Programmable Dusk to Dawn Charge Controller

Sadhana Energy Devices

DCP2

General Information

DCP2 is unique dusk to dawn charge controller with two independent outputs. While one output NML is plain dusk to dawn operation, second output AUX has additional dimming facility. This feature is specially useful for kiosks and streetlight on one pole. While NML output can be connected to streetlight (either LED or CFL with driver), second output AUX can be connected to kiosk using all LEDs. After a preset time, set by switches on board, AUX output goes in to dim mode set by another preset on board. The dimming can be set anywhere between 0to 100 percent while timer can be set in steps of 90 mins right from 3 hours to 9 hours.

With this arrangement, while streetlight will be full bright throughout the night, kiosk can be dimmed to desired level after midnight.

Alternatively, these two outputs can be used to drive two lights where one light is needed with full luminosity throughout the night while another light can be dimmed after midnight.

INSIDE

Special points of interest:

The battery can be charged with PWM mode for better absorption of charge. It is three stage operation. Initial bulk charging is followed by PWM absorption and then just float mode.

For wet batteries, equalization is possible by removing temp sensor cable from the board. It must be done under technical supervision by competent person once a month.

Available settings on board (Normal)

BAT LOW: With this setting, you can control the lowermost level of battery voltage when the load is disconnected. When this level is reached (LVD), BAT LOW indicator will turn on and load is disconnected from the battery. The state of disconnection lasts till the battery is charged to some reasonable upper limit (LVR).

BAT HIGH: When battery is getting charge from the panels, it transfers the maximum current possible till it reaches it uppermost level (HVD) when it is disconnected from the panel. Panel will not be reconnected till the battery voltage goes down to some other level (HVR). This prevents the gassing of the battery.

The charging can be made in PWM mode as well. (See *special points of interest* on this page)

DIMMER; Percentage of luminosity while the lamp is in dim mode can be set by this control. It can adjust the intensity right from 0 to 100%. This will be the intensity of the lamp during its dim light period.

Technical Information

** Charge Controller.*
** Dusk to Dawn operation.*
** Dual output*
** Temperature Compensation for battery charging.*
**PWM charging possible.*

Programmable Dusk to Dawn Charge Controller, as the name indicates has basically three operations to perform.

1. It is a Charge Controller to charge the batteries from SPV panels. It must perform the basic job of charging batteries in a controlled manner, it should prevent any reverse current flow from battery to the panels during night and should be very efficient. Additionally, as it is required in this case, it should have LVD circuitry to disconnect the load when battery voltage drops to a specified voltage.
2. It should switch on the light at dusk and make it off at the dawn. To do this operation, PV panel itself works as the ambient light sensor as the wattage output from the panel is dependent on solar insolation. This, however, is not directly related to panel voltage which we would have liked to be. Input circuitry of this controller makes the panel work in the desired manner for giving the output voltage proportional to the ambient light. Please note Voc of the panel in open condition does not help. The normal lux level at which the on / off action should take place is about a few lux depending upon the use of the system. Once the on/off command is received from the sensing circuitry, it is simple job to switch the load on or off. A simple relay could have done the job as in most controllers. We use MOSFET to do the job as it is more efficient way of doing the job.
3. Thirdly, it should have programmable control during night time operation. Immediately after dusk, it should give full bright light for a few hours when people need it most. After a time period of a few hours, depending upon the need of the people, the light can be switched to dim mode when not much of commuting is observed. The light in dim mode will last for a few hours and again it will turn to bright mode in the wee hours of the day as people have to start for their work in early morning. Such type of programming is possible with built-in chips. The duration of all these three steps is adjustable as per requirement of the site. DCP2 can be configured in this fashion as well.

Additionally, the controller should have the built-in provision to control the battery charging depending upon the ambient temperature. This controller does this work of charging the battery to different levels depending upon the ambient temperature.

Technical Specifications (Absolute Maximum Ratings)

INPUT PANEL VOLTAGE: 30 Vmax

INPUT PANEL WATTAGE: 125 Wp

BATTERY : 12V (nominal)

LOAD : 84 Wmax at 12VDC (nominal)

INPUT CHARGING CURRENT: 7 Amax

OUTPUT LOAD CURRENT : 7 Amax (both outputs together)

INPUT VOLTAGE DROPOUT: 525 mV at 5A

OUTPUT VOLTAGE DROPOUT: 350 mV at 5A

BATTERY HIGH VOLTAGE DISCONNECT: 14.4V at 25 deg C

TEMPERATURE COMPENSATION :-3.3 mV/Cell/deg C for the range of 0 to 75 Deg C

PANEL RECONNECT : 13.1V (PWM optional)

LOW VOLTAGE DISCONNECT: 11V

LOW VOLTAGE RECONNECT: 12.4V

DAY TIME CONSURMPTION: < 5mA (2.5 mA typ)

Available Settings on board (Programmable)

CLOCK: A precise real time pulses are generated by the clock circuit. The duration of these pulses can be very accurately set by this control.

To simulate long duration in short time, two different outputs are available. One is to check the real time pulse in 1/256 th of time while another output is to check it in 1/64th of time.

NML CHK; It has a link normally put on NML position. When it is in CHK position, the night time cycles are simulated in just 1/256th of real time. This helps in checking the entire operation of the controller within a few minutes which otherwise would have taken entire night to observe.

ADJ DIM: Normally, there is no link here. If a link is placed, AUX output is forcibly brought to dim position. As long as a link is here, AUX will always be in dim mode. This helps to precisely set the dimming percentage by adjusting the DIMMER control on board. When the setting is done, the link must be removed for normal operation to take place. The link does not have any effect on NML output.

Programme calibration

The entire programmable timer needs to be calibrated properly to have the exact timing signal. An oscilloscope will come to help for the purpose. Since, we have pulses of long duration also available, a simple stop watch will also serve the purpose.

It is asking too much to check the timing signal of say, 60 min in real time. The chip provides different signals at submultiples of the real time as well.

When NML CHK link is in CHK position, time signals are multiplied by 128 times so that a duration of say, 1 hour is achieved in about 28 seconds. 10 Hours duration can thus be checked in merely about 5 Min.

CAL: This is visual output to exactly set the CLOCK. The indicator gives the signal at the rate of 1/64 duration in real time. Thus if time signal is to be set at 1.5 hour, the indicator will be on for a period of 85 seconds, then off for the same period followed by on duration. This will be thus on and off for 85 seconds. You can adjust now CLOCK to have this exact period.

CAL is very important indication. CLOCK setting must be precisely done to have desired on/off indication. Remember any deviation in this setting is multiplied by 64 times. Error of 1 sec means error of 1 min in real time!

How to check the kit? (Compatible to our standard test jig)

1. See that the kit under test has its link in CHK position and no link at ADJ DIM pins.
2. Connect the board to the test jig with proper pin connections.
3. Put PV and BAT supply of the jig to 0 and switch on the jig.
4. With coarse control of the jig, increase bat voltage to 10V and with fine control increase it further to 12V.
5. Put on the load. Load current of about 570 mA will be displayed.
6. Increase PV by its fine contrd to .5V. The load should be off indicated by 0 on its current meter.
7. Decrease PV with fine control to .3V, load will be again on showing full current.
8. Put link on ADJ DIM pins. Load current will be reduced. Adjust DIMMER preset to set the current in dim position of load. Remove the link.
9. Put PV to about 1V , load will be off.
10. Take a stop watch. Put PV to 0V and instantly start the stop watch. Exactly after 85 sec, the CAL LED should be on. This will be on for 85 sec and then turn off.
11. If it is not, adjust CLOCK preset and follow the steps from 6 to 10 to get exact reading of 85 sec. This will set the timing signal to 1.5 hour step in real time.
12. Now, the entire operation of the board can be checked in single observation as under-

Put PV to 1V and keep stop watch handy. Put PV to 0V and instantly start the stopwatch. Confirm the following readings

Setting	Full load	Dim load
1,2,3,4 ON	85 sec	Till dawn
1,2,3 ON	127 sec	Till dawn
1,2 ON	170 sec	Till dawn
1 ON	212 sec	Till dawn
All off	255 sec	Till dawn

13. This confirms the real time working of the kit.
14. Now put PV to 1V, and check the no-load current (daytime consumption of the circuit) by precision current meter. It should be less than 5 mA.
15. BAT LO and BAT HI can be checked as usual.
16. Since, temp comp circuitry is provided, BAT HI setting will change with ambient temp.

Sadhana Energy Devices

"Samruddhi"
Ajinkyatara Industrial Estate,
Sinhagad Road,
PUNE 411 041 INDIA

Fax: +91-20-24391151
Email: info@sadhana.co.in

Solutions in Renewable Energy Sources.

SADHANA

Visit us
www.sadhana.co.in

We have been in the field of providing solution of utilizing solar energy in the optimal format. The controllers designed by us and being up-dated regularly are made with the sole intention of utilizing the unending but expensive to harness the solar energy.

The programmable dusk to dawn controller is designed with the view to using the available power in the best possible way.