Light-O-Rama

ServoDog DMX

14 Channel Digital I/O Controller
Protocols: DMX512, LOR & MiniSSC

User Manual
October 16, 2009
V1.0
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NOTE WELL

MiniSSC protocol is NOT active in the current release of the ServoDog firmware. This functionality will be included in firmware released in the 1st quarter of 2010.

Introduction

The Light-O-Rama (LOR) ServoDog is a 14 channel digital controller that can perform digital input, digital output, servo control and PWM dimming. It has six single bit input channels and eight single bit output channels. The output channels are independently configurable as digital output or servo output. Two of the output channels can be configured as PWM dimmers. These two channels also have MOSFET buffers which can be used as on/off switches or PWM dimmers. The MOSFETs can sink 2 amps.

The 8 output channels are fully buffered and each is capable of sourcing or sinking 24 ma at 5 VDC. The input channels can be used with simple switch closures or driven with +5 VDC logic.

The ServoDog is configured with the Windows ServoDogUtility. The ServoDog automatically detects and obeys LOR, DMX512 and MiniSSC protocols. Command sequences created with the LOR ShowTime software can be downloaded into the ServoDog's EEPROM so it can run stand-alone.

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 ServoDog Digital I/O Controller and a user's manual. This manual is also available at www.lightorama.com ► Support ► ServoDog User's Manual.

ServoDog Utility

The ServoDog Utility is included with the S2 ShowTime Software suite. The free demo version contains a fully function ServoDog Utility and is available here
http://www.lightorama.com/SoftwareDownloadPage.html

To use the ServoDog configuration utility a LOR RS485 adapter is required. The SC485 is a serial port to RS485 adapter. The USB-RS485, USB485 with booster and USB485 Isolated are USB to RS485 adapters. The USB adapters include the Windows drivers on CD and the USB cable to the PC. All are available here:
http://store.lightorama.com/accessories.html

Hardware Utility

The Hardware Utility is not strictly required by the ServoDog controller but may be used to set the Unit ID and test it as with other LOR controllers.

Configuration of the ServoDog requires the use of the ServoDogUtility included with the controller.

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 2.5.0, 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.

Software Control

The ServoDog appears in an LOR Network at the
Unit ID Assigned to it. The 8 output channels appear
as 8 channels numbered 1 through 8 in the
Sequence Editor.

Since the individual output channels can be
configured to do different functions (digital output,
PWM dimming or servo control) the behavior in
response to LOR commands, DMX intensities or
MiniSSC position values depends upon how a
particular channel is configured.

Digital Input Channels

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

Input 1 can also be used to start an internal stand
alone animation sequence. See the *Stand Alone
Operation* section for more information.

Digital Output Channels

On an LOR network, a digital output channel is ON
for any intensity greater than zero, otherwise it is
OFF. Shimmer will rapidly turn ON and OFF a digital
output channel. Twinkle will randomly turn ON and
OFF a digital output channel.

A DMX intensity of 0 turns the channel OFF. DMX
intensities from 1 to 255 turn the channel ON.

A MiniSSC position value of 0 turns the channel
OFF. Position values from 1 to 254 turn the channel
ON.

PWM Channels

Two of the output channels (4 & 5) can be
configured as digital out or PWM dimming. These
channels also have MOSFETs on them. The
MOSFETs ground an attached load when activated.
Each MOSFET can sink 2 amps at 50 volts DC.

Channels 4 & 5 behave like all other channels when
configured as digital outputs or servo outputs.

When configured for PWM dimming, they provide
256 steps in the duty cycle. The PWM duty cycle is
about 1/4000 of a second.

On an LOR network, the duty cycle will be linearly
proportional to the LOR intensity. PWM channels
support the full range of LOR effects.

In a DMX universe, the duty cycle will be linearly
proportional to the DMX intensity.

In a MiniSSC environment, the duty cycle will be
linearly proportional to the position value.

Servo Output Channels

On an LOR network, these channels respond to
Sequence Editor commands in the same was as a
normal lighting controller. 0% intensity is minimum
pulse width (fully left or counterclockwise,) 50%
intensity is median pulse width (centered) and 100%

intensity is maximum pulse width (fully right or clockwise.)

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

In a DMX universe, the intensities linearly control the pulse width. Intensity of 0 is minimum pulse width, 128 is median pulse width and 255 is maximum pulse width.

In a MiniSSC environment, position values linearly control the pulse width. A position value of 0 is minimum pulse width, 127 is median pulse width and 254 is maximum pulse width.

Unit ID for Various Protocols

LOR Network
The ServoDog appears as an 8 channel controller at the assigned Unit ID.

DMX Universe
The ServoDog appears as 8 consecutive addresses starting at the base specified by the Unit ID. See the *LOR Unit ID to DMX Address Table* section.

MiniSSC
In the MiniSSC protocol, servo numbers 0-7 appear on Unit ID 01, servo numbers 8-15 appear on Unit ID 02, etc.

Assigning a Unit ID

You can assign a Unit ID with the ServoDog Utility, see the *Unit ID* sub-section in the *Configuring the Output Channels* section.

You can also assign a Unit ID with the Hardware Utility as follows.

If you have not installed the Light O Rama Windows Showtime Software, do it now. You will also need one of the RS485 adapters installed. See the *Connecting the ServoDog to a PC* section for more information.

Power up the ServoDog. The Status LED will blink about twice/second. This means that the controller has booted and is waiting for the PC to talk to it.

Start the Hardware Utility – click **start ► All Programs ► LightORama ► Light-O-Rama Control Panel.** There will be a light bulb with a blue halo on the right side of the task bar at the bottom of the screen. Right-click the light bulb and select *Hardware Utility* from the menu. Make sure the *LOR Control* tab is selected. You will see this window:
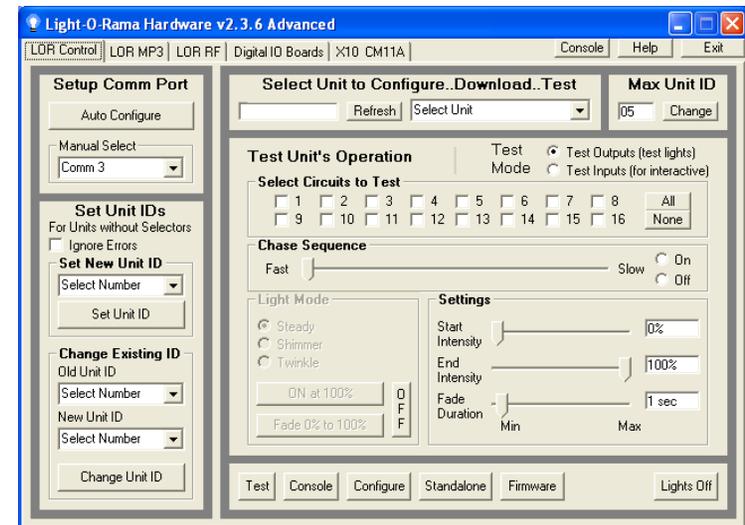
Click the *Auto Configure* button in the *Setup Comm Port* section. The Hardware Utility will search for the

COM port that your RS485 adapter is plugged into and select it.

When assigning a unit ID, only one controller may be plugged into the RS485 adapter on the PC. Be sure you do not have more than one controller connected.

Steps to set/change unit ID:

1. In the *Change Existing ID* section, use the *Old Unit ID* drop-down menu to select *Any Unit*, then click *OK* in the warning box for changing all unit IDs, there should only be one unit attached.

2. Use the *New Unit ID* drop down menu to select "01" or whatever Unit ID you want.

3. Click the *Change Unit ID* button to set your ServoDog unit ID. You will see a *Unit ID Changed* box – click OK.

Configuring the Output Channels

The ServoDog configuration utility is part of the Windows Showtime Software (S2) and is available for free download here:
http://www.lightorama.com/SoftwareDownloadPage.html

This utility requires that the ServoDog be connected to the Windows PC with an LOR USB adapter. See the *Connecting the ServoDog to a PC* section for more information.

The utility allows real time control of the channels to set the motion parameters for each servo. Below is a picture of the Simulator Screen.
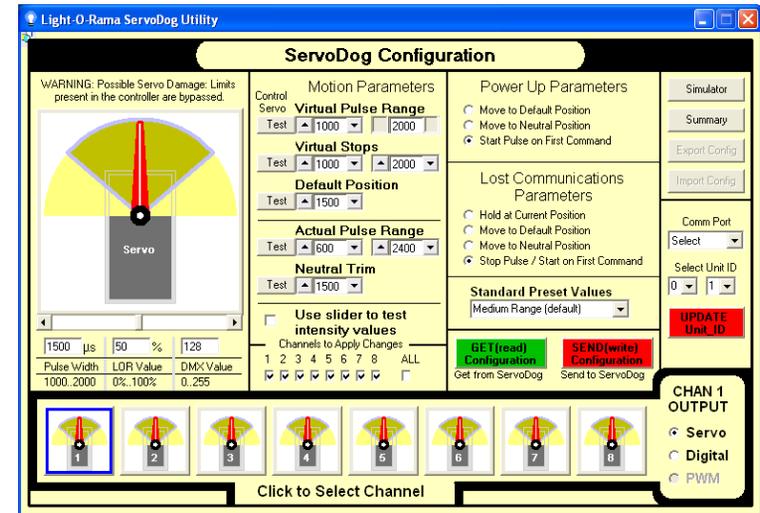
Simulator/Summary Buttons

These buttons select one of the two screens available in the ServoDog Configuration Utility.

The Summary Screen is used to display a summary of all channel configurations as seen below:
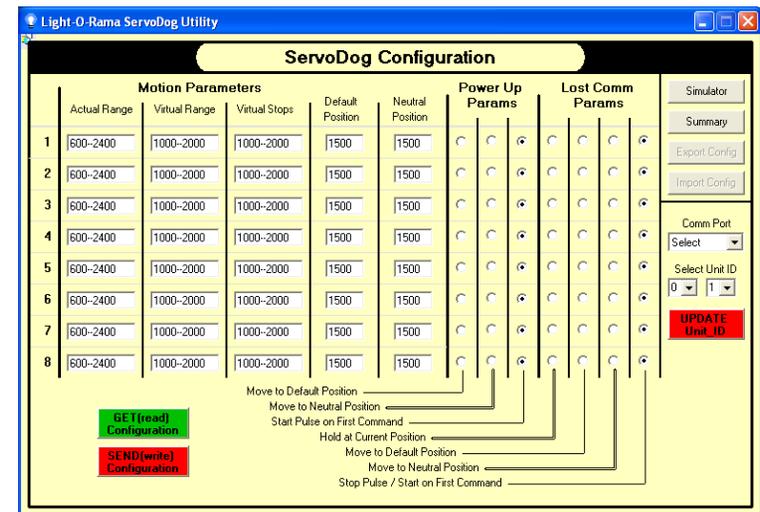
Comm Port

Use the *Comm Port* drop down menu to select the comm port of the RS485 adapter connected to the ServoDog.

When the ServoDog is powered up but not connected to a PC, the Status LED will blink about twice/second. This means that the controller has booted and is waiting for the PC to talk to it.

Once the ServoDog is physically connected to the PC, the ServoDog Utility is running and the comm port is set correctly, the Status LED will go on solid. This indicates that the ServoDog is receiving polls from the utility.

Unit ID (Selecting and Setting)

Use the *Select Unit ID* drop down menus to select a particular ServoDog controller.

You can also set the Unit ID of a connected ServoDog controller by selecting a Unit ID and clicking the *UPDATE Unit ID* button. You must have only one ServoDog controller connected to the comm port for this operation to work properly.

GET (read) Configuration

Use the green *GET (read) Configuration* button to retrieve the current configuration from the EEPROM memory of the selected ServoDog controller.

SEND (write) Configuration

After changing any parameters for the selected ServoDog controller you must click the red *SEND (write) Configuration* button to write the new

configuration to the EEPROM memory of the ServoDog controller.

Simulator Screen

The following parameters can be adjusted for each channel using the Simulator screen. Detailed descriptions follow.

- Actual pulse range
- Default position
- Lost communications parameters
- Neutral trim
- Power up parameters
- Virtual pulse range
- Virtual Stops

Channel Configuration

Select one of the channels by clicking the images at the bottom of the window. The options for that channel will appear to the right of your selection. You can choose Servo or Digital for any channel. You may also choose PWM for channels 4 and 5.

Actual Pulse Range

The actual limits of the servo. These values are used only to provide limits when setting other parameters. The values are not used to calculate any arm positions.

Channels to apply changes

If you are currently adjusting Channel 1 parameters, make changes and then want those changes to be applied to other channels, check the appropriate boxes.

Default Position

The optional position for "Power Up" and "Lost Communications" situations. Lost communications is only sensed for LOR and DMX networks.

Lost Communications Parameters

Selects how the servo channels behave when communication with a LOR network or DMX universe is lost:

- Hold at current position
- Move to default position
- Move to neutral position
- Stop pulsing, start on first command

Neutral Trim

Shifts everything left or right to "zero" the position of the servo arm.

Power Up Parameters

Selects the how the servo channels are handled when the ServoDog first powers up:

- Move to default position
- Move to neutral position
- Start pulsing on first command received

Test Buttons

Send commands to move a servo on the selected channel to the selected position. In the case of testing a range, the servo position is moved back and forth through the range. The actual servo will move much like you see the simulator move.

Virtual Pulse Range

The values used to compute arm position. When an intensity is mapped to a pulse value you have 0% = minimum virtual value and 100% = maximum virtual value 50% = (virtual max - virtual min) / 2, ...

Virtual Stops

Places hard stops that prevent the servo arm from going out of this range even though the Virtual Pulse Range would allow it. You could have a stop that would not allow the arm to go below 20% intensity….

Use slider to test intensity values

If this box is checked then when you move the slider below the large servo simulator graphic, you will send the actual pulse values to the ServoDog to control the servo on the selected channel.

Warning: Actual pulse values are sent to the ServoDog when you are testing. The ServoDog is not receiving intensity commands but rather "Send pulses with duration of 1500 uS" commands, so any limits in the ServoDog are bypassed.

Hardware Description

Refer to the following diagram for the hardware description. The upright orientation is shown below. Note that the *Light O Rama, Inc.* silk-screening is upright on the upper left, the network connection jacks are center left and the 24-pin servo header is on the right.

Digital inputs header

Digital outputs header

RJ45 Network connectors

Servos header

Reset header

V+ + DC Power Input Min 6 volts for board logic, Min 9 volts to use on-board voltage regulators, Max 14 volts

V2 Voltage adjust

V1 Voltage adjust

S2 Servo bank 2 power input
V2 Voltage regular 2 output

G Ground for logic, MOSFETs & Servos

S1 Servo bank 1 power input
V1 Voltage regular 1 output

M1 MOSFET 1 drain

M2 MOSFET 2 drain

LED1

Reset Header

The jumper must be on the reset header for the ServoDog to function normally. To reset the ServoDog, power it off, remove the jumper, power it on and wait for the Status LED to start blinking. The ServoDog is reset at this point. Power it off and replace the jumper for normal operation.

Power Block Diagram

Warning: Be very careful not to switch the polarity when applying power to the ServoDog or you will damage it.
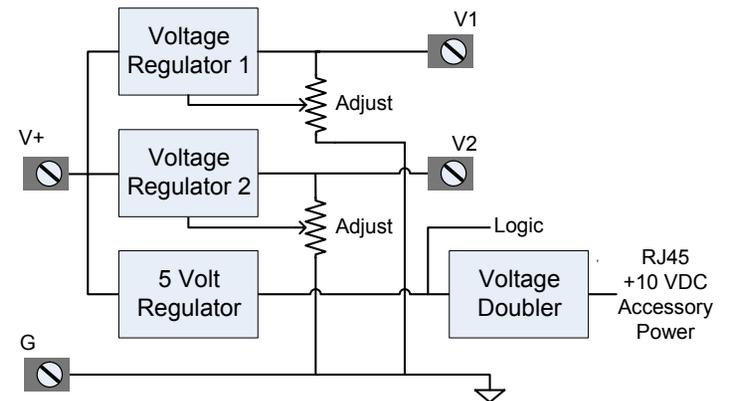
V+ must be at least 6 VDC for the ServoDog to function.

V+ must be at least 9 VDC to use Voltage Regulators 1 and 2.

V+ should not exceed 14 VDC.

V1 & **V2** are set to approximately 6 VDC when the unit is shipped.

M1 and M2 MOSFET Terminals
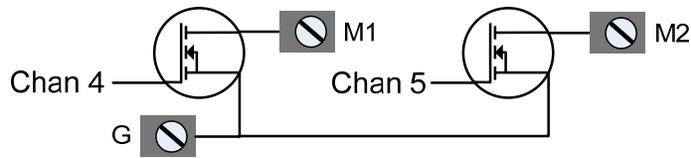
Servo Power Options

Servo power must be provided through screw terminals S1 and S2.

S1 supplies the positive DC voltage to servo header servos 1 through 4. S2 supplies the positive DC voltage to servo header servos 5 through 8.

You can use either, both or neither V1, V2 voltage sources for the servos. A positive voltage must be connected to S1 and S2 to use the servo header.

S1 is jumpered V1 and S2 is jumpered to V2 when the unit is shipped.

RJ45 Network Connections

In order to use your ServoDog, 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.)
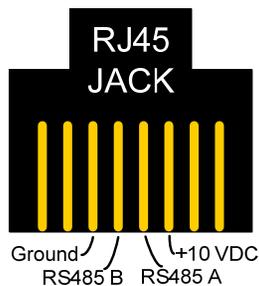
LOR Network

These jacks are designed for direct connection to an LOR network using Cat5e LAN cables. You will only be able to set the Unit ID and configure the servo pulse ranges with LOR utilities through an LOR RS485 adapter.

The LOR RS485 adapters appear as ordinary COM ports on the PC and can be used with applications using MiniSSC protocol.

DMX Universe

An RJ45 to XLR3 adapter can be used to connect the ServoDog to a DMX universe. This adapter is available here:

http://store.lightorama.com/rjtoxlr3ma.html

More information on using LOR controllers with DMX can be found in this document:

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

RS232 Serial

The ServoDog understands MiniSSC protocol at 2400 and 9600 bps. An RS232 to RS485 converter or RS485 adapter should be used, but direct connection of the RS232 serial port Transmit to RS485 A and Signal Ground to RS485 B on the ServoDog will work.

You will not be able to use the ServoDog Utility without an LOR RS485 adapter, but you can control the ServoDog channels since there is no back communication from the ServoDog.

Connecting to a PC

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

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

The following diagram shows how the pieces fit together:
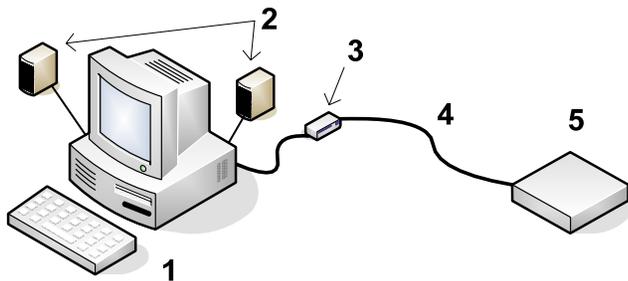
1. Your PC running the Showtime Windows Software
2. Your PC speakers to play the music
3. RS485 Adapter to convert short distance USB to long distance RS485 or RS232 serial to RS485
4. CAT5e LAN cable
5. ServoDog controller

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

You can use either of the larger jacks on the ServoDog controller.

Connecting to a Show Director

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

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

You can use either jack on the Show Director and either jack on the ServoDog.

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

You can use Cat5e cable to go from either large jack on one controller to either large jack on the other controller.

Digital Inputs Header

```
   1   3   5   7   9
  ┌─────────────────┐
  │  ●   ●   ●   ●   ●  │
  │  ●   ●   ●   ●   ●  │
  └─────────────────┘
   2   4   6   8   10
```
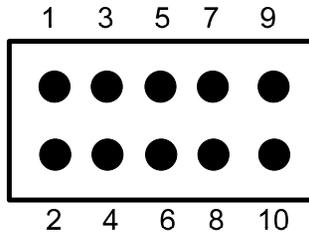
1 – Input 1	6 – Input 6
2 – Input 2	7 – Accessory V+
3 – Input 3	8 – N/C
4 – Input 4	9 – 5 VDC
5 – Input 5	10 – Ground

Digital Outputs Header

```
   1   3   5   7   9
  ┌─────────────────┐
  │  ●   ●   ●   ●   ●  │
  │  ●   ●   ●   ●   ●  │
  └─────────────────┘
   2   4   6   8   10
```
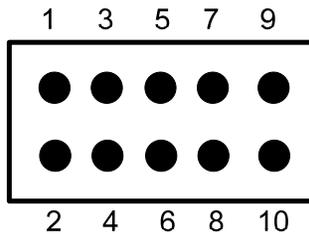
1 – Ground	6 – Output 4
2 – 5 VDC	7 – Output 5
3 – Output 1	8 – Output 6
4 – Output 2	9 – Output 7
5 – Output 3	10 – Output 8

Servo Control Header

Servo signals

```
   1  2  3  4  5  6  7  8
  ┌──────────────────────┐
S1│ ● ● ● ● ● ● ● ●│
[◇]│ ● ● ● ● ● ● ● ●│ [◇] S2
  │ ● ● ● ● ● ● ● ●│
  └──────────────────────┘
       EDGE OF CIRCUIT BOARD    [◇] G
```
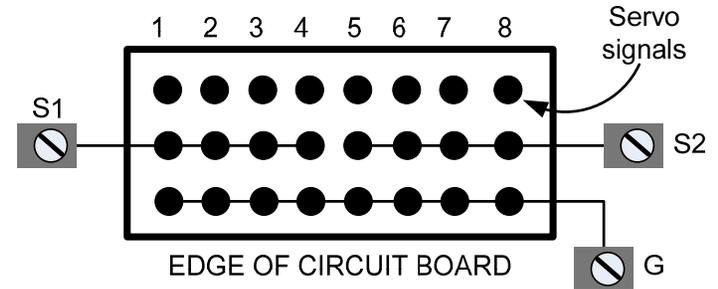
1-8 are servo pulse outputs
S1 is the screw terminal for +DC for servos 1-4
S2 is the screw terminal for +DC for servos 5-8
G is the screw terminal for ground

Status LED1

- Blinks twice per second if the ServoDog has booted correctly

- Solid on if the ServoDog sees a network director – i.e. a PC, Show Director or DMX universe

- 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 ServoDog Firmware* section to load firmware

How to Connect Input Switches

The following diagram shows how to connect a few push button (momentary contact) switches to a digital input 10-pin header.
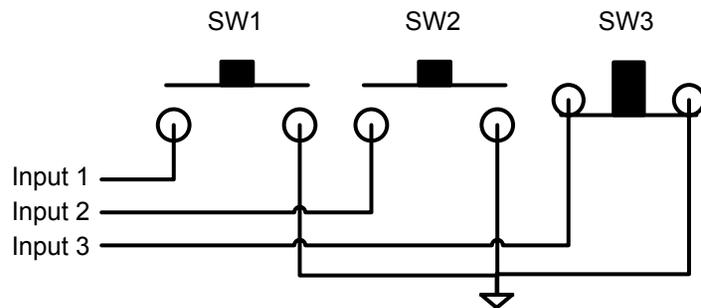
SW1 and SW2 are normally open (NO) switches, meaning they complete the circuit when pressed. SW3 is a normally closed (NC) switch that breaks the circuit when pressed.

Note that inputs on the ServoDog are pulled up to 5 VDC with 10KΩ resistors. This means resistors are not required on switches. These input channels can also be driven by 5 VDC logic if the logic can sink 0.5 ma.

Input/Output Connection Header

A header is available for the ServoDog that converts the input and output pin headers to screw terminals where A1-A6 are the inputs and B1-B8 are the outputs:
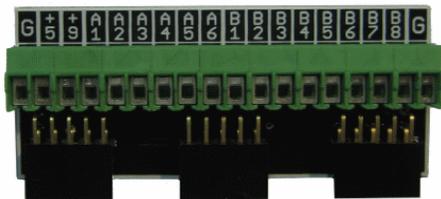
This header is available here:
    http://store.lightorama.com/mp3dicohe.html

Stand Alone Operation

A stand alone animation sequence (sequence with no accompanying audio) can be downloaded into the EEPROM of the ServoDog controller.

This sequence can contain approximately 10,000 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 ServoDog. Use the drop down menu next to the *Refresh* button to select the correct ServoDog controller.

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.

You also use this screen to remove downloaded standalone sequences. Note that all downloaded sequences are removed.

Updating Controller Firmware

Periodically, Light-O-Rama may distribute new firmware for the ServoDog. If you believe you need updated firmware, use the Hardware Utility to 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 ServoDog 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,** chose *Selected 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.

LOR Unit ID to DMX Address Table

The Hardware Utility is used to set the Unit ID of the ServoDog. See the section *Assigning a Unit ID* for more information. 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 for the controller being 41.

LOR Unit ID	DMX Address	LOR Unit ID	DMX Address
"01"	1	"21"	257
"02"	9	"22"	265
"03"	17	"23"	273
"04"	25	"24"	281
"05"	33	"25"	289
"06"	41	"26"	297
"07"	49	"27"	305
"08"	57	"28"	313
"09"	65	"29"	321
"0A"	73	"2A"	329
"0B"	81	"2B"	337
"0C"	89	"2C"	345
"0D"	97	"2D"	353
"0E"	105	"2E"	361
"0F"	113	"2F"	369
"10"	121	"30"	377

"11"	129	"31"	385
"12"	137	"32"	393
"13"	145	"33"	401
"14"	153	"34"	409
"15"	161	"35"	417
"16"	169	"36"	425
"17"	177	"37"	433
"18"	185	"38"	441
"19"	193	"39"	449
"1A"	201	"3A"	457
"1B"	209	"3B"	465
"1C"	217	"3C"	473
"1D"	225	"3D"	481
"1E"	233	"3E"	489
"1F"	241	"3F"	497
"20"	249	"40"	505

Specifications

Dimensions	4½"w x 2¼"h x 1"d
Channels	14 = 6 input + 8 output
Configuration	Outputs individually configured as digital output or servo control
High current and PWM	Two outputs with MOSFETs Also configurable as PWM
Servo Update Rate	50 Hz
PWM Speed	4 KHz
Trigger Sensitivity	Minimum pulse width to sense a trigger input is 10 ms
Input Voltage	6 to 14 VDC
Source/Sink current for digital/servo outputs	24 ma maximum
MOSFET Sink current	2 amps @ 50 VDC
Channel Input/Output voltages	Approximately 0 and 5 VDC
V1 & V2 Voltage Regulators	1 amp each Voltage range: 4 to 9 VDC