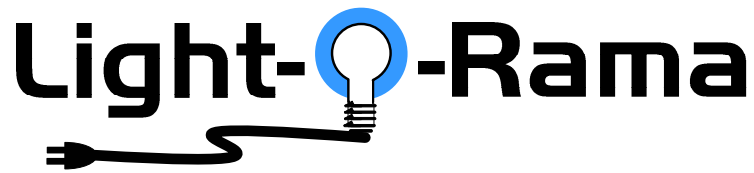


CMB16D



CMB16D

16 Channel DC Controller

User Manual

May 25, 2008

V1.01

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Table of Contents

| | |
|---|----|
| Introduction..... | 3 |
| What's in the Box..... | 4 |
| Applications | 4 |
| First vs. Second Generation Boards..... | 5 |
| Installing Heat Sinks | 5 |
| Quick Start Guide | 7 |
| Hardware Fundamentals | 8 |
| Setting the Unit ID | 8 |
| Data Cable Connections | 9 |
| Connecting to PC | 9 |
| Connecting to Other Controllers | 9 |
| Status LED..... | 9 |
| Auxiliary Power Input Barrel..... | 10 |
| Channel Power Inputs..... | 10 |
| Channel Power Outputs..... | 11 |
| JP3/PGM Header | 11 |
| Current Handling Considerations | 12 |
| First Generation Board | 12 |
| Second Generation Board | 13 |
| Nitty-Gritty | 14 |
| Connecting Controller-to-PC Data Cable..... | 14 |
| Testing the CMB16D | 15 |
| Designing and Playing a Sequence | 16 |
| Stand Alone Operation | 16 |
| Troubleshooting..... | 17 |
| Erratic Behavior When Lights Turned On..... | 17 |
| AutoConfigure fails to find COM port..... | 17 |
| Updating Controller Firmware | 18 |
| Specifications..... | 20 |

Introduction

The CMB16D is a member of the Component line of Light-O-Rama (LOR) products. It was designed to control DC lighting or any DC device that will tolerate a PWM modulated voltage. It is a microprocessor based, intelligent controller that can perform a number of lighting effects including dimming, fading, shimmering and twinkling. It can be daisy-chained with any mix of LOR controllers up to the maximum of 240 controllers.

The CMB16D must be used with the LOR Windows Showtime Software Suite. This software allows you to design your sequences (*sequences* are lighting control command sets), arrange your sequences into shows and to schedule and play your shows.

To allow your PC to communicate with this controller, you will need one of Light O Rama's RS485 adapters. When you purchase the Generic Starter Package, you get the LOR Showtime Software, a 10' Cat5e network cable and you will be given a choice of a serial port RS485 adapter or two types of USB RS485 adapters. Choose the adapter appropriate for your PC/laptop. The RS485 adapter will allow you to connect your PC/laptop via the Cat5e cable to your DC controller.

As with all LOR controllers, this controller is field firmware upgradeable so you are guaranteed compatibility with future LOR hardware and software products.

What's in the Box

The CMB16D comes a user manual. The latest version of this manual is also available at www.lightorama.com ► Support ► CMB16D User Manual. First generation CMB16Ds included a set of Low Power heat sinks.

Caution: Although most applications for this product use low voltages, this product may be used with dangerous DC voltages. It is important that you have an understanding of electrical wiring.

Applications

The CMB16D can be controlled by another LOR controller or, if you would like audio coordinated with the controller, one of the LOR Show Directors or a Windows PC. The CMB16D can also run a standalone sequence. This means a set of lighting (or other device) commands created using the Windows Showtime Software can be downloaded into the CMB16D. The CMB16D can use these internally stored commands to direct itself and additional controllers. See the *Standalone Operation* section for more information.

The low voltage (safety) and standalone capabilities allow the CMB16D to be deployed in a myriad of remote applications with no additional hardware being required. For example:

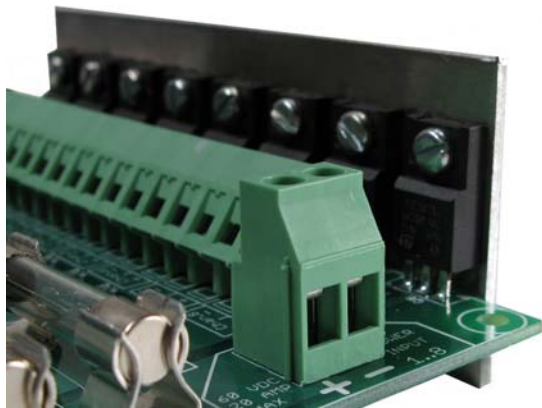
- General LED lighting (spot lights, etc.)
- Vehicle lighting (Bike, Car, Boat, etc.)
- Landscaping, pool and pond lighting
- DC Motors, solenoids, valves, relays

First vs. Second Generation Boards

First generation CMB16D boards have 8 plastic transistors along the left edge and 8 plastic transistors along the right edge of the board. Heat sinks are not required if the current draw per channel is 1.5 amps or less. The plastic transistors can be bolted directly to metal heat sinks.

Second generation CMB16Ds boards have transistors with metal tabs. Heat sinks are not required if the current draw per channel is 4 amps or less. **The metal tab of the transistor is electrically hot and a TO-220 insulating kit (mica wafer and screw grommet) is required when mounting the transistors to metal heat sinks.** Also, keep this fact in mind when using the board since it is possible to short out the metal tab transistors more easily than the plastic tab first generation board.

Installing Heat Sinks



The picture shows a heat sink properly installed. The heat sink must be attached so that it is longer toward

the bottom of the board. If you don't do this, it will be very difficult to access the output channels' terminal screws.

A small tube of thermal compound is needed to facilitate the transfer of heat from the transistors to the heat sink. **Remember to use a TO-220 insulating kit for metal tab transistors.** Put a 1/8" x 1/4" dab of heat sink compound on the back surface of the transistor just below the screw hole.

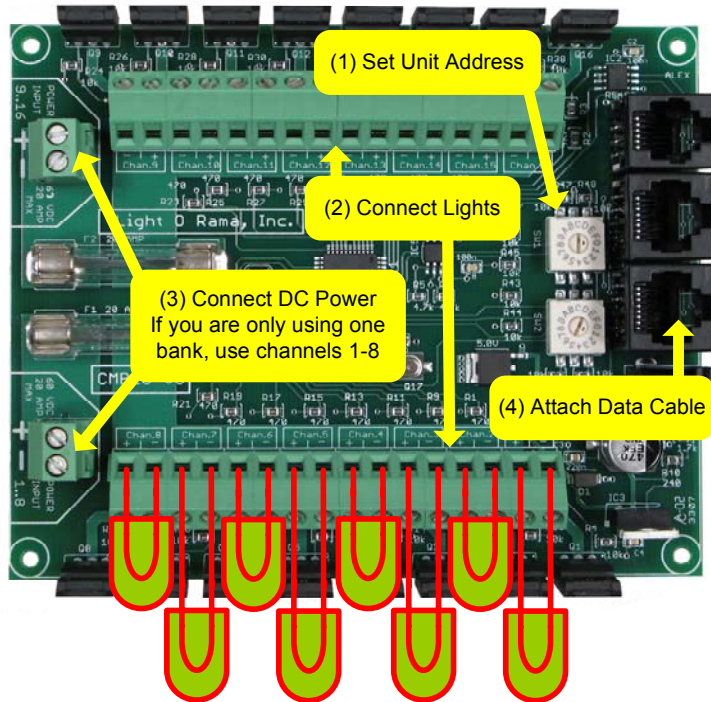
For metal tab transistors, the mica wafer goes between the transistor and the heat sink. There must be heat sink compound on both sides of the wafer. Use a screw grommet to prevent the screw from connecting the transistor's metal tab with the metal heat sink.

Put a screw from the inside of the board through the end two transistors and then align the heat sink with these two screws and press it against the transistors. Put a lock washer on each screw and a bolt, don't tighten the bolts yet. Do the same for the other six screws. Now tighten but don't over-tighten the bolts. Repeat the process for the other channel bank.

Quick Start Guide

This section assumes you have previous Light O Rama hardware experience. It provides the minimum needed to get the controller up and running.

The assumptions here are 12 volt DC power and loads not requiring heat sinks. Read the *Hardware Fundamentals* section for much more detail.



The Status LED should be blinking about twice/second. Fire up the Hardware Utility and the Status LED should be steady on. Refresh the controllers, select this controller and use the *Test Unit's Operation* section to exercise the lights.

Hardware Fundamentals

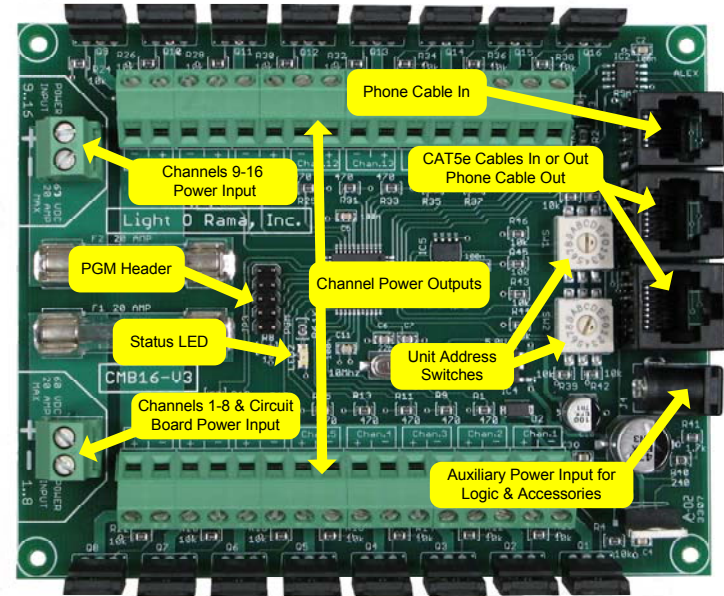


Figure 1

Setting the Unit ID

Use the Unit Address Switches to set the board's controller address. In figure 1, the top rotary switch sets the most significant digit and the bottom switch sets the least significant digit.

To set the controller address to '01,' set the top switch to '0' and the bottom to '1' as depicted in figure 1.

Legal unit address settings are '01' to 'F0' hexadecimal, in decimal that would be 1 to 240.

Data Cable Connections

The *Phone Cable In* jack is an RJ11. The two CAT5e jacks are RJ45s.

Connecting to PC

If you are using telephone cable to connect your controller to the PC RS485 adapter, plug one end of the phone cable into the adapter and the other end into the *Phone Cable In* jack. See figure 1.

If you are using Cat5e LAN cable to connect your controller to the PC RS485 adapter, plug one end of the data cable into the adapter and the other end into either of the *CAT5e Cable In or Out* jacks.

Connecting to Other Controllers

If you are using telephone cable to connect your controller to another controller, go from either CAT5e jack on one controller to the *Phone Cable In* jack on the other controller. See figure 1.

If you are using CAT5e LAN cable to connect your controller to another controller, go from either RJ45 jack on one controller to either RJ45 jack on the other controller. See figure 1.

Status LED

LED blinking approximately twice/second: Controller has booted correctly and is waiting for commands. The controller is not connected to a Light O Rama network or the network is not active.

LED is on solid: Controller is connected to an active network (is receiving the heartbeat and commands from a PC, a Show Director or another controller)

LED blinks on for a long pulse and off for a short pulse: Controller firmware needs to be downloaded. See the *Updating Controller Firmware* section.

Auxiliary Power Input Barrel

Use a 12 volt DC, 300 milliamp (or greater) external power supply here if the power input to channels 1-8 is less than 12 volts DC.

If the main power input to channels 1-8 is 12 volts DC or greater, the microprocessor and accessory power supplies will be derived from it.

The center pin of the power barrel is positive.

Channel Power Inputs

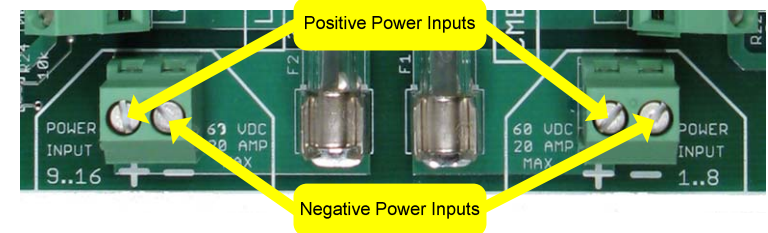


Figure 2

Figure 2 shows the two channel bank power inputs. The right power input is for channels 1 to 8. If this input is at 12 volts DC or higher, it will automatically be used to power the circuit board logic and accessories (like wireless.) If the DC power to channels' 1-8 input is less than 12 volts DC, see the *Auxiliary Power Input Barrel* section.

You may use different voltages on channel banks 1-8 and 9-16. The ground between the two channel banks is common.

Channel Power Outputs

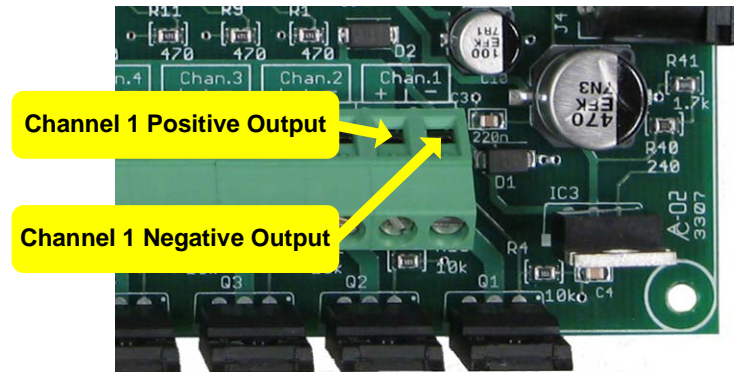


Figure 3

Figure 3 shows the power output connections for channel 1. The silk-screening on the board labels each channel and their positive (+) and negative (-) connections.

Remember that DC loads can be polarity sensitive. If you find that LEDs connected to the outputs do not light, try swapping the positive and negative connections.

JP3/PGM Header

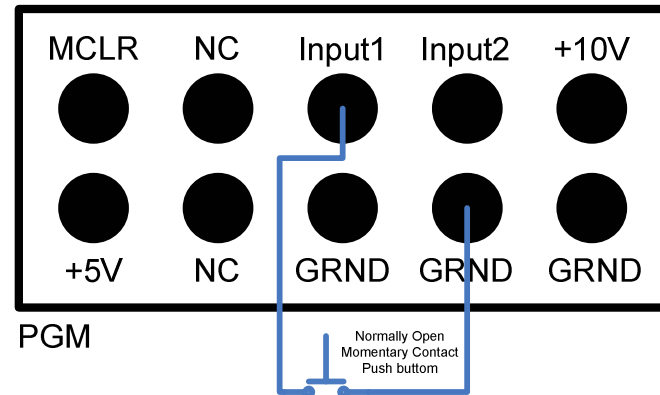
The figure on the next page shows how to connect a push button switch to the circuit board header to start a standalone sequence.

Currently, only 'Input 1' is supported. The standalone sequence in the CMB16D will start when the push button is pressed. If you use a toggle switch, the sequence will run until the switch is turned off.

The sequence always runs to completion, even if the toggle switch is turned off in the middle.

Only use the Input 1, +5V, +10V and GRND pins.

JP3



Current Handling Considerations

This is a complex subject with MOSFETs (transistors.) Their voltage drop increases with increasing current. This means that the amount of heat to be dissipated also rises rapidly with current.

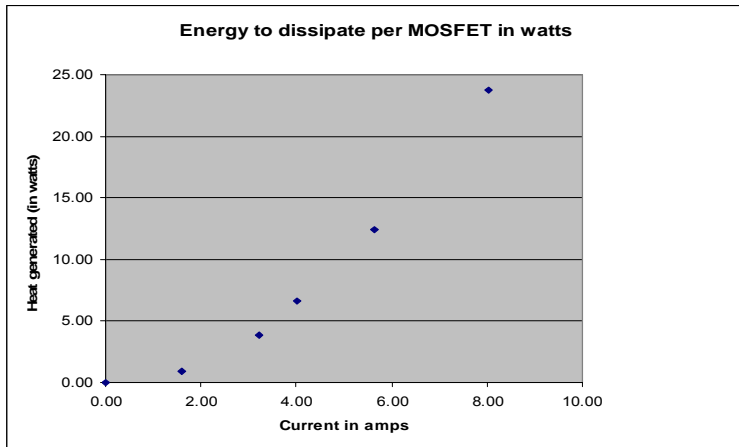
First Generation Board

Without any heat sinks, you can put 1.5 amps on each output. However, if you put the low power heat sinks on that are provided with the CMB16D, and you push 4 amps each through two channels in one bank, you will be at the limit of the heat sink. In the first case, without heat sinks, you are pushing 12 amps (8 channels * 1.5 amps) through the bank, but in the second case, with heat sinks, you can only push 8 amps through the bank.

If you are going to put more than 1.5 amps a channel, it's best to install the low power heat sinks. LOR is not currently providing any high power heat sinks, so if you really need high currents, you will have to fabricate something. This is because the

CMB16D is almost always used to control LEDs or some type of relay/solenoid, so high current is not an issue.

Trial and error is a reasonable way to go here. Connect up your load and use the Hardware Utility to slowly increase the intensity. See how warm the transistor gets, if you can't touch it, it needs a heat sink.



The low power heat sinks can dissipate about 10 watts per heat sink. Of course, in displays, the channels are rarely on continuously, so this has to be taken into account as well. Trial and error...

Second Generation Board

This board has metal tab transistors that will easily handle 4 amps each without a heat sink. For this reason LOR does not include heat sinks with the board. 4 amps times 16 channels is 64 amps which exceeds the total current carrying capacity of the board. The board is rated at 20 amps maximum per 8 channel bank.

Nitty-Gritty

This section is for technical types who are not sure whether their application would be a good match for the CMB16D.

There are two banks of MOSFETs, bank 1 for output channels 1 to 8, and bank 2 for output channels 9 to 16. The positive outputs of a bank are all tied together and connected through their fuse to the positive power input. A MOSFET is used to ground the load connected to its channel, so positive power is always present at the load.

The MOSFETs are Pulse Width Modulated at 400 Hz. $1/400^{\text{th}}$ second = 2.5 milliseconds. There are 240 possible intensities. This means that in each 400th of a second, the grounding pulse is somewhere between $0/240 * 2.5$ ms (off) and $240/240 * 2.5$ ms (full on.)

Connecting Controller-to-PC Data Cable

If you have not installed your RS485 adapter, do it now. If you have an SC485 (PC serial port adapter, shown on the left below), you need only plug it into an available PC 9-pin serial port. The cable from an SC485 serial adapter to the first controller is limited to 100' or less. Cable length to the first controller is not so limited for USB adapters.



If you have one of the USB adapters (shown center and right above), follow the installation instructions that came with the adapter.

Testing the CMB16D

To perform this test, the CMB16D must have a unit address between '01' and 'F0,' and it must be powered up and connected to the PC. The LED on the CMB16D should be blinking twice/second before the CMB16D is connected to a PC running the Hardware Utility.

In the *Max Units* section of the Hardware Utility window, click the *Change* button. Move the slider in the *Change Maximum Units* box so that the Max Units is set to 10. (Unless you are using unit addresses above 10 decimal) This will limit the search for controllers to the first 10 unit IDs, otherwise 240 controllers will be searched for – taking a long time. Click the *Save* button.

In the *Select Unit to Configure..Download..Test* section of the Hardware Utility screen, click the *Refresh* button to locate the attached CMB16D controller. Select the controller from the drop down menu to the right of the *Refresh* Button.

The *Test Unit's Operation* section of the screen should be active. Attach some lights into your controller and use the sliders and buttons in this section to test your controller.

Designing and Playing a Sequence

Lighting commands for your shows are called *Sequences* and are designed and implemented using the Sequence Editor Windows software.

Stop the Hardware Utility. You will not be able to command your controller from the Sequence Editor if the Hardware Utility is running. Only one program may use the RS485 adapter at a time to talk to Light O Rama controllers.

There are Quick Start Guides for creating animation (non-musical) and musical sequences, Flash Tutorials and much more at:

www.lightorama.com ► **Support**

The following Wiki is also an excellent source of information on all things Light-O-Rama:

www.lorwiki.com

There is also a very active and helpful Light-O-Rama user community on Planet Christmas:

www.planetchristmas.com

Stand Alone Operation

An animation sequence (sequence with no accompanying audio) can be downloaded in the CMB16D. This sequence can contain approximately 5,000 commands. These commands can also be for controllers other than this CMB16D, so this controller can direct a network of controllers. There is no restriction on the types of controllers in this network.

The sequence is designed and tested using the Showtime Software Sequence Editor. When you are

happy with the sequence, save it and stop the Sequence Editor.

Start the Hardware Utility and click the *Refresh* button to find the CMB16D. Use the drop down menu next to the *Refresh* button to select the CMB16D.

Click the *Standalone* button at the bottom of the window. Select one of “Run when power is on,” “Input (norm open switch)” or “Input (norm closed switch.)” Click the *Send Trigger info to Unit* button.

Finally, Use the *Open* button to browse to your sequence and click the *Download* button.

Troubleshooting

Erratic Behavior When Lights Turned On

The most likely cause is insufficient power. If the CMB16D is being powered by the same power supply as the lights/loads, turning them on may cause a voltage drop and crash the microcomputer. If you suspect that your power supply may not be up to the task, see the *Auxiliary Power Input Barrel* section. This section will explain how to power the card logic independently of the loads.

AutoConfigure fails to find COM port

If the COM port is not detected, you can manually select it from the drop down list.

If you are not sure which COM port is the RS485 adapter and you have a USB adapter, click **start ► My Computer ► View System Information ► Hardware** tab ► **Device Manager** button. Click the “+” in front of “Ports (COM & LPT)” – you will see “USB Serial Port (COMn)” – this is the RS485

adapter. Use the *Manual Select* drop-down box to select that COM port.

If you are not sure which COM port is the RS485 adapter and you have a serial port RS485 adapter, you will have to consult your PC’s documentation, it is normally COM1, COM2 or COM3.

Updating Controller Firmware

Periodically, Light-O-Rama will distribute new firmware for the CMB16D. If you believe you need updated firmware, use the Hardware Utility do determine your current firmware version. Use the *Refresh* button to find your controller and check its firmware version. The drop-down menu to the right of the *Refresh* button will be filled in with the attached controllers. The right part of the controller name in this drop-down is the current firmware version.

If the controller type or firmware version is not present, get the latest Hardware Utility from www.lightorama.com ► **Support** ► (bottom of page) Download Hardware Utility. Run the program downloaded to install the Hardware Utility and devices text file. Retry the *Refresh* operation.

The latest firmware can be found by going to www.lightorama.com ► **Support** and scrolling down to the **Using the Hardware – Documentation and Firmware** section. Find your controller and roll the mouse over the *Firmware* button – look at the bar in the lower left of the browser window. It will show the name of the firmware file. The file name contains the version at the end. If the version number is greater than what you saw in the Hardware Utility, new firmware is available. Click the *Firmware* button to

download the firmware installer to your PC – remember where you put it.

Run the firmware installer to install the new firmware into the firmware directory. Note the name of the .lhx file.

To load new firmware use a data cable (not wireless) to connect the controller(s) to the PC. Start the Hardware Utility and click the *Refresh* button to find your controller(s). Select the one you want to update from the drop-down menu to the right of the *Refresh* button. Click the *Firmware* button at the bottom of the window.

In the **Firmware** section of the window, under **Step 1 – Select Unit**, select the *unit* listed above. Under **Step 2 – Select Firmware File**, use the *Open* button to browse to the firmware file you downloaded. Under **Step 3 – Press Download Button** click the *Download* button. Do not interrupt this process. Your controller will reboot after the download completes.

You can click the *Refresh* button to see that the new firmware was loaded into your controller. Repeat this process for additional controllers.

Specifications

| | |
|--------------------------------|---|
| Configuration | Two banks of 8 channels |
| Individual Channel Capacity | 4 amps – No Heat Sinks 8 amps – Regular Heat Sinks |
| Individual Bank Capacity | 20 amps |
| Board Capacity | 40 amps |
| Channel Supply Voltage | 5 to 60 volts DC (Bank voltages may be different) |
| Auxiliary Power Barrel Voltage | 12 volts DC (center pin of barrel is positive) |
| Fuses | 20 amp fast acting |
| Power Connections | Screw terminals |
| Logic Power Consumption | 450 mW |
| Stand alone memory capacity | Approximately 5,000 commands |
| No Heat Sinks | 4w x 5”h x 1”d |
| Low Power Heat Sinks | 4 ½”w x 5”h x 1 ½”d |
| Regular Heat Sinks | <future> |

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