



Macon Power (P) Limited

www.macon.solar

contact@macon.in

McUD126A

Solar Charge Controller For High Power LED
Street Light (with dual output for CCTV, blinker)

12V / 75 W LOAD

12V / 350 Wp PANEL / 20 A max



Conforms to IEC 62093

ALL PRODUCTS, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT
NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.



General Information

1. The salient features are

- **Dual output:** One output for LED street light and second output if needed, can be used for CCTV, blinker etc. which can work either dusk to dawn or can be continuously ON day & night.
- Auto Dusk to Dawn Operation
- Built-in High Efficiency (> 90%) LED Driver for constant current output
- User Selectable Output Load 40W / 48W / 55W / 60W / 75W (Customised output of any other value upto 75W is also possible)
- 350 Wp panel Input max
- User Selectable Multiple Dimming And Timing Options
- Selection mode of battery- Lead Acid, Li Ion or LFP
- Compatible with motion sensor
- Protections against reverse battery and panel connection
- Protections against reverse flow of current from battery to panel during night
- Protection against lightening
- NO_BATTERY protection with panel connected
- Double side FR4, PTH board with conformal coating
- Low Loss Series Regulation
- Conforms to IEC 62093 for quality assurance

2. The options to dim the load at different timer settings are: 1. 50% dimming after 4 hours. 2. 70% dimming after 6 hours It also has unique mode for bright-dim-bright operation. The load can be operated in normal full brightness from dusk to dawn and also load can be totally switched off after set timer timings. See **Customisation** section for more details.



Please read the instructions before making any connections to the controller.

The controller uses static sensitive components. It needs a trained technician to handle it.

The controller has three terminal block groups.

One set with four terminals are marked PV+, PV-, BT+, BT-.

Second set with two terminals are marked LD+, LD-.

Third set (small) with two terminals is marked AUX +, -.

PV+/PV- Solar panel connections. Solar panel can be upto 350Wp/12V nominal. Voc of panel 30V max.

BT+/BT- Connections for nominal 12V (Lead Acid 12V or Li Ion 11.1V or LFP 12.8V) battery.

LD+/LD- Connections for LED load.

Please confirm the gadget to be connected to AUX terminals work within battery limits of LVD and HVD of the battery type used and its current requirement is not more than 500mA (unprotected). The connected gadget will be on day and night as long as battery voltage is within these limits.

The cables used for making connections to the panel, battery and load should be suitably rated for the current passing through the same. Undersized cables or loose connections to the terminals will result in malfunctioning of the controller due to drop in the voltage.

How to use:

- Connect indicator LED assemblies to the respective relimate connectors on board.
- Select the pins for MODE, BATTERY and LOAD as per requirement.(See **IMPORTANT** below)
- Sequence of connections should preferably be first battery, then load and lastly panel.
- If panel is connected and and its voltage is above dawn level , load will be off after 10 seconds.
- When panel voltage goes below dusk level, load will be on after 10 sec. (See DUSK_SENSE and DAWN_SENSE in **Technical Specifications**.)

IMPORTANT:

- If BATTERY selection pin is not used, the system will be off.

Please go through **Customisation** for selecting different links on the boards.

Power LEDs used on your MCPCB should be configured exactly as outlined in section **LED CONFIGURATION FOR LOAD (Important Precautions)** .



Technical Specifications

SYSTEM:	12V Nominal		
CAPACITY:	Input Panel 350Wp max, Voc 25V max		
	Output 40W, 48W, 55W, 60W, 75W (or any other value upto 75W as customised)		
REGULATION:	Low Loss, Series Type		
OUTPUT VOLTAGE DROP:	<300mV at 6.5A (OVD)		
INPUT VOLTAGE DROP:	<330mV at 20A (IVD)		
BATTERY OPERATION (Based on selection of Link)	BATTERY TYPE		
	Lead Acid 12V	Li Ion 11.1V	LFP 12.8
LOW VOLTAGE PROTECT:	9.5 V	8 V	10 V
LOW VOLTAGE DISCONNECT:	10.7 V	9.6 V	11.2 V
LOW VOLTAGE RECONNECT:	12.3 V	11.2 V	13.2 V
HIGH VOLTAGE DISCONNECT:	14.4 V	12.6 V	14.4 V
HIGH VOLTAGE RECONNECT:	14.3 V	12.3 V	13.8 V
HIGH VOLTAGE PROTECTION:	15V	13.5 V	15 V
DUSK_SENSE	Panel Voltage <2V, 10sec delay		
DAWN_SENSE	Panel Voltage > 4V, 10sec delay		
PROTECTIONS:	*Short Circuit / Overload		
	*Reverse Battery and Panel		
	*Reverse flow of current from Battery to Panel during night		
	*Lightening		
	*No battery but panel connected. System disabled.		
AUX out	Battery voltage, 500mA, unprotected		
APPLICATION;	In Fixture Use Only		
OPERATING TEMP RANGE;	0 to 50° C		
DIMENSIONS:	140Lx85Wx25H		



Important Precautions

Important precautions before using the controller.

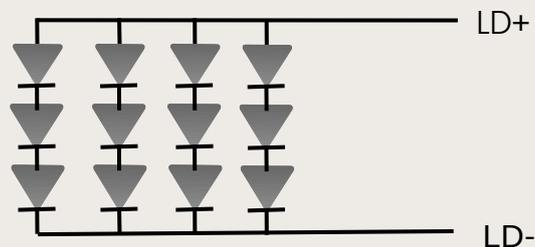
- Only trained technician should handle the controller as it houses many static sensitive devices.
- No soldering / desoldering should be carried out on the board.
- The system voltage of the controller is nominal 12V. The type of battery suitable for the controller is any of the three types- Lead Acid 12V, Li Ion 11.1V or LFP 12.8V.
- Panel suitable for the controller is of nominal 12V. Its Voc should be 25V max and capacity should be 350Wh max with desired Vmp 16 to 18V for best results. **Higher wattage panel, if connected, will result in irreparable damage of the controller.**
- While selecting the load, **if links are placed at two or more places, it will result in damage of the controller.**
- MODE selection can be done for different modes of operation. It has positions marked NML, TM1, TM2, DIM and UNQ.
- If the controller comes with our motion sensor McMS (see **Motion Sensor Add_On Module**), it should be connected at the relimate on the board marked MS.
- **No other motion sensor should be used.** Such use may result in the damage of controller and/or sensor. The controller is designed to accept our own motion sensor only.

LED CONFIGURATION FOR LOAD:

The controller has buck type of high efficiency driver. Since the system is of 12V nominal system, the maximum voltage in series should be max 10v. For LED having Vf of 9V, all should be connected in parallel.



(Forward voltage of LEDs: 8.2V to 10 V)



(Forward voltage of LEDs: 2.7 V to 3.4 V)



Understanding The Operation

INDICATORS AND CONNECTORS:

- Connector marked LOAD has NO PIN / CUSTOM 40W, 48W, 55W, 60W and 75W. If no link is used, it will result in 40W operation. Link should not be placed at more than one place which may result in damage to the controller.
- Connector marked MODE is for selecting the mode of operation. It has 5 different positions.
 - NML: Load will be full bright from dusk to dawn.
 - TM1: Load will be full on at dusk and switch off after 4 hours.
 - TM2: Load will be full on at dusk and switch off after 6 hours.
 - DIM: Load will be 50% bright from dusk to dawn. If links are placed at both DIM and TM1 (or TM2), the load will be full on at dusk and after 4 (or 6) hours, the load will be 50% bright till dawn.
 - UNQ: Load will be full bright for 5 hours, then 30% bright for next 5 hours and then switches to full bright till dawn.
 - Motion sensor operates only during the dimming period of operation. When motion is sensed, load will be full bright for 30 seconds and then reverts to dimming mode.

VOLTAGE SETTINGS:

LVR (Low Voltage Reconnect)

If battery voltage is at least equal to LVR, LED will turn Green and load will be on.
If LED is Red or blinking Red, battery voltage is less than LVR.

LVD (Low Voltage Disconnect)

Red LED will be continuously on.

HVD (High Voltage Disconnect)

Green LED will be blinking. Battery is fully charged.

LVP /HVP (Low and High Voltage Protection)

If battery voltage is less than LVP or more than HVP, the controller is disabled and no action takes place.

EASY SELECTION TABLES:

MODE SELECTION TABLE

You can select how controller should work in different dimming options. Two short links are provided with each unit for this operation. Depending upon your requirement, these two pins or single one need to be used. You should strictly adhere to the table given below to select any one mode out of 6 modes mentioned. Erroneous or extra connections other than suggested at these pins will result in unpredictable performance.

SR NO	NML	TM1	TM2	DIM	UNQ	RESULT
1						100 % LIGHT FROM DUSK TO DAWN
2	NC		NC	NC	NC	FIRST 4 HOURS FULL LIGHT THEN OFF
3	NC		NC		NC	FIRST 4 HOURS FULL LIGHT THEN 50% LIGHT TILL DAWN
4	NC			NC	NC	FIRST 6 HOURS FULL LIGHT THEN OFF
5	NC				NC	FIRST 6 HOURS FULL LIGHT THEN 50% LIGHT TILL DAWN
6	NC	NC	NC	NC		FIRST 5 HOURS FULL LIGHT, NEXT 5 HOURS 30% LIGHT, THEN FULL LIGHT TILL DAWN (or Customised settings for dimming and timing profile)

LOAD SELECTION TABLE

SR NO	48	55	60	75	RESULT
1	NC	NC	NC	NC	40W OPERATION OR CUSTOMISED*
2		NC	NC	NC	48W OPERATION
3	NC		NC	NC	55W OPERATION
4	NC	NC		NC	60W OPERATION
5	NC	NC	NC		75W OPERATION

*If Customised wattage upto 75W is requested, all other wattage settings are disabled.

You can select the output drive current of the controller depending upon the load requirement. (The power LEDs MUST be configured in the format mentioned on page 5 of this brochure. No other configuration is permitted.

Please note
USING MORE THAN ONE PIN AT LOAD SELECT MAY RESULT IN IRREPARABLE DAMAGE.

BATTERY SELECTION TABLE

SR NO	SMF	Lilon	LFP	RESULT
1	NC	NC	NC	Controller disabled Fault indicator/ Custom
3		NC	NC	12V Lead Acid battery selected
4	NC		NC	11.1V Lithium Ion battery selected
5	NC	NC		12.8V Lithium Ferro Phosphate battery

BATTERY selection is of very importance for proper operation of the controller. You cannot leave this connector without pin.* Else, fault condition is displayed by BT_STS blinking Red and Green and also CHRG is on. If link is put at wrong place, depending upon the battery voltage, fault condition may or may not be displayed. You make sure the battery link is selected correctly.

***(If Custom setting is requested, NO LINK will result in customised values as desired.)**

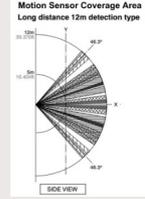
LEGENDS USED

	DON'T CARE
	PIN CONNECTED (SHORT LINK USED)
NC	NO CONNECTION (NO LINK)



Motion Sensor Add_On Module

McMS



McMS is available as add_on module for connecting to the main charge controller unit. It is available in different sense-ranges, from 6m to 15m. It comes with 3 way relimate connector to be directly plugged in the main unit which has 3-way base provided exclusively for this module.

Technical Specifications:

- Operating voltage: 5 to 15V
- Quiescent current: <9uA
- Level output: 3.3V Hi, 0V Lo
- Block time: 5sec
- Sensor Angle : 110 °
- Sensing range: 6 m to 15 m (depending upon the type)
- Operating temp: -15 to 70°C

Instructions for use:

- The module is electrostatically sensitive.
- It is provided with relimate cable with standard length of 12".
- It directly fits into connector marked MS on the main controller. Power is provided to the module and signal is received from the module from the same connector.
- The module needs about 60 sec to stabilize for operation. During this initialization, it will toggle output for 3 times. Once stabilized, it will go into normal mode of working.
- Module has dual probe sensor placed at rectangular window. If movement is along this length, the sensitivity is excellent. Place the module such that movement is along its length i.e. human movement should be parallel to its length for best results.
- If the movement is facing the sensor, or from its width, sensitivity is reduced.
- In the optimal direction, sense distance is 6m to 15m depending upon the type used.
- Avoid direct sunlight or heavy winds on the module which will result in malfunction.



FAQs Frequently Asked Questions

LOAD IS NOT ON:

1. BT_STS is off.
Check the battery connections. Battery might be reverse connected or no connections to the terminals BT+/BT-.
2. BT_STS is blinking Red and Green alternately.
Battery selection link is not used or properly put in the place or wrong battery selection is done.
3. BT_STS is Red or blinking Red.
If battery selection is correct, battery voltage is less than LVR. Battery needs charging till indicator turns Green.
4. BT_STS is green and steady,
 - a) Panel might be connected with some light on it. Remove panel. Wait for 10 sec.
 - b) Load might be connected in the reverse direction at LD+/LD- terminals. Correct the polarity.

BATTERY NOT CHARGING:

1. CHRG LED is not on.
 - a) Panel is not connected properly or connected in reverse direction.
 - b) Panel is without sufficient insolation. Check voltage at PV+/PV- . It needs to be more than 12V.
2. CHRG LED is on.
Panel is not giving power sufficient to charge battery. Battery voltage will increase very slowly. Panel and battery combination is not matched properly.
3. CHRG LED is on and BT_STS blinking Red and Green.
Battery is damaged or wrong selection of battery or panel is very over sized for battery capacity.

LOAD TURNS OFF AFTER SOME TIME IN THE NIGHT:

1. If battery capacity is reduced to give full back up till dawn, or panel is not charging the battery to desired SOC. If battery goes to full charge (CHRG blinks during day time), battery capacity is drastically gone down. Replace battery.
2. Check the cables used for connecting battery and load are of proper gauge.

EXCESSIVE HEATING WHILE CHARGING:

Please confirm the panel connected is not more than 220Wp. If yes, reduce the panel capacity.

WHAT ARE THE THINGS THAT CAN BE CUSTOMISED:

1. Battery Voltage settings different from factory defaults.
2. Load wattage different from the factory default
3. Light dimming percentage
4. Dimming time selection



Product Test Specifications

You can check the performance of controller with the procedure outlined below. Components needed to carry out these tests are Digital Multimeter, Dual Output (Independent) Variable Power Supply (CVCC) with volt/ampere display, Electronic load, 2 sq mm cable lengths for connections, DSO to see waveforms (not needed for routine check). **ONLY TECHNICALLY COMPETENT PERSON SHOULD CARRY OUT THE FOLLOWING TESTS**



COLD TESTS:

- **Select the BATTERY type first from on board selector. If no pin is used, controller is disabled.**
- First connect the cables to BT+ and BT- securely to the respective terminals of power supply.
- Gradually increase the supply such that voltage is just above LVR. BT_STS will turn Green. Reduce the voltage slightly and BT_STS will show Green plus flickering Red both together. Reduce voltage further to LVD.
- BT_STS will now be fully Red.
- Increase voltage slightly, BT_STS will show flickering Red only. This completes LVR and LVD check.
- Increase voltage to more than HVDD. BT_STS will alternately turn Red and Green. This indicates the system is disabled and voltage will not be available to the load.
- Switch off the supply and now connect with other pair of cables PV+ and PV- to respective terminals of other part of power supply.
- Put battery voltage to LVR and gradually increase voltage to PV terminals. Battery voltage will track the PV voltage when battery voltage is more than LVD. CHRG indicator will now turn on. Increase PV till battery voltage reaches HVD. Now CHRG will turn on and off alternately. This will continue till voltage is HVDD Afterwards, system is disabled.

LOAD TESTS:

- Above tests in the same sequence can be carried with load connected to the controller.
- If electronic DC load is not available, connect your assembled power LED cluster to respective terminals of LD output.
- Depending upon the load used, select LOAD select pin to match output current.
- Put the link on NML or TM1, TM2 or UNQ on MODE connector.
- Keep battery voltage to at least LVR and panel voltage to 0. Load will be on. You can check the output current of battery. *Please note this is not the actual current passing through the power LED cluster.* This is the battery current at the instantaneous battery voltage. If battery voltage is increased, this current will be reduced and vice-a-versa. This indicates the proper working of SMPS driver.
- If you connect a precision current meter in series with LED load, the current indicated will be constant even if battery voltage is varied up and down.
- Remove link and put it on DIM. Load current indicated will be half of previous reading.
- UNQ or TM1/TM2 operations can be checked only in real time environment.
- When battery voltage is above LVR and load is on, increase panel voltage gradually to slightly above 3.5V. Wait for 10 sec and load will be off. Now gradually reduce panel voltage to slightly less than 1.8V and load will be on again in. This completes DUSK_SENSE and DAWN_SENSE settings.

EFFICIENCY CALCULATIONS:

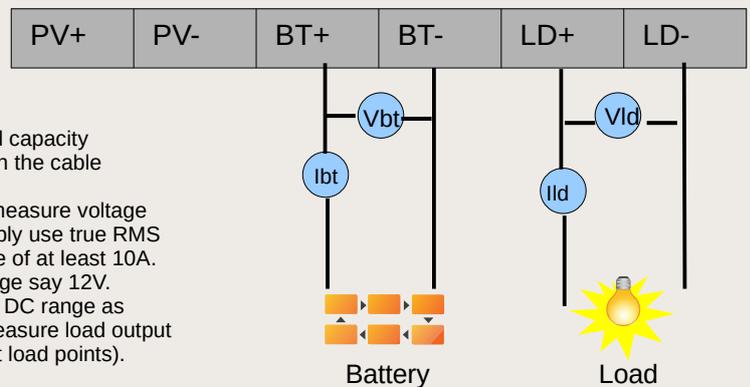
Precautions should be taken to use rated capacity wires to make connections so that drop in the cable is minimised.

At least two meters are needed, one to measure voltage and another to measure current. Preferably use true RMS quality multimeters with DC current range of at least 10A. Set the power supply to some fixed voltage say 12V. Connect the load with multimeter on 10A DC range as shown in red. Use other multimeter to measure load output voltage at the controller terminals (not at load points). This will give you Output power.

Without disturbing the set up, connect the mutimeters at battery terminals in the same way. This will give you input power.

Since meters in series always have some mV drop across it, voltage at load terminals on the controller and actual at load pins are different. This results in error in calculations. Input and output power of controller must be calculated at controller points only. Else drop in the cable and current meter are not taken into account and calculations go wrong.

CONTROLLER TERMINALS



$$EFF = (Vld * Ild) / (Vbat * Ibat)$$

Use thick wires to minimise cable loss

