CTB04-PC-ELL Shown

CTB04-PC & CTB04-PC-ELL

Computerized Light Controller

Generation 3 User Manual

August 4, 2015

V1.00

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Introduction

The Light O Rama (LOR) CTB04-PC and CTB04-PC-ELL are four channel computerized lighting controllers. The CTB04-PC–ELL contains an internal RFV5 Easy Light Linker (ELL) radio transceiver for wireless control. They are both single power cord, 15 amp controllers.

These controllers are designed to control incandescent and line voltage LED lighting. They operate on 120 VAC, 50/60 Hz. They can control approximately 4,500 incandescent mini-lights or 35,000 LED mini-lights or some combination of both.

These controllers include “ghost loads” which drain off charge to prevent low brightness LED glow when LEDs should be off. The “ghost loads” also permit smoother LED fading.

The CTB04-PC-ELL is designed for LOR network protocol. The CTB04-PC understands both LOR and DMX network protocols.

The g3 firmware included with these controllers has individual channel lighting curves for smooth, glitch-free dimming and effects with LED lighting. This firmware also increases the number of brightness steps from 250 to 1000 for smoother fading with LEDs.

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

These controllers are components in the *Hobbyist Line* of LOR products. They are housed in

weatherproof, plastic enclosures. They are microprocessor based, intelligent controllers that can perform a number of lighting effects including dimming, fading, shimmering and twinkling. They can be daisy-chained with any mix of LOR controllers up to the maximum of 240 controllers.

Sample uses:

- Receive commands wirelessly (CTB04-PC-ELL only.)
- Daisy chained off of an LOR1602MP3 Show-in-a-Box lighting controller with a built in Show Director
- Connected to your PC running the LOR Showtime Windows software
- Connected to one of LOR’s Show Directors (DC-MP3 or mDM-MP3)
- Running a standalone set of commands loaded into the controller’s flash memory
- Daisy chained off of another controller that is either running stand alone or getting its commands from one of the other sources listed above

To allow your PC to communicate with these controllers, 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’ Cat5 network cable and you will be given a choice of several types of USB RS485 adapters or a serial port RS485 adapter. Choose the adapter appropriate for your PC/laptop. The RS485 adapter will allow you to connect your PC/laptop via the Cat5 cable to your lighting controller.

If you intend to use wireless control, then you will need one ELL wireless unit to connect to your PC with a USB485B adapter. You may also cable your PC's USB adapter or Show Director to one of the CTB04-PC-ELL controllers and the wired connection will control the lighting controller and the internal ELL will broadcast lighting commands wirelessly to other CTB04-PC-ELL controllers.

The controllers are shipped set to Unit ID 1 for LOR networks and DMX starting address 1 in the DMX universe.

What's in the Box

In addition to your lighting controller you will also receive this user manual

The latest copy of the manual is available at www.lightorama.com ► *Support* ► *User Manuals* section.

Safety Considerations

The plastic enclosure is weather resistant provided that the device is mounted with the wires pointing downward. The pigtail outlets must be at least one foot off the ground. Keep the unit away from heavy splashing water and forced water flows such as from irrigation sprinklers.

Anchor communication cables using wire ties to a stable point. Do not seal entire unit with tape; it needs to breath.

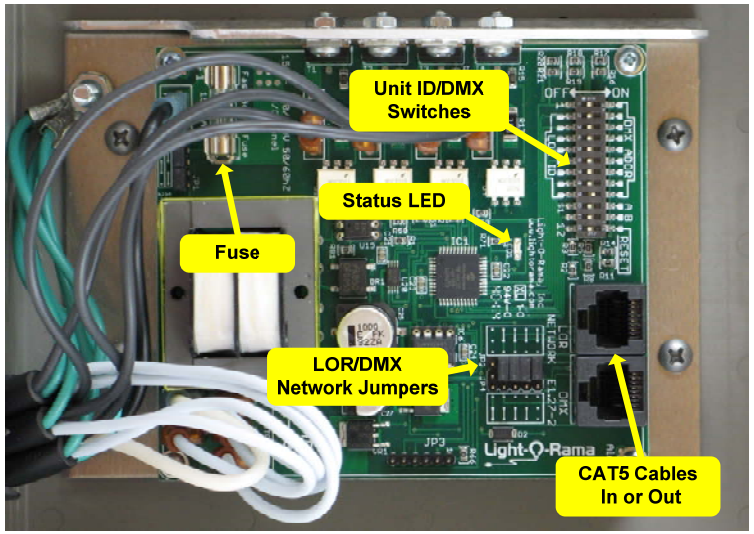
To connect the communications cable, set the Unit ID/DMX address or change the fuse, you must open

the front cover. **These units are not weatherproof when this cover is opened**.

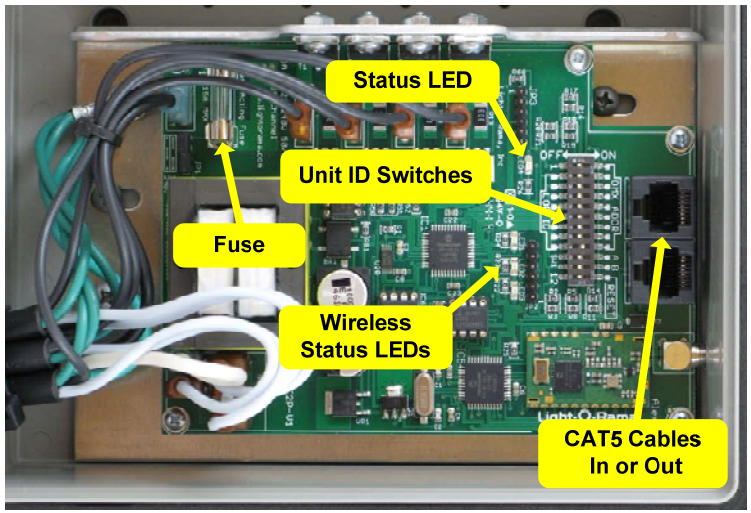
Component Locations

Make sure the cover screw is completely loose and depress the tab on the latch to open the cover.

CTB04-PC Cover Open



CTB04-PC-ELL Cover Open



Quick Start Guide

This section gets you going in the common case where you bought the SPK-ST Generic Start Kit (Showtime Windows software, RS485 adapter and Cat5 connecting cable.) You will be using the Showtime software on your PC to direct your lighting controller.

If you have problems, see the detailed sections: *Connecting up the Controller* and *Testing with the Hardware Utility.*

(1) Install the Showtime PC software.

(2) Install the RS485 adapter. If you have the SC485 serial port adapter, just plug it into a serial port on the back of your PC. If you have one of the

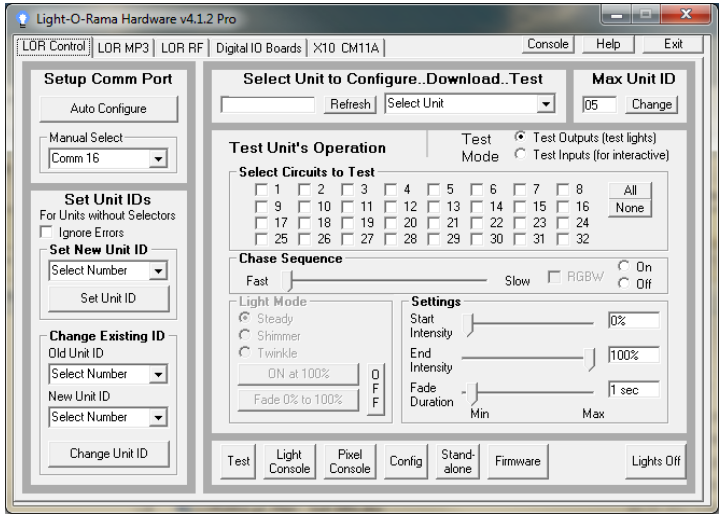
USB adapters (USB485 or USB485B) follow the directions that came with the adapter.

(3) Make sure the cover screw is loose, depress the tab and swing open the cover.

(4) **For wired connection**, Plug one end of the Cat5 cable into the RS485 adapter connected to your PC and the other end into either of the large RJ45 jacks on the controller. **For wireless connection**, consult the RFV5 Manual for connecting a wireless transceiver to your PC. The factory default configurations for both the stand-alone ELL connected to your PC and the one built into your CTB04-PC-ELL will allow communications right out of the boxes.

(5) Plug in the controller power cord, the Status LED will flash twice/second meaning no connection to a PC or Show Director. If you have a CTB04-PC-ELL, LED1 will also be flashing once/second indicating that the wireless transceiver is listening.

(6) Start the Light O Rama Control Panel: click ***start ► All Programs ► Light-O-Rama ► Light-O-Rama Control Panel.*** Answer OK to any initialization boxes. There will be a light bulb with a red halo on the right side of the task bar at the bottom of the screen. Right-click the light bulb and select *Hardware Utility* (HWU) from the menu. You will see this window:



(7) Click the *Autoconfigure* button on the upper left. The HWU will search for the Light O Rama port.

> Tip: Under "Max Units" on the upper right, click the *Change* button and move the slider to select 10 units. This will cut down the scan time because the HWU will not have to scan for 240 controllers. Click OK.

(8) Click the *Refresh* button at the center top. The HWU will scan for all connected controllers. Your controller will appear in the drop down menu to the right of the *Refresh* button.

(9) The Hardware Utility should find your CTB04 regardless of whether it is wired or wirelessly connected. The Box to the right of the Refresh button will fill in with the controller type (CTB04g3.) The status LED should be on solid and LED2 should be flashing faintly about 3 times a second indicating that the heartbeat is being received.

10) Connect some lights to you controller and you should be able to control them with either the "Test Unit's Operation" section of the Hardware Utility screen or you can use the "Light Console" for more control.

Connecting Up the Controller

In order to use your controller, you must connect it to a show director, Windows PC or run it in standalone mode (see the *Stand Alone Operation* section.)

Connecting to a PC

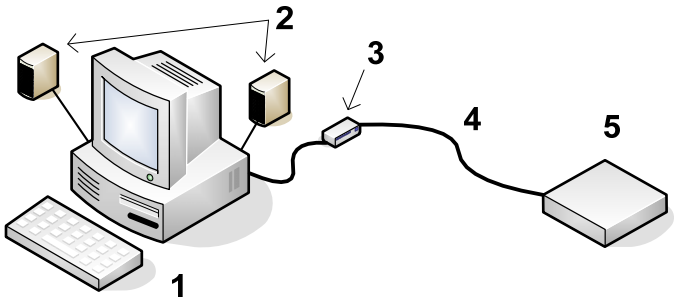
You will need the following to connect your lighting controller to a PC:

- Showtime Windows Software
- RS485 Adapter
- CAT5 LAN cable or an ELL wireless transceiver to talk to the internal ELL in your CTB04-PC-ELL
- Your lighting CTB04-PC or CTB04-PC-ELL controller
- Windows PC running XP through Win 10

The first three items are available in the LOR SPK-ST Generic Starter Package. www.lightorama.com ► *On-line Store* ► *Showtime Products*. You will have to choose an RS485 adapter type. It's best to go with the USB485 if you have no intention of going wireless from your PC to the controller. If wireless is desired and you will not be using one of the CTB04-PC-ELL controllers wired to your PC, get the USB485B adapter.

Wired Connection

The following diagram shows how the pieces fit together for a wired connection:



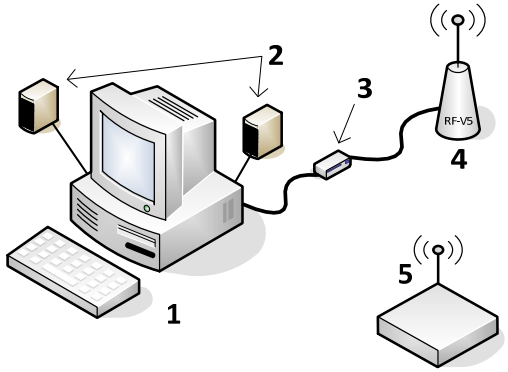
1. Your PC running the Showtime Windows Software
2. Your PC speakers to play the music
3. RS485 Adapter to convert short distance USB to long distance RS485
4. CAT5 LAN cable
5. CTB04-PC or CTB-PC-ELL lighting controller

If your USB adapter has more than one RJ45 jack, you can use either.

If you use a CTB04-PC-ELL in this configuration, it will also transmit wirelessly all commands received over the wired link. This allows other CTB04-PC-ELLs to be controlled or other LOR controllers that have external ELLs attached to them.

Wireless Connection

The following diagram shows how the pieces fit together for a wireless connection:



1. Your PC running the Showtime Windows Software
2. Your PC speakers to play the music
3. USB485B Adapter to convert short distance USB to long distance RS485 and power the ELL transceiver
4. ELL transceiver
5. CTB04-PC-ELL lighting controller

In this configuration, the transceiver inside the CTB04-PC-ELL will not re-transmit commands received on the wireless link.

Connecting to an LOR1602MP3

You will need the following to connect your lighting controller to a LOR1602MP3 “Show in a Box Controller”:

- LOR1602MP3
- CAT5 cable

- Your CTB04-PC or CTB04-PC-ELL controller

Just cable the two devices together.

Connecting to a Show Director

You will need the following to connect your lighting controller to a Show Director:

- mDM-MP3 or DC-MP3 Show Director
- CAT5 cable
- Your lighting controller

Since the CTB04-PC or CTB04-PC-ELL will be powering the show director, the cable connecting a show director to the controller should be 50' or less in length. Longer cables may result in a voltage drop causing erratic operation of the show director.

Connecting to another Controller

Just run a CAT5 cable between the two controllers.

Creating a Show

The simplest way to create a show is to purchase pre-made musical sequences from LOR or other vendors. These can be purchased in sets on a CD, or individually via download from the LOR website. To see the currently available musical sequences, go to www.lightorama.com ► *Sequences*.

You can also create the sequences yourself using the Showtime Windows software.

Once you have the sequences on your PC, the *Simple Show Builder* is the easiest way to arrange these sequences into a show and schedule the show.

The *Simple Show Builde*r is accessed by right-clicking the LOR light bulb in the lower right tray and selecting *Simple Show Builder*. Follow the instructions on the screen to create your show. In a few simple screens, you will have arranged your musical sequences into a show and scheduled this show.

Creating a Show (Full Capabilities)

If you are looking for more flexibility in your show, the following features not available with *Simple Show Builder:*

- More than one show
- More flexible scheduling
- Interactive shows

See the Showtime Windows software guide for more information on running shows from your PC using the Showtime Windows software.

See the DC-MP3 User Manual for more information on running shows with a DC-MP3 Show Director.

See the mDM-MP3 User Guide for more information on running shows with an mDM-MP3 miniDirector.

Power Considerations

This section attempts a simple answer to the question "How many lights can I use?"

The CTB04-PC and CTB05-PC-ELL have a total capacity of 15 amps.

The maximum current on a single channel is 8 amps. The maximum current for all channels is 15

amps. So you have to divide up your lights on the 4 channels so you don't exceed either of these two limits.

E.g., you could put 3 amps on 3 channels and 6 amps on the remaining channel and that would be 15 amps. Or, you could put 8 amps on 1 channel, 3 amps on 2 channel and 1 amp on the last channel and that would be 15 amps.

Christmas Light Power Consumptions

The following table gives the approximate current consumption for various types of Christmas lights.

Description	Lights/string	Amps/string
Mini-lights	50	0.17
Mini-lights	100	0.33
C7 bulbs	25	1.04
C9 bulbs	25	1.5
100 watt bulb	1	0.75
150 floodlight	1	1.25
LED mini-lights	70	0.03
LED C6 or C7	25	0.02

If you put six sets of 100 mini-lights on one channel, that would be 6 * 0.33 = about 2 amps. If you put six sets of 70 LED mini-lights on one channel, that would be 6 * 0.03 = about 0.18 amps. You can see that you can have a lot of LEDs with very little power.

Make a chart of all the lights you want to connect to the controller's channels and then work out the numbers to see if you hit any limits.

Lighting Curves

The g3 firmware supports lighting curves. These are used to allow different types of lights to behave similarly when dimming. LEDs tend to go from off to full brightness over a much narrower range of voltages than incandescent lights. This means that a fade going from 0 to 100% voltage with an incandescent light will not produce the same results with LED lights. The LED lights will come on later and reach full brightness sooner than incandescent lights.

There is a built-in Standard curve for incandescent lights which behaves as a simple, linear 0 to 100% voltage provider. This is the behavior seen with previous versions of the firmware and most DMX dimmer packs.

There is a built-in On/Off curve. This on/off 'curve' is used on a channel where the connected devices do not tolerate dimming, for example, the air blower motors in inflatables. Setting a channel configured for on/off operation to any intensity 50% or greater results in 100% intensity or 'on'. Intensities below 50% result in the channel being off.

Finally, a LED curve is provided which is the average for various LED colors and dimmable power supply configurations. This curve is provided with the software, so if you choose to change it you can recover the original. It is custom curve 1.

The g3 firmware permits the controller to accept up to eight downloaded, custom curves.

Each channel is configured with its own curve from the ten possible curves the controller may have available.

The default location for curve files is

…Light-O-Rama\DimmingCurves

The curve file names are LOR-Curve01.ldc through LOR-Curve08.ldc.

A curve file is a list of comma delimited numbers with as many numbers per line as you like. Text on a line preceded by '#' is treated as a comment.

There are 1024 numbers in a curve file. The first number represents off and the last full brightness. A number in the curve file is a value between 0 and 1023. The curve files map into the LOR brightness world for which LOR will provide a conversion utility.

Configuring Lighting Curves

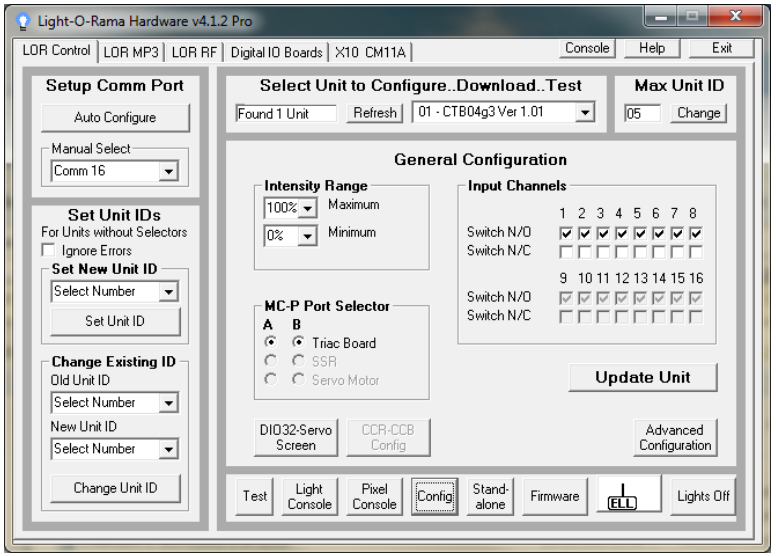
Each channel on the controller is assigned a lighting curve. Initially, all channels are configured with the Standard curve. See the *Lighting Curves* section for more information on what curves are and which curves come with the controller.

The Hardware Utility is used to read current curve information from the controller, download new curves to the controller and associate curves with the output channels.

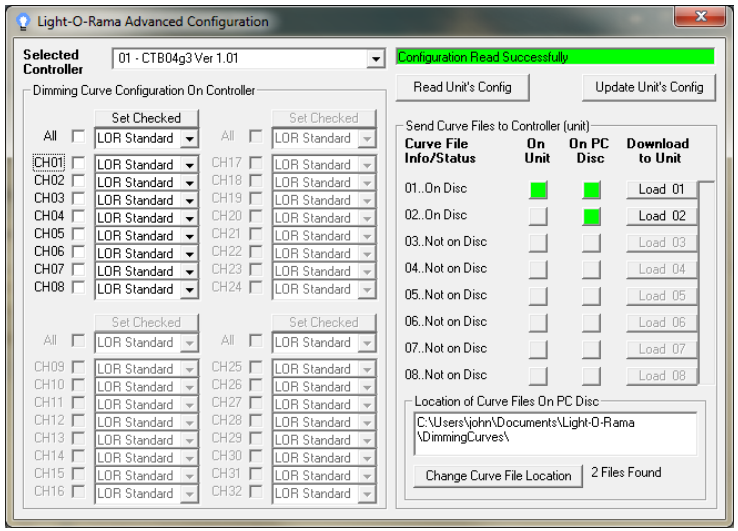
Start the Hardware Utility (see *the Assigning a Unit ID* section).

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 (or the maximum number of controllers you have configured.) This will limit the search for controllers to the first 10 unit IDs, otherwise 240 controllers would be searched for – taking a long time. Click the *Save* button.

Click the "Refresh" button to find your controller(s). Select a controller from the drop down menu to the right of the Refresh button. Then click the "Configure" button at the bottom of the window. You will see this window:



Click the "Advanced Configuration" button on the lower right. The Hardware Utility will read the current curve information from the controller, find the curve files on your PC (if any) and display this window:



This initial configuration shows all channels configured for the Standard curve, also shown is one custom curve file loaded into the controller and two custom curve files located on the PC disk.

The CTB04-PC and CTB04-PC-ELL] are 4 channel controllers so only the first 4 channels are usable.

To transfer a new curve from the PC to the controller or update an existing curve on the controller from the PC, click the appropriate "*Load nn*" button. The curve file on disk will be transferred to the controller. The vertical progress bar to the right of the "*Load nn*" buttons will indicate percent transferred to controller.

The *Read Unit's Config* button will ask the controller for its channel to curve file mapping and show which custom curves are loaded into the controller.

Setting Multiple Channels in a Group

You can change the curve association with all channels by checking the "All" row above the first channel group. If you only want to change some of the channels, check their individual check boxes. Then use the drop down menu in the "All" row to select the curve for the checked channels and click the *Set Checked* button. Those channels will be changed to the curve selected. Finally, click the *Update Unit's Config* button to send the new curve configuration to the controller.

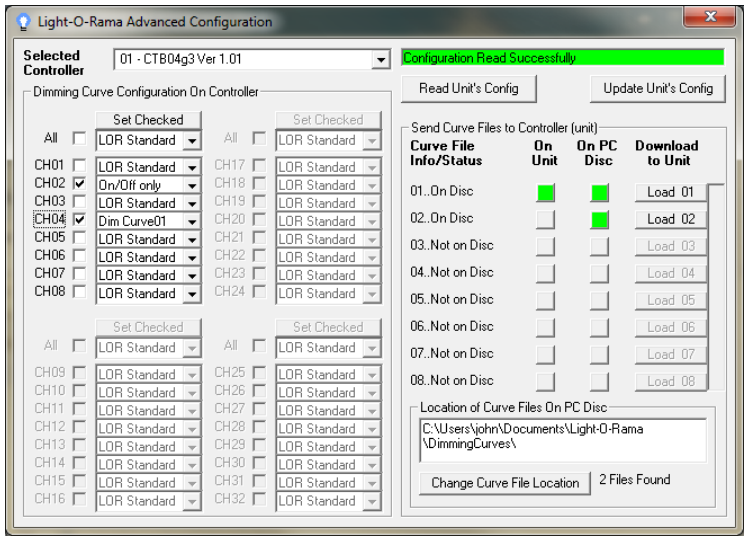
Setting Individual Channels

Do not check the "All" box, but do check the boxes to the left of the channels for which you want to change curves. Then use the drop down menu next to the checked box to select the curve you want for that channel. Finally, click the *Update Unit's Config* button to send the new curve configuration to the controller.

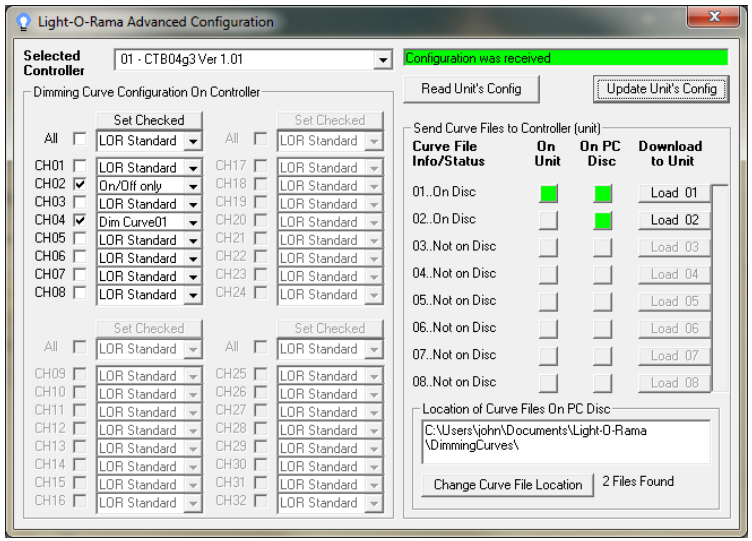
Note: If you configure a channel for a curve that does not exist in the controller, the Standard curve will be used.

Example

In the following example, channel 2 is being set to On/Off and channel 4 is being set to custom curve 01. The check boxes for channels 2 and 4 are checked and the drop down menus have been used to select the desired curves:



Clicking the *Update Unit's Config* button sends the new curve configuration to the controller. The controller is updated and the text in the upper right box changes to indicate this:



Hardware Description

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 or a Show Director)

LED is blinking fast: Controller is resetting because Switch 12 is ON. See the section on *Reset / Normal Operation*.

LED is not on at all: There is no power to the controller, verify power source with a working lamp. The fuse is blown – unplug the controller from AC power and replace the fuse.

Assigning a DMX Address

To set the DMX Address of a CTB04-PC controller, unplug the controller from AC power and use the table in Appendix A to select Switches 1-9's settings for the DMX starting address you want.

Assigning a Unit ID

To set the Unit ID, of a CTB-04PC or CTB04-PC-ELL, unplug the controller from AC power and use the table in Appendix A to select Switches 1-9's settings for the LOR Unit ID you want.

Each LOR light controller used in a network must have a unique ID assigned. [If two controllers are given the same unit ID, then they will both perform the same effects.] Every channel that you control in

a sequence (A Sequence is a set of lighting controller commands constructed using the Showtime Windows software) has to identify a particular output circuit on a particular lighting controller (Unit.)

For example, in a sequence that you construct, a channel you call “Front door” may be assigned to Unit ID 03 circuit 3. Because the controllers are daisy chained together, every controller sees every command sent but Unit 03 will only react to commands that are marked “for Unit 03.”

Resetting the Controller

To reset the controller, unplug the AC power, turn Switch 12 to ON and plug the controller back into AC power. The Status LED should flash rapidly indicating the controller has been reset. Unplug the controller from AC power and turn Switch 12 OFF to return the controller to normal operation.

Wireless Status LEDs

See the RFV5 Manual available at www.lightorama.com ►Easy Light Linker ►User Guide.

Testing with the Hardware Utility

Use this section to learn how to connect your controller to your PC. If you have already installed the RS485 adapter and verified its operation with another controller, you can skip to the *PC Communications Configured* section.

Once power has been supplied to the controller the Status LED flash twice/second – see the *Status*

LED section. This indicates that the Unit is functioning and that there is no communication. Once communication with a PC, Show Director or another controller is established, the Status LED will light continuously.

Installing LOR Software

You must have the LOR ShowTime software installed on your PC to proceed. Follow the instructions that came with the software to install it.

Connecting Controller-to-PC Data Cable

If you want to experiment with the lighting controller using the LOR Windows Software, you will have to install an RS485 adapter so you can talk to it from your PC.

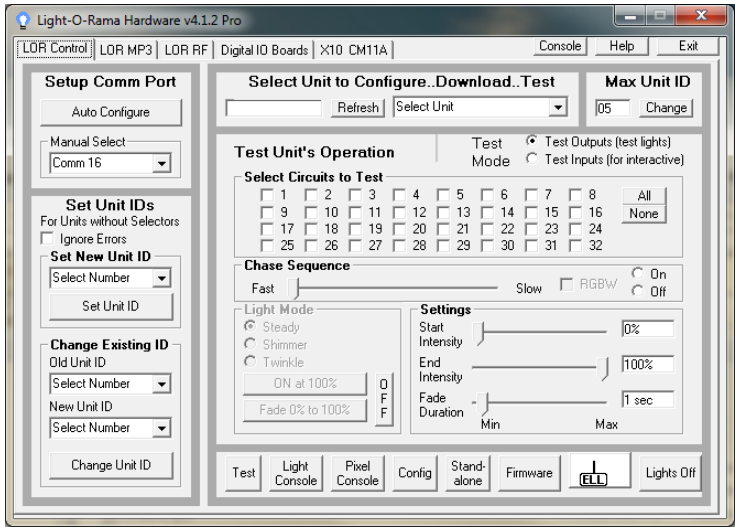
If you have an SC485 (PC serial port adapter, shown on the left in the following picture), you need only plug it into an available PC 9-pin serial port. The cable from this serial adapter to the controller is limited to 100’ or less.

If you have one of the USB adapters (shown in the previous picture on the center and right), follow the installation instructions that came with the adapter to install it. If your adapter has two RJ45 jacks, you can use either.

Plug one end of the Cat5 data cable into the adapter and the other end into either of the *RJ45 In or Out* jacks on your controller.

Configuring the PC Communications Port

First start the Showtime software control panel by clicking ***start ► All Programs ► Light-O-Rama ► Light-O-Rama Control Panel.*** There will be a light bulb with a red halo on the right side of the task bar at the bottom of the screen. Right-click the light bulb and select *Hardware Utility* (HWU) from the menu. You will see this window:



With your controller powered up and cabled to your PC, click the *Auto Configure* button on the top left. The HWU will pop up a window asking you to make sure everything is connected, click OK. It will then search through all ports on your PC looking for the port being used by Light O Rama and you will see this window like this one:

Click *OK*, your RS485 adapter has been located and is functioning properly. This will also make this port available to other LOR software, like the Sequence Editor which is used to create your lighting control sequences. See the *Troubleshooting* section if you have problems.

PC Communications Configured

> Tip: Under “Max Units” on the upper right, click the *Change* button and move the slider to select 10 units. This will cut down the scan time because the HWU will not have to scan for 240 controllers. Click OK.

Click the *Refresh* button (center top of window) to have the Hardware Utility scan for all controllers attached to the PC. When it finishes, the drop down menu to the right of the *Refresh* button will list all controllers found. Use this menu to select your controller. See the *Troubleshooting* section if you have problems.

You can use the “Test Unit’s Operation” portion of the window to test the controller. Make sure you have some lights plugged into the controller and use the various options to test the lights.

This is a good time to experiment with different intensities, fade rates and chase speeds. This

information will be useful if you want to create your own light shows.

Stand Alone Operation

A standalone animation sequence (sequence with no accompanying audio) can be downloaded into the flash memory of the lighting controller.

This sequence can contain approximately 10,000 lighting commands. These commands can also be for controllers other than this controller, so this controller can direct a network of controllers. There are no restrictions on the types of LOR 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 lighting controller. Use the drop down menu next to the *Refresh* button to select the controller.

Click the *Standalone* button at the bottom of the window. Select “Run when power is on” because the CTB04-PC and CTB04-PC-ELL have no inputs.

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

You also use this screen to remove downloaded standalone sequences. You can also remove a standalone sequence by resetting the controller, see the *Resetting the Controller* section.

Troubleshooting

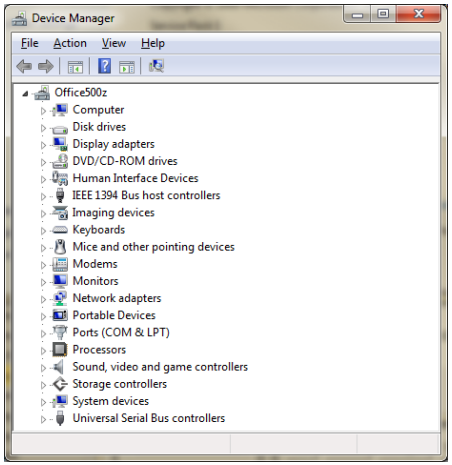
Autoconfigure does not find COM Port

If the automatic method of determining the communication port used by LOR does not work, you may be able to locate the port and select it manually.

If you have an SC485 serial port RS485 adapter, you will have to examine the connection on your computer or consult the owner’s manual to determine which port it is plugged into. It is usually Comm1 or Comm2.

If you have a USB485 or USB485B serial port adapter, use the following procedure to find the communications port.

Click **start ► My Computer** or **Computer ► View System Information** or **System Properties** If there is a Hardware tab, click it. Then click “Device Manager.” You should see a *Device Manager* window like this one:



Scroll down and expand “Ports (COM & LPT).” You should see a “USB Serial Port (COMn).” This is your LOR communications port. Use the *Manual Select* drop down menu in the Hardware Utility to select this port. Proceed with your testing.

Refresh does not find the controller

You have previously successfully configured the comm port, manually selected the comm port or used another controller to Autoconfigure the comm port. In other words, you’re sure the RS485 adapter has been properly installed and is working. If this is not the case, consult the C*onfiguring the PC Communications Port* section.

When the controller is powered up but no data cable is connected to it, the Status LED should be blinking about twice/second. This means that the controller is working, but is not in communication with a Show Director or PC. If the Hardware Utility is running, the RS485 adapter is properly configured and you attach a cable from the RS485 adapter to the controller, this Status LED should go on solid. If this is not the case, then the RS485 adapter is not properly installed, the Hardware Utility is not running or some component is broken.

If the Status LED is on solid, then manually type the Unit ID into the box to the right of the *Refresh* button in the Hardware Utility. Connect some lights to the controller and try clicking the ‘On at 100%’ button in the “Test Unit’s Operation’ section. If the lights come on, your controller is working. If no good at this point, contact LOR support.

Warnings and Liability

WARNING: The CTB04-PC and CTB04-PC-ELL can pose a dangerous electrical hazard if not used properly. Care should be taken to keep the inside of the controller dry. When the controller is directly connected to a PC via one of the RS485 adaptors, there is a direct electrical connection between the low voltage logic side of the controller and the PC. If the controller is physically damaged causing traces to short or the device is allowed to get wet inside, either through direct contact with water or condensation, the logic side of the controller could receive direct line voltage. In that case damage to any connected hardware such as a PC can occur.

IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, NOR SHALL LIGHT-O-RAMA’s LIABILITY EXCEED THE PURCHASE PRICE OF THE GOODS.

Appendix A: Unit ID/DMX Switches

'1' means On and '0' means Off.

DMX Start	LOR ID	Switch 1-9	DMX Start	Switch 1-9
1	01	0 0000 0001	257	1 0000 0001
2	02	0 0000 0010	258	1 0000 0010
3	03	0 0000 0011	259	1 0000 0011
4	04	0 0000 0100	260	1 0000 0100
5	05	0 0000 0101	261	1 0000 0101
6	06	0 0000 0110	262	1 0000 0110
7	07	0 0000 0111	263	1 0000 0111
8	08	0 0000 1000	264	1 0000 1000
9	09	0 0000 1001	265	1 0000 1001
10	0A	0 0000 1010	266	1 0000 1010
11	0B	0 0000 1011	267	1 0000 1011
12	0C	0 0000 1100	268	1 0000 1100
13	0D	0 0000 1101	269	1 0000 1101
14	0E	0 0000 1110	270	1 0000 1110
15	0F	0 0000 1111	271	1 0000 1111
16	10	0 0001 0000	272	1 0001 0000
17	11	0 0001 0001	273	1 0001 0001
18	12	0 0001 0010	274	1 0001 0010
19	13	0 0001 0011	275	1 0001 0011
20	14	0 0001 0100	276	1 0001 0100
21	15	0 0001 0101	277	1 0001 0101
22	16	0 0001 0110	278	1 0001 0110
23	17	0 0001 0111	279	1 0001 0111
24	18	0 0001 1000	280	1 0001 1000
25	19	0 0001 1001	281	1 0001 1001
26	1A	0 0001 1010	282	1 0001 1010
27	1B	0 0001 1011	283	1 0001 1011
28	1C	0 0001 1100	284	1 0001 1100
29	1D	0 0001 1101	285	1 0001 1101
30	1E	0 0001 1110	286	1 0001 1110
31	1F	0 0001 1111	287	1 0001 1111
32	20	0 0010 0000	288	1 0010 0000
33	21	0 0010 0001	289	1 0010 0001
34	22	0 0010 0010	290	1 0010 0010
35	23	0 0010 0011	291	1 0010 0011
36	24	0 0010 0100	292	1 0010 0100
37	25	0 0010 0101	293	1 0010 0101
38	26	0 0010 0110	294	1 0010 0110

39	27	0 0010 0111	295	1 0010 0111
40	28	0 0010 1000	296	1 0010 1000
41	29	0 0010 1001	297	1 0010 1001
42	2A	0 0010 1010	298	1 0010 1010
43	2B	0 0010 1011	299	1 0010 1011
44	2C	0 0010 1100	300	1 0010 1100
45	2D	0 0010 1101	301	1 0010 1101
46	2E	0 0010 1110	302	1 0010 1110
47	2F	0 0010 1111	303	1 0010 1111
48	30	0 0011 0000	304	1 0011 0000
49	31	0 0011 0001	305	1 0011 0001
50	32	0 0011 0010	306	1 0011 0010
51	33	0 0011 0011	307	1 0011 0011
52	34	0 0011 0100	308	1 0011 0100
53	35	0 0011 0101	309	1 0011 0101
54	36	0 0011 0110	310	1 0011 0110
55	37	0 0011 0111	311	1 0011 0111
56	38	0 0011 1000	312	1 0011 1000
57	39	0 0011 1001	313	1 0011 1001
58	3A	0 0011 1010	314	1 0011 1010
59	3B	0 0011 1011	315	1 0011 1011
60	3C	0 0011 1100	316	1 0011 1100
61	3D	0 0011 1101	317	1 0011 1101
62	3E	0 0011 1110	318	1 0011 1110
63	3F	0 0011 1111	319	1 0011 1111
64	40	0 0100 0000	320	1 0100 0000
65	41	0 0100 0001	321	1 0100 0001
66	42	0 0100 0010	322	1 0100 0010
67	43	0 0100 0011	323	1 0100 0011
68	44	0 0100 0100	324	1 0100 0100
69	45	0 0100 0101	325	1 0100 0101
70	46	0 0100 0110	326	1 0100 0110
71	47	0 0100 0111	327	1 0100 0111
72	48	0 0100 1000	328	1 0100 1000
73	49	0 0100 1001	329	1 0100 1001
74	4A	0 0100 1010	330	1 0100 1010
75	4B	0 0100 1011	331	1 0100 1011
76	4C	0 0100 1100	332	1 0100 1100
77	4D	0 0100 1101	333	1 0100 1101
78	4E	0 0100 1110	334	1 0100 1110
79	4F	0 0100 1111	335	1 0100 1111
80	50	0 0101 0000	336	1 0101 0000
81	51	0 0101 0001	337	1 0101 0001
82	52	0 0101 0010	338	1 0101 0010

83	53	0 0101 0011	339	1 0101 0011
84	54	0 0101 0100	340	1 0101 0100
85	55	0 0101 0101	341	1 0101 0101
86	56	0 0101 0110	342	1 0101 0110
87	57	0 0101 0111	343	1 0101 0111
88	58	0 0101 1000	344	1 0101 1000
89	59	0 0101 1001	345	1 0101 1001
90	5A	0 0101 1010	346	1 0101 1010
91	5B	0 0101 1011	347	1 0101 1011
92	5C	0 0101 1100	348	1 0101 1100
93	5D	0 0101 1101	349	1 0101 1101
94	5E	0 0101 1110	350	1 0101 1110
95	5F	0 0101 1111	351	1 0101 1111
96	60	0 0110 0000	352	1 0110 0000
97	61	0 0110 0001	353	1 0110 0001
98	62	0 0110 0010	354	1 0110 0010
99	63	0 0110 0011	355	1 0110 0011
100	64	0 0110 0100	356	1 0110 0100
101	65	0 0110 0101	357	1 0110 0101
102	66	0 0110 0110	358	1 0110 0110
103	67	0 0110 0111	359	1 0110 0111
104	68	0 0110 1000	360	1 0110 1000
105	69	0 0110 1001	361	1 0110 1001
106	6A	0 0110 1010	362	1 0110 1010
107	6B	0 0110 1011	363	1 0110 1011
108	6C	0 0110 1100	364	1 0110 1100
109	6D	0 0110 1101	365	1 0110 1101
110	6E	0 0110 1110	366	1 0110 1110
111	6F	0 0110 1111	367	1 0110 1111
112	70	0 0111 0000	368	1 0111 0000
113	71	0 0111 0001	369	1 0111 0001
114	72	0 0111 0010	370	1 0111 0010
115	73	0 0111 0011	371	1 0111 0011
116	74	0 0111 0100	372	1 0111 0100
117	75	0 0111 0101	373	1 0111 0101
118	76	0 0111 0110	374	1 0111 0110
119	77	0 0111 0111	375	1 0111 0111
120	78	0 0111 1000	376	1 0111 1000
121	79	0 0111 1001	377	1 0111 1001
122	7A	0 0111 1010	378	1 0111 1010
123	7B	0 0111 1011	379	1 0111 1011
124	7C	0 0111 1100	380	1 0111 1100
125	7D	0 0111 1101	381	1 0111 1101
126	7E	0 0111 1110	382	1 0111 1110

127	7F	0 0111 1111	383	1 0111 1111
128	80	0 1000 0000	384	1 1000 0000
129	81	0 1000 0001	385	1 1000 0001
130	82	0 1000 0010	386	1 1000 0010
131	83	0 1000 0011	387	1 1000 0011
132	84	0 1000 0100	388	1 1000 0100
133	85	0 1000 0101	389	1 1000 0101
134	86	0 1000 0110	390	1 1000 0110
135	87	0 1000 0111	391	1 1000 0111
136	88	0 1000 1000	392	1 1000 1000
137	89	0 1000 1001	393	1 1000 1001
138	8A	0 1000 1010	394	1 1000 1010
139	8B	0 1000 1011	395	1 1000 1011
140	8C	0 1000 1100	396	1 1000 1100
141	8D	0 1000 1101	397	1 1000 1101
142	8E	0 1000 1110	398	1 1000 1110
143	8F	0 1000 1111	399	1 1000 1111
144	90	0 1001 0000	400	1 1001 0000
145	91	0 1001 0001	401	1 1001 0001
146	92	0 1001 0010	402	1 1001 0010
147	93	0 1001 0011	403	1 1001 0011
148	94	0 1001 0100	404	1 1001 0100
149	95	0 1001 0101	405	1 1001 0101
150	96	0 1001 0110	406	1 1001 0110
151	97	0 1001 0111	407	1 1001 0111
152	98	0 1001 1000	408	1 1001 1000
153	99	0 1001 1001	409	1 1001 1001
154	9A	0 1001 1010	410	1 1001 1010
155	9B	0 1001 1011	411	1 1001 1011
156	9C	0 1001 1100	412	1 1001 1100
157	9D	0 1001 1101	413	1 1001 1101
158	9E	0 1001 1110	414	1 1001 1110
159	9F	0 1001 1111	415	1 1001 1111
160	A0	0 1010 0000	416	1 1010 0000
161	A1	0 1010 0001	417	1 1010 0001
162	A2	0 1010 0010	418	1 1010 0010
163	A3	0 1010 0011	419	1 1010 0011
164	A4	0 1010 0100	420	1 1010 0100
165	A5	0 1010 0101	421	1 1010 0101
166	A6	0 1010 0110	422	1 1010 0110
167	A7	0 1010 0111	423	1 1010 0111
168	A8	0 1010 1000	424	1 1010 1000
169	A9	0 1010 1001	425	1 1010 1001
170	AA	0 1010 1010	426	1 1010 1010

171	AB	0 1010 1011	427	1 1010 1011
172	AC	0 1010 1100	428	1 1010 1100
173	AD	0 1010 1101	429	1 1010 1101
174	AE	0 1010 1110	430	1 1010 1110
175	AF	0 1010 1111	431	1 1010 1111
176	B0	0 1011 0000	432	1 1011 0000
177	B1	0 1011 0001	433	1 1011 0001
178	B2	0 1011 0010	434	1 1011 0010
179	B3	0 1011 0011	435	1 1011 0011
180	B4	0 1011 0100	436	1 1011 0100
181	B5	0 1011 0101	437	1 1011 0101
182	B6	0 1011 0110	438	1 1011 0110
183	B7	0 1011 0111	439	1 1011 0111
184	B8	0 1011 1000	440	1 1011 1000
185	B9	0 1011 1001	441	1 1011 1001
186	BA	0 1011 1010	442	1 1011 1010
187	BB	0 1011 1011	443	1 1011 1011
188	BC	0 1011 1100	444	1 1011 1100
189	BD	0 1011 1101	445	1 1011 1101
190	BE	0 1011 1110	446	1 1011 1110
191	BF	0 1011 1111	447	1 1011 1111
192	C0	0 1100 0000	448	1 1100 0000
193	C1	0 1100 0001	449	1 1100 0001
194	C2	0 1100 0010	450	1 1100 0010
195	C3	0 1100 0011	451	1 1100 0011
196	C4	0 1100 0100	452	1 1100 0100
197	C5	0 1100 0101	453	1 1100 0101
198	C6	0 1100 0110	454	1 1100 0110
199	C7	0 1100 0111	455	1 1100 0111
200	C8	0 1100 1000	456	1 1100 1000
201	C9	0 1100 1001	457	1 1100 1001
202	CA	0 1100 1010	458	1 1100 1010
203	CB	0 1100 1011	459	1 1100 1011
204	CC	0 1100 1100	460	1 1100 1100
205	CD	0 1100 1101	461	1 1100 1101
206	CE	0 1100 1110	462	1 1100 1110
207	CF	0 1100 1111	463	1 1100 1111
208	D0	0 1101 0000	464	1 1101 0000
209	D1	0 1101 0001	465	1 1101 0001
210	D2	0 1101 0010	466	1 1101 0010
211	D3	0 1101 0011	467	1 1101 0011
212	D4	0 1101 0100	468	1 1101 0100
213	D5	0 1101 0101	469	1 1101 0101
214	D6	0 1101 0110	470	1 1101 0110

215	D7	0 1101 0111	471	1 1101 0111
216	D8	0 1101 1000	472	1 1101 1000
217	D9	0 1101 1001	473	1 1101 1001
218	DA	0 1101 1010	474	1 1101 1010
219	DB	0 1101 1011	475	1 1101 1011
220	DC	0 1101 1100	476	1 1101 1100
221	DD	0 1101 1101	477	1 1101 1101
222	DE	0 1101 1110	478	1 1101 1110
223	DF	0 1101 1111	479	1 1101 1111
224	E0	0 1110 0000	480	1 1110 0000
225	E1	0 1110 0001	481	1 1110 0001
226	E2	0 1110 0010	482	1 1110 0010
227	E3	0 1110 0011	483	1 1110 0011
228	E4	0 1110 0100	484	1 1110 0100
229	E5	0 1110 0101	485	1 1110 0101
230	E6	0 1110 0110	486	1 1110 0110
231	E7	0 1110 0111	487	1 1110 0111
232	E8	0 1110 1000	488	1 1110 1000
233	E9	0 1110 1001	489	1 1110 1001
234	EA	0 1110 1010	490	1 1110 1010
235	EB	0 1110 1011	491	1 1110 1011
236	EC	0 1110 1100	492	1 1110 1100
237	ED	0 1110 1101	493	1 1110 1101
238	EE	0 1110 1110	494	1 1110 1110
239	EF	0 1110 1111	495	1 1110 1111
240	F0	0 1111 0000	496	1 1111 0000
241		0 1111 0001	497	1 1111 0001
242		0 1111 0010	498	1 1111 0010
243		0 1111 0011	499	1 1111 0011
244		0 1111 0100	500	1 1111 0100
245		0 1111 0101	501	1 1111 0101
246		0 1111 0110	502	1 1111 0110
247		0 1111 0111	503	1 1111 0111
248		0 1111 1000	504	1 1111 1000
249		0 1111 1001	505	1 1111 1001
250		0 1111 1010	506	1 1111 1010
251		0 1111 1011	507	1 1111 1011
252		0 1111 1100	508	1 1111 1100
253		0 1111 1101	509	1 1111 1101
254		0 1111 1110	510	1 1111 1110
255		0 1111 1111	511	1 1111 1111
256		1 0000 0000	512	n/a

Specifications	Features
• **Channel Capacity**: maximum of 8 amps on a channel • **Controller Capacity**: CTB04-PC and CTB4-PC-ELL is 15 amps, • **Isolation**: Opto isolators are used to isolate triacs • **Supply Voltage**: 120VAC 50/60Hz • **Power Connections**: NEMA 5-15P NEMA 5-15R • **Control Input**: RS485 via RJ45 jacks or wireless via ELL transceiver • **Dimensions**: CTB04-PC: 8”w x 10h x 4”d; CTB04-PC-ELL: 8”w x 14 ¾” x 4”d	• **CTB04-PC:** DMX and LOR network support • **CTB04-PC-ELL**: LOR network • **Unit IDs**: Up to 240 controllers. Up to 3,840 channels. • **Fading**: 1000 levels used for smooth fading effects. Fades from 0.1 to 25 seconds. • **Dimming**: 100 levels (0%...100%) • **Effects**: Ramp, Fade, Intensity, Flicker, Shimmer • **Sequences**: Single internal sequence • **Presets**: High-burn and low-burn settings.

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