Operating Manual: SanDevices ELOR   Light-O-Rama to E1.31 Protocol Converter

March 31, 2012 added 'capabilities and limitations' section

March 13, 2012 revised external power connection information

Feb 24, 2012: various changes regarding ID setting, and error led. Added network warning re cross-connecting Ethernet and LOR networks. Added board photo. Misc changes.   Added connector illustrations. Added address switch table.

Feb 20, 2012: PRELIMINARY

About ELOR: Capabilities and Limitations

The purpose of ELOR is to allow Light-O-Rama's sequencing software to interface with RGB pixel controllers that use the E1.31 protocol. ELOR is a controller board that inputs LOR lighting commands from a standard LOR network, and converts them to E1.31 commands that can be understood by a pixel controller such as the SanDevices E681, or any other pixel controller that works with multicast E1.31.

Each ELOR board can control enough channels to operate a <u>MAXIMUM </u>of 680 pixels. I emphasize maximum, because the nature of the LOR protocol creates limitations which may well reduce this number. Unlike standard DMX, (and E1.31 which is just standard DMX transported via Ethernet), the LOR network has no exact defined capacity as to the total number of channels that it can control. This is because of the way that the LOR network operates. Unlike protocols such as DMX that update every channel many times per second, LOR only sends commands on the network when a channel's status changes. In addition the LOR protocol offloads tasks such as managing fades, shimmers, and twinkles, to each of the attached controllers.

As an example, if you fade 500 channels over 1 second using DMX, you would see a DMX packet sent every 1/40th of a second, each with slightly lower intensity values for every channel. On the LOR network, you would see a burst of activity at the beginning of the fade, (where LOR is telling the attached controllers to fade those channels over 1 second), then LOR is done, no more data is sent until there is another change, because the actual job of handling the fade has been off-loaded to the controllers.

The advantage to the LOR protocol is that it's generally able to control a larger number of channels, over a slower network connection, than can be done with DMX. The disadvantage is that as activity on the channels becomes more complex, (shorter time slices, more channels being controlled, and more complex channel activity), the LOR network will reach a point of saturation where it simply can no longer keep up. At that point some LOR commands get dropped, and the result typically is observed as channels getting stuck on (if they miss a turn off command for example), or some lighting commands being skipped entirely.

The problem is that it's impossible to place hard numbers on this, since it depends both on the number of channels being controlled as well as the type of activity on those channels. The bottom line is that a single LOR network connection is probably sufficient to drive a full load of 680 pixels via ELOR in many cases, but

there can also be cases where, because of there being a lot of rapid sequencing activity, that the capacity of the LOR network won't be sufficient.

The same effect will be seen with standard LOR hardware, the best example would be the use of multiple CCRs. One LOR user, for example, reported that he was unable to control 12 CCRs over a single LOR network when used in a mega-tree application. 12 CCRs is roughly equivalent to the maximum capacity of one ELOR.

ELOR beta testers on the other hand have run hundreds of pixels on a single ELOR without a network loading problem. The difference, presumably, is in the complexity of the sequencing being used. So please keep in mind, that if you really "go crazy" with your pixel sequencing, you may saturate the LOR network before you reach the 680 pixel maximum. A future firmware update will allow the ELOR to connect directly to two LOR networks simultaneously to add additional capacity.

ELOR is a new product, and therefore there is not a large base of user feedback yet. Please anticipate that bugs will be found, and that there will be periodic firmware updates to correct bugs and add new features. Since the ELOR does not have the ability to update its firmware over the LOR network, firmware updates can be done in two ways: by swapping eeproms, or by using a Parallax tool called a "Prop Plug" to download firmware updates directly to the ELOR board. I encourage all ELOR users to purchase a prop plug ($15) to facilitate firmware updates.

Light-O-Rama has promised built-in E1.31 capability for their sequencing software, the target date as of now is Summer of 2012. Because of this, some have questioned the need for the ELOR product. To me, the benefits of ELOR are:

To get a head start on pixel sequencing. Even if the LOR update comes through on schedule, by using ELOR now you can have several additional months to work on sequencing your pixels.
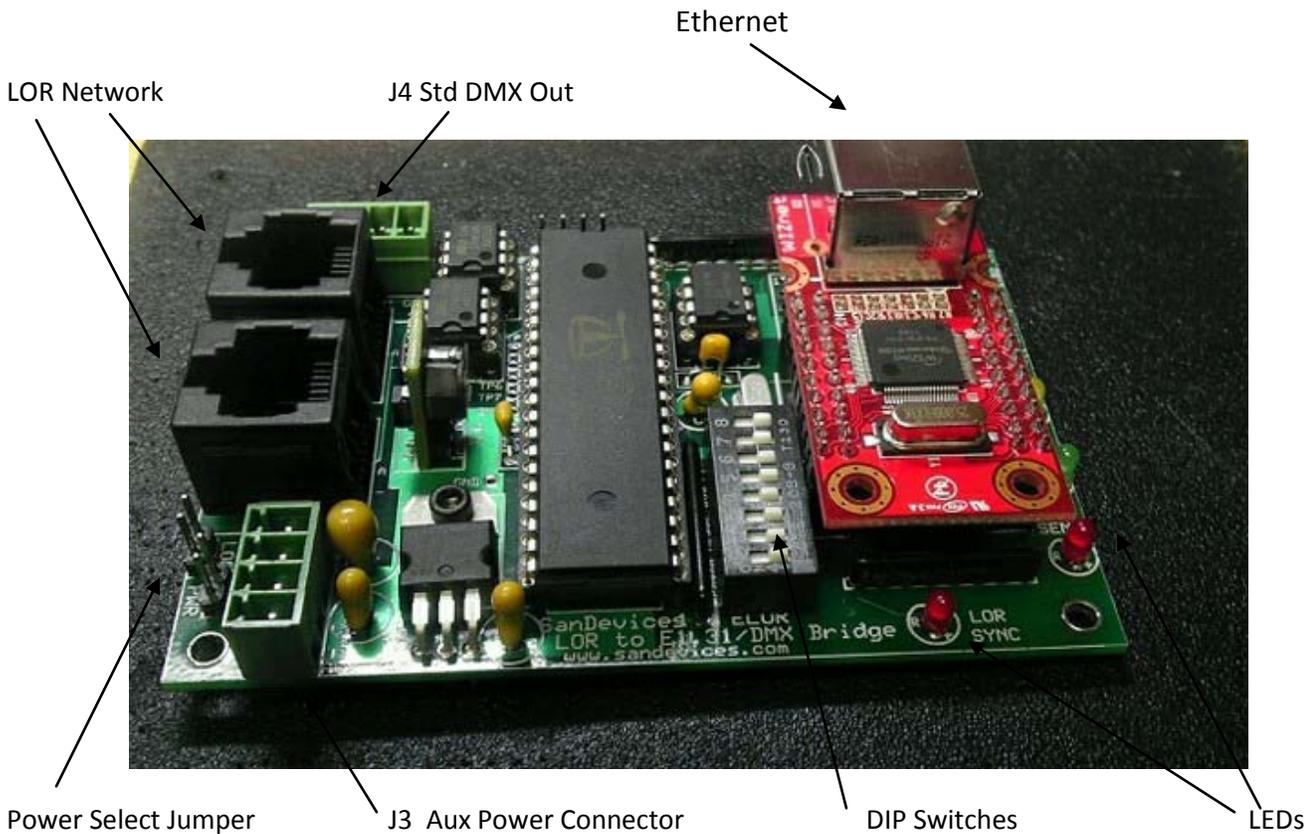
As a hedge against LORs E1.31 time frame slipping.

For users who don't want to upgrade their LOR software.

For users who can't easily run Ethernet to their display area, ELOR can be installed in the yard at the point of use.

For users who need the ability to run pixels or wired DMX channels in a stand-alone (PC-less) system, using a LOR show controller for example.

For users who want the ability to add some wired DMX channels to their existing LOR network using ELOR's wired DMX universe output.

Ethernet

LOR Network   J4 Std DMX Out

Power Select Jumper   J3 Aux Power Connector   DIP Switches   LEDs

In this manual, references to locations on the ELOR circuit board, are with reference to the orientation shown above.

Description:

The SanDevices ELOR is a protocol bridge that attaches to a LOR (Light-O-Rama) network and converts the LOR data into E1.31 data suitable for driving E1.31-based controllers. It is typically used in conjunction with a pixel controller such as the SanDevices E681, but should be compatible with any E1.31 controller that accepts multicast E1.31 data. The ELOR also provides a single universe of standard wired RS485 DMX out.

Physically, the ELOR is a single PC board measuring 2.5"x3.8".   There are four 1/8" mounting holes on 2.2"x3.5" centers. For outdoor use it is the user's responsibility to provide a suitable enclosure. When mounting the controller in an enclosure, be sure to leave sufficient clearance at the top edge of the board to allow connection of the Ethernet cable.

Power Source:

Power may be supplied to the ELOR in two ways: from the LOR network (most common), or from an external power supply. In order to power ELOR from the LOR network, you must have a nearby controller or interface that supplies power to the network. For powering from the network, the "LOR PWR" jumper must be in place. Do not connect anything to J3. If power is available on the LOR network, you will see the red "LOR SYNC" LED begin to flash or go steady on, a few seconds after ELOR is plugged into the LOR network. If this doesn't happen it means that there is no power on your LOR network, and power will have to be supplied externally.

 If an external power supply is used it can be of the simple "wall wart" variety, and needs to be rated for at least 300ma, and supply between 6 and 24 volts DC. External power is connected to J3, the auxiliary power connector toward the lower-left corner. The upper pin (nearest the LOR network connectors) is +V and the pin below it is ground.

If using external power, you must remove the LOR PWR jumper. (Revised 03/13/2012, there is now only ONE LOR PWR jumper, instead of two.)
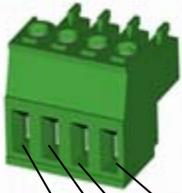
Mating plug for connector J3, Aux Pwr (lower left-hand corner)

+V in connect external power supply (+) here, 6-24VDC (if used)

GROUND Connect negative of external power supply here

+5VDC OUT, up to 1A, depending on capacity of external power supply used

GROUND

Connection to the LOR Network:

******** LOR – ETHERNET cross-connection WARNING ********

Warning: Light-O-Rama and ETHERNET use identical cables and connectors but they are <u>NOT</u> compatible with each other. It is very important that you <u>NEVER</u> plug an LOR cable into an ETHERNET jack, or vice versa. Doing so will likely damage one or both of the units that those cables are connected to. Since the ELOR, by design, must connect to both LOR and ETHERNET networks, we <u>strongly</u> recommended that you mark the network cables that will connect to your ELOR to prevent inadvertently cross-connecting your LOR and ETHERNET networks.

The cable pair used by LOR to carry power on their network is a data pair on an ETHERNET cable. The transformer used by ETHERNET jacks will appear as a short circuit to the LOR power source and will likely burn out the LOR power source or burn out the transformer inside the ETHERNET jack.

On the ELOR, the 2 identical side-by-side vertical RJ-45 jacks are for connection to the LOR network. The single silver horizontal RJ-45 jack is for ETHERNET.
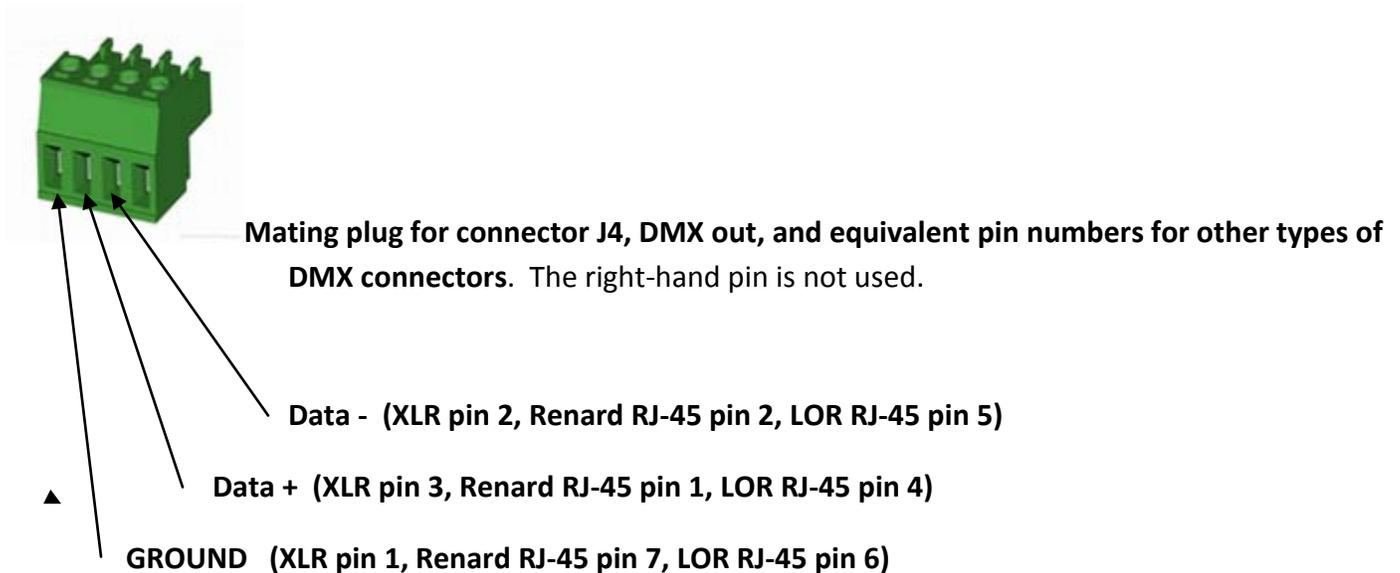
The ELOR has two vertical 8-pin RJ45-type LOR network jacks like any LOR controller. They are located along the left edge. Either may be used as in or out. The ELOR may be the only controller on the LOR network, it may be at the end of the line, or it may be in the middle. **<u>NEVER CONNECT EITHER OF THESE PORTS TO AN ETHERNET NETWORK</u>**!

E1.31 Output to Pixel Controller:

See important network cross-connection warning above! The E1.31 (DMX over Ethernet) output is on the Ethernet module at the right side of the controller. This is a standard Ethernet output and should be connected either to your LAN, or directly to an E1.31 pixel controller. Either a standard or crossover cable may be used. If you need to be able to access your pixel controller's web page, both the ELOR and the pixel controller should be connected to your LAN. If you don't need to access the pixel controller's web page then you can use a direct connection between the ELOR and the pixel controller. **This connector is for ETHERNET ONLY. NEVER connect an LOR cable to the E1.31 jack!**

Wired DMX Output:

One universe of standard wired RS485 type DMX out is provided on connector J4, at the top left of the board.   The right-hand pin is ground, the next pin is plus, and the next to that is minus. The wired DMX output mirrors the 4th E1.31 universe.

Mating plug for connector J4, DMX out, and equivalent pin numbers for other types of DMX connectors. The right-hand pin is not used.

Data - (XLR pin 2, Renard RJ-45 pin 2, LOR RJ-45 pin 5)

Data + (XLR pin 3, Renard RJ-45 pin 1, LOR RJ-45 pin 4)

GROUND   (XLR pin 1, Renard RJ-45 pin 7, LOR RJ-45 pin 6)

Configuration Switches:

There is a bank of eight small 'dip' switches on the ELOR for configuration. From bottom to top they are numbered 1 through 8. The function of these switches is:

Switches 1-5 are the starting universe number for the E1.31 output. As shipped, ELOR is configured for universes 1 through 4, with switch 1 ON, and 2 thru 5 OFF. Switch#1 has a value of 1, switch#2 has a value of 2, switch #3 has a value of 4, switch #4 has a value of 8, and switch #5 has a value of 16. The sum of the values of all of the 'ON' switches (switch handle to the left) will be the starting universe number of the E1.31 output. For example, if you want the E1.31 output to be on universes 1 through 4, you would turn switch#1 on (push it's handle to the left) , and leave switches 2-5 off (to the right).   The ELOR always outputs 4 universes of E1.31 data, on consecutive universe numbers, beginning with the universe number assigned by the switches. If all switches are OFF, the starting universe will be 32. The ELOR must be restarted to recognize a universe number change. Switch settings for starting universe numbers from 1-11 are shown below.

Starting Universe Number	Switch 1 (1)	Switch 2 (2)	Switch 3 (4)	Switch 4 (8)	Switch 5 (16)
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF

Switch 6, if ON, will force the 3 channels that make up each RGB pixel to be "in sync" when the twinkle effect is used. This will cause pixels to twinkle between their normal color and off. If this switch is OFF, every channel is independent as far as the twinkle effect is concerned, and pixels will change colors while the twinkle effect is active since one color channel of the pixel may be twinkling OFF while another channel is twinkling ON.

Switch #7 is not presently used.

Switch #8 is for system testing and should be left OFF.

Assigning the LOR Network ID to ELOR:

Just like any other controller on an LOR network, ELOR must be assigned an LOR network ID. ELOR's ID on the LOR network is set via the LOR hardware utility just as is done with any of the LOR controller's which don't have ID select switches. If you scan your LOR network using the 'Refresh' function of the hardware utility, the ELOR will always appear on the LOR network as 4 DMX1000 controllers, (firmware version will display as 9.1 to distinguish them from 'real' DMX1000s) on consecutive IDs. The ID you set in the LOR hardware utility will be the lowest ID, and the ELOR will use that ID and the following 3. You can use either the "Set New Unit ID" function (but make sure that the ELOR is the ONLY controller connected), or you can use the "Change Existing ID" function where you enter both old and new ID. Since the ELOR will occupy four LOR IDs, the highest ID you can select is ED, which would assign IDs ED, EE, EF, and F0.

For example, if you assign ID 01, the ELOR will appear in a network scan as IDs 01, 02, 03, and 04. You need to assign a base ID to the ELOR such that none of the 4 IDs it uses will conflict with other controllers on your LOR network.

Unlike the 'real' DMX1000, there is no 'legacy mode' addressing option. Regardless of the assigned address, the ELOR will always appear as 4 512-channel controllers.

When using the Hardware Utility's "Change Existing ID" function you may specify any of the 4 current addresses as the "Old Unit ID" value. Whatever value you enter as the "New Unit ID" will be the first of the 4 new addresses.

After changing ELORs IDs, you MUST REFRESH your network configuration for the controller list to be accurate.

The 4 universes of E1.31 data that the ELOR outputs will match 1:1 with the 4 LOR IDs. The data belonging to the lowest ELOR ID number will always be output on the lowest assigned universe number, and so on. For example, if you have selected ELOR ID 11 and universe starting number 5, then commands to channels on LOR controller # 11 will be output on E1.31 universe #5, commands to #12 will be output on universe #6, etc. Data on the last E1.31 universe (in our example it would be LOR ID 14 and E1.31 universe 8) is also sent to the standard RS485 2-wire DMX output on J4. Note that universe numbers are always in decimal, while LOR controller IDs are in hexidecimal (digits 0-9 plus letters A-F). Channel numbers are identical between the LOR controller and the universe. In other words channel X on the LOR controller will always correspond to slot X in the E1.31 output.

Using ELOR with the Light-O-Rama Sequence Editor

In the LOR sequence Editor, select Edit / Preferences / Network Preferences, and make sure the network that the ELOR is on has the button selected for "Short Range Fastest Speed", then click OK.

Assigning Channels to the ELOR in the LOR Sequence Editor:

Assign ELOR channels as if you had 4 512-channel controllers. Controller type will be "Light-O-Rama Controller". When you manually assign the first channel the software will prompt if you want to assign additional consecutive channels, if using all channels let it assign for a full 512-channel controller. If you know you will only be using a certain number of RGB channels, then only assign that many. You will use at most the first 510 channels of each controller, possibly less depending on the number of pixels that are attached to each universe. 510 channels is exactly 170 pixels.

When defining RGB channels in LOR it's important that you start with a channel number that is the first (RED) channel of an RGB pixel. In other words channels 1, 4, 7, 10, 13, etc, up to 508. This insures that the 3 consecutive LOR channels that make up an RGB channel will all belong to the same pixel. You should follow the same rule when assigning DMX addresses on the pixel controller.

The ELOR should properly respond to all LOR sequencing functions: ON, OFF, Set Intensity, Fades, Twinkle, Shimmer, and Twinkle/Shimmer combined with a fade.

LED Indicators:

There are four LED indicators on the ELOR. The red **LOR SYNC** LED functions much the same as the red LED on a standard LOR controller. It will be lit steadily if the ELOR sees incoming LOR data and is locked to it, it will flash on and off if there is no data, or if it's determining the communication speed on the network. It's normal for this LED to continue to flash for several seconds after the LOR network is connected, while the controller determines the network data rate. This LED also serves as a power indicator. Whenever there is power applied to the ELOR, the **LOR SYNC** LED should either be flashing or lit steadily. If you are attempting to power the ELOR from the LOR network, and the LOR SYNC led doesn't light, verify that the LOR power jumpers are in place. If the jumpers are in place and the LED is still off, it means there's no power available on the LOR network, and you'll have to remove the jumpers and attach an external power supply to J3 as described earlier.

The red **LOR SEND** led will only light briefly when the ELOR is communicating back to the PC. This will only happen during a network 'refresh' or an ID change, when running the LOR Hardware Utility.

The green **LOR RCV** led will light whenever the ELOR receives a command addressed to it. If this LED doesn't light when you are running a sequence, it's most likely caused by a mismatch between the controller ID in the sequencer and the controller ID(s) assigned to the ELOR.

The yellow **CMND ERROR** led will flash for several seconds whenever the ELOR receives a command that it doesn't understand. In normal usage this LED should remain off. If it lights consistently at the same point in a running sequence, it most likely is indicating that there is an LOR command that isn't properly programmed in the ELOR. This LED will also light if you attempt to do functions with the hardware utility (such as change configuration, or update firmware) that the ELOR isn't programmed for. It's also possible that the error LED will flash because of an error on the network.

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