LUTRON Integration Partner	CONVERGING SYSTEMS	Integration Note
Automation/Lighting Panel Manufacturer:	**Lutron Electronics Co. Inc.**	
Platform	**RadioRA2**	
Model Number(s):	- e-Node with ILC-x00 family of LED lighting controllers, **and/or** - e-Node/DMX (for third party DMX Fixtures)	
Partner Software Platforms	All Lutron setup software (Essentials and Inclusive)	
Specific Profile/Driver Version:	No driver required from Lutron. E-Node v 2.9 or later. Pilot s/w 4.4 build 2 or later. Note: new functionality may require newer versions of e-Node firmware and/or Pilot software	
Partner/Driver Developer:	Converging Systems Inc.	
Document Revision Date:	11/21/2016	

Integration Note Table of Contents

Please the following table of contents to help you navigate through this Integration Note.

OVERVIEW AND SUPPORTED FEATURES

The Lutron lighting systems, RadioRA®2 and Homeworks® QS support the Converging Systems' family of motor and LED lighting control products using the Converging Systems e-Node device. This integration note is customized for the **RadioRA2** platform. If you desire to develop compatibility with Homeworks QS systems, please see the separate Integration Note referencing the Homeworks QS system.

Integration of the Converging Systems' platforms are enabled from Lutron keypads, and Android and iOS devices both locally and remotely.

THE FOLLOWING OPTIONS ARE SUPPORTED BY THE CONVERGING SYSTEMS LUTRON EMBEDDED SMART INTERFACE (WITHIN E-NODE GATEWAY AND ILC-X00 FAMILY CONTROLLER OR WITHIN E-NODE/DMX GATEWAY)

- Discrete control of LED states (ON/OFF)
- One-way control of Correlated Color Temperature (CCT) (or sometimes referred to as "Dynamic White") settings with RGB, and RGBW devices using Converging Systems FLLA LED elements. Specific CCT settings can be selected as well as CCT UP/DOWN controls for CCT adjustments
- One-way control of Circadian Rhythm (Sunrise to midday sun to Sunset dynamic settings) using Converging Systems RGBW FLLA devices (with ILC-400c controller only).
- Support of communication utilizing Telnet with authentication (Port 23)
- One-way control of color settings in the RGB, RGBW (within ILC-400 only), or HSB color space.
- Ability to store and recall specific colors set by a user.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

- Ability to recall specific Effects stored (within e-Node/DMX limited to Effect 1).
- Ability to change Dissolve Rates (time it takes to transitions from one state to another) (i) for On and Off states, (ii) for Presets to other Presets (color) settings, and (ii) for state to state transitions within Effects.
- Ability to change Sequence Rates (time after any dissolve that a Preset color is maintained before transitioning to the next color in sequence) in Effects 1 and 4.
- Control via all thin client interfaces (PC, Home Control + and all Lutron RadioRA2 compatible interfaces

THE FOLLOWING OPTIONS are not supported by CS-Bus (lighting) driver:

- Connectivity using RS-232c interface (IBT-100)

Tabular Summary of Supported Features

The following commands are supported by the current Smart Interface/driver for the various lighting and motor control devices (except those that are grayed out).

LED Lighting Commands

General CS-Bus Commands	Elan Naming Convention[1]	ILC-100 m	ILC-100c (sa)	ILC-400 (RGBW mode	ILC-400 (4 ch Mono)	e-Node DMX
	General LED Control Commands					
ON	eNode_On	✓	✓	✓	✓	✓
OFF	e-Node_Off	✓	✓	✓	✓	✓
EFFECT,n	Execute_Effect	✓	✓	✓	✓	✓[1]
STORE,#	Store Preset	✓	✓	✓	✓	✓
RECALL,#	Recall Preset	✓	✓	✓	✓	✓
DISSOLVE.1=XX	Set_Dissolve_Rate	✓	✓	✓	✓	✓
DISSOLVE.2=XX	Set_Dissolve_Rate	✓	✓	✓	✓	✓
DISSOLVE.3=XX	Set_Dissolve_Rate	✓	✓	✓	✓	✓
DISSOLVE.5=XX	Set_Dissolve_Rate	✓	✓	✓	✓	✓
SEQRATE=XX	Set_Sequence_Rate	✓	✓	✓	✓	✓
SUN_UP	Sun_Up			✓		
SUN_DOWN	Sun_Down			✓		
SUN.S	Set_Circadian_Value			✓		
	HSB (HSL) Color Space Commands					
FADE_UP	Fade_Up	✓	✓	✓	✓	✓
FADE_DOWN	Fade_Down	✓	✓	✓	✓	✓
SET,L	Set_Brightness	✓	✓	✓	✓	✓
HUE_UP	Hue_Up		✓	✓		✓
HUE_DOWN	Hue_Down		✓	✓		✓
HUE,H	Set_Hue_Value		✓	✓		✓
SAT_UP	Sat_Up		✓	✓		✓
SAT_DOWN	Sat_Down		✓	✓		✓
SAT_S	Set_Saturation_Value		✓	✓		✓

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

STOP	STOP	✓	✓	✓	✓	✓
COLOR=H.S.L	Set_Preset_HLS Colorspace	✓	✓	✓	✓	N/A
PRESETH.X=XXX .XXX.XXX	Set LED Presets/HLS Color spacer for preset x	✓	✓	✓	✓	✓
	RGB(W) Color Space Commands					
RED,R	Set_RED_Value		✓	✓		✓
GREEN,G	Set_GREEN_Value		✓	✓		✓
BLUE,B	Set_BLUE_Value		✓	✓		✓
VALUE=R.G.B	???					
WHITE,W	Set_BLUE_Value	✓	✓	✓	✓	✓
RGB,R.G.B	Set RGB Value		✓	✓		✓
RGBW,R.G.B	Set RGBW Value			✓		
PRESET.X=XXX.X XX.XXX (3-color)	Set LED Presets/RGB Color spacer for preset x					
PRESET.X=XXX.X XX.XXX (4-color)						
STOP	Stop adjustment	✓	✓	✓	✓	✓
Correlated Color Temperature (CCT) Commands						
CCT,XXXX	SET_Correlated_Color _Temp			✓		✓
CCT_UP	Color_Temp_Up			✓		✓
CCT_DOWN	Color_Temp_Down			✓		✓
Bi-Directional Commands (not relevant currently)						
COLOR=?	Automatic polling within Driver. **Note**: Driver achieves same function with Notify ON	✓	✓	✓	✓	✓
VALUE=?	Automatic polling within Driver **Note**: Driver achieves same function with Notify ON	✓	✓	✓	✓	✓
PRESETH.X=?		*		*		*
PRESET.X=?		*		*		*
Accessory Enode Command/Setup Parameters						
Verbose Mode						
UDP Port 4000/5000						
Telnet Login with Authentication (with e-Node		✓	✓	✓	✓	✓
Telnet Login						

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

without Authentication						

Notes:

- reserved
** reserved
[1] Effect (1) only supported
[2] reserved

Motor Commands

General Commands	Elan Naming Convention	IMC-100	BRIC ("Bric Mode ")	IMC-300 (MKII)
General Motor Control Commands				
UP		✓	✓	✓
DOWN		✓	✓	✓
STOP		✓	✓	✓
RETRACT		✓	✓	✓
STORE,#		✓	✓	✓
RECALL,#		✓	✓	✓
PRESET.X=XX.XX				
Bi-Directional Commands				
STATUS=?				
POSITION=?				✓
Accessory Enode Command/Setup Parameters				
Verbose Mode		✓	x	✓
UDP Port 4000/5000				
Telnet Login with Authentication (with e-Node		✓	✓	✓
Telnet Login without Authentication				

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Theory of Operation

A Lutron RadioRa2 processor along with (i) one or more connected CS-Bus compatible devices (LED or projection screen motors) and a single e-Node (for up to 254 controllers) or (ii) one to 32 third-party DMX fixtures using a single e-Node/**dmx** is all that is required for system operation and perfect Lutron/Converging Systems operation. See Appendix 4 for DMX instructions.

No drivers or changes to Lutron equipment in general are required to establish communication with Converging Systems equipment, although you may wish to fine tune the button logic in your Lutron project to generate the type of output commands which will most effectively control the Converging Systems equipment. For those who wish to understand further the magic of our inter-operability with technology from Lutron, see the following diagram.

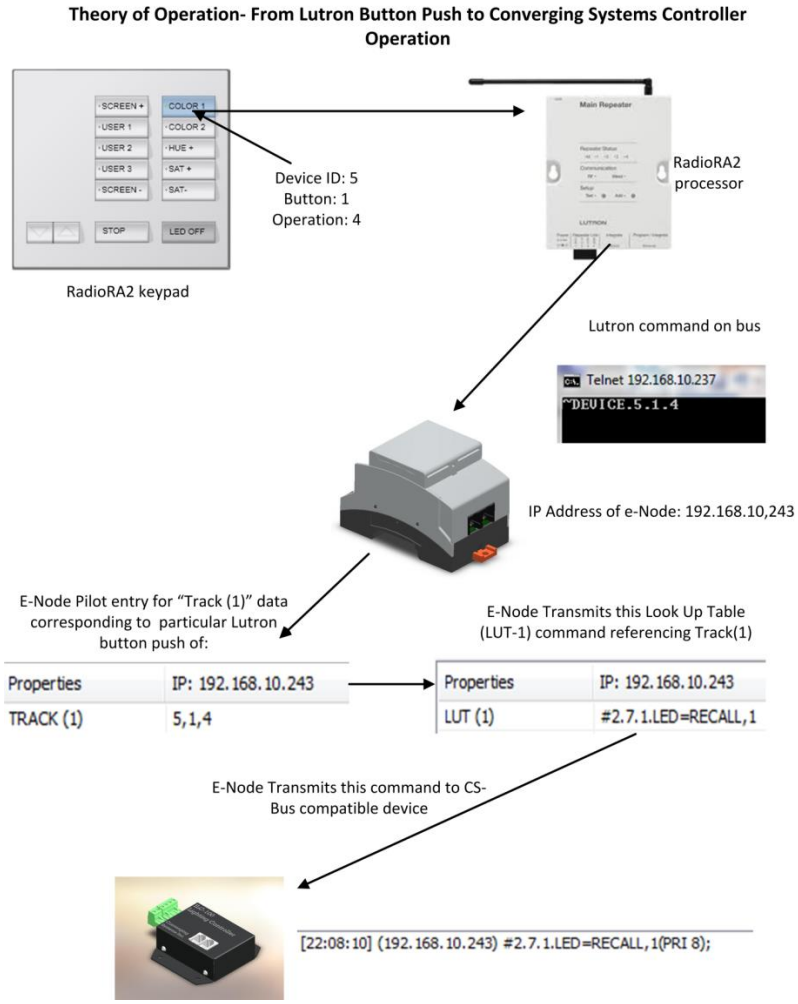


Figure 1

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

SYSTEM ARCHITECTURE AND REQUIRED COMPONENTS

1. WIRING DIAGRAM (for RadioRA2) with CS-Bus equipment

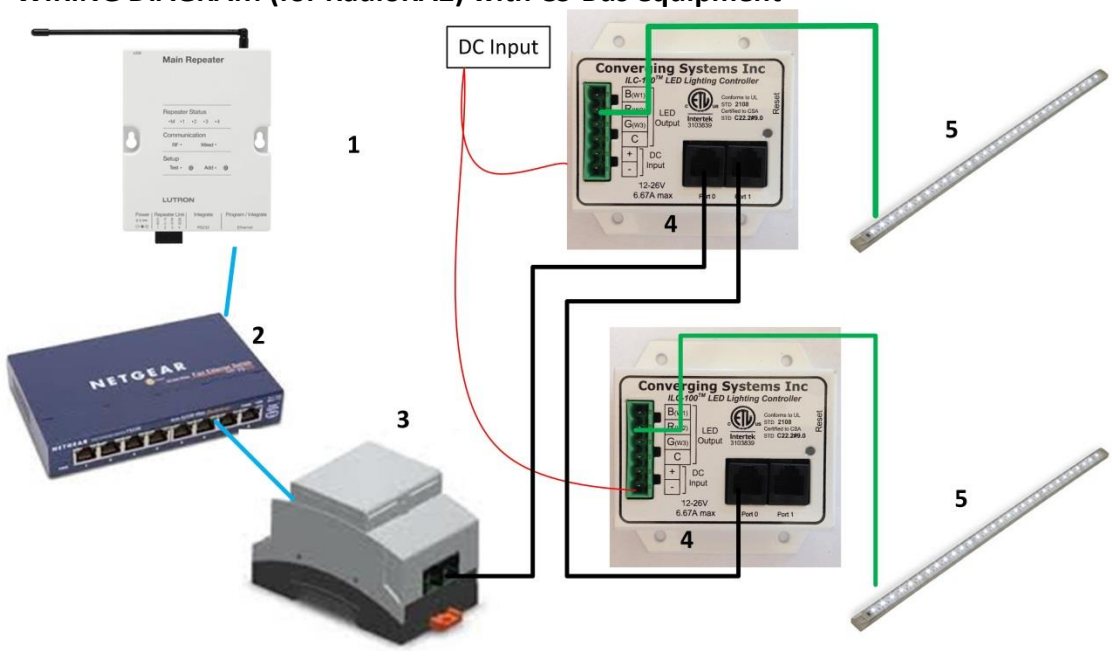


Figure 2

Wiring/Configuration Notes:

1. Maximum length of CS-Bus cabling from e-Node to the last ILC-x00 using CAT5e or better cabling (and obeying the 1-1 pin-out requirements for the RJ-25-RJ25 cable) = 4000 feet
2. Maximum number of ILC-x00 controllers and Converging Systems' keypads (if provided) that can exist on a single network connected to a single e-Node device = 254
3. Maximum number of e-Nodes that can exist on a Lutron RadioRA2 or Homeworks QS system = 254

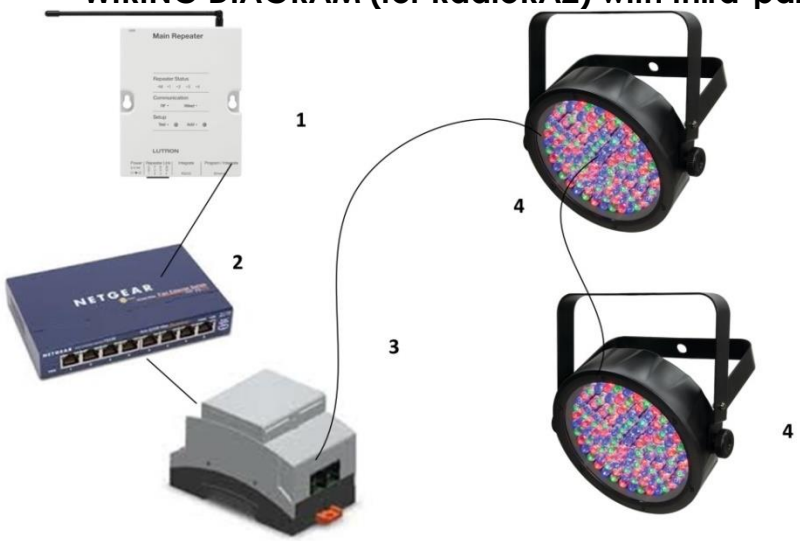
2. BILL OF MATERIALS (for RadioRA2)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	RadioRA2 processor	Lutron	RR-Main-REP-WH	Ethernet	various	
2	Network Switch	Various	Various	Ethernet	RJ-45	
3	e-Node	Converging Systems	e-Node	Ethernet	RJ-45 (for Ethernet) RJ-25 for local bus	
4	Lighting Controller (or Motor Controller)	Converging Systems	ILC-x00 or IMC-x00 or (Stewart BRIC)	CS-Bus protocol	RJ-25 for CS-Bus communication	Must terminate beginning and end of bus with 120 ohm resister on

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

						pins 3/4
5	Flexible Linear Lighting (FLLA) RGB or RGBW luminaries	Converging Systems	FLLA-RGB-xxx FLLA-RGBW-xxx		3-color 4 pin 4-color 5 pin 1-color 4 pin	

3. WIRING DIAGRAM (for RadioRA2) with third-party DMX equipment



Wiring/Configuration Notes:

1. Maximum length of CS-Bus cabling from e-Node to the last DMX fixture using DMX cabling = 1200 meters (3,900 feet)
2. Maximum number of DMX fixtures connected to a single e-Node/dmx device = 32. If more than 32 fixtures are required, implement additional e-Node/dmx devices.
3. Maximum number of e-Nodes that can exist on a Lutron system = 254

4. BILL OF MATERIALS (for e-Node/DMX)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	RadioRA2 processor	Lutron	RR-Main-REP-WH	Ethernet	various	
2	Network Switch	Various	Various	Ethernet	RJ-45	
3	e-Node/dmx	Converging Systems	e-Node/dmx	Ethernet	RJ-45 (for Ethernet) RJ-25 for local DMX bus	
4	Third party DMX fixtures	Various	Various	DMX512	RJ-25 for DMX communication	Must terminate final OUT or THRU connector on last DMX fixture using a 120 ohm resistor

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Converging Systems Hardware Setup

NOTE: Converging Systems LED and Motor Controllers REQUIRE a preliminary amount of initial setup/commission which requires the e-Node Ethernet adapter. There are two primary steps that need to be followed:

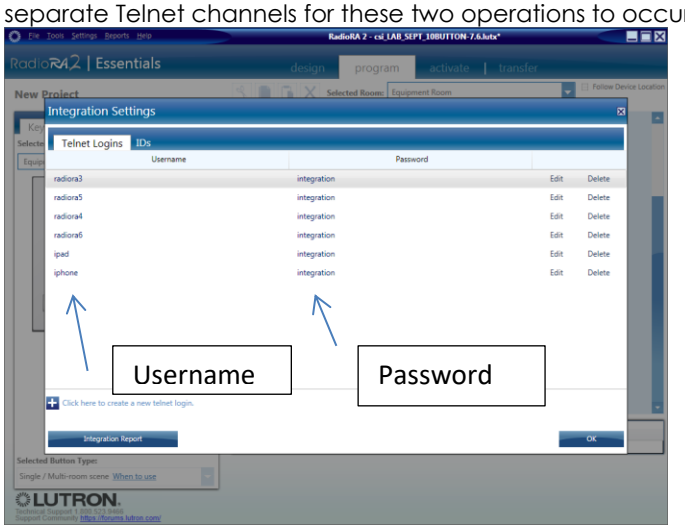
-Hardware interconnections
-Software setup including device discovery and device addressing.

The core section of this manual assumes that the above two steps have already been performed. In case they have not, please see Appendix 2 and more detailed documentation available on the Converging Systems' website including
-e-Node Commissioning Guide (long version)
-ILC-x00 Intelligent Lighting Controller
-IMC-x00 Motor Controller Manual

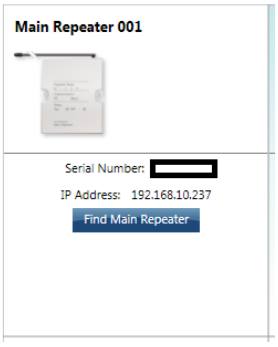
Warning: Only if these above steps have been completed, including device addressing, please proceed to next section.

Lutron/Converging Systems Integration Process

1. Lutron Communication Setup

Step	Step	Detail
1a	Establish a **Telnet Username** with **Telnet Password** within Lutron that you can allocate to enable the Converging Systems network connection.	Program into your Lutron processor a ***dedicated*** **Telnet Username** and **Telnet Password** for a Telnet channel that can be dedicated to the Converging Systems' interface. Telnet channels cannot be shared, so if you wish to have the Lutron Home Control + app and the Converging System application running, it is necessary to establish two separate Telnet channels for these two operations to occur.  Either write down these credentials or print off the Spreadsheet in Appendix 8 for use later on in these instructions.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

1b	Take note of the IP addresss for the Lutron processor	You can find this within Lutron software as follows:  Either write down this IP address or print off the Spreadsheet in Appendix 8 for use later on in these instructions.

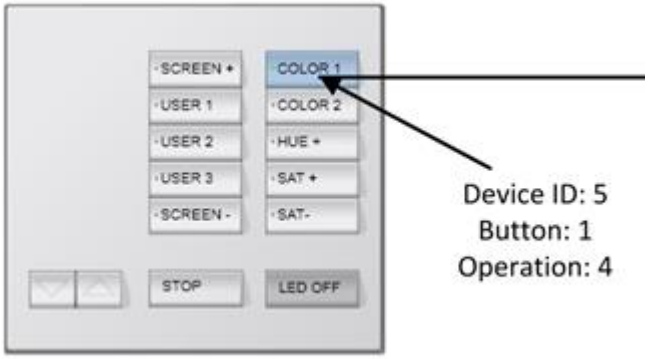
2. Perform any Necessary Lutron Button Push Tweaks and Gather any Required Data within Essentials or Inclusive

Note: Within RadioRA2, buttons can be created to behave in several discrete manners. Those relevant to our setup instructions are specified below. These button operations are summarized in the table in Appendix 1 and described in further detail after that table. **It is important to understand the discrete operations for how button behave, for the Converging Systems connected devices can only be programmed to respond to those output commands generated by Lutron**. If those buttons do not generate the correct Lutron output codes, Converging Systems' products cannot properly respond--PERIOD.

This is particularly true for the creation of dummy sliders or dummy keypads for display on Home Control+ where each dummy sliders or keypad needs to be linked to some phantom or random load in Lutron software in order to have those controls transmit out signals that we can sense.

Step	Step	Detail
2a	Determine if you have one or more existing buttons on ***already programmed (activated)*** keypads that you wish to program to control Converging Systems controls' specific operations.	If so, Print out or view a Lutron Integration Report to determine these numbers/parameters.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

<table>
<tr>
<td></td>
<td></td>
<td>


For example, the top button on this keypad has the following data parameters associated with it.
<table>
<tr><th>Integration ID</th><th>Button Number</th><th>Operation Type</th></tr>
<tr><td>5</td><td>1 (top button)</td><td>4 (for a release)</td></tr>
</table>

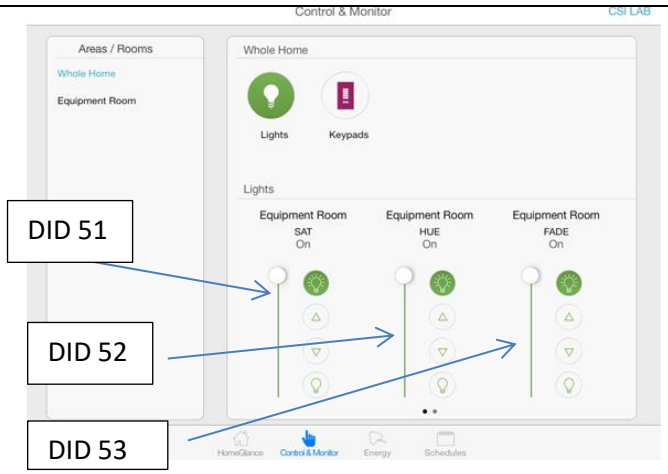
See Appendix 1 as well for the Operation Type (i.e. “3”, “4”, etc.) available for each button type. Also See Appendix 1 for a cheat sheet of all Lutron Button ID numbers.

-Next, either write down these triad of number for each targeted button that you wish to monitor on a sheet of paper or print off the Spreadsheet in Appendix 8 and enter it there for use later.
</td>
</tr>
<tr>
<td>2b</td>
<td>Determine if you want to generate more interesting customized sliders for the control of these type of features:
-Hue Slider
-Saturation Slider
-Red Slider
-Green Slider
-Blue Slider
-etc.</td>
<td>If these types of sliders are desired, you can “trick” Lutron and create one or more non-activated/dummy keypad(s) to be re-purposed to create non-traditional User Interface controls.

An example here would be to create sliders in Home Control + to control variable output for Hue, Saturation, Color Temperature or other variable type output.

Note: This would be a slider that normally would not be considered to be standard Lutron UI control, but in this case will become very practical for enhanced color control.</td>
</tr>
</table>

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

<table>
<tr>
<td></td>
<td></td>
<td>


-In this case, you would create three **Dummy dimmer devices** and name them **Hue**, **Sat** and **Fade** within Lutron software ***but simply not ACTIVATE them.***

-Next go into xxxx and connect them to some load.

-Next, generate an Integration Report and write down the single **Device ID** for each dummy dimmer device and then either write down this **Device ID** number on a sheet of paper or print off the Spreadsheet in Appendix 8 and enter it there for use later on in these instructions (i.e. Device ID of 51, 52 and 53 have been created).

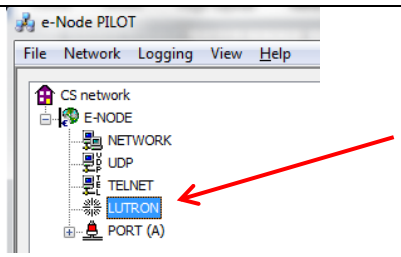
-For example, the **Device ID** for the three dummy dimmers is as follows:

<table>
<tr><th>Dummy Button</th><th>Button Number</th></tr>
<tr><td>Hue</td><td>51</td></tr>
<tr><td>Sat</td><td>52</td></tr>
<tr><td>Fade</td><td>53</td></tr>
</table>
</td>
</tr>
<tr>
<td>2d</td>
<td>Complete Lutron programming (only if more sliders are required).</td>
<td></td>
</tr>
</table>

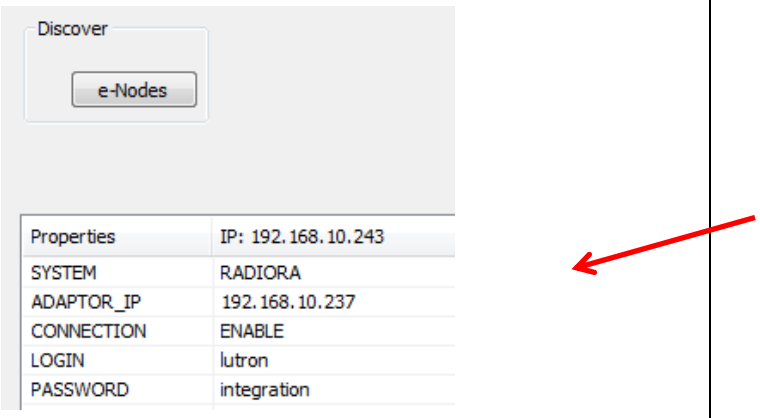
3. Enter Data Derived in Sections #1 and #2 above into the e-Node through the e-Node Pilot application or the Web-Pilot application.

Step	**Step**	**Detail**
3a	Setup e-Node for **RadioRa2** and program the Lutron Processor IP address	**-**Launch the e-Node Pilot or Web-Pilot application -Select the View **e-Node view**, and highlight the **Lutron** tab.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

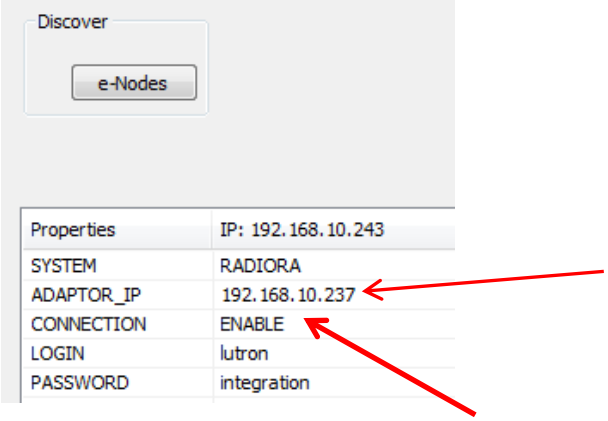


- For a RadioRA2 system, select **RADIORA** (or RADIORA2 if listed).



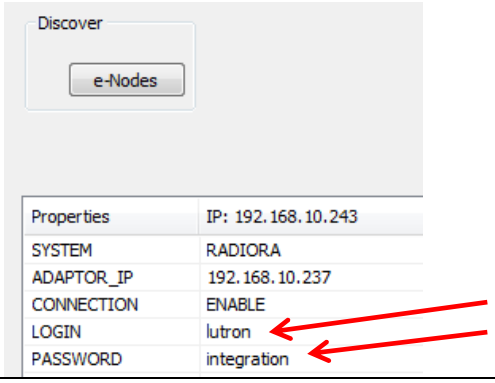
Note: The Converging Systems e-Node/Lutron driver is only compatible with RADIORA**2** systems and even though earlier versions of e-Node firmware abbreviated RADIORA2 systems as "RADIORA," you should select "RADIORA" even though there is no compatibility with RadioRA systems.

-Set the **ADAPTOR_IP** address for that of the Lutron RadioRa2 processor (which address can be obtained using the Lutron Essentials/Inclusive software setup utility package).



-Enable the **CONNECTION** tab (representing the Telnet client function) to **ENABLE** to turn on the Telnet Client function within e-Node to enable communication with the

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

		Lutron processor. **Note**: The e-Node supports both Telnet ***Client*** communications (for communication from the Lutron processor) as well as Telnet ***Server*** communications (for communication to other third-party Control systems), both of which can be used concurrently. For this purposes of this Integration Note, we are only dealing with the Telnet Client settings available under the **Lutron tab**.
3b	Enter LOGIN and PASSWORD credentials	-Finally enter an applicable **LOGIN** and **PASSWORD** entry for an available Telnet channel that you previously set-up within the Lutron setup software similar to how you might have set up an iPad® Login/Password field if you were going to run the Lutron Home Control+ application. 

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

4. Enter Connectivity Data to Link Lutron button push(es) to Converging Systems operation**—"TRACKS" and "LUTS" (look-up-table)**

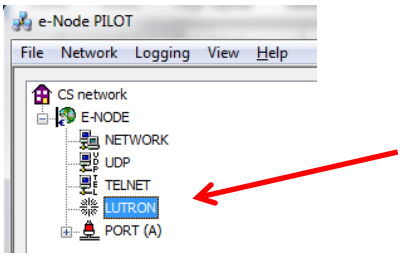
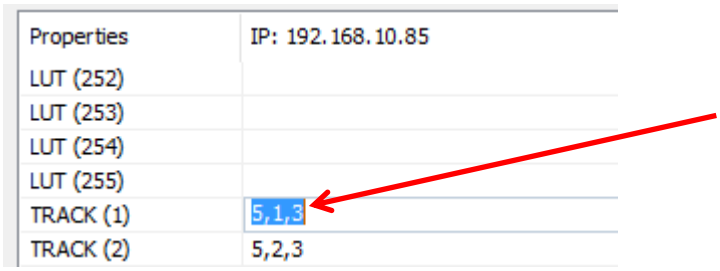
You have 255 data fields within our Smart Lutron Interface Monitor (SLIM) in our various e-Nodes that will enable

- Any Lutron button push to trigger a Converging Systems operation, or
- Any Lutron slider movement to trigger a Converging Systems operation.

Here is how it works:

The Magic. The Flowchart in Figure 1 shows that if a Lutron identified button (that is to say, a button with a known Device ID, a known Button Number, and a known mode of operation output string, such as a "3", a "4" or a "5") is activated, the SLIM software logic within the e-Node is able to translate that button push into a compatible CS-Bus command that can be directed to any CS-Bus compatible controller on that CS-Bus (or a compatible DMX output command with the e-Node/dmx. The steps below will show the programming for the following simple example

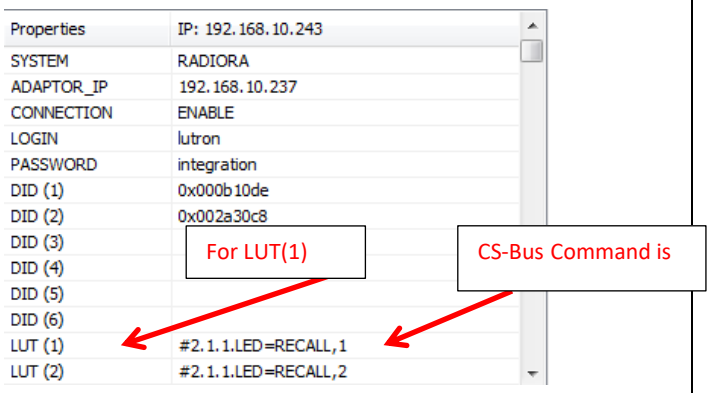
"SLIM" Tab Programming

Step	Step	Detail
4a	Set-up the **TRACK(n)** entry to what Lutron button push operation you want **monitor** and to which you desire the Converging Systems' controller to respond	Within the **View e-Node** view, once again select the **Lutron** tab (if you are not already there).  -Scroll down until you see the first **TRACK(n)** entry (where "n" is a discrete number between 1 and 255 which matches a similar LUT(n) entry. For example, TRACK(1) monitors a certain Lutron button push and if received executes the instruction (or command) listed under LUT(1). Similarly TRACT(2) executes LUT(2) and so one.  -From your spreadsheet, enter the **Device ID, Button Number, and Button Operation** code in the format **X,Y,Z** from your spreadsheet in Appendix 8 (commas not periods). In the above

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

<table>
<tr><td></td><td></td><td>example, TRACK(1) has been set to the following:

<table><tr><td>Device ID</td><td>5</td></tr><tr><td>Button Number</td><td>1</td></tr><tr><td>Button Operation</td><td>3</td></tr></table></td></tr>
<tr><td>4b</td><td>Set-up the LUT(n) entry for the Converging Systems operation that you wish to have performed when a matching TRACK(n) command with the same “n” value is received.</td><td>-Scroll down until you see the LUT(n) entry for the same “n” value that you set in Step 4a above.

-From your Appendix 8 Spreadsheet, enter the Converging Systems CS-Bus command that you want to have triggered for a specific “n” when an incoming TRACK for the same “n” value is received. For example, if you wanted a device with a Zone, Group, Node (Z/G/N) address of 2.1.1. to invoke a Recall,1 command, here would be the entry:

<table><tr><td>When a TRACK(n) received</td><td>This CS-Bus command will be triggered (to be entered under LUT(n) field</td></tr><tr><td>TRACK(1)</td><td>LUT(1) #2.1.1.LED=RECALL,1</td></tr></table>
Note: There is limited error-handling within PILOT, so must check your work carefully, and if all the data entries are valid, immediately after you populate the fields, your e-Node will be able to make the proper translations and your system should be operational.</td></tr>
<tr><td>4c</td><td>Continue Process until all LUT(n) and TRACK(n) are entered for all Lutron button push/CS-Bus operations that you wish to program.</td><td>Logically then, there would be a matching LUT(n) for each TRACK(n) programmed. Here is a screen shot of the programming that is described below under Example #1.</td></tr>
</table>

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

<table>
<tr><td></td><td></td><td>
<table>
<tr><th>Properties</th><th>IP: 192.168.10.243</th></tr>
<tr><td>TRACK (1)</td><td>5,1,4</td></tr>
<tr><td>TRACK (2)</td><td>5,2,4</td></tr>
<tr><td>TRACK (3)</td><td>5,3,4</td></tr>
<tr><td>TRACK (4)</td><td>5,4,4</td></tr>
<tr><td>TRACK (5)</td><td>5,5,4</td></tr>
<tr><td>TRACK (6)</td><td>5,16,4</td></tr>
<tr><td>TRACK (7)</td><td>5,6,4</td></tr>
<tr><td>TRACK (8)</td><td>5,7,4</td></tr>
<tr><td>TRACK (9)</td><td>5,7,5</td></tr>
<tr><td>TRACK (10)</td><td>5,8,4</td></tr>
<tr><td>TRACK (11)</td><td>5,8,5</td></tr>
<tr><td>TRACK (12)</td><td>5,9,4</td></tr>
<tr><td>TRACK (13)</td><td>5,9,5</td></tr>
</table>
<table>
<tr><th>Properties</th><th>IP: 192.168.10.243</th></tr>
<tr><td>LUT (1)</td><td>#2.7.1.LED=RECALL,1</td></tr>
<tr><td>LUT (2)</td><td>#2.7.1.LED=RECALL,2</td></tr>
<tr><td>LUT (3)</td><td>#2.7.1.LED=HUE_UP</td></tr>
<tr><td>LUT (4)</td><td>#2.7.1.LED=SAT_UP</td></tr>
<tr><td>LUT (5)</td><td>#2.7.1.LED=SAT_DOWN</td></tr>
<tr><td>LUT (6)</td><td>#2.7.1.LED=OFF</td></tr>
<tr><td>LUT (7)</td><td>#1.1.1.MOTOR=UP</td></tr>
<tr><td>LUT (8)</td><td>#2.7.1.LED=RECALL,10</td></tr>
<tr><td>LUT (9)</td><td>#2.7.1.LED=STORE,10</td></tr>
<tr><td>LUT (10)</td><td>#2.7.1.LED=RECALL,11</td></tr>
<tr><td>LUT (11)</td><td>#2.7.1.LED=STORE,11</td></tr>
<tr><td>LUT (12)</td><td>#2.7.1.LED=RECALL,12</td></tr>
<tr><td>LUT (13)</td><td>#2.7.1.LED=STORE,12</td></tr>
</table>
</td></tr>
<tr><td>4d</td><td>Programming Note</td><td>There is no requirement for the order in which you add commands, with the only caveat being that the TRACK(n) and LUT(n) index numbers for the same operation must relate to each other.

Specifically, TRACK(1) is associated with LUT(1), TRACK(2) is associated with LUT(2), TRACK(3) is associated with LUT(3).

There are a total of 255 unique TRACKS, and therefore 255 associated LUTS that can be utilized by programmer. You can have duplicate entries from one TRACK(n) entry to another TRACK(n) entry to enable two different CS-BUS commands to be invoked from the same LUTRON button push, which is effectively an easy way to program a macro in this environment, conceptually.</td></tr>
<tr><td>4e</td><td>Note on Testing /Troubleshooting</td><td></td></tr>
</table>

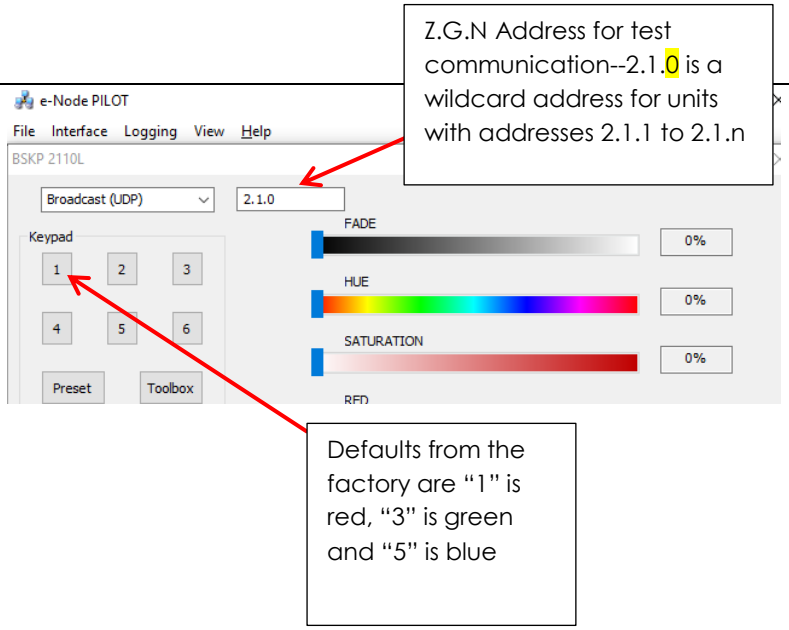
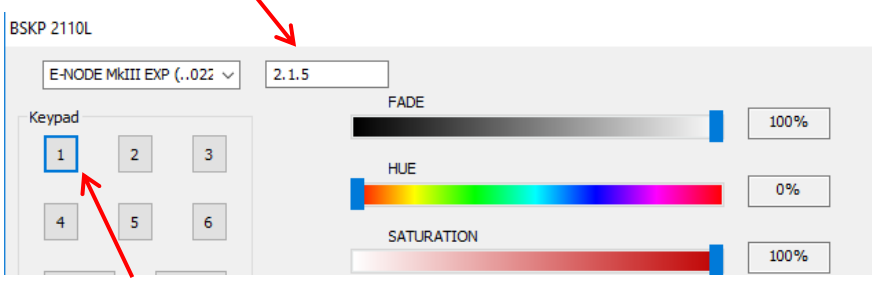
5. Test

Step	Step	Detail
5a	Restart the e-Node if you have made any IP address or login/password changes to the LUTRON tab	Press various buttons on all Lutron UI devices and see if proper operations are occurring on Converging Systems' devices. If not go to the next Troubleshooting section.

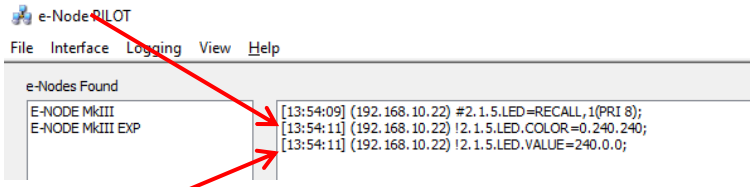
6. Troubleshooting

Step	Step	Detail
6a	User the e-Node Virtual Terminal to see if particular functions are working with the Converging Systems' setup prior to testing/troubleshooting Lutron.	-Test to see if system is working with the e-Node Virtual Terminal feature within e-Node pilot. Use the sliders or presets buttons send commands to a particular Z/G/N address

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

		 Consult the e-Node documentation or see Appendix 10 for more troubleshooting information.
6b	Use the e-Node Pilot application to monitor traffic received by the e-Node or e-Node/dmx devices to start your troubleshooting process.	We highly recommend launching the e-Node Pilot application and selecting the **VIEW TRAFFIC** window to make sure the proper commands that have been programmed can be seen on the CS-BUS. We can almost guarantee that if there is no appropriate CS-BUS commands appearing in the VIEW TRAFFIC window, then the **TRACK** and **LUT** entries ***were not properly entered***. In order to remotely monitor actual commands flowing to a particular controller, within the e-Node Pilot standalone application, select the **View Traffic** Tab, and select the **Discover e-Node** button. Monitor the traffic in the right window to troubleshoot the system. As an example, say you wanted to send a **Red** out to a device with address **Z/G/N**=2.1.5  Here the Keypad "1" is pressed on the Virtual Keypad which sends out a Recall 1 (which is a red initially from the factory). In effect, by pressing this button, this command is transmitted to our bus: **#2.1.5.LED.VALUE=RECALL,1** In this case, if **NOTIFY** is set to BOTH (that is to say, VALUE data and COLOR data are both turned on), a response comes back on the bus (starting with a "!" mark) from that unit with an address of 2.1.5.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

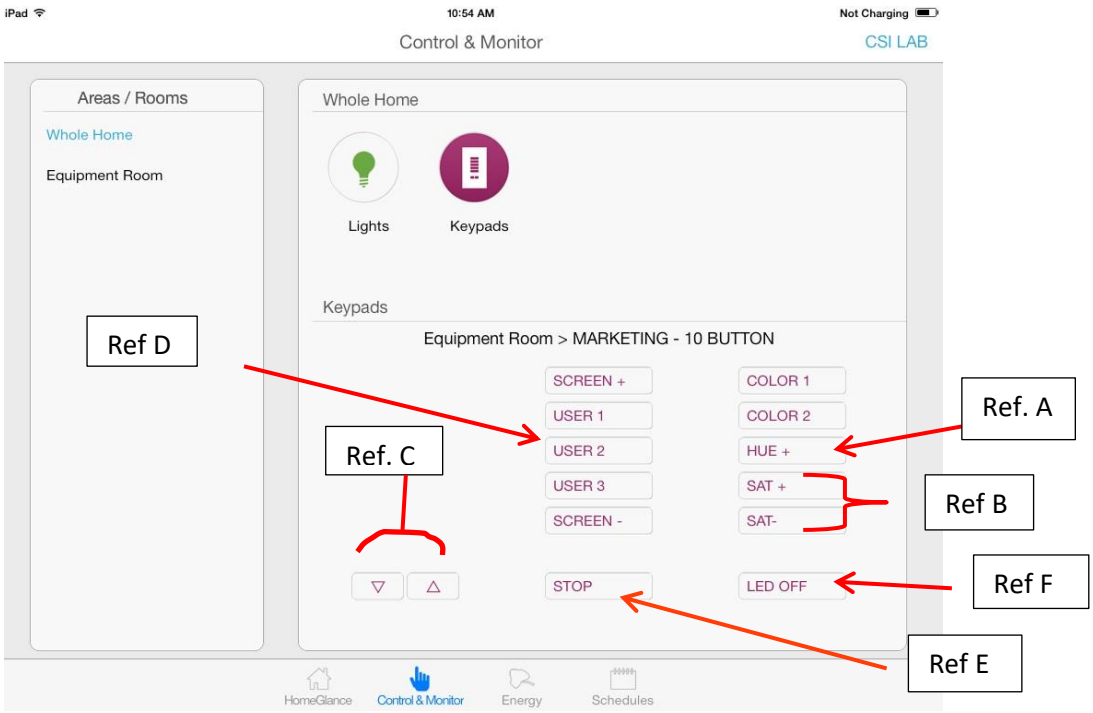
		The **LED.COLOR** response shows that the H/S/B specification for red is Hue=240. Sat=240 and Fade=240.  Alternatively, the **LED.VALUE** response shows the R/G/B specification for red is Red=240, Green=0, and Blue-0). Depending upon your configuration your addresses will vary as well as the specification for a selected color.)
6c	Additional Telnet troubleshooting	You can also launch your computer's TELNET application, to verify the expected Lutron command strings are appearing on the IP bus. ***If those commands are NOT appearing on the IP bus, then there is no way the Converging Systems' e-Node can do its work.***

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Examples

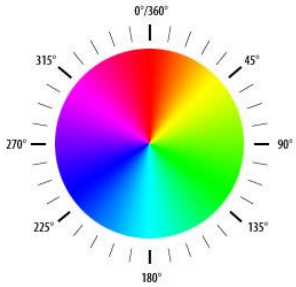
Example 1

Following is a simple example all of the button programming on the specified 10-button RadioRA2 keypad (RR-T10RL). The intent is that we will have buttons from a standard RR-T10RL (which just as easily could be 5 button or 15 button keypad) control various lighting and/or motor operations. The layout of the example keypad might be as follows:

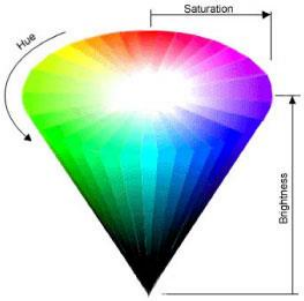


The logic or operation of the various buttons can be described as follows:

- [**Ref A**] One button when pressed will trigger colored LEDS to start the process of visiting briefly each color around the color wheel (called Hue). A single HUE+ button goes clockwise, while a HUE- (if present) button would just go counterclockwise.



- [**Ref B**] Two buttons would control Saturation+ (UP) and Saturation – (DOWN). Saturation is the absence or presence of white in a particular color.



- [**Ref C**] The normal Lutron fade buttons would control brightness as opposed to shifting the color itself to some unexpected shade.
- [**Ref D**] Additional buttons User 1/User 2/User3 can be thought of a Recall of a scene (previously stored color).
- [**Ref D**] An option exists that if a User(n) button is depressed for an extended period of time it could be multi-purposed as a Store Button if Lutron programming can give us a discrete button operation in this case
- [**Ref E**] Color adjustment STOP button (which would stop any auto sequencing set into motion with the HUE or SAT commands).
- [**Ref F**] Standard OFF button

All of this magic can be quickly programmed within e-Node pilot or the Web-Pilot application. And as you can see, nearly everything to make this work, exists outside of standard Lutron application programming (except if you want to tweak a particular button's operation).Depending upon your specific environment, simply adjust the example below with the following:

- Specific **Device IDs** for your Lutron **devices** (see **Device ID** field below)
- Specific **Button ID** numbers for the ***specific button*** on a device. See **Button ID** field below)
- Specific **Ref #** for the ***button operation*** type
  Note: see Appendix 1 for more information. In general, use a "**3**" for a press, a "**4**" for a release, a "**5**" for a hold and a "**6**" for a double tap.)
- Your specific Converging Systems device **Z/G/N** address. See **Z/G/N** field below.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Here is a Pilot example showing these fields

Device ID)

Button ID

Ref # for Button

Z.G.N address

Properties	IP: 192.168.10.243
TRACK (1)	5,1,4
TRACK (2)	5,2,4
TRACK (3)	5,3,4
TRACK (4)	5,4,4
TRACK (5)	5,5,4
TRACK (6)	5,16,4
TRACK (7)	5,6,4
TRACK (8)	5,7,4
TRACK (9)	5,7,5
TRACK (10)	5,8,4
TRACK (11)	5,8,5
TRACK (12)	5,9,4
TRACK (13)	5,9,5

Properties	IP: 192.168.10.243
LUT (1)	#2.7.1.LED=RECALL,1
LUT (2)	#2.7.1.LED=RECALL,2
LUT (3)	#2.7.1.LED=HUE_UP
LUT (4)	#2.7.1.LED=SAT_UP
LUT (5)	#2.7.1.LED=SAT_DOWN
LUT (6)	#2.7.1.LED=OFF
LUT (7)	#1.1.1.MOTOR=UP
LUT (8)	#2.7.1.LED=RECALL,10
LUT (9)	#2.7.1.LED=STORE,10
LUT (10)	#2.7.1.LED=RECALL,11
LUT (11)	#2.7.1.LED=STORE,11
LUT (12)	#2.7.1.LED=RECALL,12
LUT (13)	#2.7.1.LED=STORE,12

Note: Please note that the number in parenthesis we refer to as the Index number of which there are 255 discrete pairs. Index 1 on the left column causes Index 1 on the right to operate. Similarly Index 2 on the left column causes Index 2 on the right to operate, and so on.

For more information on this programming example, refer to the table below for specific entries that should be made to complete the programming for each Lutron UI button.

Marked Lutron Button*	Desired Action	Lutron output string	CS Bus resultant command
Color 1	-On button push, causes controller to go to Preset 1 (Recall, 1).	TRACK(**1**)=**5**, 1, 4	LUT(**1**)#2.7.1.LED=RECALL,1
Color 2	-On button push, causes controller to go to Preset 2 (Recall, 2).	TRACK(**2**)=5,2,4	LUT(**2**)#2.7.1.LED=RECALL,2
HUE UP	-On button push, causes controller to go start incrementing the HUE variable. Note: just a button push will start this operation, a release will do nothing in RADIORA2	TRACK(**3**)=5,3,4	LUT(**3**)#2.7.1.LED=HUE_UP
SAT UP	-On button push, causes controller to go start incrementing UP the SAT variable. Note: just a button push will start this operation, a release will do nothing in RADIORA2	TRACK(**4**)=5,4,4	LUT(**4**)#2.7.1.LED=SAT_UP
SAT DOWN	-On button push, causes controller to go start	TRACK(**5**)=5,5,4	LUT(**5**)#2.7.1.LED=SAT_DOWN

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

	incrementing down the SAT variable. **Note**: just a button push will start this operation, a release will do nothing in RADIORA2		
LED OFF	-On button push, causes controller to turn any already ON LEDS to turn OFF.	TRACK(**6**)=5,16,4	LUT(**6**)#2.7.1.LED=OFF
SCREEN UP	-On button push, causes connected projection screen to MOVE UP. **Note**: With RadioRA2, a button release will not issue a STOP command	TRACK(**7**)=5,6,4	LUT(**7**)#1.1.1.MOTOR=UP
USER 1	-On button push, causes LEDS to go to a USER 1 setting (in this case RECALL location #10) -If the button is held for 10 seconds, the system stores the current color state into memory location #10	TRACK(**8**)=5,7,4 TRACK(**9**)=5,7,5	LUT(**8**)#2.7.1.LED=RECALL, 10 LUT(**9**)#2.7.1.LED=STORE,10
USER 2	-On button push, causes LEDS to go to a USER 1 setting (in this case RECALL location #11) -If the button is held for 10 seconds, the system stores the current color state into memory location #11	TRACK(**10**)=5,8,4 TRACK(**11**)=5,8,5	LUT(**10**)#2.7.1.LED=RECALL,11 LUT(**11**)#2.7.1.LED=STORE,11
USER 3	-On button push, causes LEDS to go to a USER 1 setting (in this case RECALL location #12) -If the button is held for 10 seconds, the system stores the current color state into memory location #12	TRACK(**12**)=5,9,4 TRACK(**13**)=5,9,5	LUT(**12**)#2.7.1.LED=RECALL,12 LUT(**13**)#2.7.1.LED=STORE,12
SCREEN DOWN	-On button push, causes connected projection screen to MOVE DOWN. **Note**: With RadioRA2, a button release will not issue a STOP command	TRACK(**14**)=5,10,4	LUT(**14**)#1.1.1.MOTOR=DOWN
STOP	-On button push, stops all Saturation, HUE, and FADE processes already in motion. -In addition, as an option, if the keypad is also set to control a projection screen, a button push will issue a MOTOR STOP as well.	TRACK(**15**)=5,17,4 TRACK(**16**)=5,17,4	LUT(**15**)#2.7.1.LED=STOP LUT(**16**)#1.1.1.MOTOR=STOP
FADE DOWN	-On button push, FADES LEDS DOWN	TRACK(**17**)=5,24,3	LUT(**17**)#2.7.1.LED=FADE_DOWN

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

	-On button release, STOPS the fade process	TRACK(**18**)=5,24,4	LUT(**18**)#2.7.1.LED=STOP
FADE UP	-On button push, FADES LEDS UP -On button release, STOPS the fade process	TRACK(**19**)=5,25,3 TRACK(**20**)=5,25,4	LUT(**19**)#2.7.1.LED=FADE_UP LUT(**20**)#2.7.1.LED=STOP

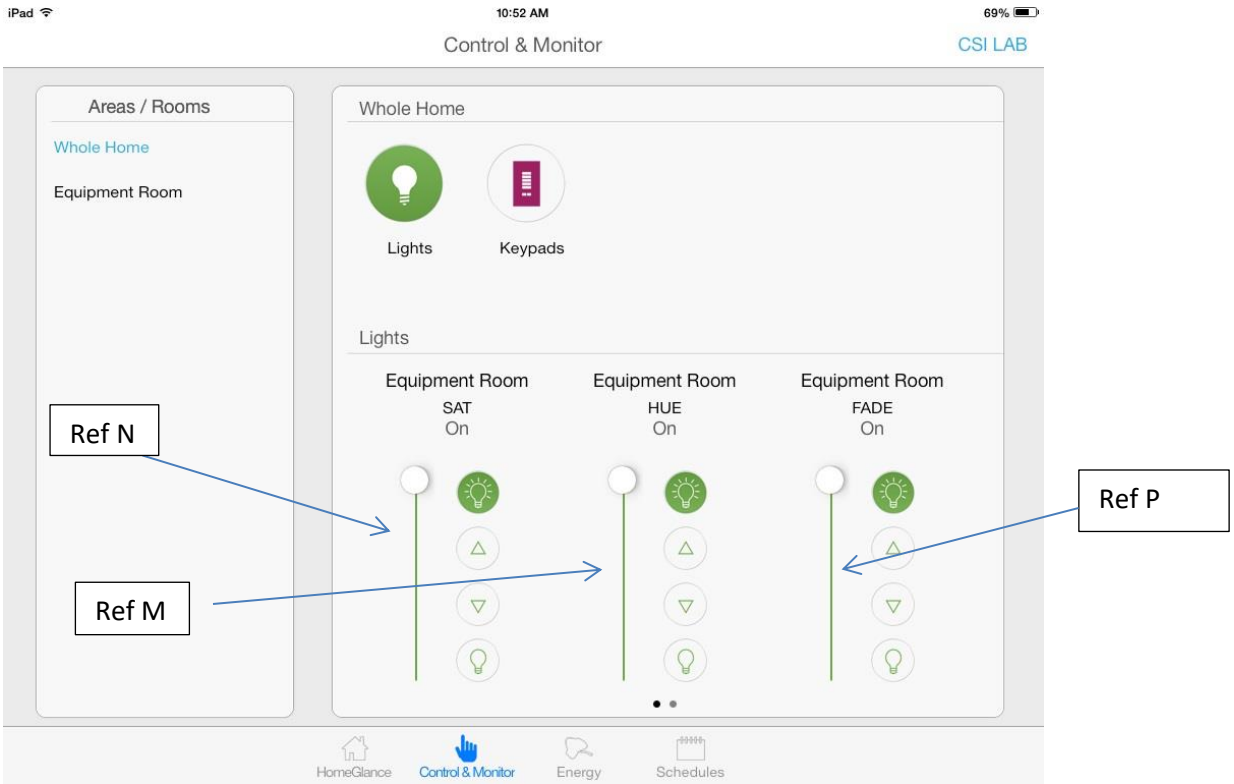
*Note: **(color indicates Type 1, Type 2 or Type 3 button logic—see pages 7 and 8)**

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Example 2

Following is a more advanced example of slider control using dummy loads and UI available within Home Control +. The intent is that we will have 3 or more sliders that can control Hue/Sat/Brightness. The layout for this example might be as follows:

Contained within Appendix 5 is more detail on this topic.

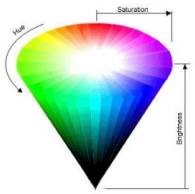


The logic or operation of the various buttons can be described as follows:

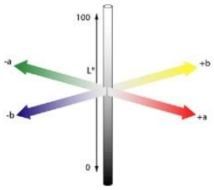
- [**Ref M**] One slider when adjusted will change the Hue for a selected output device. In reality Hue is best represented by a wheel, but with the Lutron App, a simple slider performs the same function. The bottom 0% represents Red, with Green at 33%, Blue at 66% (and Red again at 100%).

- **[Ref N]** One slider when adjusted will change the Saturation for a selected output device(to and from the white center in this figure.) As saturation increases, colors appear more "pure." As saturation decreases, colors appear more "washed-out."

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275



- **[Ref P]** One slider when adjusted will change the Brightness for a selected output device. As brightness increases, the intensity of that color becomes greater (toward the arrow pointer). As brightness decreases, the intensity of that color weaken (toward the center from any location in the space).

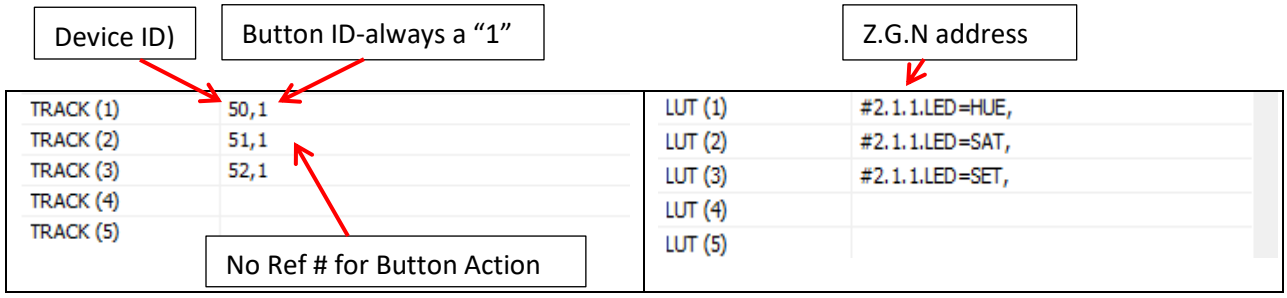


All of this magic can be quickly programmed within e-Node pilot or the Web-Pilot application. And as you can see, nearly everything to make this work, exists outside of standard Lutron application programming (except if you want to tweak a particular button's operation).Depending upon your specific environment, simply adjust the example below with the following:

- The specific **Device IDs** for your Lutron devices (see **Device ID** field below)
- The specific **Button ID** for your Lutron devices (see **Device ID** field below).
  Note: In this case, just enter a "**1**" for the Button ID. All sliders are a "1"
- The Button ID number (not needed in this example because it is a slider)
  Note: ***In this case with sliders there is no need to determine the specific Button ID number, for our SLIM software will read the variable output of each slider and map it accordingly***
- The specific Converging Systems device **Z/G/N** address. See **Z/G/N** field below.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Here is a Pilot example showing these fields



Note: Please note that the number in parenthesis we refer to as the Index number of which there are 255 discrete pairs. Index 1 on the left column causes Index 1 on the right to operate. Similarly Index 2 on the left column causes Index 2 on the right to operate, and so on.

For more information on this programming example, refer to the table below for specific entries that should be made to complete the programming for each Lutron UI button.

Marked Lutron Button*	Desired Action	Lutron output string entry	CS Bus resultant command
Hue Slider	-On movement of slider from 0% to 100%, Hue commands are transmitted to CS-Bus system. **Note:** HUE of 0 or 100% equates to RED, while a HUE of 80 equates of GREEN, and a HUE of 160 equates to BLUE	TRACK(**50**)=8,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**50**)#2.7.1.LED=HUE **Note**: there is no trailing characters after the HUE command in this slider case
Sat Slider	-On movement of slider from 0% to 100%, SAT commands are transmitted to CS-Bus system. **Note:** SAT of 0 is fully saturated (very white) while a SAT of 100 preserves the HUE of the original selected color	TRACK(**51**)=7,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**51**)#2.7.1.LED=SAT **Note**: there is no trailing characters after the SAT command in this slider case
Brightness Slider	-On movement of slider from 0% to 100%, Brightness (FADE) commands are transmitted to CS-Bus system. **Note:** FADE of 0 is fully OFF (dark) while a FADE of 100 is fully ON	TRACK(**52**)=6,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**52**)#2.7.1.LED=SET **Note**: there is no trailing characters after the SET command in this slider case
CCT Slider	-On movement of slider from	TRACK(**53**)=10,1	LUT(**53**)#2.7.1.LED=CCT

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

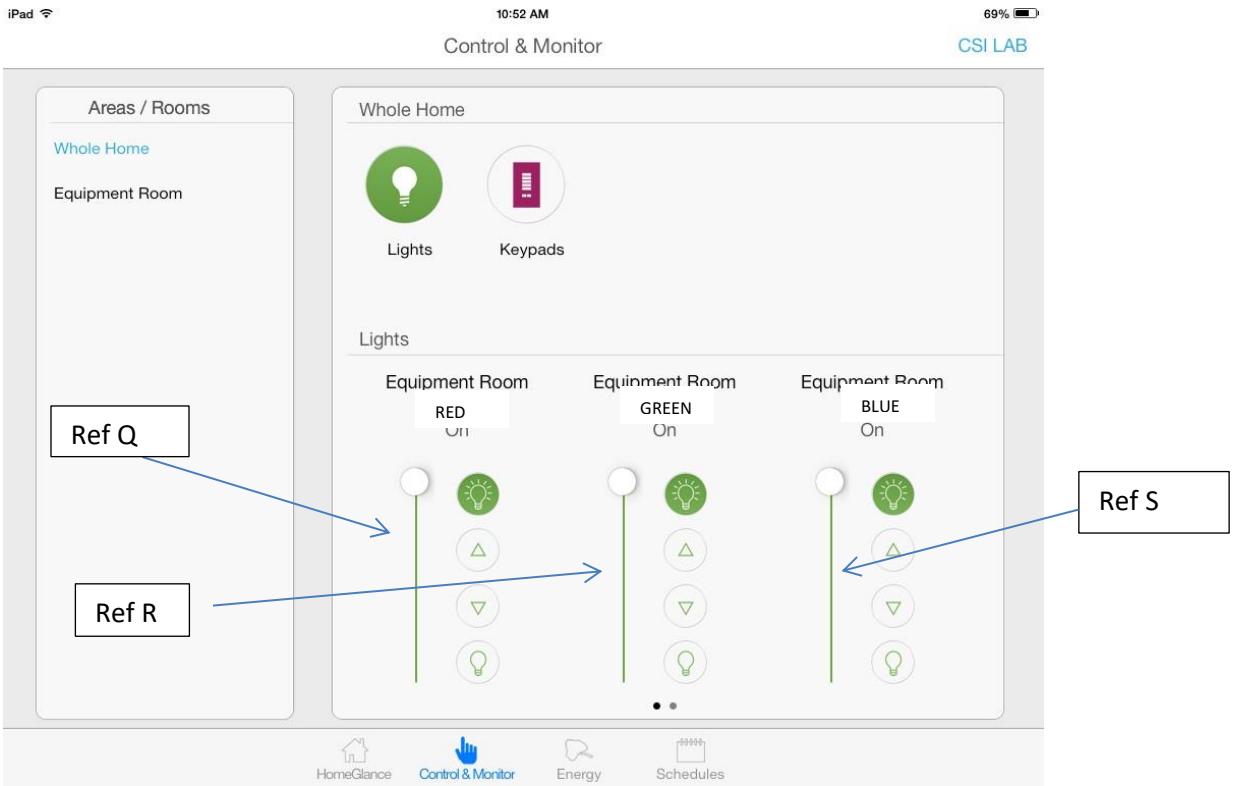
(Color Temperature)	0% to 100%, Correlated Color Temperature (CCT) commands are transmitted to CS-Bus system. **Note:** CCT of 0% equates to a CCT of 1800K while CCT of 100% equates to a CCT of 7000K	**Note**: there is no trailing comma and third number in this slider case	**Note**: there is no trailing characters after the CCT command in this slider case

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Example 3

Following is a more advanced example of slider control using dummy loads and UI available within Home Control +. The intent is that we will have 3 sliders that can control Red/Green/Blue or 4 sliders to control R/G/B/W or additional sliders to control Color Temperature or Circadian tuning. The layout for this example might be as follows:

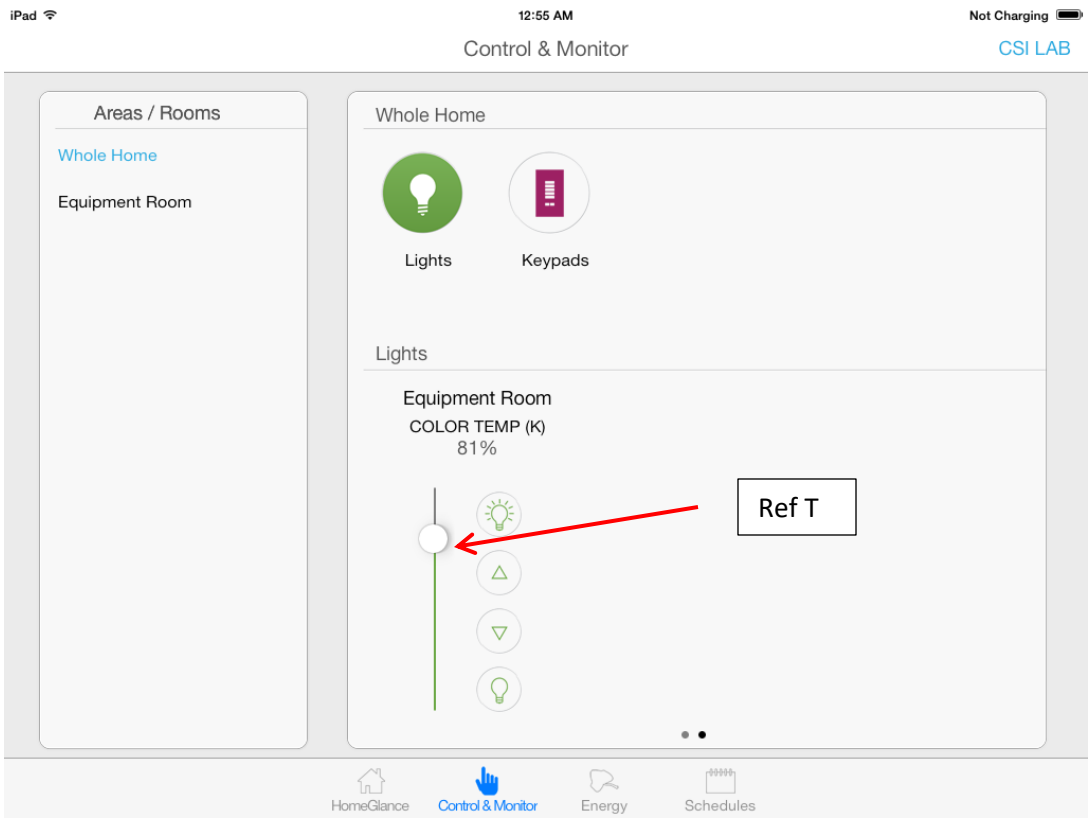
Contained within Appendix 5 is more detail on this topic.



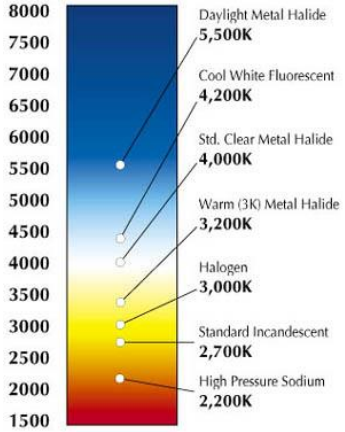
The logic or operation of the various buttons can be described as follows:

- [**Ref Q,R, S**] One slider when adjusted will change the **Red** component for a selected output device. Another slider when adjusted will change the **Green** component, while another slider will change the **Blue** component. Optionally for RGBW systems, the 4th slider can change the white component.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275



- **[Ref T]** One slider when adjusted will change the Color Temperature for a selected RGB or RGBW supported device (i.e. our own RGB and RGBW FLLA strips). The bottom range is 1700K (for RGBW) and 1800K (for RGB). The top range is 7000K. The Lutron reference of 0 to 100% correlates to the range between the lowest and highest color temperature possible.

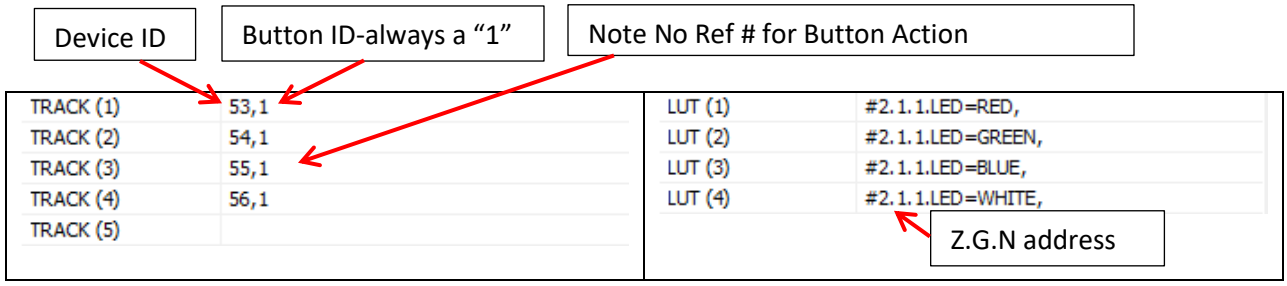


Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

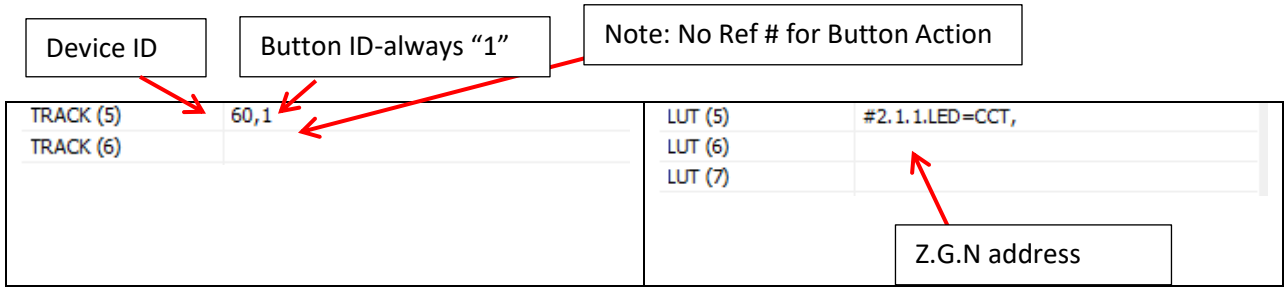
All of this magic can be quickly programmed within e-Node pilot or the Web-Pilot application. And as you can see, nearly everything to make this work, exists outside of standard Lutron application programming (except if you want to tweak a particular button's operation). Depending upon your specific environment, simply adjust the example below with the following:

- The specific **Device IDs** for your Lutron devices (see **Device ID** field below)
- The specific **Button ID** for your Lutron devices (see **Device ID** field below).
  Note: In this case, just enter a "**1**" for the Button ID. All sliders are a "1"
- The Button ID number (not needed in this example because it is a slider)
  Note: ***In this case with sliders there is no need to determine the specific Button ID number, for our SLIM software will read the variable output of each slider and map it accordingly***
- The specific Converging Systems device **Z/G/N** address. See **Z/G/N** field below.

Here is a Pilot example showing these fields for RGB or RGBW (index 4 covers white)



Here is a Pilot examples showing a simple example for Color Temperature (CCT)



Note: Please note that the number in parenthesis we refer to as the Index number of which there are 255 discrete pairs. Index 1 on the left column causes Index 1 on the right to operate. Similarly Index 2 on the left column causes Index 2 on the right to operate, and so on.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

For more information on this programming example, refer to the table below for specific entries that should be made to complete the programming for each Lutron UI button.

Marked Lutron Button*	Desired Action	Lutron output string entry	CS Bus resultant command
Red Slider	-On movement of slider from 0% to 100%, Red component is transmitted to CS-Bus system.	TRACK(**1**)=53,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**1**)#2.1.1.LED=RED **Note**: there is no trailing characters after the HUE command in this slider case
Green Slider	-On movement of slider from 0% to 100%, Green component is transmitted to CS-Bus system.	TRACK(**2**)=54,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**2**)#2.1.1.LED=GREEN **Note**: there is no trailing characters after the SAT command in this slider case
Blue Slider	-On movement of slider from 0% to 100%, Blue component is transmitted to CS-Bus system.	TRACK(**3**)=55,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**3**)#2.1.1.LED=BLUE **Note**: there is no trailing characters after the SET command in this slider case
White Slider	-On movement of slider from 0% to 100%, White component is transmitted to CS-Bus system (RGBW systems only).	TRACK(**4**)=56,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**4**)#2.1.1.LED=WHITE **Note**: there is no trailing characters after the SET command in this slider case
CCT Slider (Color Temperature)	-On movement of slider from 0% to 100%, Correlated Color Temperature (CCT) commands are transmitted to CS-Bus system. **Note:** CCT of 0% equates to a CCT of 1800K while CCT of 100% equates to a CCT of 7000K	TRACK(**5**)=10,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**5**)#2.7.1.LED=CCT **Note**: there is no trailing characters after the CCT command in this slider case

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 1

Lutron/RadioRA2 Button Types

1. Keypad Button Logic

Button Type	Operation	Lutron system software output				Cases where this type of button is desirable
		Push	Release	Double Push	Extended hold	
Type 1	Standard type	"**3**"	N/A	N/A	N/A	ON, OFF, HUE UP, MOTOR DOWN, STOP
Type 2	Adv. Setting type	N/A	"**4**"	N/A	"**5**"	All of the above commands PLUS User Recall button which you want to double as a Store button when held for 10 seconds. **Note**: **If you don't care about doubling up on the functionality of buttons, disregard Type 2 buttons.**
Type 3	Special FADE UP/DOWN	"**3**"	"**4**"	N/A	N/A	FADE UP, or FADE DOWN (or MOTOR UP, or MOTOR DOWN)

Type 1- Standard operation. This is standard and most common operation that can be used for the bulk of Converging Systems' operations such as *ON, OFF, RECALL n, MOTOR UP, STOP* and to initiate a *HUE UP, SATURATION UP* or similar type operation. In this case the Lutron system generates a "**3**" from the Lutron processor, and no other output strings are possible.

Note: within RadioRa2, all buttons except the ***FADE DOWN and FADE UP*** buttons generate a "**3**" from the Lutron processor when these buttons are first depressed (except if they are programmed as a Type 2 button—see below). There is no separate output command stream generated by Lutron in this case for a button release.

Type 2-Advanced Settings. As an option, the Lutron programming software allows a hardware button to be pressed and held for ten seconds to generate a different output sequence. In this case, if the button is depressed and then released quickly, the Lutron system generates a "**4**" as a button operation. If the button is held for 10 seconds and then released, the Lutron system generates a "**5**" instead (note in this case there is never a "**3**" generated by ANY Button from the entire keypad that is being programmed). **This is the recommended option where you (i) want to establish a dual mode of operation of a button (like to Recall a previously saved color and then**

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

to SAVE that color state for future recall). You can right click on the non-button areas of the keypad being programmed within the Lutron software and pick the Advanced Settings tab as seen in Figure 5 below.

Note: As long as there **no** other buttons on the keypad that you are programming that would be impacted by such a SAVE operation, Converging Systems recommends that this **Type 2 Advanced Setting** button type be used on all keypads that are dedicated to Converging Systems operation because separate button operations can be leveraged (together) saving money for the customer.

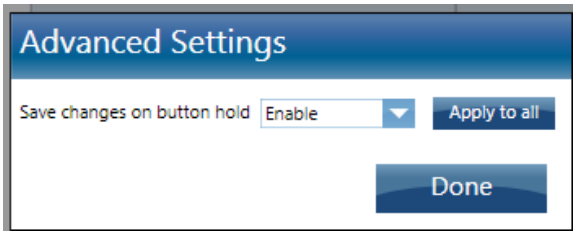


Figure 3

Type 3- Special FADE (up and down) BUTTONS. Within RadioRA2, these are the only two buttons that have a different operation. These buttons are reserved for FADE type operations. When these buttons are pressed, the Lutron system generates a "**3**" but when these buttons are released, there is the special case of a "**4**" being generated. This logic is particular good only for our FADE UP and FADE DOWN LED commands which would provide a STOP command when the button is released.

Required Action (Potentially). Now with this information in mind, update any of your Lutron Essentials or Inclusive programming for each button programmed that you wish to trigger a Converging Systems' event in a unique way, if required. Also, take note within the **Lutron Integration Report** seen in Figure 6 can be found the **Integration IDs** that will be used later in this Integration Note to link Lutron button pushes with Converging Systems' invoked CS-Bus commands.

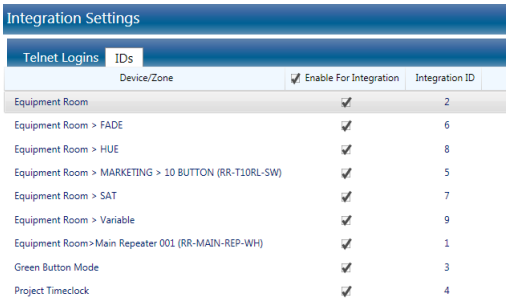


Figure 4

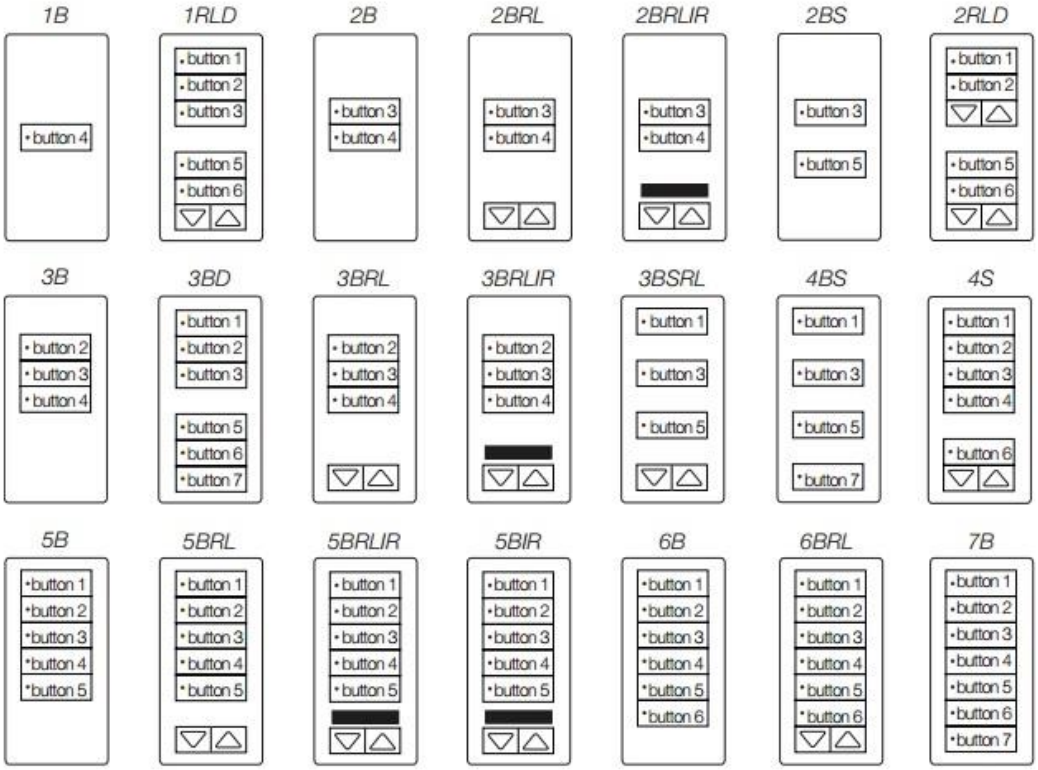
Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

2. Keypad Button IDs

Use these Button IDs for various Lutron keypads

seeTouch® Keypad

QS Models (QSWS2-): 1B, 1RLD, 2B, 2BRL, 2BRLIR, 2RLD, 3B, 3BD, 3BRL, 3BRLIR, 5B, 5BRL, 5BRLIR, 7B
RadioRA® 2 Models (RRD-W): 1RLD, 2RLD, 3BD, 3BRL, 3BSRL, 4S, 5BRL, 5BRLIR, 6BRL, 7B
HomeWorks® QS/myRoom™ Models (HQRD-W, HQWD-W, HQWA-W, HQRA-W, HQWAS-W):
1B, 1RLD, 2BS, 2RLD, 3BS, 3BD, 3BSRL, 4BS, 4S, 5B, 5BRL, 5BIR, 6B, 6BRL, 7B
Clear Connect® Device Models (CCD-W): 6BRL



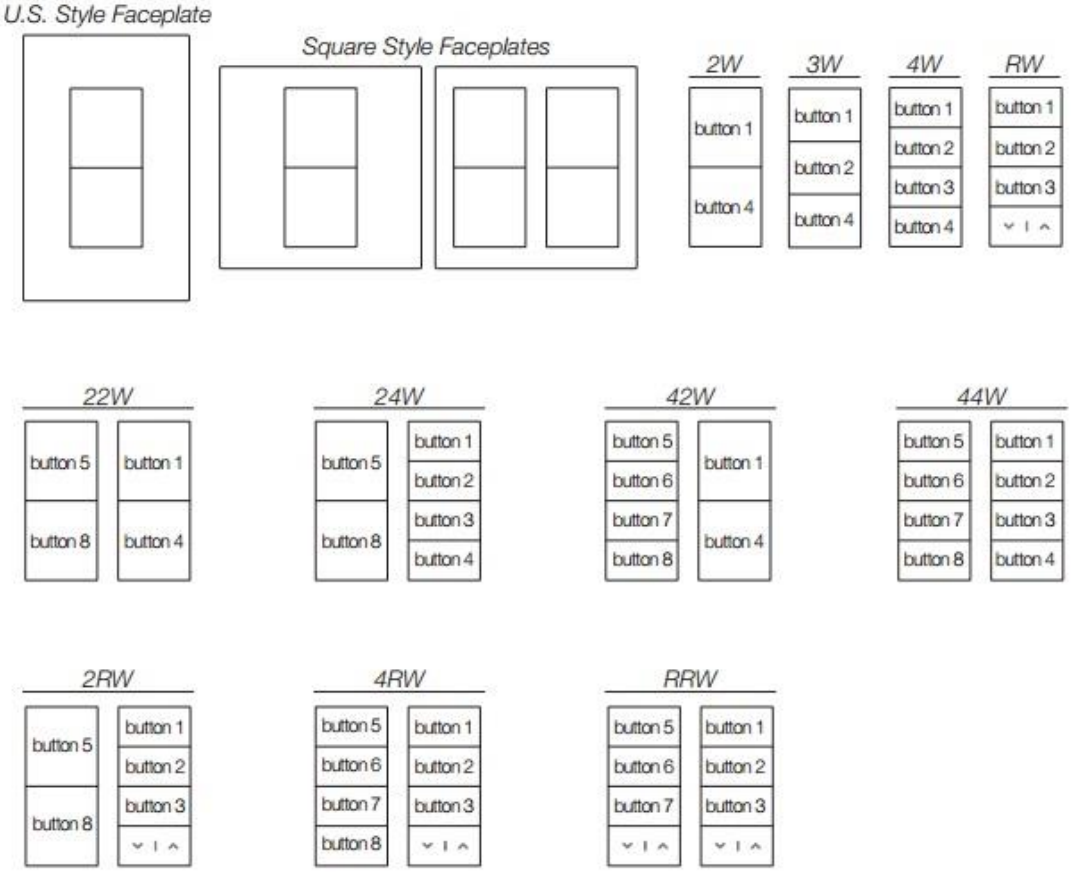
Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Palladiom® Keypad

QS Models (QWP-): U-2W, U-3W, U-4W, U-RW,
S-2W, S-3W, S-4W, S-RW, S-22W, S-24W, S-42W, S-44W, S-2RW, S-4RW, S-RRW,
B-2W, B-3W, B-4W, B-RW, B-22W, B-24W, B-42W, B-44W, B-2RW, B-4RW, B-RRW.

HomeWorks® QS Models (HQWT-): U-P2W, U-P3W, U-P4W, U-PRW,
S-P2W, S-P3W, S-P4W, S-PRW, S-P22W, S-P24W, S-P42W, S-P44W, S-P2RW, S-P4RW, S-PRRW,
B-P2W, B-P3W, B-P4W, B-PRW, B-P22W, B-P24W, B-P42W, B-P44W, B-P2RW, B-P4RW, B-PRRW.

myRoom™ Models (MWP-): U-2W, U-3W, U-4W, U-RW,
S-2W, S-3W, S-4W, S-RW, S-22W, S-24W, S-42W, S-44W, S-2RW, S-4RW, S-RRW,
B-2W, B-3W, B-4W, B-RW, B-22W, B-24W, B-42W, B-44W, B-2RW, B-4RW, B-RRW.

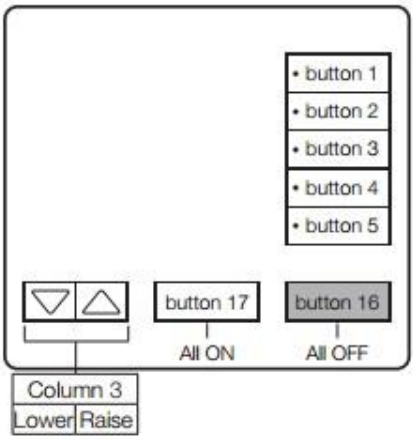


Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

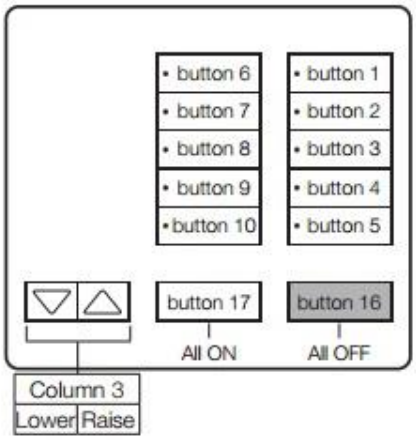
Tabletop seeTouch® Keypad

RadioRA® 2 Models (RR-): T5RL, T10RL, T15RL
HomeWorks® QS Models (HQR-, HQK-, HQQ-, HQM-, HQN-):
T5RL, T10RL, T15RL, T5CRL, T10CRL, T15CRL

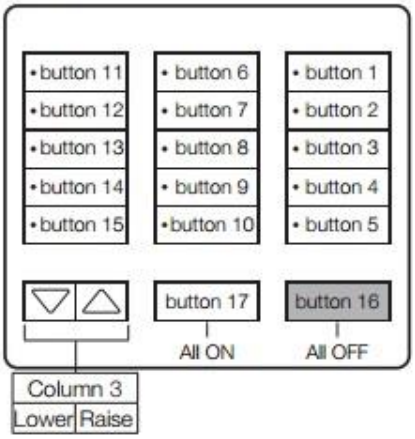
T5-RL



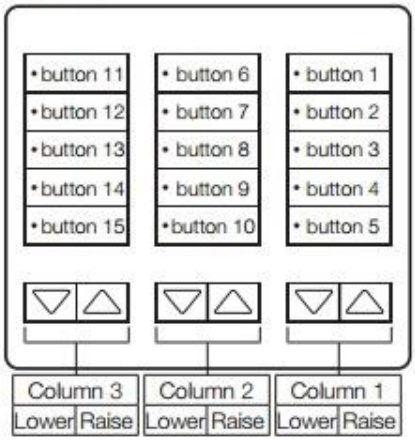
T10-RL



T15-RL



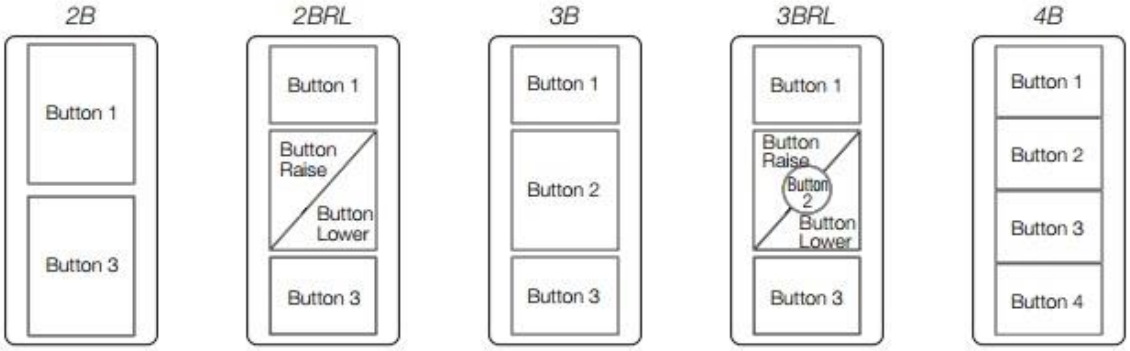
T15-CRL



Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Pico® Wireless Control

CURRENT Models: PJ-2B, PJ-2BRL, PJ-3B, PJ-3BRL, PJ2-2B, PJ2-2BRL, PJ2-3B, PJ2-3BRL, PJ2-4B
LEGACY Models:
QS Models (QSR4P-, QSR8P-, QSRKP-, QSRMP-): 2, 2R, 3B
RadioRA® 2 Models (RRD- P): 3BRL-L, 3BRL-S



Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 2

Converging Systems System Setup/Configuration

Before proper operation between the Converging Systems' controllers and the Lutron system can begin, it will be first necessary for most installations to configure the Converging Systems' products using the e-Node Pilot (PC-based) application and an e-Node or e-Node/dmx (Ethernet communication device).

In case you have not previously configured a Converging Systems controller product, please refer to the extended instructions in this Appendix.

Background

The Converging Systems e-Node is an Ethernet communication device which can be used to connect the Lutron Host to one or more Converging Systems motor and/or lighting controllers. (The e-Node/dmx is a similar gateway product that enables a Lutron Host to be connected to 1 to 32 third-party DMX fixtures.)

However, regardless of whether you desire to interface ***more than one*** lighting controller (or motor controller) each with its own controllable operation (i.e. its own **Z**one/**G**roup/**N**ode or **Z/G/N** address) with either the e-Node (Ethernet) or e-Node/dmx, **you must still follow the directions below under (i) e-Node Programming** and **(ii) ILC-100/ILC-400 Programming** in order to establish **unique ZGN address(es) for connected loads**.

Settings that can be implemented using this setup are as follows:

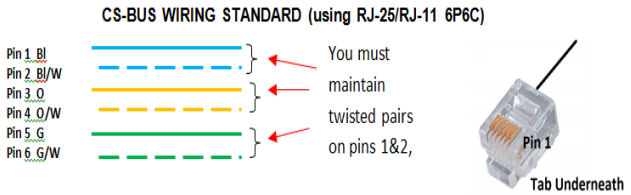
Setup Table of Contents

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

COMPONENT HARDWARE SETUP-For CS-Bus Equipment (for DMX see Appendix 3)

NOTE: The CS-BUS uses standard RJ-25 (RJ-11 6P6C) connectors available at Home Depot, and all electrical distributors). The mandatory pinout is 1-1, 2-2, 3-3, 4-4, 5-5, and 6-6 with twisted pairs on 1&2, 3&4 and 5&6). **You cannot use standard flat telephony cable for telephony cable does not use twisted pairs and the wiring topology is swapped (1-6, 2-5, 3-4, etc.).** **Failure to follow the CS-BUS wiring standard will void your warranty**. If you return a unit to Converging Systems with its communication chip destroyed this is a telltale sign that you used Telephone cabling. **REPEAT--DO NOT USE TELEPHONY CABLE**. Also, do **not** attempt to use standard Ethernet cabling (568B or 568A) and simply chop off the browns for this will leave the twisted pairs inconsistent with our CS-BUS Wiring Standard (the middle two lines will not be a twisted pair and data integrity will be lost). If you do not have 6P6C RJ11RJ-25 modular connectors and wish to proceed, refer to Appendix 1 for a workaround.

Cabling Detail

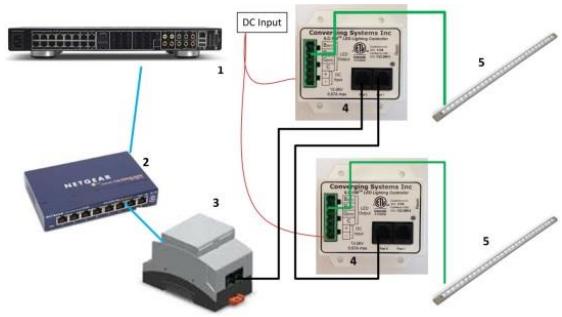


Recommended RJ-25 6P6C connections 6 wires		
e-Node Side	**ILC-x00 side**	**Color of wire**
Pin 1	**Pin 1**	**blue**
Pin 2	**Pin 2**	**Blue/white**
Pin 3	**Pin 3**	**Orange**
Pin 4	**Pin 4**	**Orange/white**
Pin 5	**Pin 5**	**Green**
Pin 6	**Pin 6**	**Green/white**

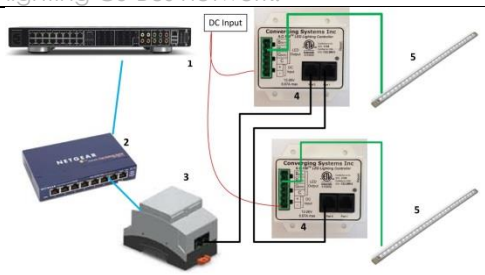
Suboptimal RJ-11 4P4C connection 4 wires		
e-Node Side	**ILC-x00 side**	**Color of wire**
Pin 1	**Pin 1**	**Orange**
Pin 2	**Pin 2**	**Blue**
Pin 3	**Pin 3**	**Blue/white**
Pin 4	**Pin 4**	**Orange/white**

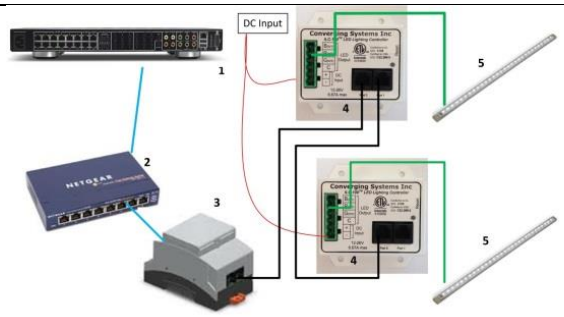
Note: For the purposes of commissioning if *you do not have* 6P6C RJ-25 connectors, you can use standard 4-pin RJ11 connectors, but follow the wiring directions above preserving twisted pairs on Pin 2/3 and Pins 1 /4. **This cable will not work for keypad communication or IBT-100 communication**.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Step	Setting	Choices
HW-1	Connect IMC-x00 and ILC-000 controllers to each other	Interconnect controllers sequentially in a daisy-chain fashion (without "Y"s or "T"s) by connecting Port **1** of one device to Port **0** of the next sequential device. Utilize standard CAT5 (or better) wiring and maintain 1/1 pinouts between ends (see **CS-Bus Wiring Standard** above). Also maintain twisted pairs as shown above (1&2, 3&4, 5&6). See termination footnote below [1] **Note: Failure to follow the CS-BUS wiring standard will void your warranty**. If you return a unit to Converging Systems with its communication chip destroyed this is a telltale sign that you used Telephone cabling. **REPEAT--DO NOT USE TELEPHONY CABLE**. Also, do **not** attempt to use standard Ethernet cabling (568B or 568A) and simply chop off the browns for this will leave the twisted pairs inconsistent with our CS-BUS Wiring Standard (the middle two lines will not be a twisted pair and data integrity will be lost). If you do not have 6P6C RJ11/RJ-25 modular connectors and still wish to proceed, refer to the ILC-x00 family controller Instruction manual for more information.
HW-2	Connect controllers to Gateway	 **e-Node connections.** Interconnect either CS-Bus (RJ-25 not RJ-45) port on the e-Node to an available/unused CS-Bus on the first or last ILC-x00 controller using a fabricated CAT 5(or better) cable wired as per the **CS-Bus Wiring Standard**. Connect the supplied 12vdc power adapter to the mating 2-pin connector on the e-Node. Connect a standard Ethernet wire from your network switch to the RJ-45 connector on the e-Node. (In case you wish to share power supplies, the e-Node can operate from 24vdc as well.) -**IBT-100 connections (not applicable for Lutron)**. If you are using serial connectivity, connect a **CS-BUS Standard** cable from Port 0 on the first ILC-x00 controller to the single RJ-25 port on the IBT-100. Plug the IBT-100's DB-9 connector directly onto your computer or controller's

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

<table>
<tr><td></td><td></td><td>serial port or to a USB/Serial adapter connected to your system (57,600,n.8,1,n).
Note: The IBT-100 requires power to operate which is only available from **Port 0** of the ILC-x00 controllers. Should **Port 0** be unavailable on a convenient ILC-x00 device, unplug the existing wire plugged into Port 0 and swap it into Port 1 of the target ILC-x00 controller and in a sequential fashion reverse the connections **of all other** connections from Port 1/Port 0 to Port 0/ Port 1 across the lighting CS-Bus network.</td></tr>
<tr><td>HW-3a</td><td>(For Lighting devices only)
Connect Lighting Elements to Controllers</td><td> 

FLLA connections. Connect the flying leads from the header end of the FLLA device to the ILC-x00 controller using recommended cabling (typically 16 awg or 18 awg). See Voltage Drop table for more info.
<table>
<tr><td>RGB
(4 pin)</td><td>ILC-100c (**C, G, R, B**) Note: **C** is positive common
ILC-400m (**C, G, R, B, W**)</td></tr>
<tr><td>RGBW
(5 pin)</td><td>ILC-400 (**C,G,R,B, W**) Note: **C** is positive common</td></tr>
<tr><td>Mono
(2 pin)</td><td>ILC-400 (**C,1**) &/or (**C,2**) &/or (**C,3**) &/or (**C,4**)
ILC-100m (**C,W**) Note: **C** is positive common</td></tr>
</table></td></tr>
<tr><td>HW-3b</td><td>(For Motor devices only)
Connect Motor(s) to Controllers</td><td>Connect as per separate Motor Control instructions.</td></tr>
<tr><td>HW-4a</td><td>(For Lighting Devices)
Connect Power</td><td> 

DC Constant Voltage Power Supply Connection. Connect power supply which provides the same voltage as the FLLA LED rating (typically 24vdc). Obey the polarity printed on the ILC-x00 case. If your controller has a 3-pin power connection (+,– and **GND**), you should connect a separate GND lead from a solid earth ground to the ILC-x00 Ground connection after connecting the + and – terminals (this is for low-end dimming without flicker).</td></tr>
<tr><td>HW-4b</td><td>(For Motor Devices)
Connect Power</td><td>Connect as per separate Motor Control instructions.</td></tr>
</table>

Notes:

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

[1] : The CS-BUS by design is a modified IEEE-485 bus which requires termination on the beginning and the end of the CS-Bus. Please be advised that in most cases, termination is not required but if you do experience communication issues, it would be wise to turn on termination (in software using the Pilot software) on the first unit of the chain. If the e-Node is used as the last item in the chain, those units have built-in termination. It is important, however, not to turn on any other termination features on any other unit.

COMPONENT SOFTWARE SETUP (using e-Node and e-Node Pilot app)

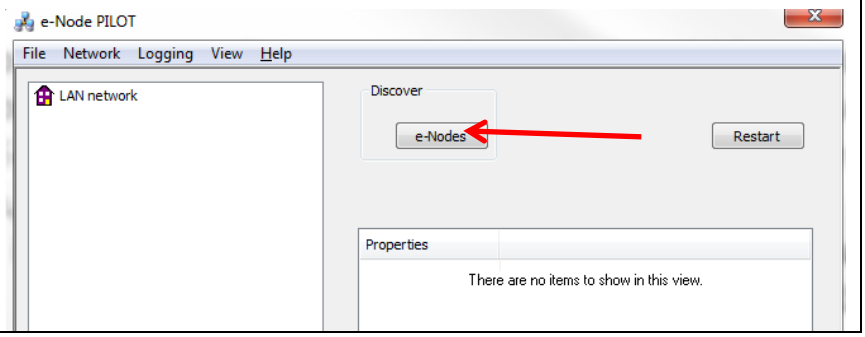
NOTE: Converging Systems LED and Motor Controllers REQUIRE a preliminary amount of initial setup/commission which requires the e-Node Ethernet adapter. This is required to set **Z**one/**G**roup/**N**ode addressing. This section is an abridged version of necessary steps which need to be followed. For more information, consult the more detailed documentation available on the Converging Systems' website including

-e-Node Commissioning Guide (long version)
-ILC-x00 Intelligent Lighting Controller
-IMC-x00 Motor Controller Manual

e-Node Programming/Device Programming

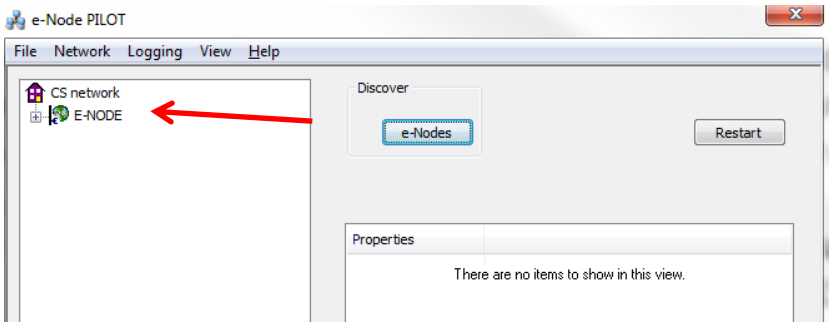
Min. requirements for this operation

- Computer running Windows XP or later OS, preferably with a wired Ethernet connection to a local router using CAT5 type cabling
- Converging Systems E-Node Ethernet adapter, connected using CAT5 cabling to the above router.
- Download of the latest version of e-Node Pilot application, unzipped and operating on your computer platform

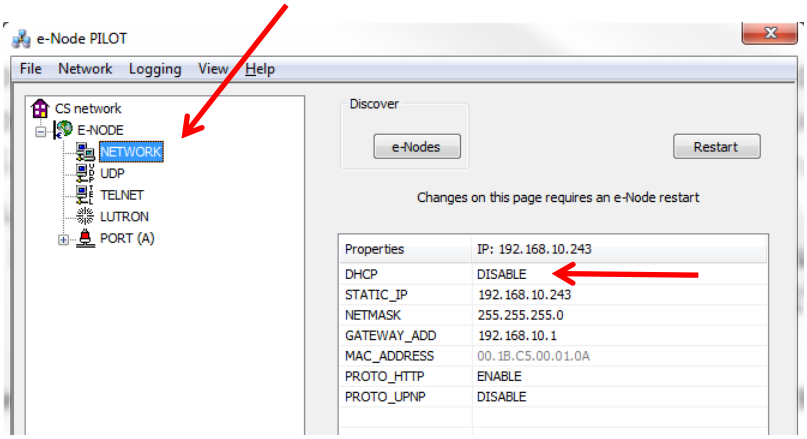
Step	Setting	Choices
EN-1	**e-Node IP Address** setting Set up the e-node with an appropriate Static or Dynamic IP address. Refer to the separate "e-Node Quick Start Guide" on how to make such settings.	Static or Dynamic Addressing -Launch the e-Node Pilot application. 

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

-Select the **View e-Node** tab and select the Discover **e-Node** button. Any e-Node(s) connected on the same network will appear as shown.



-Select the **+** mark in front of the e-Node found to expand the menu.



-Review the **DHCP** entry, the factory default is ENABLE which means **DHCP** is activated. DISABLE for **DHCP** refers to static IP addressing. If you wish to set a **STATIC** IP address, enter the following variables ***in the order specified below:***

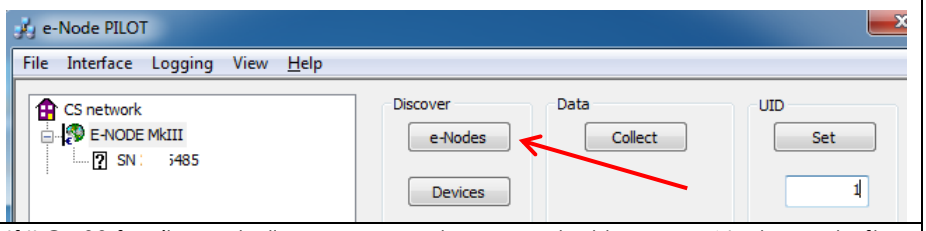
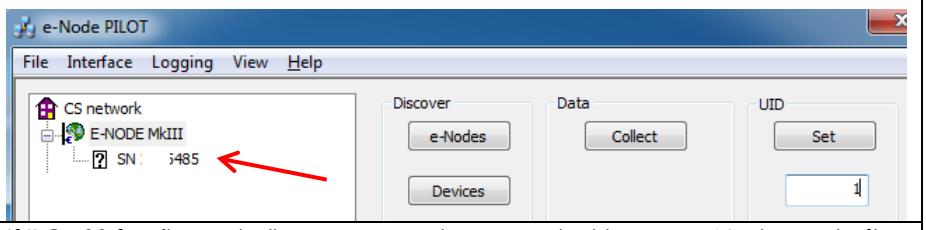
STATIC_IP	xxx.xxx.xxx.xxx	Your new static IP address
GATEWAY_ADD	xxx.xxx.xxx.xxx	Typically the address of your network's gateway
FINALLY ***and only after you have set the above variables***, select **DHCP**	And Set to **DISABLE**	Now reboot the e-Node for this to take effect.

-Note: It is recommended that only STATIC addressing be used with the Elan processors.

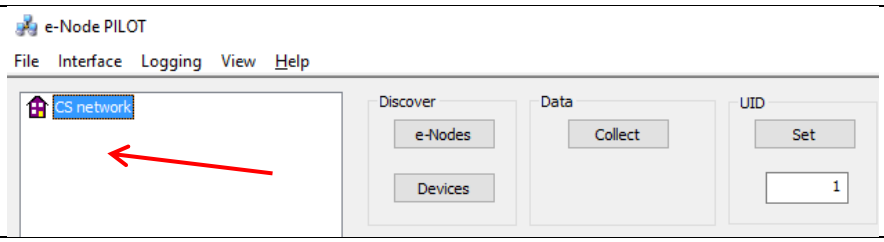
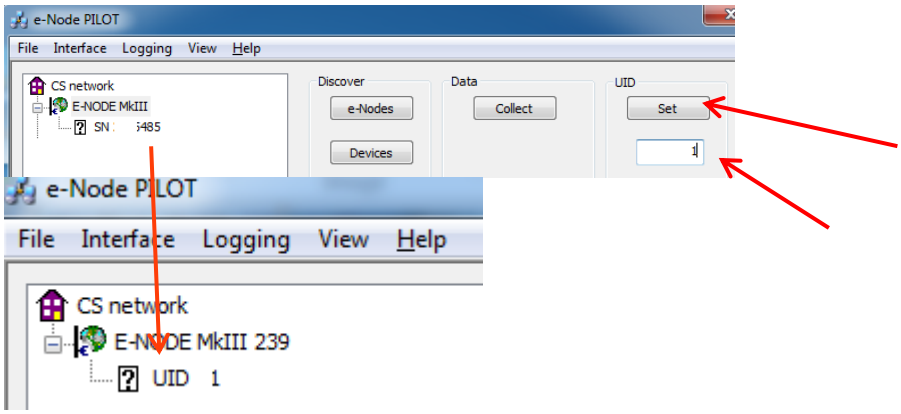
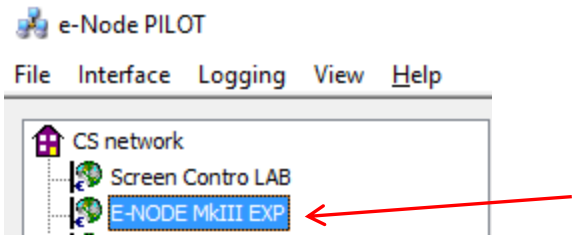
EN-2	Reserved	

IBT-100 Programming

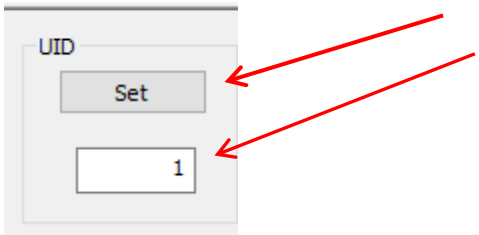
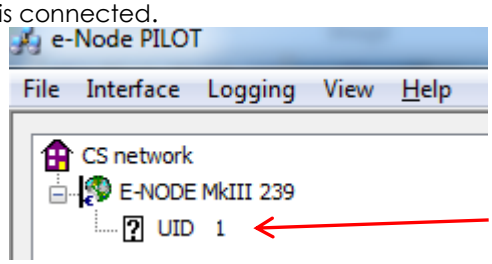
The IBT-100 is not compatible with the Lutron Radiora2 or Homeworks QS system.

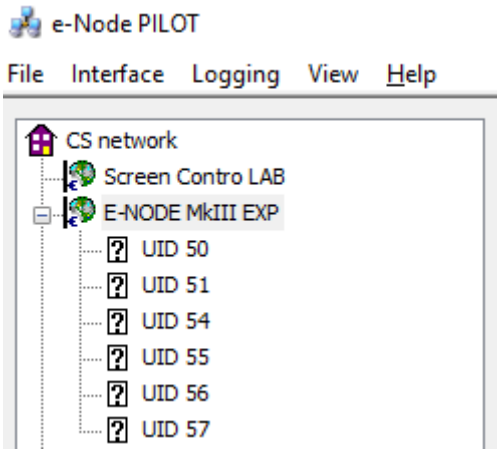
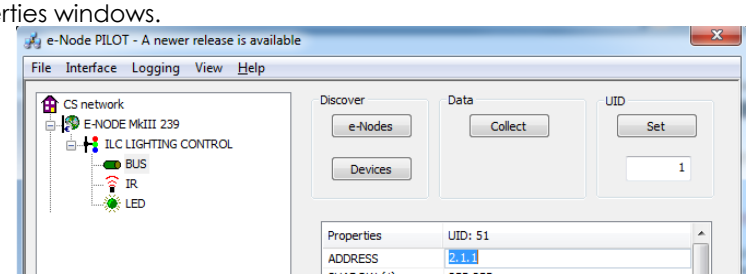
Step	Setting	Choices
DV-1	Discover Devices	Units from the factory do not have a pre-programmed UID address and therefore it is impossible to perform any additional programming to these devices including address changes until the UID is assigned. The following steps illustrate this process. It is necessary that all devices (led and motor controllers) are (i) discovered and then (ii) assigned a unique UID (Unique ID). The procedure to do so varies if you have earlier versions of ILC-x00 controllers or more current ones. To determine which version of firmware you have, start by selecting the **Discover Devices** button as shown below. 
DV-2a	Initial Procedure	If ILC-x00 family controllers are properly connected to your e-Node, and after the **Discover e-Node** button has been selected, any ILC-x00 devices connected to that e-Node will auto-populate under that e-Node as a "**SN XXXXX**" entry. If this occurs, you have devices with **SN addressing**. Proceed to Step DV-3a below. 
DV-2b	Initial Procedure	If ILC-x00 family controllers are properly connected to your e-Node, and after the **Discover e-node** button has been selected, and if ***no entries appear*** under the previously discovered e-Node then you have **pre-SN Addressing firmware**. (Before you determine that this is the case, make sure the ILC-x00 devices are properly powered on and the interconnect cables with proper pinouts are connected between the e-Node and the ILC-x00 controllers.) If no entries populate, you have devices with **pre-SN addressing and an alternative process is required to discover these (earlier) firmware units**. Proceed to Step DV-3b below.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

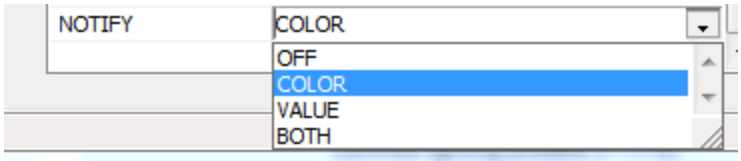
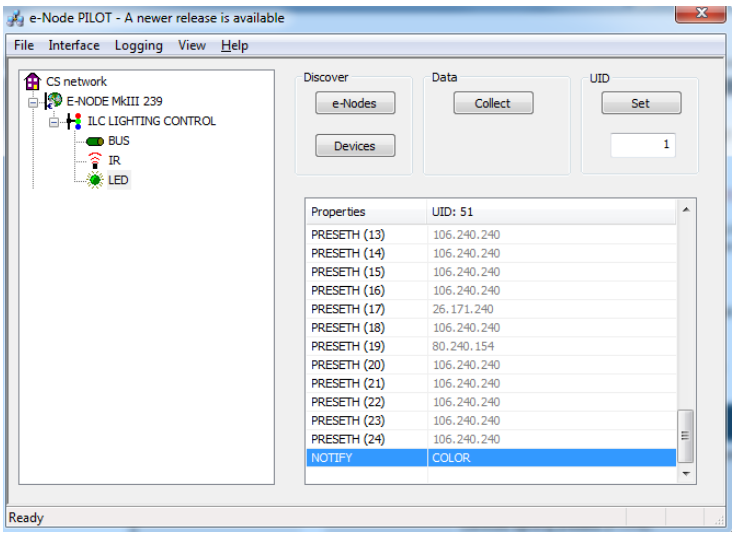
		
DV-3a	Assign UID to Device (for SN Addressing)	First select the **SN entry** for the device that you wish to assign a unique UID by highlighting that entry within Pilot. Next (i) assign an unused UID (unique ID) to the lighting or motor controller to be addressed (generally start with the UID value of "1" and work up sequentially) by entering each subsequent number under the UID set box. To finalize the UID selection, select the Set box and the "**SN**" entry will automatically change to the entered **UID** number.  -Proceed through all lighting and motor controllers connected to each e-Node until completed. Proceed to DV-4.
DV-3b	Assign UID to Device (for pre-SN Addressing	-First highlight the e-Node to which the target device Is connected.  - Next (i) assign an unused UID (unique ID) to the lighting or motor controller to be addressed (generally start with the UID value of "1" and work up sequentially) by entering that number under the **UID set box**, then (ii) press the **Set** button and finally (ii) **carefully** press for ½ second the discovery/reset button[1] on the ILC-xx device using a larger type paper clip (small paperclips have a hard time finding the internally positioned reset button).

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

		 -If successful, the device's on-board PCB LED will blink off for a moment then re-light AND the newly assigned UID entry will auto-populate under the e-Node to which it is connected.  - Proceed through all lighting and motor controllers connected to each e-Node until completed. Note for Discovery Button. Depending upon the device, the discovery/reset button may be in a different location. Consult the product's manual for the exact location. Here is some detail for two popular controllers: • **ILC-100.** Take a larger type paper clip or similar device and **gently** insert it into the reset/discovery hole on the side of the chassis and press the momentary button that you will feel for ½ second and then release. The existence of the ILC-100 will appear under the e-Node entry within Pilot. • **ILC-400**. Remove the white plastic protective shroud to the left of the dual RJ-25 connectors with your finger nail or a small flat-headed to expose a push button mounted to the PCB. Depress the pushbutton for ½ second and then release. The existence of the ILC-400 will appear under the e-Node entry within Pilot -Now proceed to DV-4
DV-4	Note on Duplicate UID Addresses	If you by chance enter duplicate UIDs for two controllers, the system will fail to work. In this case since you may not know which unit was the original and which was the duplicate, you must **reset both units** according to documentation found for the respective controller on the Converging Systems website and then assign unique UIDs to each one again (i.e. "Unique" IDs).
DV-5	Enter Z/G/N Addresses	From the factory the **ILC-x00** controllers have wildcard Zone/Group/Node address of **Zone**=2, **Group**=1, and **Node**=undefined or a 0. Motor controllers have a similar wildcard address of **Zone**=1, **Group**=1, and **Node**=undefined or a 0. The concept is that they will respond to broadcasts but need a real non-zero address in order to operate properly. The following procedure demonstrates this process. Currently if you leave the system unmodified, the Lutron system will communicate with a device with a factory address of **2.1.0** but no

		backchannel information will be provided back to the host system. ***However, it is often the case that our systems are additionally connected*** to third-party automation systems such as those manufactured by Control4, Crestron, Elan, Savant, etc. which **do** support back-channel data for this reason, **we recommended that you change all Node addresses to non-zero values during initial installation**. -Enter a discrete **Z**one/**G**roup/**N**ode address for each Lighting or Motor Controller identified within step #3 above. To do so, click on the "**?**" mark and/or the "**+**" mark in front of the targeted controller to expand its data fields. For more information on Zone/Group/Node address, review the detailed explanation of Zone/Group/Node addressing within the Background on Addressing section of this document. The directions below indicated how to perform this operation. (See **Step 2b** below as well as **Appendix 3** for more information on **Z**one/**G**roup/**N**ode addressing.)  - After the selected motor or lighting controller is expanded, a number of data fields with icons will appear. Select the **BUS** tab, to expose the BUS properties windows.  - Enter the Zone/Group/Node address separated by **PERIODs** and hit **ENTER**. When the field turns BLUE you know the data has been successfully entered.
DV-6 ***(not req'd for Lutron)***	Set Notify Mode (not relevant here for there is no programmed bi-directional	In order to invoke bi-directional communication for the ability for Elan's dimmer sliders to automatically respond to changes in color states (a really cool feature), set the **NOTIFY** Flag to either **COLOR** (for the HSV or Hue, Saturation, Value color space) or to **VALUE** (for the old school Red, Green, Blue color space—***old school because there is no dimmer in this color***

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

	communication back to the Lutron system from the Converging Systems' controllers)	***space***). If you want to have both sets of sliders (not really recommended in larger systems where bus traffic may become excessive), set the flag to **BOTH**.  Here is an example of NOTIFY set to COLOR in enable Hue/Saturation/Brightness sliders to operate.  The system will need to be installed and configured according to the Converging Systems documentation prior to integration with the g! system. The Converging Systems e-Node Pilot application (required for setup) is available for download for free from the Converging Systems website under Resources/Software Downloads/Software (http://www.convergingsystems.com/downloads_library.php). IP configuration using the e-Node is possible using both dynamic and static addressing. **NOTE**: It is recommended that the Converging Systems LED controllers (ILC-x00 controllers as well as the e-Node Ethernet gateway) are running the latest version of firmware available at the time of installation.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 3

Background on Addressing

This information is only relevant for when you ***start*** adding buttons and sliders within the GUI section of your Lutron. All Converging Systems' devices (loads or controllers as opposed to communication devices) that are connected to a communication device (e-Node ore-Node/dmx) will be addressed using a unique **Z**one/**G**roup/**N**ode addressing scheme (**Z**/**G**/**N**). Those addresses are referred to within g! Tools as **Zone, Group and Node Addresses.**

Background on ZGN Addresses: The largest group is referred to as the **Zone**, which might be associated with a floor of a building. The next smaller group is referred to as the **Group**, which might be associated with a room on that floor of a building. Finally, the smallest entity is referred to as the **Node**, or the particular unit in that Room or Group, and within that Floor of Zone. From the factory, all lighting devices have a default address of **Zone**=2, **Group**=1, **Node**=0 ("0" refers to an undefined unit).

Range of Z/G/N Addresses: Enter a number between 1 and 254 for **Z**one numbers, **G**roup numbers, and **N**ode numbers.

Please note -- no two controllers should be assigned the same Z/G/N address.

Background on Bi-Directional Feedback (bi-direction feedback is currently not supported with Lutron-WIP): Once a load device (CS-Bus controllers) is programmed using the e-Node Pilot application to a non-zero value, then **AND ONLY THEN** can those devices can be queried or monitored for state data (color or motor position) which is quite useful in auto-updating sliders and numerical readouts.

The figure below describes this hierarchy.

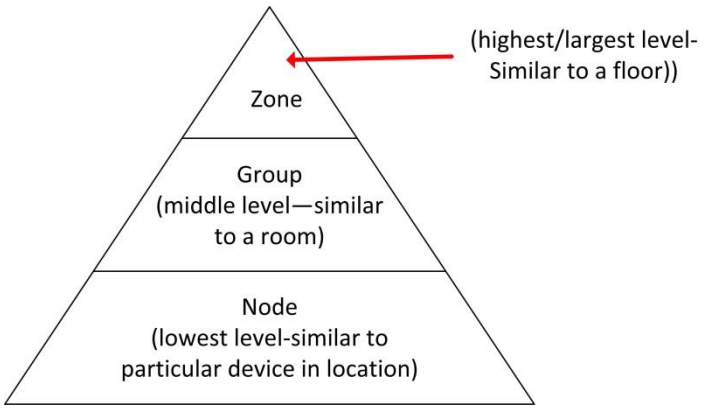


Figure 5

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

YOU MUST HAVE PRE-ASSIGNED Z/G/N ADDRESSES TO ALL LOADS BEFORE PROCEEDING WITH Lutron interfacing. See the Converging Systems' documentation on the e-Node Pilot application for more information here.

At this point after you assigned **Z/G/N** address to all loads (ILC-100 or ILC-400 controllers as well as DMX channel). it would be useful to write down a "map" of all interconnected loads and their re-assigned **Z/G/N Addresses** for use when programming within the Lutron Tab.

Specifically, if you had more than one ILC-100/ILC-400 controllers (or DMX device), you could give them (through the e-Node Pilot application) addresses as follows:

Table 1

ILC unit	Zone/Group/Node Address
First Unit	2.1.**1**
2nd unit	2.1.**2**
nth unit	2.1.**3** or some other number up to **254**

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 4

COLOR SPACE ISSUES

Note on Color Space.

Converging Systems recommends that only the HSB (Hue, Saturation and Brightness color space is used for it is infinitely more accurately and user friendly to control color. Although **Figure 6** below shows both HSB and RGB on the same UI, this is probably more confusing for the typical user than the simple subset of HSB (hue, saturation, brightness) controls**. Since there is no concept of dimming within the RGB color space, having RGB sliders only frustrates the user who may just want to dim an existing colored output. However, if the User is intent on having RGB sliders, we would recommend leaving the Brightness slider to get accurate dimming.**

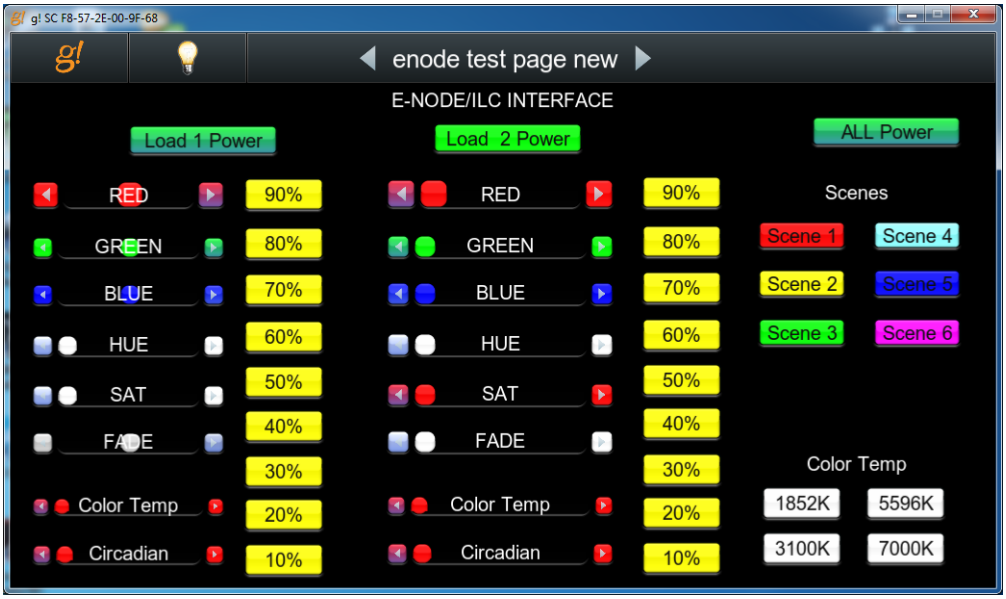


Figure 6

Note: this UI is not currently available from within Lutron but the concept is still valid with respect to the type of sliders shown—**we recommend showing Hue/Saturation and Brightness sliders for accurate color control.**

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 5

Home Control+ Slider Application Notes

This section details Level 2 more sophisticated programming techniques. Two important topics will be covered:

-Lutron LED Button Logic handling
-Slider utilization within the Home Control+ application.

The following illustrations provide some sample user interfaces (UI) where sliders are integrated for the Home Control+ application. In addition, detailed examples showing programming steps that can be followed to insure that the Lutron indicator LED logic implemented on Lutron hardware dimmers and Lutron touchscreen buttons operate predictably. A sample project with all of these steps embedded is also available as a download from Converging Systems' website.

A. Standard Keypad Control—Standard Buttons with Operational Lutron Button LED indicators

Below can be seen a screen that reveals standard and actual hardware Lutron keypad previously programmed. Some of these buttons refer to the control of Converging System's LED lighting control products, while other buttons refer to the control of Converging Systems' motor (projection screen) control products. Your specific application may vary.

Programming Steps. Actual programming steps are detailed on pages 11-13 above. No changes are required to generate this specific screen within the Home Control + application.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

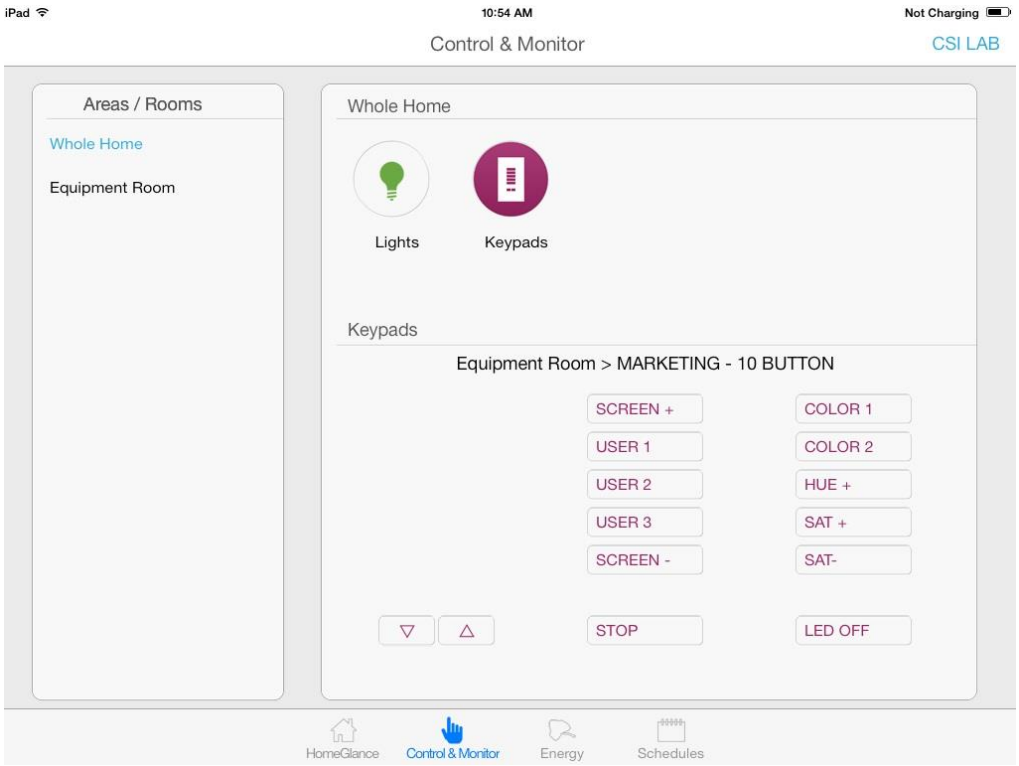


Figure 7

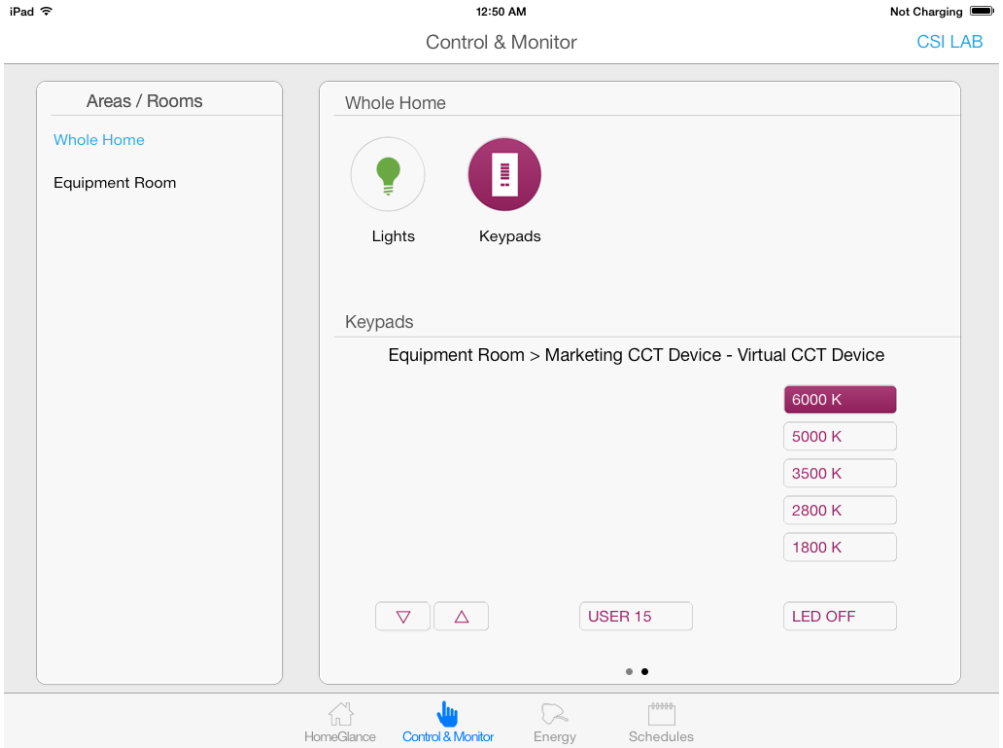


Figure 8

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

B. Slider Control (Full color Hue, Saturation, Brightness as well as Correlated Color Temperature Control--CCT)

Below can be seen two screens that reveal (i)standard **Hue**, **Saturation**, and **Brightness** control as well (ii) **Correlated Color Temperature** (CCT) control. All of these controls are derived from the creation of set of Lutron phantom keypads with the Lutron Essentials or Inclusive applications but which utilize a derivative of the standard CS-Bus command set to interrelate with sliders only.

Programming Steps. Actual programming sets for the e-Node Pilot application are provided after the screens.

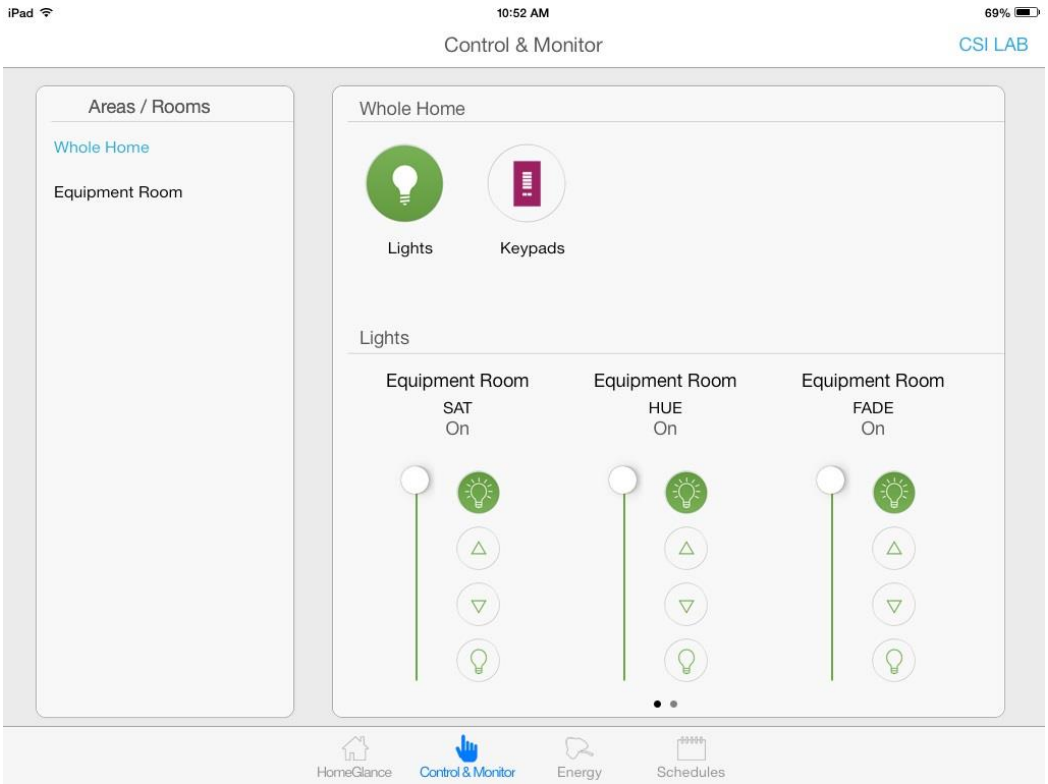


Figure 9

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

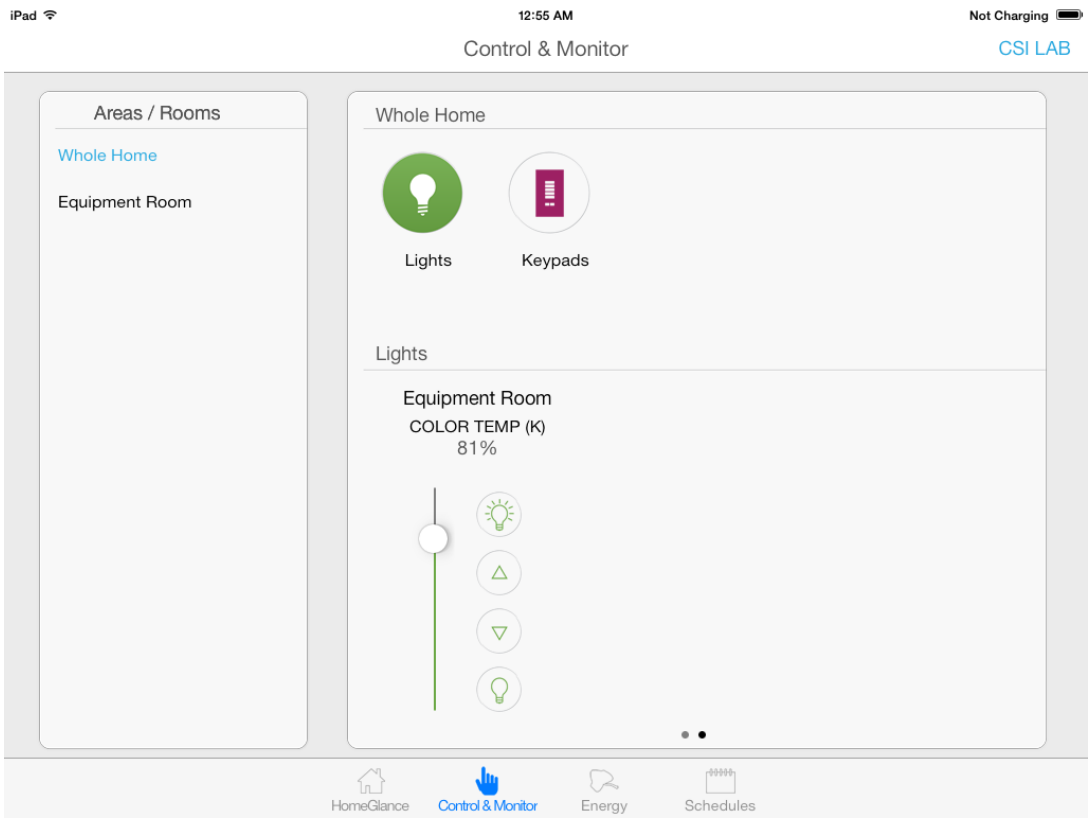


Figure 10

Programming Steps

The above Slider can be easily integrated into the above project with the insertion of the following steps:

Marked Lutron Button*	Desired Action	Lutron output string entry	CS Bus resultant command
Hue Slider	-On movement of slider from 0% to 100%, Hue commands are transmitted to CS-Bus system. **Note:** HUE of 0 or 100% equates to RED, while a HUE of 80 equates of GREEN, and a HUE of 160 equates to BLUE	TRACK(**50**)=8,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**50**)#2.7.1.LED=HUE **Note**: there is no trailing characters after the HUE command in this slider case
Sat Slider	-On movement of slider from 0% to 100%, SAT commands are transmitted to CS-Bus system. **Note:** SAT of 0 is fully saturated (very white) while a SAT of 100 preserves the HUE	TRACK(**51**)=7,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**51**)#2.7.1.LED=SAT **Note**: there is no trailing characters after the SAT command in this slider case

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

	of the original selected color		
Brightness Slider	-On movement of slider from 0% to 100%, Brightness (FADE) commands are transmitted to CS-Bus system. **Note:** FADE of 0 is fully OFF (dark) while a FADE of 100 is fully ON	TRACK(**52**)=6,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**52**)#2.7.1.LED=SET **Note**: there is no trailing characters after the SET command in this slider case
CCT Slider (Color Temperature)	-On movement of slider from 0% to 100%, Correlated Color Temperature (CCT) commands are transmitted to CS-Bus system. **Note:** CCT of 0% equates to a CCT of 1800K while CCT of 100% equates to a CCT of 7000K	TRACK(**53**)=10,1 **Note**: there is no trailing comma and third number in this slider case	LUT(**53**)#2.7.1.LED=CCT **Note**: there is no trailing characters after the CCT command in this slider case

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 6

ADVANCED Lutron PROGRAMMING

AP Topic 1

1.0 How to set up group control of loads using sliders with feedback available to sliders.

Addressing Background CS-Bus controllers can be address with a unique **Z**one/**G**roup/Node (ZGN) address. Up to 254 entries can be used for each field. The first field is the **Zone** (or largest range), the middle field is the **Group**, and the last field is the **Node**. No two loads can share the same **Z/G/N** address. As an example, if you will be populating a pair of two controllers within each of two rooms on two floors of a building here would be the suggested addressing that could be used.

Table 2

	Floor One	Floor Two
Room 1	2.1.1 for first controller in room. 2.1.2 for second controller in this room	
Room 2	2.2.1 for first controller in room. 2.2.2 for second controller in this room	
Room 3		3.1.1 for first controller in room. 3.1.2 for second controller in this room
Room 4		3.2.1 for first controller in room. 3.2.2 for second controller in this room

Group Addressing**.** In certain cases it is desirable is simply send a wildcard address for a group of controllers to all respond in unison rather than programming each individually to respond through macros. There are two problems with macros in general. One is that often they are executed serially which means that if you had two hundred loads referenced within a macro, the timing of the execution of the last command sent out might be delayed from the first command sent out. In this case, not all LEDs would turn on or OFF at the same time, potentially. The second issue involves the actual programming time required to program scores or even hundreds of commands for a simple ALL OFF button.

Within the CS-Bus software protocol is the concept of utilizing a "0" within any address field as a surrogate for defined numbers ranging from 1 to 254 within that same field. Thus, if you issued a command of #2.1.0.LED=ON:<cr> , all units with addresses of 2.1.1 to 2.1.254 would immediately respond. Please see the table below for an example of how various wildcards could be used.

Table 3

Specific controller address	Specific command that will trigger targeted controller
2.1.1	2.1.0 or 2.0.0 or 0.0.0
2.1.2	2.1.0 or 2.0.0 or 0.0.0

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

2.1.3	2.1.0 or 2.0.0 or 0.0.0
2.2.1	2.2.0 or 2.0.0 or 0.0.0
2.2.2	2.2.0 or 2.0.0 or 0.0.0
2.2.254	2.2.0 or 2.0.0 or 0.0.0
5.254.4	5.254.0 or 5.0.0 or 0.0.0

NOTIFY Command Background Converging Systems has a **NOTIFY** function which automatically provides color state feedback (from the targeted controller) provided a unique **Z**one/**G**roup/**N**ode (**Z/G/N**) address is provided with an action/argument payload to that specific controller. Specifically, if a command to invoke a color change is directed to a controller that has a **Z/G/N** address of 2.1.1, that specific controller with that address will respond back to the automation system as to its specific color state if and only if there is a color state change impacted on that specific controller.

In some cases as has been discussed above, there might be a requirement to send a group command or all hail command to more than one controller. In this case, the group command would be directed not to a single controller or load but to a series of controllers. To reduce bus traffic when a series of controllers is given the same command, ***only the first controller whose node number is 1 greater than the wildcard command of "0" will respond*** (which reduces bus traffic by up to 243 messages). The logic here is that if 254 controllers are all told to turn **Red**, only the surrogate for that group of controllers will respond and within the CS-Bus messaging logic that surrogate is the controller with a node of "1." So for example, if a **#2.1.0.LED.VALUE=240.0.0:<cr>** command is transmitted to 254 controllers, they will all turn to **Red** , but only the controller with an address of **2.1.1** will respond with its new color status. In this case, a command on the bus from that surrogate controller would come back as follows: **!2.1.1.LED.VALUE=240.0.0** (the exclamation mark indicates that it is a message from CS-Bus device rather from an automation controller). Please see the diagram on the next page for the theory of operation here.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

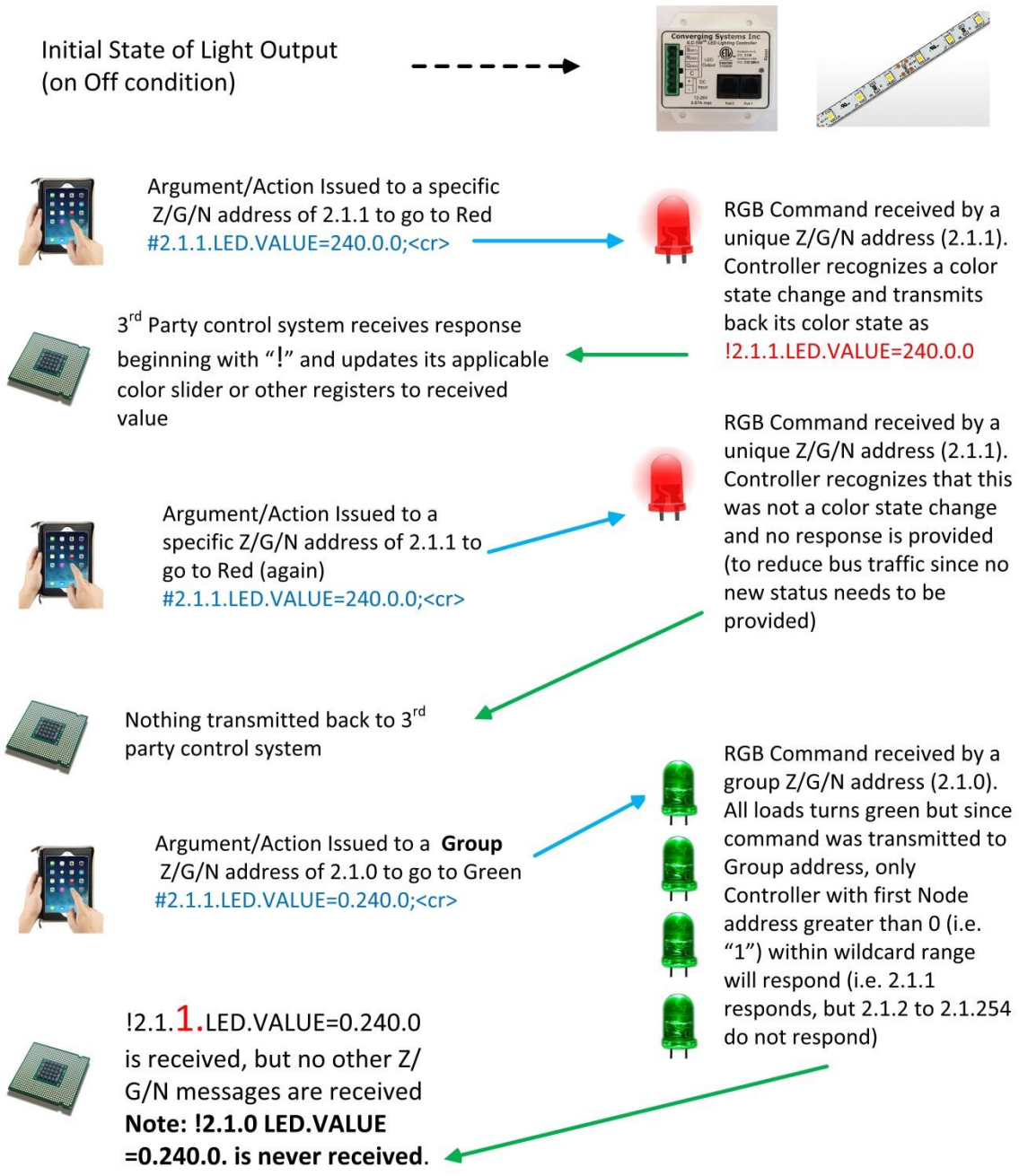


Figure 11

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 7

DMX Options

Note on DMX Lighting Devices. There are many third-party lighting devices available in the marketplace that support the DMX512 lighting standard ("standard for digital communication). DMX devices were originally utilized for theatrical interior and architectural lighting application only, but recently their adoption rate has grown in other areas where colored lighting is desired. DMX 3-color lighting fixtures utilize the Red, Green, Blue (RGB) color space which although practical for theatrical uses and the trained lighting designer is quite limited for traditional dimming application ***for the technology inherently lacks the most basic dimming slider*** which would preserve a specific hue while lowering the brightness to full off. But that has all changed now...

Converging Systems' e-Node/dmx. Converging Systems has developed an adaptation of its lighting/dimming technology currently available within its ILC-x00 line of LED controllers and has re-purposed that technology into a separate product known as the e-Node/dmx. The existing e-Node/Lutron drivers compatible with the ILC-x00 LED controllers can also drive directly the e-Node/dmx (color engine/dmx translator), and the e-Node/dmx makes the necessary color adjustments within its own processor to translate incoming commands to outgoing DMX commands **and transmits those directly onto *a DMX bus***. What is unique about this implementation is that the Converging Systems' hue-accurate dimming technology (with a built-in dimmer slider) can now drive DMX fixtures by using **SLIM** software already in existence within Converging Systems' products. (See the listing of commands that are supported with the e-Node/dmx device see LED Commands in this document.)

Please follow the directions which follow to drive DMX fixtures from a LUTRON System

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

WIRING DIAGRAM (for DMX control using e-Node/dmx and IP)

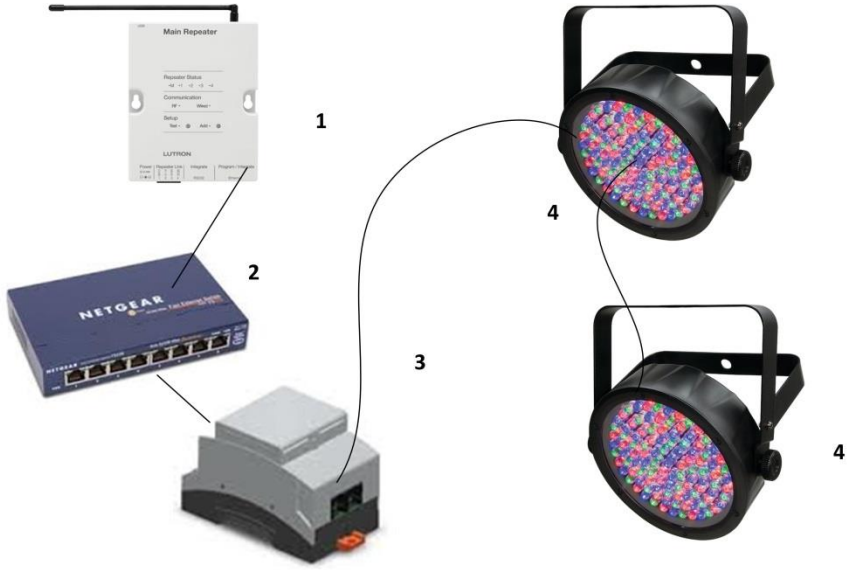


Figure 12

Wiring/Configuration Notes:

1. Maximum length of CS-Bus cabling from e-Node to the last DMX fixture using DMX cabling = 1200 meters (3,900 feet)
2. Maximum number of DMX fixtures connected to a single e-Node/dmx device = 32. If more than 32 fixtures are required, implement additional e-Node/dmx devices.
3. Maximum number of e-Nodes that can exist on a Lutron system = 254

BILL OF MATERIALS (for IP control)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	RadioRA2 processor	Lutron	RR-Main-REP-WH	Ethernet	various	
2	Network Switch	Various	Various	Ethernet	RJ-45	
3	e-Node/dmx	Converging Systems	e-Node/dmx	Ethernet	RJ-45 (for Ethernet) RJ-25 for local DMX bus	
4	Third party DMX fixtures	Various	Various	DMX512	RJ-25 for DMX communication	Must terminate final OUT or THRU connector on last DMX fixture using a 120 ohm resistor

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

e-Node Programming/Device Programming

Minimum requirements for this operation.

-e-Node/dmx with power supply
-Necessary cabling to connect e-Node/dmx to first DMX fixture (see "e-Node Interfacing with DMX Guide"). For reference the pin-outs on the e-Node/dmx are as follows:

e-Node/dmx (MkIII) PORT 2 RJ-45 connector

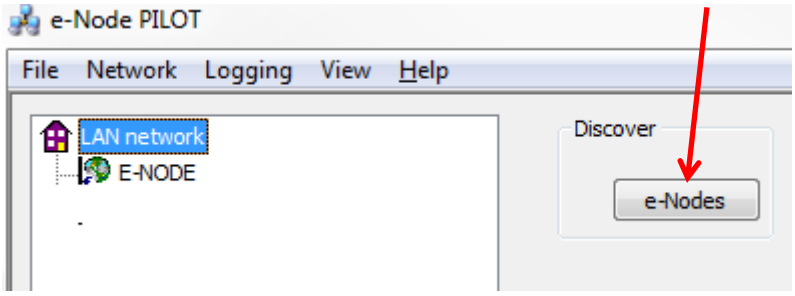
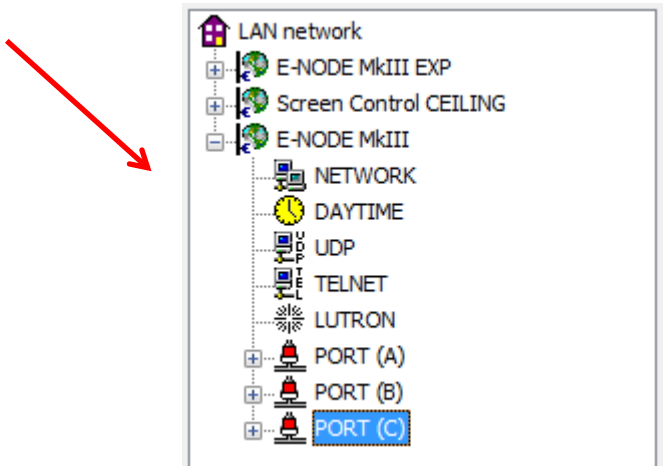
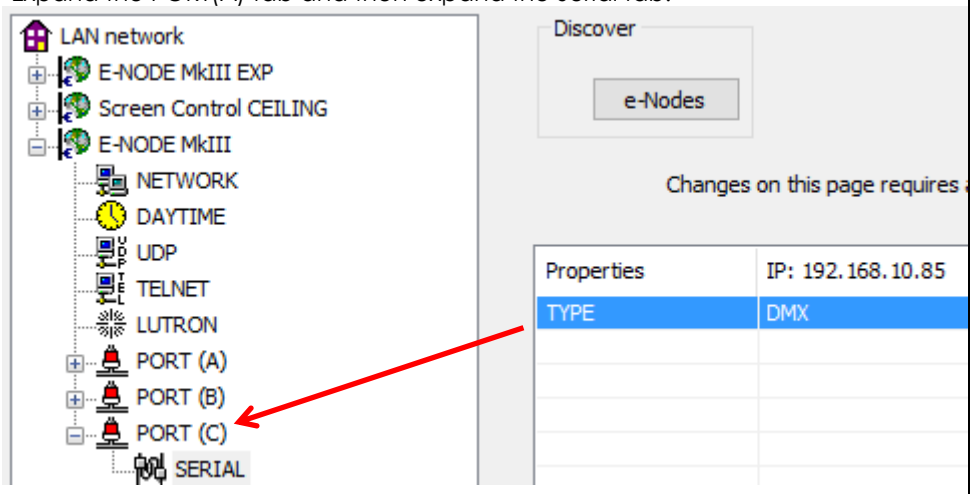
Pin	Signal
1	Data +
2	Data -
3	Do not connect
4	Do not connect
5	Do not connect
6	Do not connect
7	Ground
8	Do not connect

Note: Even though Converging Systems recommends that RJ-25 6P6C plugs should be used for most CS-Bus wiring, the DMX wiring can utilize a 4P4C RJ11 plug.

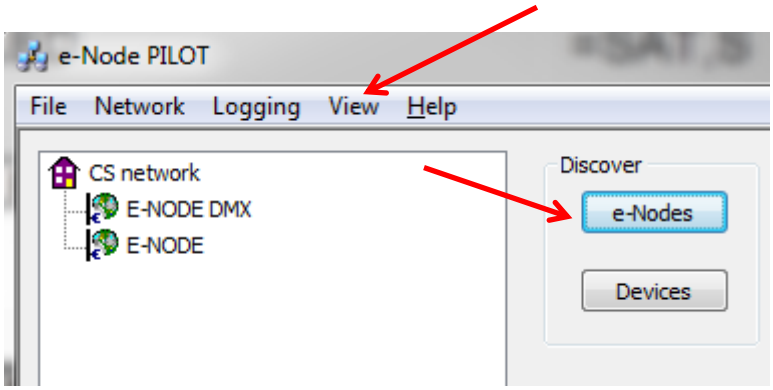
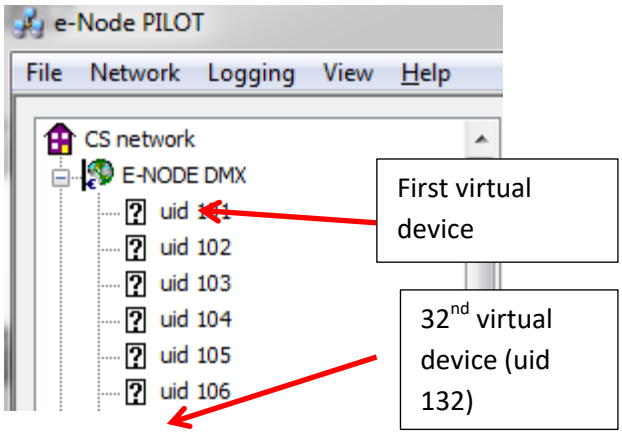
e-Node/dmx Programming

Step	Setting	Choices
DMX-1	e-Node/dmx setup	Follow the directions under e-Node Programming in Appendix 2 (Step EN-1 and EN-2).

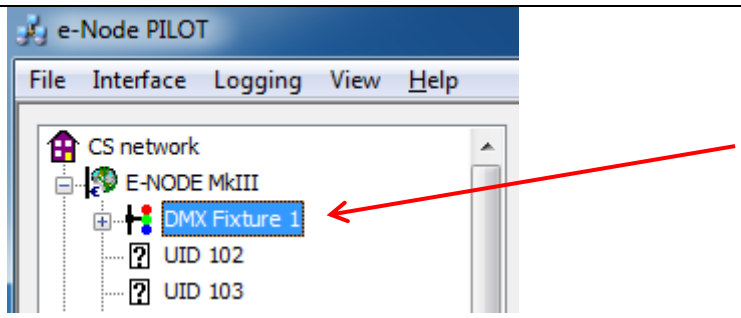
Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

DMX -2	Verify the e-Node DMX is set to communicate to DMX fixtures	-Select the **View e-Node** tab and select the **Discover e-Node** button. Any e-Node(s) connected on the same network will appear as shown.  -Select the **+** mark in front of the e-Node/dmx that you wish to program to expose the sub-tabs.  -Expand the PORT(A) tab and then expand the Serial tab. 

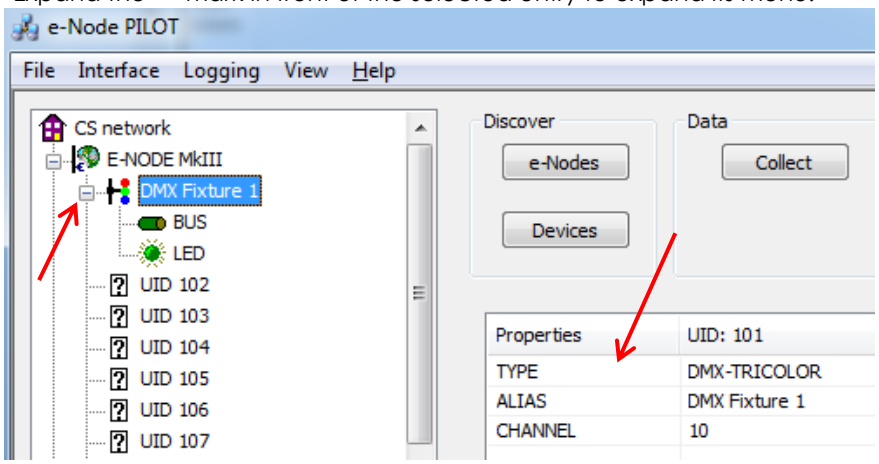
Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

		-Verify that after the **TYPE** entry, the data field indicates **DMX**. If it does not indicate **DMX**, select **DMX** from the pull down menu and reboot the e-Node/dmx in order to make this setting active. Note: the e-Node/dmx can also be configured to communicate with standard CS-Bus devices (ILC-100, ILC-400) and therefore only when this entry is set to **DMX**, will the e-Node/dmx properly communicate to DMX fixtures.
DMX -3	Device Discovery	-Select the **View Map** tab and select the **Discover e-Node** button. Any e-Node(s) connected on the same network will appear as shown. -Select the Discover Devices button.  -Immediately 32 virtual "DMX Devices" will appear as follows:  Note: this picture shows the first 6 devices discovered. In a real example, all 32 virtual devices will appear.
DMX -4	DMX Fixture Type	- Select the **View Map** tab and select a specific **uid entry** (101-132) such that the entry is highlighted and then switches to a specific **DMX Fixture** (1 to 32).

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

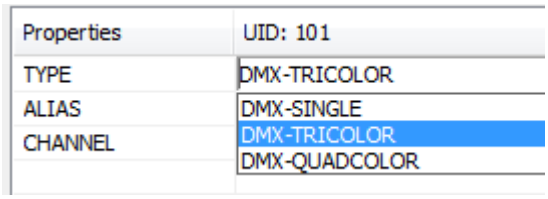


-Expand the **+** mark in front of the selected entry to expand its menu.



-Within the **Properties** select the appropriate type of DMX fixture that you wish to support. For example, a 3-color DMX device (typically RGB colorants) is referred to as **DMX-TRICOLOR**, while a 4-color DMX device (regardless of those four colors) would be referred to as a **DMX-QUADCOLOR** and a 1-color DMX device would be referred to as a **DMX-SINGLE.**

Note: For each **UIDn/DMX** Fixture it is important to select the appropriate type in order for the embedded software to be able to properly adapt itself for the target output device.



Note: The MKIII hardware release of e-Node/dmx is required for this level of functionality operating with firmware versions 1.02 or later.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

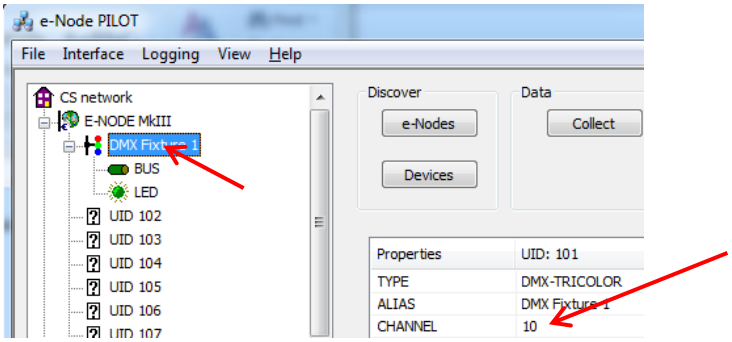
DMX -5	Set up Device Addressing	The DMX data packet is mapped to CS messages by assigning a unique **Z**one/ **G**roup/ **N**ode number to a particular **UIDn/DMX Fixture** (regardless of the number for channels which are associated with that DMX Fixture). Specifically in the example below, the start DMX address for DMX Fixture 1 is **10** and the required number of successive DMX addresses is automatically internally assigned within the e-Node/dmx to those discrete channels within that fixture. For example, for a 4-channel DMX fixture which will be addressed with a default **Z/G/N** address of 2.1.1, the default start DMX channel would be 10 and the e-Node/dmx firmware automatically allocates 4 sequential channels for the 4 colors of that fixture (e.g. 10/11/12/13). Typically (unless the defaults are changed by the installer), Red would be assigned to DMX Channel 10, Green would be assigned to DMX Channel 11, Blue would be assigned to DMX Channel 12 and White would be assigned to DMX Channel 13. All DMX ***Start*** addresses and associated **Z/G/N** addresses can be changed by the installer. DMX start default channels, Z/G/N default addresses are mapped as shown in the following table:

DMX Fixture	Default UID	DMX Channel Allocation	CS-Zone/Group/ Node
1	101	10-19	2.1.1
2	102	20-29	2.2.1
3	103	30-39	2.3.1
4	104	40-49	2.4.1
5	105	50-59	2.5.1
6	106	60-69	2.6.1
7	107	70-79	2.7.1
8	108	80-89	2.8.1
9	109	90-99	3.1.1
10	110	100-109	3.2.1
11	111	110-119	3.3.1
12	112	120-129	3.4.1
13	113	130-139	3.5.1
14	114	140-149	3.6.1
15	115	150-159	3.7.1
16	116	160-169	3.8.1
17	117	170-179	4.1.1
18	118	180-189	4.2.1
19	119	190-199	4.3.1
20	120	200-209	4.4.1
21	121	210-219	4.5.1
22	122	220-229	4.6.1
23	123	230-239	4.7.1
24	124	240-249	4.8.1
25	125	250-259	5.1.1

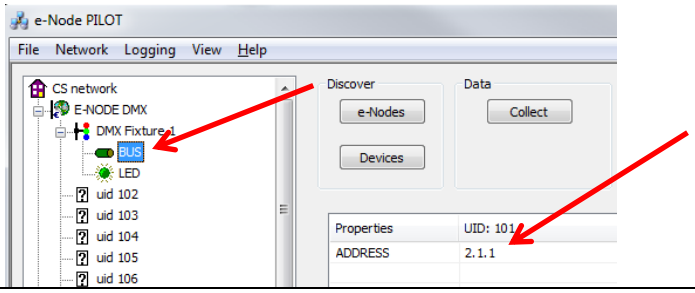
Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

26	126	260-269	5.2.1	
27	127	270-279	5.3.1	
28	128	280-289	5.4.1	
29	129	290-299	5.5.1	
30	130	300-309	5.6.1	
31	131	310-319	5.7.1	
32	132	320-329	5.8.1	

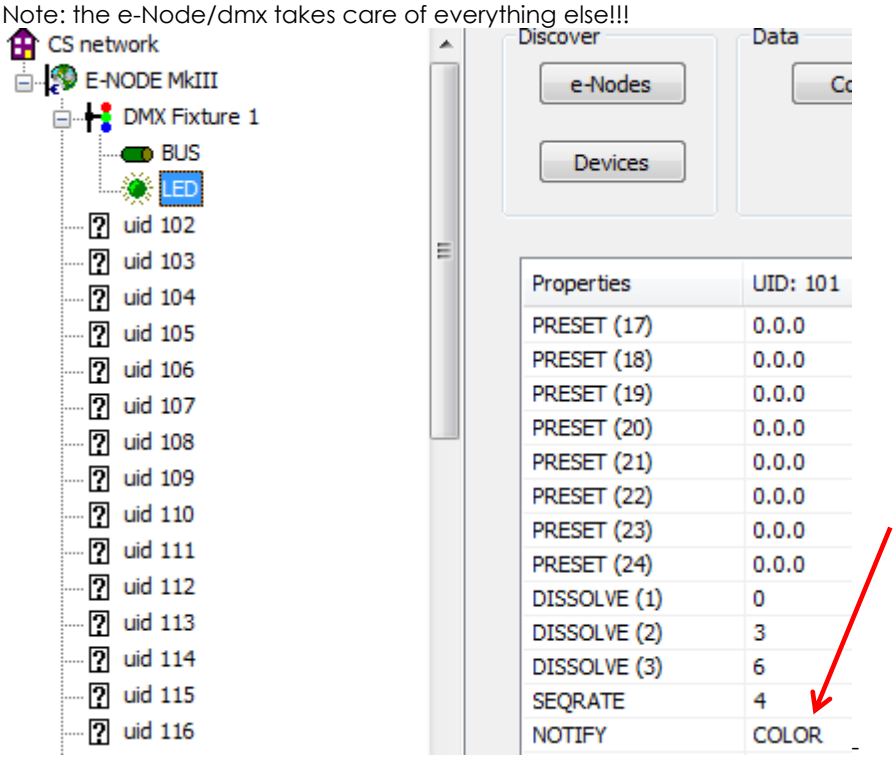
-If you desire to change any default DMX start address, click on the DMX Fixture entry and change the address as appropriate.



-If you desire to change any **Z**one/**G**roup/**N**ode address, click on the BUS entry, and change the address as appropriate.



Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

DMX -6	Turn on NOTIFY as applicable for your project (**not required for Lutron operation since bi-directional feedback is not utilized**)	-Program the Device **Notify** parameter for the e-Node/dmx. Change the parameter for the specific device (UID-DMX Fixture) for which you which to invoke the NOTIFY function. **Note**: See section DV-2 in Appendix 2 for explanation of the NOTIFY function. Also understand In this case, you will not be programming ILC-100 or ILC-400 devices, so you can skip the ILC-100/400 section (Steps DV-1 and DV-2) in Appendix 2. -Proceed to standard Lutron Programming (Steps 1 onwards above in the main body of this Integration Note). Note: the e-Node/dmx takes care of everything else!!!  Note: the e-Node/dmx takes care of everything else!!!

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 8

Lutron Programming Spreadsheet

Telnet Username	
Telnet Password	
IP address of the Lutron primary processor	___ ___ ___, ___ ___ ___, ___ ___ ___, ___ ___ ___

(note **RED BOLD Column Entries** below are required for Programming)

Lutron button targeted for connection to Converging Systems LED or Motor operation							**Desired outcome when Lutron button is pushed**	**Command that needs to be entered into e-Node Pilot application[1]**
Index		Button Alias[1]	**Integration ID**	**Button Number**	**Button Logic**		Descriptive Summary[2]	**Actual programming string[3]**
		Recall 1	(e.g.) 5.	(e.g.) 1.	(e.g.) 3.		(e.g.)Color goes to Recall 1	(e.g.) #2.1.1.LED=RECALL,1
(1)								
(2)								
(3)								

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

(4)								
(5)								
(6)								
(7)								
(8)								
(9)								
(10)								
(11)								
(12)								
(13)								
(14)								
(15)								
(16)								
(17)								
(18)								
(19)								
(20)								
(21)								
(22)								
(23)								
(24)								

(Up to 256 indexes are available, please make additional copies of this table as needed.)

[1]Note: CS-Bus commands that can be utilized are described in a separate document entitled "Third-Party CS-Bus Device Driver Toolkit-Programmers Guide (DDK) which can be downloaded from http://www.convergingsystems.com/inres_programmingdesignkit.php

[2]These entries are not required for programming but are only provided to assist in the programmer's ease of project documentation.

[1]These programming strings assume a pre-programmed CS-Bus device with a Zone address of 2, a Group address of 1, and Node address of 1. The factory default for lighting controllers is Z.G.N= 2.1.0 while the defaults for motor controllers is Z.G.N=1.1.0. The e-Node Pilot application is required to change the factory default address to a unique address. The device address shown above as #2.1.1 can be any address from 1-254 per field. This address would need to have been programmed for the specific device being controlled using the e-Node Pilot application also available from Converging Systems under Downloads.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 9

Common Mistakes

Common Mistakes

1. Forgetting to set turn on the Telnet Login under the **TELNET** page (to ENABLE). The Lutron processor does require a valid username and password, If **TELNET** is set to no login, the e-Node and the Lutron processors will fail to communicate.

2. Forgetting to input accurate **Z**one/**G**roup/**N**odes addresses within the LUTRON tab. The factory defaults will work with some systems but certainly, if your particular lighting or motor controllers do not function, check these addresses.

3. Forgetting to press the **RESTART** button within e-Node Pilot application after changes on the **NETWORK**, **TELNET**, or **LUTRON** pages are made.

4. Forgetting to match a valid LUT for each related TRACK within e-Node Pilot or the web application.

5. Forgetting to properly use COMMAS within the TRACK section or failure to properly use PERIODS within the LUT section of the e-Node Pilot application.

Here is an example that works (commas with TRACK and periods with LUT):

TRACK(1) 5,1,4	LUT(1) #2.7.1.LED=FADE_UP

Here is an example THAT WILL NOT WORK

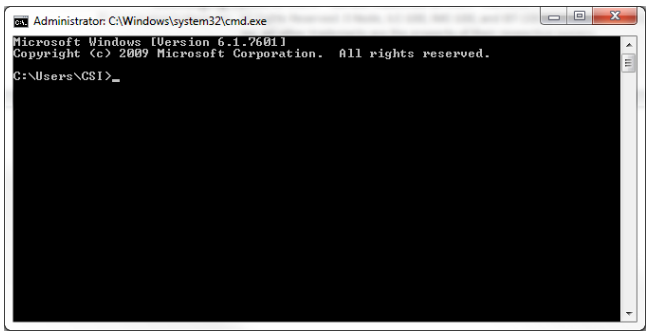
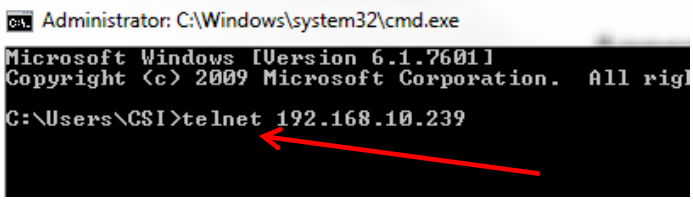
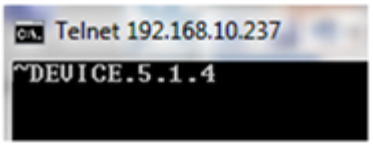
TRACK(1) 5.1.4	LUT(1) #2,7,1,LED=FADE_UP

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Appendix 10

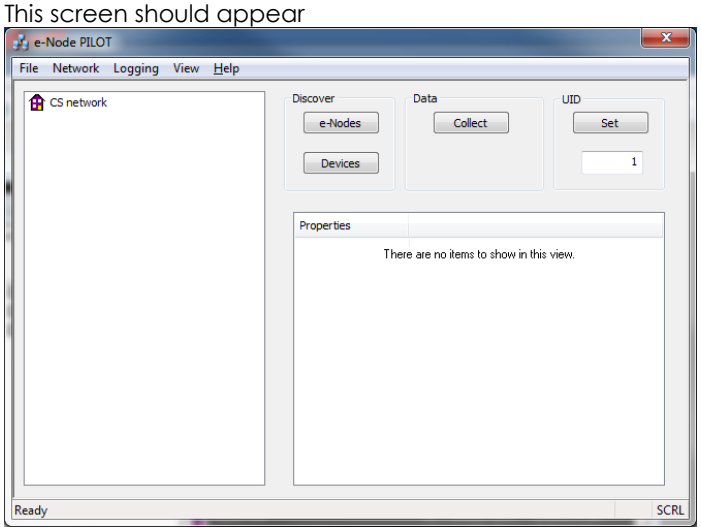
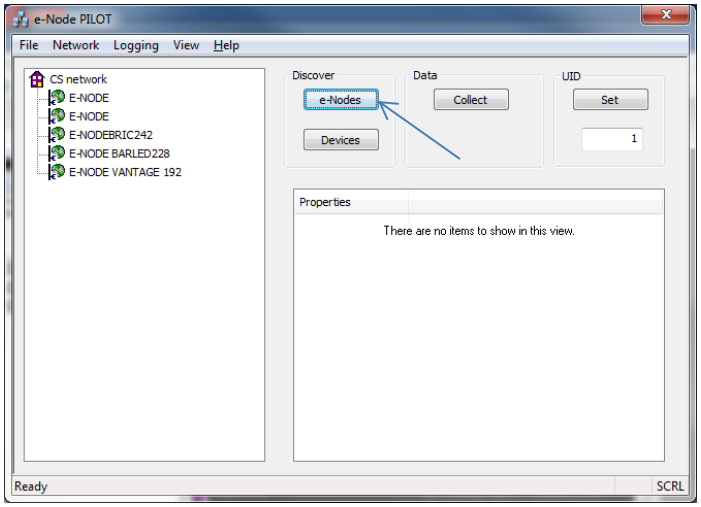
Troubleshooting/System Monitoring

Using Telnet Tools

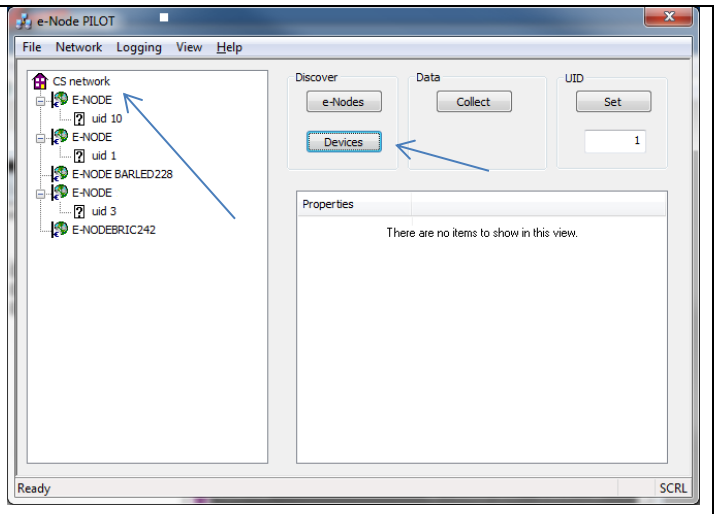
Step #	Step Overview	Detail
A5.1.1	Launch MS-DOS Telnet application. **Note**: If the Telnet utility is not immediately available on your PC, you will need to add it under Add Programs—it is a Windows utility available but not always installed.	-Enter the command prompt but typing in "CMD" in the search box within your PC.  -Launch the Telnet application by typing in the following command followed by the IP address for your Lutron processor. 
A6.1.2	Monitor Lutron button pushes to verify if the Device ID, Button Push, and Button operation are being accurately transmitted through Telnet.	Here is representative Telnet output stream indicating that a button from the following device has been pushed.  In this case, the parameters represented by this Telnet output stream represent the following: Device ID: 5 Button Number: 1 Button Operation: 4 Thus if you are seeing a 5,1,4 from Lutron but you have entered a TRACK(n) of **5**,**2**,**4** into the e-Node, and nothing is happening, you have just discovered why. Change the TRACK(n) entry, and try once again.

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Using Converging Systems' Tools

Step #	Step Overview	Detail
A5.2.1	Launch **e-Node Pilot** application	This screen should appear 
A5.2.2	Discover e-Node devices(s)	Select **View Map** and press the **Discover e-Node** button. If your e-Node can be seen, you should see it appear under CS-Network 
A5.2.3	Discover Devices	Next press the **Discover Device** button. Any connected loads (i.e. ILC-100 or motor controllers) should appear

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275

Converging Systems Inc.● 32420 Nautilus Drive● Rancho Palos Verdes, CA 90275