazard and explosion of batteries. During equalization charging, check the changes in the specific gravity of acid of each cells every hour and stop charging if the gravity and voltage of cells no longer rises during the gassing stage. Further improvement of the cell is not possible and continued charging will spoil batteries.

### **Enabling limited ampere charging in MPPT charge controller.**

Enter settings menu 14. AMP-LT (Follow function settings page in user manual)

### **Enabling equalization charging in MPPT charge controller.**

In default condition equalization charging will be active once in a month

Enter settings menu and configure following settings for enabling equalization charging.

**4.EQLZ-V** : Set the upper limit of equalization voltage.

As the equalization is an over charging process, ask a battery expert before setting the maximum applicable upper voltage limit. Blind settings will spoil the batteries.

**5.BVLC-V** : Select the battery low voltage level to start equalization charging based on battery terminal volt. (Configure a value slightly less than inverter's low voltage cut off to avoid frequent equalization charging)

**6.N-DAYS** : Set period of Equalization charging.

N-DAYS = 0 =>Disables all modes of Equalization charging

N-DAYS = 1 =>Equalization charging starts every alternate days

N-DAYS = 2 =>Equalization charging starts every 2 days

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N-DAYS = 30 => Once in a month (Recommended)

N-DAYS = 90 => Once in 3 months

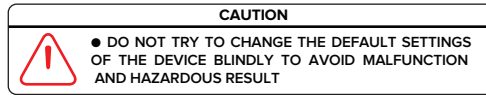
N-DAYS = 180 => Once in 6 months

It is recommended to preset 14th Menu AMP-LT (initial limited ampere charging) in mode "2" if equalization charging is activated. This option is recommended because system will not shift from grid to solar mode till the equalization charging is completed which helps to rise battery terminal voltage gradually and attains maximum gravity of electrolyte and gets good backup from batteries.



## CHANGING THE DEFAULT SETTINGS OF ASHAPOWER MPPT CHARGE CONTROLLER

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**Note:** Before changing the default settings values of the device, refer user guide of the connected battery and ensure the maximum ampere and voltage applicable for battery type and brand. This device is designed for direct charging of ( LEAD-ACID, SMF, GEL) batteries. Blind settings may cause severe damage to the batteries and charge controller. Default values given are for lead acid C10 grade solar batteries. To reset to default settings enter settings menu 16 (F-RST factory reset ) and change the value to "1". (Refer function settings page of user manual)

### How to enter settings mode of MPPT charge controller.

Connect the charge controller to the desired battery bank. Consecutive pressing of the ENTER button (Ⓞ) displays the existing function settings of the charger. Note down the default settings before changing. Accessing settings menu allows the user to customise and calibrate the charge controller

To enter setup mode, press OFF button (∨) first and press ENTER button (Ⓞ) also for 3 seconds without releasing OFF button. Charger enters Setup mode displaying version number and model name. Press the ENTER button to scroll through the various setup menu as given in the function settings page. Use the ON button (∧) to increase and the OFF button (∨) to decrease the default values. When kept idle for 5 seconds or gone through all settings menu the device saves the changes and goes to normal mode.

When default settings are changed charge controller will be in Auto bypass OFF mode. To turn ON the Auto bypass mode press and hold UP button (∧) for 2 seconds.

## ASHAPOWER SOLAR MPPT CHARGE CONTROLLER FUNCTION SETTINGS

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	MENU	TYPE	DESCRIPTION	RANGE		
				MIN	DEFAULT	MAX
1	FLOAT-V Battery float charging limit	SETTINGS	Limit the float charging voltage recommended for the batteries. This value varies in different types of batteries. Default value given is for C10 grade solar lead acid batteries. For SMF and Gel batteries this value is between 13.0V to 13.8V. Refer battery user manual to change the value	13.0V	13.8V	15.5V
2	ABSN-V Battery Absorption charging limit	SETTINGS	Limit the absorption charging voltage limit for the connected batteries. Default value given is for C10 grade lead acid batteries.  <b>(Whenever the battery voltage goes below the float voltage limit system goes to absorption mode and goes back to float level)</b>	13.0V	14.3V	15.5V
3	BULK-V Battery bulk charging limit	SETTINGS	Limit the maximum bulk charging voltage recommended for the batteries. This value varies in different types of batteries. Default value given is for C10 grade solar Lead acid batteries. For SMF and Gel batteries this value is between 13.5V to 14.5V (Refer battery user manual before changing)	13.5V	14.5V	16.5V

(continued..)

## ASHAPOWER SOLAR MPPT CHARGE CONTROLLER FUNCTION SETTINGS Vers.7.7

	MENU	TYPE	DESCRIPTION	RANGE		
				MIN	DEFAULT	MAX
4	EQLZ-V Battery equalization upper volt limit	Battery equalization charging settings	(Never try to equalize sealed (SMF,SLA,GEL) batteries). Limit the maximum voltage required to boost the lead acid batteries. Equalization is an over charging of battery above their recommended bulk charging voltage to equalize terminal volt of all cells (see reference in manual)	14.0V	14.8V	16.5V
5	BVLC-V Battery equalization lower volt limit		Select the battery low volt level to activate auto equalization based on battery volt.(Select a volt limit just below the inverter low volt cutoff level to control frequent equalization)	9.0V	10.5V	13.0V
6	N-DAYS Select the equalization period in days		Select the number of days to activate periodic equalization	"0" day	"30" day	180 day
7	MAX - AMP Set the output ampere of MPPT charge controller	SETTINGS	Limit the charging current to the battery if needed. (maximum charging current is recommended as 20% of the Ah of a single 12V lead acid battery. Eg: for a 150Ah battery, 30 ampere is the maximum charging current recommended. Refer battery user manual before changing the value	4A	50A	50A
8	GRID-TO- SOLAR Set grid power mode to solar mode shifting volt	SETTINGS	If grid power is connected to inverter through MPPT to shift the load automatically from grid power to battery power (solar power) set the changeover battery voltage preferred	11.0V	14.2V	16.5V
9	SOLAR-TO-GRID Set solar power to grid power shifting voltage	SETTINGS	Set the changeover battery voltage preferred to change the load automatically from solar power (battery power) to grid power	10.0V	11.5V	16.5V
10	BLOW-LED Battery low volt warning limit	SETTINGS	Blinking of blue LED indicates low battery volt. Set this value above the value given in the 9th menu SOLAR-TO- GRID changeover volt limit	LB	11.7V	16.5V
11	BATTERY-AH Set the Ah of the connected battery	SETTINGS	Set the Ah of the connected battery bank to limit the bulk charging time Eg: If 2 X 150Ah battery is connected in series set the value 150Ah and if connected in parallel set as 300Ah	10Ah	150Ah	600Ah

(continued..)

**ASHAPOWER MPPT CHARGE CONTROLLER FUNCTION SETTINGS. (continued)**

**(Vers.7.7)**

	MENU	TYPE	DESCRIPTION	RANGE		
				MIN	DEFAULT	MAX
12	<b>CAL-AMP</b> Ampere calibration setting of the charger	CALIBRATION	When MPPT charging is going on connect a true RMS DC clamp meter ( Fluke brand is better ) over the positive battery wire and ensure the same reading is seen on the MPPT display.Calibrate and correct if there is difference.If the reading is less in clamp meter increase 2 or 3points using UP button and save changes.If the reading is high in the clamp meter decrease 2 or 3 points and save the changes.Repeat the charging process till both display shows same reading	90	98	110
13	<b>CAL-VOLT</b> Volt calibration setting of the charger	CALIBRATION	Note the battery volt reading on the MPPT display.Measure battery terminal volt using a true RMS DC voltmeter.If there is difference in reading UP or DOWN the default value till both readings are equal	-	-	-
14	<b>AMP-LT</b> Settings for initial limited ampere charging  ( Initial Charging ampere is limited to 20% of the Ah of the connected battery )	SETTINGS	A) Select option "0" to stop all initial limited ampere battery charging B) Select option "1" for initial limited ampere charging upto the preset volt of 8 the menu. (Grid to solar shifting volt 14.2V default) C) Select option "2" for initial limited amp charging up to the preset volt of 3rd menu. (Bulk charging limit 14.8V default) Charger releases ampere limiting when bulk charging ends (float charging starts) D) Select option "3" for daily bulk charging with limited ampere even if the charger is in float charging mode E) Select option "4" for daily bulk charging without ampere limit even if the charger is in float charging mode	-	"0" ZERO	"1" , "2" , "3" "4"
15	<b>S-MODE</b> Grid to solar/Solar to grid shifting dependency	SETTINGS	A) Option " 1 " Grid to Solar changeover function depends on solar presence B) Option " 0 " Grid to Solar/Solar to grid changeover function depends on battery terminal voltage	-	"1"	"1" , "0"
16	<b>F-RST</b> Factory Reset	SETTINGS	To reset all settings to default settings	-	"0" ZERO	"1"

## CONVERTING A NORMAL INVERTER TO A SMART SOLAR INVERTER USING SMU MPPT CHARGE CONTROLLER

Before starting it is better to make a plan of your solar energy needs and ensure your existing inverter and batteries are suitable for solar application. When a battery is charged with limited charging ampere (6Amp to 10Amp ) for long hours it delivers good energy backup. Solar charging and discharging is a daily process with high current from solar panels. We get only 4 to 5 hours average sun light in a day and have to charge the batteries in this time. C10 grade solar batteries above 100 Ah have the capacity to handle high current charging and discharging. Usually inverter batteries are either C20 grade or C10 grade normal batteries. An inverter battery is always connected to grid power and continuously charging the batteries in limited ampere for long hours (6AMP to 10AMP) and gives good back up. That is why we don't get enough backup from normal batteries when charged from solar power with high current. If we use normal batteries for solar charging with limited charging current they can't be fully charged before evening. So always insist on C10 grade solar batteries for solar applications. Now check your home inverter is provided with a grid charging ON/OFF switch. Most of the branded normal type inverters are not provided with a grid charging ON/OFF switch on them. When we use this type of normal inverter in solar off-grid system it will charge batteries from grid power and we do not get actual solar benefit. Customers use external grid changeover relay systems to overcome this problem.

### HOW THE CHARGE CONTROLLER DRIVES THE CONNECTED INVERTER

Most of the SMU type solar MPPT charge controllers are provided with an inbuilt relay to control grid power to the inverter. Remove grid power phase wire from your inverter and connect to PHASE IN terminal of MPPT. Connect a wire from the PHASE OUT terminal of MPPT to the PHASE IN terminal of the inverter. (Never connect the neutral wire of grid power to any connectors of MPPT). When charging starts terminal volt of the battery rises to the preset voltage 14.2 V (this value is adjustable) MPPT disconnects the AC mains to the inverter and the connected load on the inverter works on battery power (solar power). when the battery terminal volt goes down (in the evening or cloudy sky) and reaches 11.5 V (this value is adjustable) MPPT reconnect grid power to the inverter. If your inverter is a normal type without a grid charging disabling switch it will charge the batteries and we don't get the solar benefit. To overcome this it is better to limit the load on the inverter and keep the battery terminal volt always high. Some customers use solar power only in the day time and shift the load to AC mains by keeping the shifting to AC mains voltage 12.0 V or more. Fitting an external grid change over the relay system for bypassing grid power directly to load is also applicable. If we use an inverter with a grid charging ON/OFF switch we can keep the switch in off position to avoid charging from the grid. Only on cloudy days we can keep the switch in on position and charge the batteries from grid power.

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Kizhisseri, Kuzhimanna PO, Malappuram  
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