

Light-O-Rama



DIO32 DMX

32 Channel Digital I/O Controller

Daughter Boards: **DIO16AC** – 16 Channel Dimmer
DIO8RLY – 8 Channel Relay
DIO8ACF – 8 Channel Dimmer
DIO16IOS – 16 Channel Connector

User Manual
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Introduction

The Light-O-Rama (LOR) DIO32 is a 32 channel digital controller that can be used in a LOR Network or in a DMX512 universe to perform digital output, dimming control and servo control. Digital input is also possible in a LOR network. It has four eight-bit ports. Each eight-bit port can be configured independently.

There are four optional daughter boards that can be mixed and matched to create the controller required by your application. The daughter boards are:

- DIO8RLY – Eight channel relay board, each channel can handle 16 amps at 250 vac
- DIO8ACF – Eight channel, high power, 120/240 vac, 60 amp total, filtered triac dimming board
- DIO16AC – Sixteen channel, 12/24/120/240 vac, 60 amp total, triac dimming board
- DIO16IOS – Sixteen channel, screw terminal connection board

The 32 I/O channels are fully buffered and each channel is capable of sourcing or sinking 24 ma at 5 vdc. The DIO32 may be used without any of the daughter boards depending upon your application.

The Windows Showtime software is used to design and build *Sequences* (controller commands that may be choreographed to audio/music.) These user created sequences and/or pre-programmed musical sequences available from LOR are then arranged into *Shows*. These shows are played by your PC or one of the LOR Show Directors which command the controller(s).

What's in the Box

The box contains a DIO32 Digital I/O Controller and this user manual. The latest manual is also available at www.lightorama.com ► Support ► DIO32 User's Manual.

Important Considerations

***** WARNING *****

In order to provide maximum flexibility, the DIO32 can use a variety of power sources. Be sure to consult the **Hardware Description Checklist** section before connecting power to the board. If all the power related jumpers are not properly configured, the board may be irreparably damaged.

Hardware Utility Version

The version of the Hardware Utility appears in the title bar to the right of "Light-O-Rama Hardware." If the version number is less than 2.4.7, then you need a new Hardware Utility. The latest version is available for download at www.lightorama.com ► Support ► Software Downloads. Click the **Download** button to the left of the Hardware Utility and run the installer.

Port Capabilities

The four ports (A, B, C & D) are configured independently. An individual port (8 bits) can be all Digital Input, all Digital Output, all Dimming or all Servo Control.

Note that only ports C & D have 3-pin servo connectors but all ports can be used for servo control.

Software Control

The DIO32 appears in a LOR Network at the address set by its Unit ID switches. Each 8-bit port appears as a set of 8 channels in the Sequence Editor. Port A is channels 1-8, Port B is 9-16, Port C is 17-24 and Port D is 25-32.

The board also supports a “Legacy Mode” that causes the board to appear as two consecutive Unit IDs. The first ID is set by the Unit ID switches and represents Ports A & B. The second ID is at the Unit ID switches + 1 and represents Ports C & D. This allows the board to be used in environments where the maximum number of channels supported per controller is limited to 16. See the *Legacy Mode Jumper* section for more information.

Since the individual ports can be configured to do different functions (digital input, digital output, dimming or servo control) the behavior in the Sequence Editor depends upon how a particular port is configured.

Reading a port not configured for input returns a random result. An output command (intensity,

shimmer, fade, etc.) to a port configured for input will be ignored.

Digital Input Ports

Digital input ports are used to sense user inputs, normally to provide for interaction in shows. See the *How to Connect Input Switches* section for information on connecting push-buttons or switches.

Port A can also be used to start one internal stand alone animation sequence. See the *Stand Alone Operation* section for more information.

Digital Output Ports

A digital output port is ON for any intensity greater than zero, otherwise it is off. Shimmer will rapidly turn ON and OFF a digital output port. Twinkle will randomly turn ON and OFF a digital output port. Digital output ports are normally used to control relays.

Dimming Output Ports

These ports respond to Sequence Editor commands in the same way as a normal lighting controller. All effects are supported.

Servo Output Ports

These ports respond to Sequence Editor commands in the same way as a normal lighting controller. 0% intensity is fully left or counterclockwise (minimum pulse width), 50% intensity is centered and 100% intensity is fully right or clockwise (maximum pulse width.)

Servo pulses on a port do not start until the first command is received for that channel. If your sequence has all off at its start, then when the sequence starts the servo ports will start pulsing and go to the minimum pulse width (0% intensity.) Servo mechanical structures should be able to withstand servo position at minimum pulse width.

Servo pulses will stop when communication is lost to the controller and will restart when the first command is received for the channel corresponding to the servo port.

Note that shimmer and twinkle are not supported on servo ports.

Hardware Utility Configuration of Ports

The Hardware Utility is used to configure the servo pulse width ranges. If the port's selection switches are set to allow Hardware Utility configuration of inputs (refer to the *Port IO Select DIP Switches* section) then NO/NC can be set for each input bit individually.

The Hardware Utility will read the setting of the Port Select DIP switches to determine how the ports are being used.

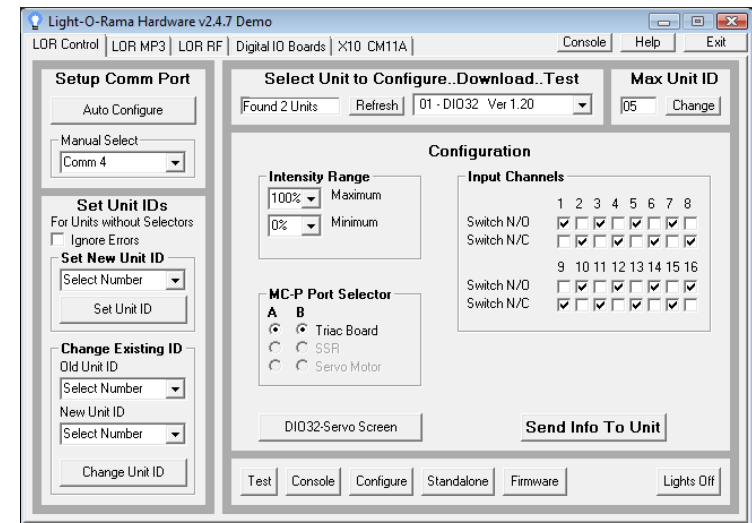
To configure the DIO32, start the Hardware Utility and click the *Digital IO Boards* tab. You will see the *Configuration* screen. This screen allows you to configure the NO/NC option for input ports. To switch to the *DIO32 – Servo Configuration* screen, click the *DIO32-Servo Screen* button on the lower left of the window. You can return to the Configuration screen by clicking the *Return to*

Config Screen button on the lower left of the Servo Configuration screen.

Currently the DIO32 supports only Legacy mode which means that it appears as two consecutive unit IDs starting with the unit ID set by the on-board switches.

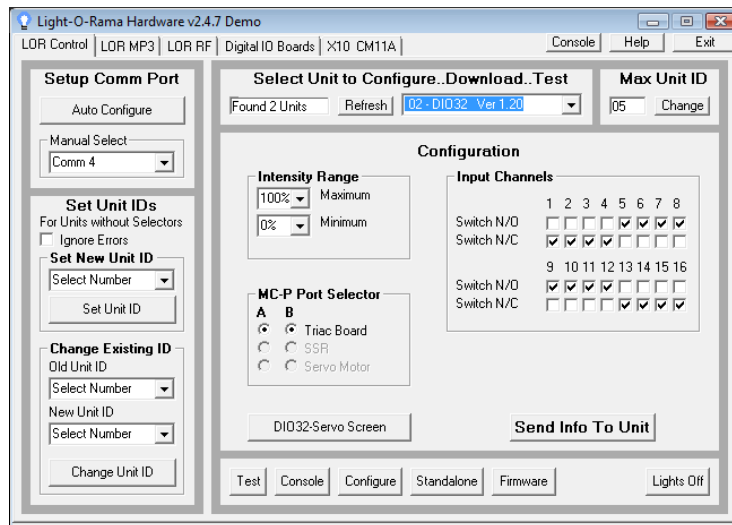
Setting Input NO/NC Selection

The following screen capture shows the *Digital IO Boards* tab configuration screen for the first unit ID, ports A & B. If the Port Select DIP switches are set to off-on-on-on for one or both ports, then you can set the NO/NC parameter for the inputs using this screen.



After setting the NO/NC parameter for the input ports, be sure to click the *Send Info To Unit* button so that the DIO32 will save these settings in its non-volatile memory.

The next screen capture shows the *Digital IO Boards* tab for the second unit ID:

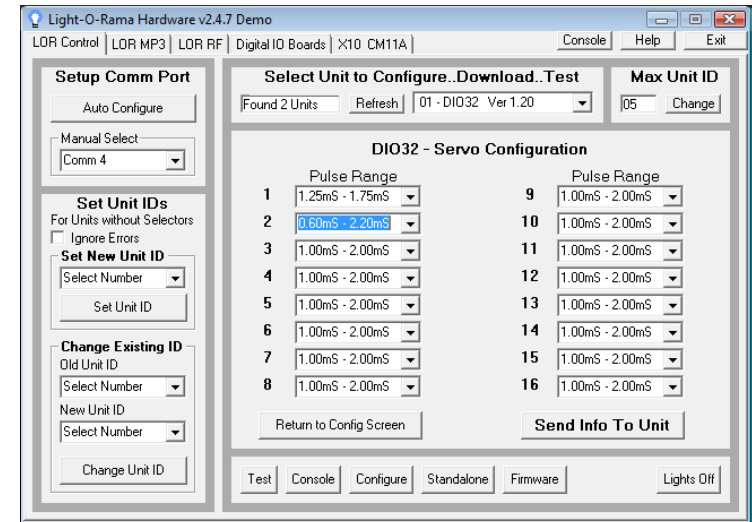


Setting Servo Pulse width ranges

The following pulse width ranges can be selected:

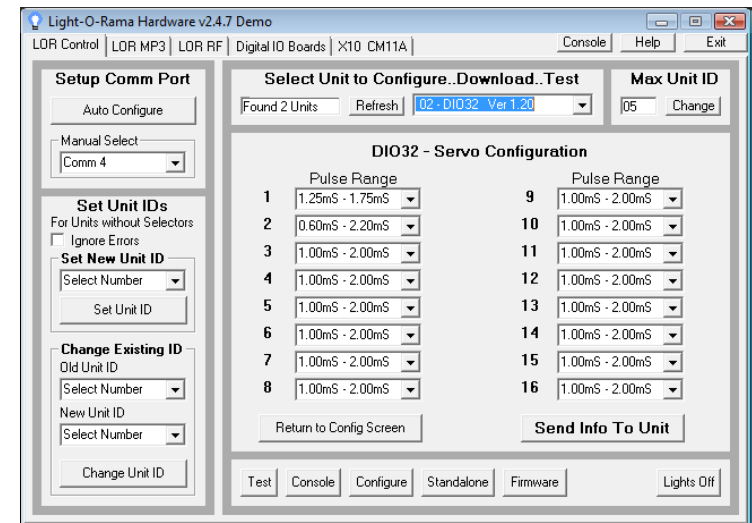
- 1.25ms - 1.75ms
- 1.20ms - 1.80ms
- 1.10ms - 1.90ms
- 1.00ms - 2.00ms
- 0.90ms - 2.10ms
- 0.80ms - 2.14ms
- 0.70ms - 2.18ms
- 0.60ms - 2.20ms

The following screen capture shows the Hardware Utility's *Digital IO Boards* tab after the *DIO32-Servo Screen* button has been clicked. Since the board is in Legacy mode, it shows up as two unit IDs. The first unit ID, shown below, sets the pulse widths for servo ports A & B:



After setting the pulse widths for the servo ports using the drop down menus, be sure to click the *Send Info To Unit* button so that the DIO32 will save these settings in its non-volatile memory.

The second unit ID, shown below, sets the pulse widths for servo ports C & D:



DMX Mode

The DIO32 automatically recognizes DMX512 protocol if the unit ID switches are set according to *Appendix B, LOR Unit ID to DMX Address*. The controller occupies 32 DMX addresses.

The DIO32 controller has RJ45 network connectors. You will need the LOR *RJ-45 to XLR 3-pin Male* connector to connect the controller to a DMX universe. It is available from the Web Store on the accessories page:

<http://store.lightorama.com/accessories.html>

After the first LOR controller, you can use Cat5e LAN cables to daisy chain additional DMX capable LOR controllers.

Input is not possible in DMX mode so ports configured for input will not be useable.

For digital output ports, a DMX intensity of 0 turns the port off (0 vdc) any non-zero DMX intensity will turn the output port on (+5 vdc.) If the Port Select DIP Switches select inverted output, the output voltages are reversed.

For dimmer ports, the triac/SSR duty cycle will be linearly set by the DMX intensity.

For servo ports, DMX intensity 0 is minimum pulse width (fully counterclockwise,) intensity 128 is median pulse width (centered) and 255 is maximum pulse width (fully clockwise.)

For more detailed information on DMX use of LOR controllers see:

<http://lightorama.com/Documents/DMX-DOC.pdf>

Hardware Description

Refer to the following picture for the hardware description. The upright orientation is shown below. Note that the *Light O Rama, Inc.* silk-screening is upright, the network connection jacks are on the upper right and the 16-pin port connection headers are on the bottom.



Hardware Configuration Checklist

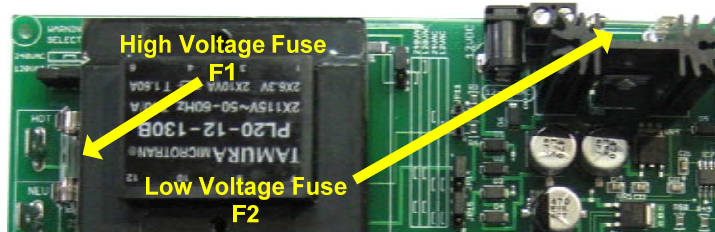
******* WARNING *******

Each of the following steps must be completed before powering up the DIO32. If all the power related jumpers are not properly configured, the board may be irreparably damaged.

1. The board must be powered down when making any changes to switches or jumpers.
2. See the *Legacy Mode* section for information on making this board appear as two consecutive 16 channel controllers.

3. Choose one of the *Powering with xxx* sections below and set the jumpers for your power source.
4. Refer to the *Port IO Select DIP Switches* section to set the desired function for Ports A, B, C & D.
5. Refer to the *Port DC Power Jumpers* section to connect the on-board DC power supplies to the 16 pin port connectors.
6. If you are using any ports for servo control, refer to the *Servo Power Connection* and *Servo Control 24 Pin Connectors* sections.
7. If you are using any ports for triac dimming control, refer to the *Zero-Cross Selection* section.

Fuses



F1 – This is a 1 amp 250 vac fuse used in the line voltage power supply. This fuse is required when running the DIO32 from 120 or 240 vac.

F2 – This is a 2 amp 32 vac fuse used in the low voltage power supply section of the DIO32. This fuse is always required for operation.

JP6 Header

No connections should be made to this header.

JP7 Header

This header is reserved for future expansion. No connections should be made to this header.

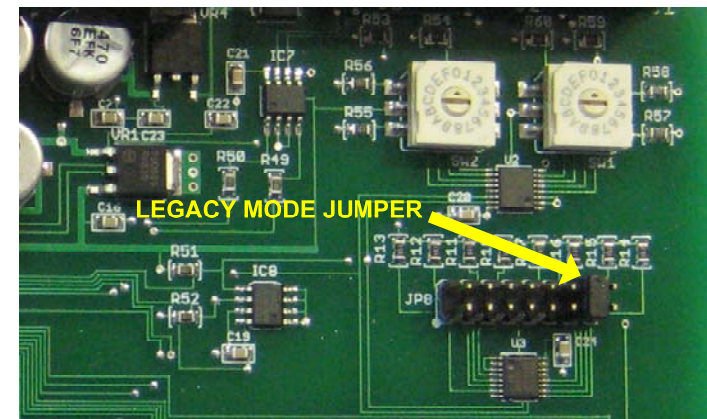
Legacy Mode Jumper

Note: Only legacy mode is supposed at this time and the jumper described below is not used.

In Legacy Mode, the DIO32 appears as two 16 channel controllers. The Unit ID switches set the address of the first controller. The second controller is at the address of the Unit ID switches + 1. If this jumper is not present, then the controller operates in normal mode, meaning it has one Unit ID with 32 channels.

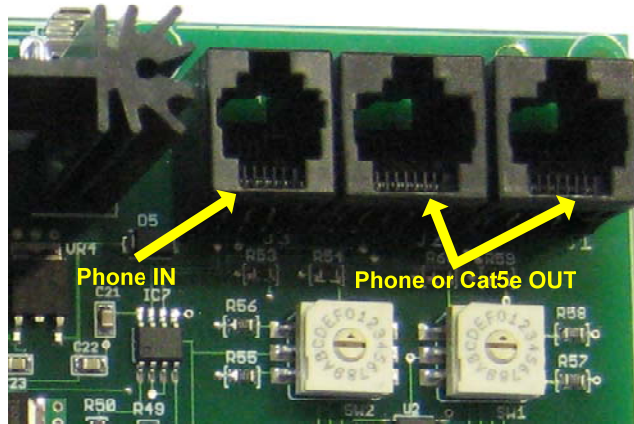
In Legacy Mode, ports A & B appear on the first controller ID with Port A being channels 1 to 8 and Port B being channels 9 to 16. Ports C & D appear on the second controller ID with Port C being channels 1 to 8 and Port D being channels 9 to 16.

To activate Legacy Mode, place a plastic jumper block on the 2nd vertical set or pins from the right on jumper header JP8. See picture below:



Network Connections

In order to use your DIO32, you must connect it to a Windows PC, a LOR Show Director or run it in stand alone mode (see the *Stand Alone Operation* section for more information.) The following picture labels the LOR network connectors:



Connecting to a PC

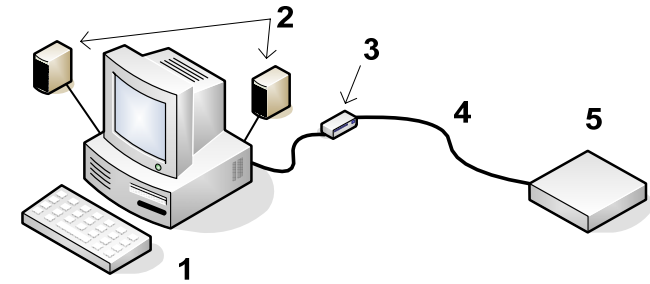
You will need the following to connect your DIO32 controller to a PC:

- Showtime Windows Software
- RS485 Adapter
- CAT5e LAN cable or phone cable
- Your DIO32 controller
- Windows PC running 98 SE, 2000, ME, XP or Vista

The first three items are available in the LOR SPK-ST Generic Starter Package. www.lightorama.com
 ► *Web 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, get the USB485B.

The following diagram shows how the pieces fit together:



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. Phone or CAT5e LAN cable
5. DIO32 controller in your enclosure

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

If you are using phone cable to connect the RS485 adapter to your controller, make sure you use the smaller "Phone In" jack on the DIO32. If you are using CAT5e LAN cable, you can use either of the larger jacks on the controller.

Connecting to a Show Director

You will need the following to connect your DIO32 controller to a Show Director:

DIO32

- LOR1602MP3 Show-in-a-Box controller (has an internal DC-MP3 Show Director), mDM-MP3 Show Director or DC-MP3 Show Director
- Phone or CAT5e LAN cable
- Your DIO32 controller

If you are using phone cable to connect a show director to the DIO32, you can use either jack on the show director. Make sure you use the smaller “Phone Cable In” jack on the DIO32.

If you are using CAT5e LAN cable, you can use either jack on the show director and either of the large jacks on the DIO32.

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. This 50’ limitation does not apply to the Show Director internal to the LOR1602MP3. It gets its power for the co-housed controller.

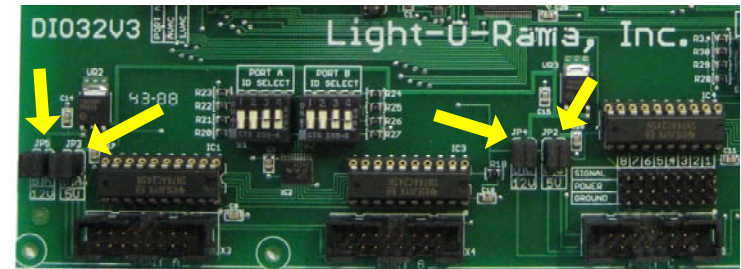
Connecting to another Controller

If you are using phone cable to connect two controllers together, always go from either of the large jacks on one controller to the smaller “Phone In” jack on other controller.

If you are using CAT5e LAN cable, you can go from either large jack on one controller to either large jack on the other controller.

DIO32

Port DC Power Jumpers



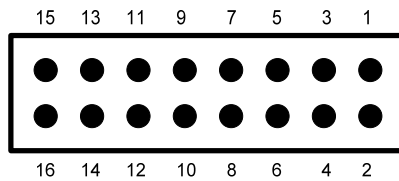
These jumpers allow the on-board 5 and 12 vdc power supplies to be connected through to the 16-pin port headers. These connections are required by some of the LOR daughter boards available for use for this controller.

The total draw on the 5 vdc power must be kept under 1 amp. Likewise, the total draw on the 12 vdc power supply must be kept under 1 amp. Both the 5 and 12 volt supplies may draw their 1 amp simultaneously.

For example, if you place a vertical jumper on the right two pins of JP3, then the 5 vdc supply will appear on pin 9 of the port A 16-pin header. See the *Port 16-Pin Connectors* section for more information.

Port 16-Pin Connectors

The next diagram shows one of the four 16-pin port headers.



1. I/O channel 5
2. I/O channel 1
3. I/O channel 6
4. I/O channel 2
5. I/O channel 7
6. I/O channel 3
7. I/O channel 8
8. I/O channel 4
9. 5 vdc (optional, see the *Port DC Power Jumpers* section)
10. Ground
11. Zero-Cross input (optional, see the *Zero-Cross Selection* section)
12. 12 vdc (optional, see the *Port DC Power Jumpers* section)
13. Reserved, do not use
14. Reserved, do not use
15. Reserved, do not use
16. Reserved, do not use

Unit ID to Sequence Editor Channel

The Following table shows the mapping of I/O channels described above to Sequence Editor channels:

Port, I/O channel	Normal Mode	Legacy Mode
A, 1	Unit ID, Chan 1	Unit ID, Chan 1
A, 2	Unit ID, Chan 2	Unit ID, Chan 2
A, 3	Unit ID, Chan 3	Unit ID, Chan 3
A, 4	Unit ID, Chan 4	Unit ID, Chan 4
A, 5	Unit ID, Chan 5	Unit ID, Chan 5
A, 6	Unit ID, Chan 6	Unit ID, Chan 6
A, 7	Unit ID, Chan 7	Unit ID, Chan 7
A, 8	Unit ID, Chan 8	Unit ID, Chan 8
B, 1	Unit ID, Chan 9	Unit ID, Chan 9
B, 2	Unit ID, Chan 10	Unit ID, Chan 10
B, 3	Unit ID, Chan 11	Unit ID, Chan 11
B, 4	Unit ID, Chan 12	Unit ID, Chan 12
B, 5	Unit ID, Chan 13	Unit ID, Chan 13
B, 6	Unit ID, Chan 14	Unit ID, Chan 14
B, 7	Unit ID, Chan 15	Unit ID, Chan 15
B, 8	Unit ID, Chan 16	Unit ID, Chan 16
C, 1	Unit ID, Chan 17	Unit ID+1, Chan 1
C, 2	Unit ID, Chan 18	Unit ID+1, Chan 2
C, 3	Unit ID, Chan 19	Unit ID+1, Chan 3
C, 4	Unit ID, Chan 20	Unit ID+1, Chan 4

C, 5	Unit ID, Chan 21	Unit ID+1, Chan 5
C, 6	Unit ID, Chan 22	Unit ID+1, Chan 6
C, 7	Unit ID, Chan 23	Unit ID+1, Chan 7
C, 8	Unit ID, Chan 24	Unit ID+1, Chan 8
D, 1	Unit ID, Chan 25	Unit ID+1, Chan 9
D, 2	Unit ID, Chan 26	Unit ID+1, Chan 10
D, 3	Unit ID, Chan 27	Unit ID+1, Chan 11
D, 4	Unit ID, Chan 28	Unit ID+1, Chan 12
D, 5	Unit ID, Chan 29	Unit ID+1, Chan 13
D, 6	Unit ID, Chan 30	Unit ID+1, Chan 14
D, 7	Unit ID, Chan 31	Unit ID+1, Chan 15
D, 8	Unit ID, Chan 32	Unit ID+1, Chan 16

Port IO Select DIP Switches

The following table shows the affect of setting a Port's Select DIP Switch to various values. There is one DIP switch for each 8-bit port. The ports are configured independently.

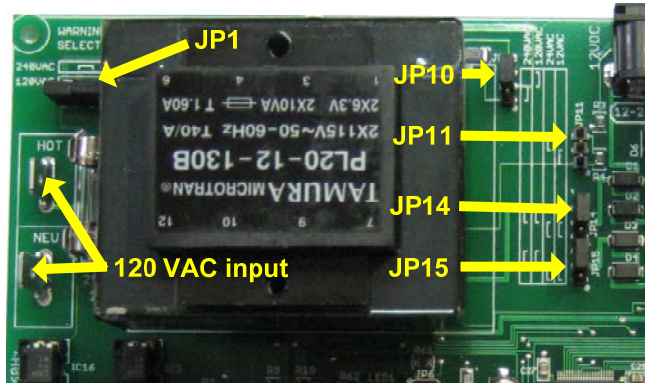
DIP Switch	Function
off-off-off-off	Digital Input – NO switch
off-off-off-on	Digital Input – NC switch
off-off-on-off	Digital Output
off-off-on-on	Digital Output (inverted)
off-on-off-off	Dimming, use port A zero cross
off-on-off-on	Dimming, use zero cross from individual port
off-on-on-off	Servo control
off-on-on-on	Digital Input – Hardware Utility sets NO/NC

NO means Normally Open – meaning that the channel will read as ON if there is +5 vdc present at the header pin.

NC means Normally Closed so the channel reads as ON when 0 vdc is present at the header pin.

Powering with 120 vac

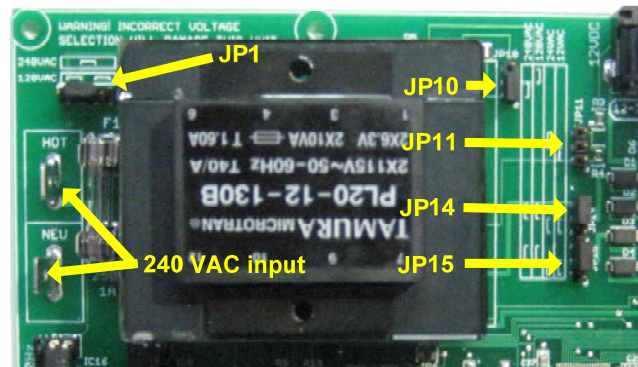
Referring to the following picture:



- JP1 – two jumpers, side by side
- JP10 – jumper on top two pins
- JP11 – no jumpers
- JP14 – jumper on top two pins
- JP15 – Jumper on top two pins
- 120 vac power to terminals AC1 & AC2

Powering with 240 vac

Referring to the following picture:

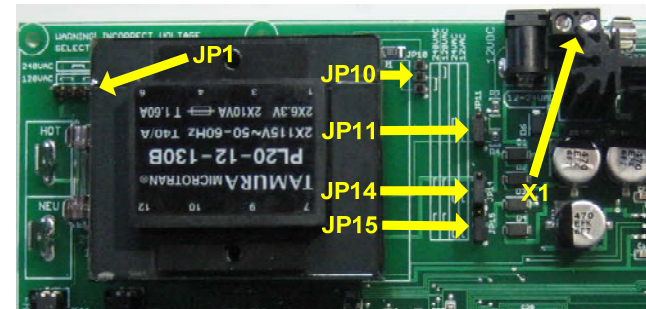


- JP1 – one jumper on center two pins

- JP10 – jumper on bottom two pins
- JP11 – no jumpers
- JP14 – jumper on top two pins
- JP15 – Jumper on top two pins
- 240 vac power to terminals AC1 & AC2

Powering with 12 vac

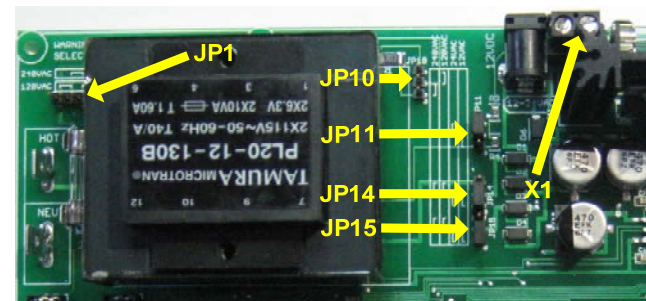
Referring to the following picture:



- JP1 – no jumpers
- JP10 – no jumpers
- JP11 – jumper on bottom two pins
- JP14 – jumper on bottom two pins
- JP15 – Jumper on bottom two pins
- 12 vac power to screw terminals X1

Powering with 24 vac

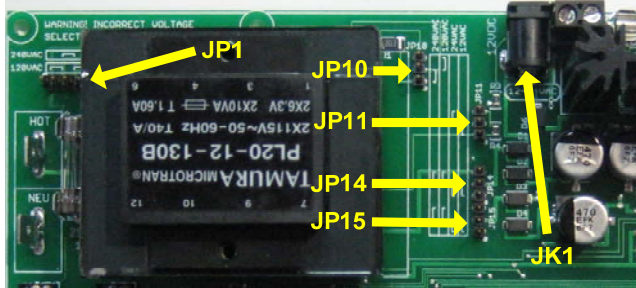
Referring to the following picture:



- JP1 – no jumpers
- JP10 – no jumpers
- JP11 – jumper on top two pins
- JP14 – jumper on bottom two pins
- JP15 – Jumper on bottom two pins
- 24 vac power to screw terminals X1

Powering with 12 vdc

Referring to the following picture:

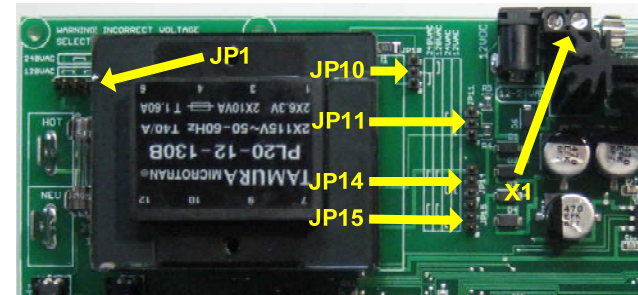


- JP1 – no jumpers
- JP10 – no jumpers
- JP11 – no jumpers
- JP14 – no jumpers
- JP15 – no jumpers
- 12 vdc (± 0.5 volts) power to barrel jack JK1, center pin positive

Note: on board zero-cross detector is disabled when using DC power.

Powering with 15 to 36 vdc

Referring to the following picture:

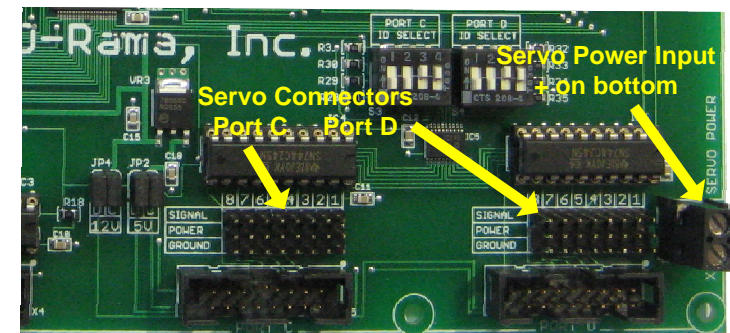


- JP1 – no jumpers
- JP10 – no jumpers
- JP11 – no jumpers
- JP14 – no jumpers
- JP15 – no jumpers
- 15 to 36 vdc power to screw terminals X1, right screw terminal is positive

Note: on board zero-cross detector is disabled when using DC power

Servo Control Connectors (24 Pin)

Ports C & D may be used to control servos. DC Servo power must be supplied to the screw terminals to the right of the servo connection headers. See the next section for more info on servo power.



On the servo connection headers, the top row of pins is the servo control pulse outputs. The middle row is positive power and the bottom row is ground.

Sequence Editor Channel to Servo Port

The following table shows the Sequence Editor Channel number to servo port connection:

Port and Servo #	Normal Mode	Legacy Mode
C, 1	Unit ID, Chan 17	Unit ID+1, Chan 1
C, 2	Unit ID, Chan 18	Unit ID+1, Chan 2
C, 3	Unit ID, Chan 19	Unit ID+1, Chan 3
C, 4	Unit ID, Chan 20	Unit ID+1, Chan 4
C, 5	Unit ID, Chan 21	Unit ID+1, Chan 5
C, 6	Unit ID, Chan 22	Unit ID+1, Chan 6
C, 7	Unit ID, Chan 23	Unit ID+1, Chan 7
C, 8	Unit ID, Chan 24	Unit ID+1, Chan 8
D, 1	Unit ID, Chan 25	Unit ID+1, Chan 9
D, 2	Unit ID, Chan 26	Unit ID+1, Chan 10
D, 3	Unit ID, Chan 27	Unit ID+1, Chan 11
D, 4	Unit ID, Chan 28	Unit ID+1, Chan 12
D, 5	Unit ID, Chan 29	Unit ID+1, Chan 13
D, 6	Unit ID, Chan 30	Unit ID+1, Chan 14
D, 7	Unit ID, Chan 31	Unit ID+1, Chan 15
D, 8	Unit ID, Chan 32	Unit ID+1, Chan 16

Servo Power Connection

Due to the voltage and current requirements of servos, the on-board power supplies cannot be used to power servo actuators. DC servo power must be brought into the board using screw terminals X2 located on the lower right edge of the board.

Status LED1

- Blinks twice per second if the DIO32 has booted correctly
- Solid on if the DIO32 sees a network director – either a PC or Show Director
- Blinks one long on and a short off repeatedly if in the bootloader. This means that the firmware is not loaded or corrupted. See the *Updating the DIO32 Firmware* section to load firmware

Status LED2

Reserved for future use.

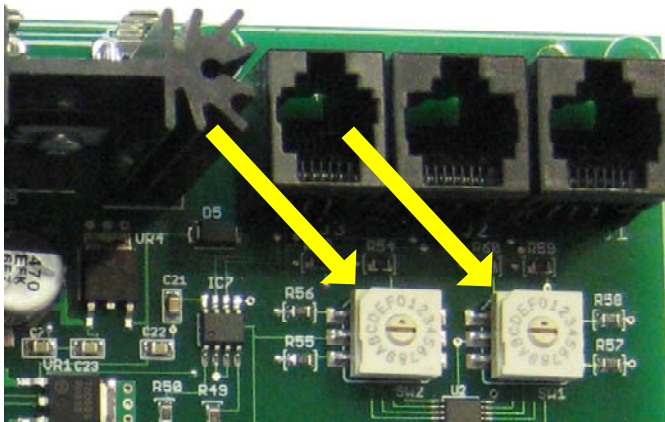
Unit ID Switches

Each LOR controller used in a network must have a Unit 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 controller commands constructed using the Showtime Windows software) has to identify a particular output circuit (or channel) on a particular controller (Unit.)

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For example, in a sequence that you construct, a channel you call “Front door” may be assigned to Unit ID 03 circuit 10. Because the controllers are daisy chained together, every controller sees every command sent but only Unit 03 will react to commands that are marked “for Unit 03.”

The two hexadecimal rotary dip switches (shown in the next picture) are used to set a controller’s Unit ID. Valid Unit ID values are 01 to F0 hex(1 to 240 decimal.) 00 is not a valid Unit ID.



To set the Unit ID to ‘01,’ the left rotary switch would be set to ‘0’ and the right rotary switch would be set to ‘1.’

See Appendix A for a conversion of Hexadecimal controller unit IDs set with the switches and their decimal equivalents.

Zero-Cross Selection

Zero-cross detection is required for dimming control using triacs or random-cross SSRs (Solid State Relays.) The DIO32 has the ability to detect zero-cross on any of its AC input voltages. The jumper

DIO32

selections (jumper JP10 and jumper JP11) for the zero-cross detectors are set when the AC power source is set. See the appropriate *Power From xxx* section.

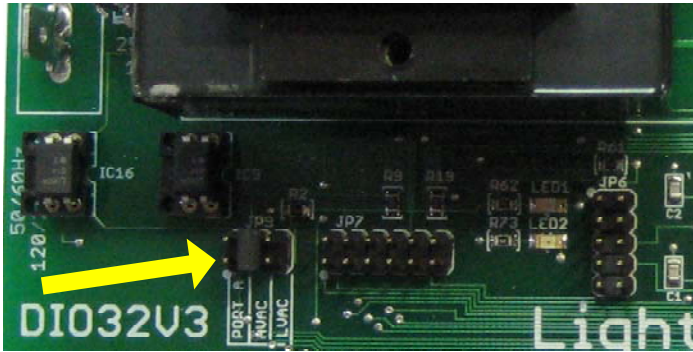
It is also possible to have the DIO32 determine the zero-cross from a signal received on the 16-pin port headers. This allows the DIO32 to perform dimming where the zero-crosses are different due to 3-phase power. The zero-cross signal is a 5 vdc signal that pulses positive at the zero-cross point.

The setting of the Port IO Select DIP Switches determines the zero-cross source for a port. See the *Port IO Select DIP Switches* section for more information.

Port A zero-cross is a special case. Jumper JP9 is used to select the zero-cross source for port A. The options are:

- Get zero-cross from the 16-pin port A header “PORT A”
- Get the zero-cross from the low voltage AC detector (12 or 24 vac) “LVAC”
- Get the zero-cross from the high voltage AC detector (120 or 240 vac) “HVAC”

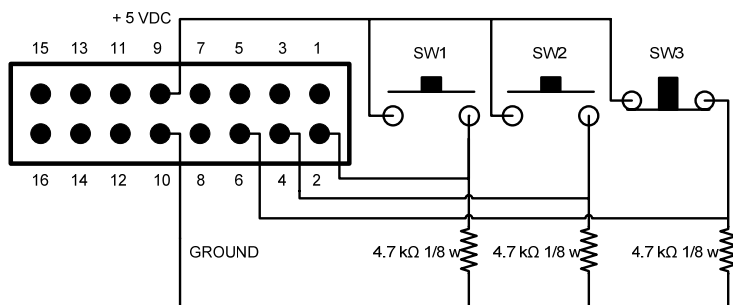
This jumper, shown in the next picture, is located just below the large transformer. Place a vertical jumper on a column of two pins on the jumper shown below to make the selection.



Note that the firmware in the controller is coded to work with the zero-cross detectors designed by Light O Rama. A foreign zero-cross detector may not present the zero-cross signal at exactly the same time as a LOR detector. If the foreign detector is not different by much you may notice incorrect dimming near the very dim and very bright settings. If it is significantly different, behavior may appear erratic, even with full on/off commands.

How to Connect Input Switches

The following diagram shows how to connect a few push button (momentary contact) switches to a digital input port 16-pin header.



SW1 and SW2 are normally open (NO) switches, meaning they complete the circuit when pressed.

SW3 is a normally closed (NC) switch that breaks the circuit when pressed. When a port is used as digital inputs to control a show, all switches on that port must be either NC or NO.

If the DIO32 port used is port A, then SW1 would be channel 1, SW2 would be channel 2 and SW3 would be channel 3.

Since the ports can be input or output, they are floating and the 4.7K Ω resistor is required to set the port state.

Stand Alone Operation

A stand alone animation sequence (sequence with no accompanying audio) can be downloaded into the flash memory of the DIO32 controller.

This sequence can contain approximately 5,000 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 DIO32. Use the drop down menu next to the *Refresh* button to select the controller.

Click the *Standalone* button at the bottom of the window. Note that the trigger conditions set by the Hardware Utility in the stand-alone window are ignored.

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If you are using a switch to activate a sequence, then Port A on the controller must be configured for input. If port A is not configured for input, the sequence runs all the time. Port A, channel one starts the internal sequence according to the NO/NC rules set for this channel. See the *Port IO Select DIP Switches* section for more information.

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

You also use this screen to remove downloaded standalone sequences. Note that all downloaded sequences are removed. You can also remove standalone sequences by turning the controller off, setting the Unit ID switches to '00' and turning it on for 10 seconds. Then turn it off and reset the Unit ID switches to the original value.

Daughter Boards

This section describes the daughter boards that are available to extend the functionality of the DIO32. Daughter boards can be mixed and matched as needed using the 32 channels available.

Available daughter boards:

DIO8ACF – 8 channel filtered triac dimmer, 120/240 vac, up to 60 amps total

DIO16AC – 16 channel triac dimmer, 12/24 or 120/240 vac, up to 60 amps total

DIO8RLY – 8 channel SPDT relay, 16 amps @ 250 vac per relay

DIO16IOS – 16 Channel Connector

DIO32

DIO8ACF 120/240 vac, High Current, Filtered 8-Channel Triac Dimming



DIO8ACF Specifications

- 8½" w x 5¼" h x 2" d
- Eight 10 amp triac dimming channels
- Two banks of four channels
- 30 amps @ 120/240 vac per bank, 60 amps per board
- Both input power and output channels fully filtered with common mode chokes and capacitors
- Each bank and each channel separately fused
- Power limited to 20 amps per bank with supplied standard heat sinks
- Both power feeds must be on the same phase in three phase systems

Connecting the DIO8ACF to the DIO32

- This device uses one 8-bit port on the DIO32 and appears as 8 channels.

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- Connect the DIO8ACF board to the DIO32 main board using one 16-line ribbon cable.
- Jumper through the 5 vdc power on the main board, see *Port DC Power Jumpers* section for more information
- Set the Port IO Select DIP Switch for dimming. See the *Port IO Select DIP Switches* for more information

DIO8ACF Power Connections

The DIO8ACF has two 30 amp input screw terminal sets toward the bottom of the board. This board has only one zero-cross detector, therefore when it is used in a 3-phase environment, both power input terminal sets must be on the same phase.

Power to the connected lighting is via ¼" blade terminals that run along the left and right edges of the board.

DIO16AC 12/24/120/240 vac, 16-Channel Triac Dimming



DIO32

DIO16AC Specifications

- 8½" w x 5¼" h x 1½" d
- Sixteen 8 amp triac dimming channels
- Two banks of eight channels
- 30 amps @ 12/24/120/240 vac per bank, 60 amps per board
- Each bank and each channel separately fused
- Power limited to 20 amps per bank with supplied standard heat sinks
- Each bank can be on a different phase in three phase systems

Connecting the DIO16AC to the DIO32

- This device can use one or two 8-bit ports on the DIO32 and appears as 8 or 16 channels.
- Connect the DIO16AC board to the DIO32 main board using one or two 16-line ribbon cables.
- Jumper through the 5 vdc power on the main board for the DIO32 ports used, see the *Port DC Power Jumpers* section for more information
- Set the Port IO Select DIP Switches for dimming. See the *Port IO Select DIP Switches* section for more information

DIO16AC Power Connections

The DIO16AC has two 30 amp input screw terminal sets toward the bottom of the board. The left screw terminal set powers the left 8 channels and the right screw terminal set powers the right 8 channels.

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This board contains two zero cross detectors so that the two input power terminal sets may be on different phases in 3-phase systems.

Power to the connected lighting is via ¼" blade terminals that run along the left and right edges of the board.

DIO8RLY 8-Channel Relay



DIO8RLY Specifications

- 8½" w x 5¼" h x 1½" d
- Eight Single Pole Double Throw (SPDT) relays
- Relay inputs and outputs are completely independent of one another, there is no common wiring
- Each relay is rated to handle 16 amps at 250 vac
- ¼" blade terminals for connection
- Each relay is separately fused

DIO32

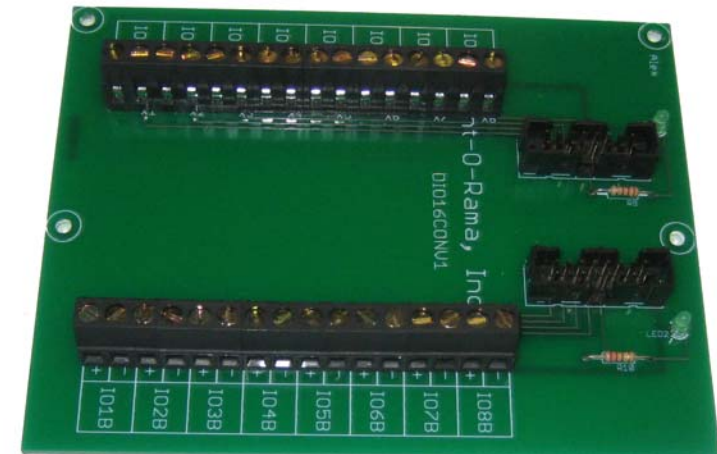
Connecting the DIO8RLY to the DIO32

- This device uses an 8-bit port on the DIO32 and appears as 8 channels.
- Connect the DIO8RLY board to the DIO32 main board using one 16-line ribbon cable.
- Jumper through the 5 vdc and the 12 vdc power on the main board, see the *Port DC Power Jumpers* section for more information

DIO8RLY Power Connections

There are three ¼" blade connectors for each relay. One is a common connection and the others are the NO (normally open) and the NC (normally closed) contacts. Use ¼" female quick connects on your connection wires.

DIO16IOD 16-Channel Connection Board



DIO16IOD Specifications

- 8½" w x 5¼" h x 1½" d

- 16 sets of screw terminals to facilitate connection of custom devices to the DIO32 main board
- Provided to eliminate the need to make a custom 16-pin ribbon cable to your device cable

Connecting the DIO16IOS to the DIO32

- Connect the DIO16IOS board to the DIO32 main board using one or two 16-line ribbon cables. Only connect one cable if you will only be using 8 of the 16 ports.
- Jumper through the 5 vdc power on the main board, see *Port DC Power Jumpers* section for more information.

DIO16IOS Input/Output Connections

- The '-' connections on the IOS board are a common ground.
- The '+' connections on the IOS board are the 0/5 vdc inputs/outputs depending upon the DIP configuration switch. See the *Port IO Select DIP Switches* section for more information.

Updating the DIO32 Firmware

You must have:

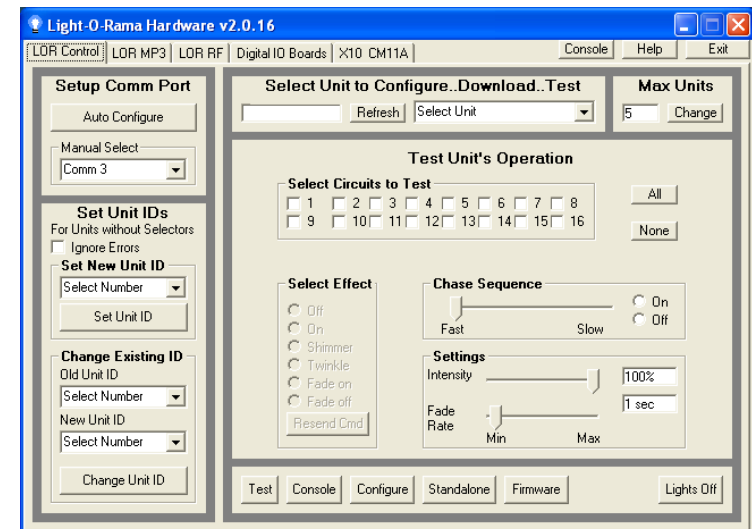
- Hardware Utility version 2.0.16 or later, see the section *Hardware Utility Version*
- The DIO32 powered (see the *Power ...* sections) and connected to the PC via one of the RS485 adapters – Do not use wireless

Get the latest firmware. www.lightorama.com ► *Support* ► *Using the Hardware – Documentation and Firmware* section. Click the **Firmware** button in the DIO32 line and run the firmware installer program which will install the firmware file on your PC. Note the name of the firmware .lhx file. The normal location of firmware files is C:\Program Files\Light-O-Rama\Firmware.

Start the LightORama Control Panel if it is not running by clicking **start** ► **All Programs** ► **LightORama** ► **Light-O-Rama Control Panel**. The Light-O-Rama light bulb icon will appear in the system tray on the lower right of your screen.

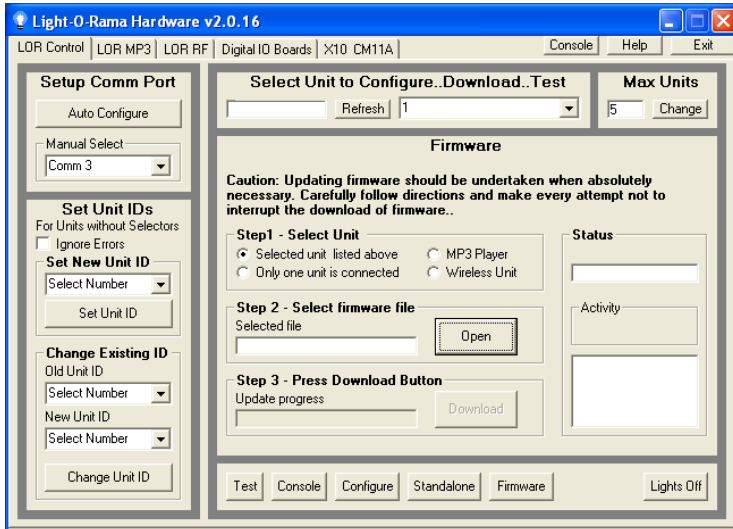
Start the **Hardware Utility** by right-clicking the Light-O-Rama Control Panel light bulb and selecting **Hardware Utility** from the menu.

Click the **Firmware** button in the **LOR Control** tab and you will see this window:



In **Step 1 – Select Unit**, choose the **DIO32** radio button.

In **Step 2 – Select firmware file**, click the **Open** button. Use the *Open* file box to select the firmware file. This is the .lhx file you saved in the Firmware folder. Click the **Open** button. The window will look like this:



In **Step 3 – Press Download Button**, click the **Download** button – the firmware download will start automatically.

The *Update progress* bar will fill from left to right. When the new firmware is loaded, the *Status* will change to “Successful” and the DIO32 will reboot.

Appendix A Hexadecimal to Decimal

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
01	01	3D	61	79	121	B5	181
02	02	3E	62	7A	122	B6	182
03	03	3F	63	7B	123	B7	183
04	04	40	64	7C	124	B8	184
05	05	41	65	7D	125	B9	185
06	06	42	66	7E	126	BA	186
07	07	43	67	7F	127	BB	187
08	08	44	68	80	128	BC	188
09	09	45	69	81	129	BD	189
0A	10	46	70	82	130	BE	190
0B	11	47	72	83	131	BF	191
0C	12	48	72	84	132	C0	192
0D	13	49	73	85	133	C1	193
0E	14	4A	74	86	134	C2	194
0F	15	4B	75	87	135	C3	195
10	16	4C	76	88	136	C4	196
11	17	4D	77	89	137	C5	197
12	18	4E	78	8A	138	C6	198
13	19	4F	79	8B	139	C7	199
14	20	50	80	8C	140	C8	200
15	21	51	81	8D	141	C9	201
16	22	52	82	8E	142	CA	202
17	23	53	83	9F	143	CB	203
18	24	54	84	90	144	CC	204
19	25	55	85	91	145	CD	205
1A	26	56	86	92	146	CE	206
1B	27	57	87	93	147	CF	207
1C	28	58	88	94	147	D0	208
1D	29	59	89	95	147	D1	209

1E	30	5A	90	96	150	D2	210
1F	31	5B	91	97	151	D3	211
20	32	5C	92	98	152	D4	212
21	33	5D	93	99	153	D5	213
22	34	5E	94	9A	154	D6	214
23	35	5F	95	9B	155	D7	215
24	36	60	96	9C	156	D8	216
25	37	61	97	9D	157	D9	217
26	38	62	98	9E	158	DA	218
27	39	63	99	9F	159	DB	219
28	40	64	100	A0	160	DC	220
29	41	65	101	A1	161	DD	221
2A	42	66	102	A2	162	DE	222
2B	43	67	103	A3	163	DF	223
2C	44	68	104	A4	164	E0	224
2D	45	69	105	A5	165	E1	225
2E	46	6A	106	A6	166	E2	226
2F	47	6B	107	A7	167	E3	227
30	48	6C	108	A8	168	E4	228
31	49	6D	109	A9	168	E5	229
32	50	6E	110	AA	170	E6	230
33	51	6F	111	AB	171	E7	231
34	52	70	112	AC	172	E8	232
35	53	71	113	AD	173	E9	233
36	54	72	114	AE	174	EA	234
37	55	73	115	AF	175	EB	235
38	56	74	116	B0	176	EC	236
39	57	75	117	B1	177	ED	237
3A	58	76	118	B2	178	EE	238
3B	59	77	119	B3	179	EF	239
3C	60	78	120	B4	180	FO	240

Appendix B LOR Unit ID to DMX Address

See the section *Unit ID Switches* for instructions on setting the controller's unit ID. The controller must be set to one of the LOR Unit IDs listed in the following table to recognize DMX protocol. E.g. setting the LOR Unit ID to "06" will result in the first DMX address (base address) for the controller being 81.

LOR Unit ID	DMX Address	LOR Unit ID	DMX Address
"01"	1	"11"	257
"02"	17	"12"	273
"03"	33	"13"	289
"04"	49	"14"	305
"05"	54	"15"	321
"06"	81	"16"	337
"07"	97	"17"	353
"08"	113	"18"	369
"09"	129	"19"	385
"0A"	145	"1A"	401
"0B"	161	"1B"	417
"0C"	177	"1C"	433
"0D"	193	"1D"	449
"0E"	209	"1E"	465
"0F"	225	"1F"	481
"10"	241	"20"	497

Specifications

Dimensions	8½" w x 5¼" h x 2" d
Channels	32 broken into four groups of 8
Source/Sink current for outputs	24 ma maximum
Channel Input/Output voltages	Approximately 0 and 5 vdc
Maximum draw from on-board power supplies	1 amp total for all 4 ports from the 5 vdc and 1 amp total for all 4 ports from the 12 vdc. Both power supplies may be used simultaneously.

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