CONVERGING SYSTEMS

Integration Note

Automation/Lighting Panel Manufacturer:	Key Digital
Platforms:	**KD MC-2500 controllers (MC-1000)**
Versions:	Compass Navigator v1.1.13 or newer
Specific Module Version:	-CS-Bus V __ or later (consolidated version for IP and Serial control using Telnet Port 23).
Download location for Profile/Driver	Compass Navigator "Add Modules" tab within "Program" Note: current name is CS-BUS device under TCP/IP tab.
Document Revision Date:	May 14, 2015

OVERVIEW AND SUPPORTED FEATURES

The Key Digital Master Controllers and associated Compass Navigator design software support the Converging Systems' family of motor and LED lighting control products using either Ethernet (e-Node) or RS-232 serial connection (IBT-100).

Integration with Converging Systems' platforms is enabled from the range of iOS devices including iPads®, iPad® mini, iPhone®, and iPod touch® devices. Additionally, status available from a number of Converging Systems' controllers can trigger commands and other events within the above lighting /automation system. For example, a motor movement can trigger a lighting event. Or a lighting command issued can signal back to the touchscreen device as to its current setting (slider movement or level setting).

CURRENT DRIVER SUPPORT THE FOLLOWING FEATURES

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

LED Lighting Commands

General CS-Bus Commands	Key Digital Naming Convention[1]	ILC-100	ILC-400	e-Node DMX

General LED Control Commands				
ON	Node_On	✓	✓	✓
OFF	Node_Off	✓	✓	✓
EFFECT,n (>1)	Execute_Effect	✓	✓	N/A
STORE,#	Store_Preset	✓	✓	✓
RECALL,#	Recall_Preset	✓	✓	✓
DISSOLVE.1=XX	Set_Dissolve_Rate	✓	✓	N/A
DISSOLVE.2=XX	Set_Dissolve_Rate	✓	✓	N/A
DISSOLVE.3=XX	Set_Dissolve_Rate	✓	✓	N/A
DISSOLVE.4=XX	Set_Dissolve_Rate	✓	✓	N/A
SEQRATE=XX	Set_Sequence_Rate	✓	✓	N/A
SUN_UP	Sun_Up	✓	✓	N/A
SUN_DOWN	Sun_Down	✓	✓	N/A
SUN.S	Set_Circadian_Value	✓	✓	N/A
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	✓	✓	✓
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	*	*	N/A
RGB Color Space Commands				
RED,R	Set_RED_Value	✓	✓	✓
GREEN,G	Set_GREEN_Value	✓	✓	✓
BLUE,B	Set_BLUE_Value	✓	✓	✓
VALUE=R.G.B				N/A
WHITE,W	Set_WHITE_Value	✓	✓	N/A
VALUE=R,G,B,W		*	*	N/A
PRESET.X=XXX.XXX.XXX (3-color)	Set LED Presets/RGB Color spacer for preset x	*	*	N/A
PRESET.X=XXX.XXX.XXX (4-color)		*	*	N/A
STOP	???	✓	✓	✓
Correlated Color Temperature (CCT) Commands				
CCT,XXXX	SET_Correlated_Color_	✓	✓	N/A

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	Temp			
CCT_UP	Color_Temp_Up	✓	✓	N/A
CCT_DOWN	Color_Temp_Down	✓	✓	N/A
Bi-Directional Commands				
COLOR=?	Automatic polling within Driver	✓	✓	N/A
VALUE=?	Automatic polling within Driver	✓	✓	N/A
PRESETH.X=?		*	*	N/A
PRESET.X=?		*	*	N/A
Accessory Enode Command/Setup Parameters				
Verbose Mode				
UDP Port 4000/5000		✓	✓	✓
Telnet Login with Authentication (with e-Node		✓	✓	✓
Telnet Login without Authentication		✓	✓	✓

Notes:

***When needed, these can be implemented using dealer programmed serial strings using The TCP-IP Manager or the RS-232 Manager, modules available within Compass Navigator. .

[1]See Appendix 4 below for information on how to see supported Key Digital commands.

Motor Commands (WIP currently)

General Commands	Key Digital Controls Naming Convention	IMC-100	BRIC ("Bric Mode")	
General Motor Control Commands				
UP		✓	✓	
DOWN		✓	✓	
STOP		✓	✓	
RETRACT		✓	✓	
STORE,#		✓	✓	
RECALL,#		✓	✓	
PRESET.X=XX.XX				
Bi-Directional Commands				
STATUS=?				
POSITION=?				

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Accessory Enode Command/Setup Parameters				
Verbose Mode				
UDP Port 4000/5000				
Telnet Login with Authentication (with e-Node		✓	✓	✓
Telnet Login without Authentication		✓	✓	✓

CURRENT PROFILES DO NOT SUPPORT THE FOLLOWING FEATURES

Other than any features that are grayed out below, any features specified below are currently unsupported.

Any feature not specifically notes as supported should be assumed to be unsupported

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WIRING DIAGRAM (for IP connection)

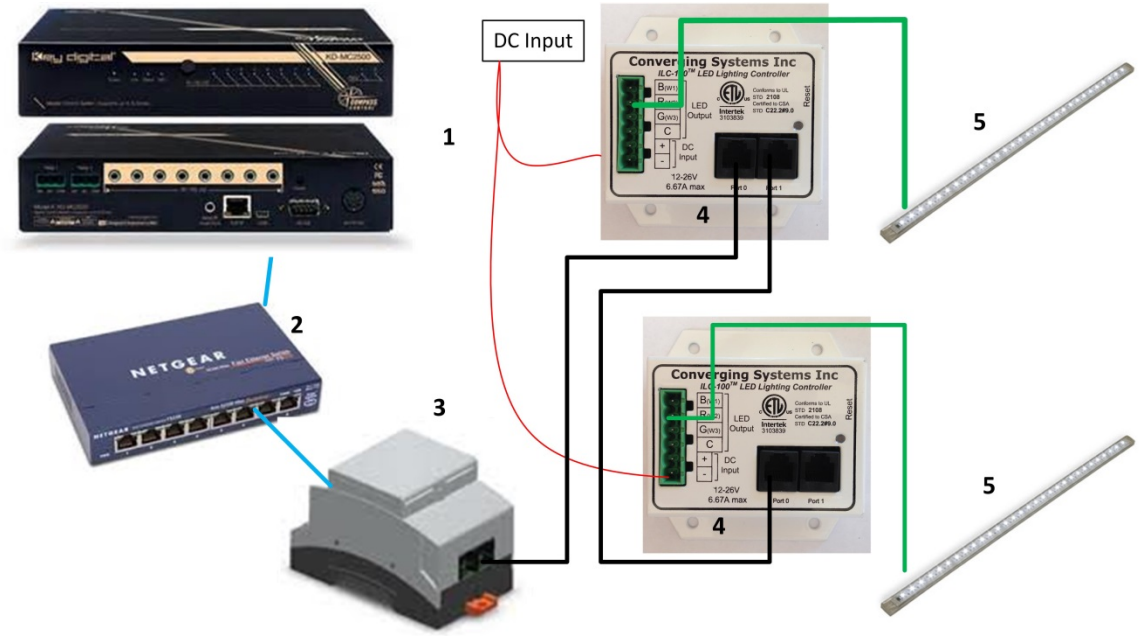

Figure 1

Wiring/Configuration Notes:

1. Maximum length of CS-Bus cabling from e-Node to the last ILC-100/ILC-400 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-100/ILC-400 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 Key Digital system = 254

BILL OF MATERIALS (for IP control)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	Key Digital Master Controller	Key Digital	KD MC-2500 KD MC-1000	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-100 or IMC-100 or (Stewart BRIC)	CS-Bus protocol	RJ-25 for CS-Bus communication	Must terminate beginning and end of bus with 120 ohm

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						resister on 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	

WIRING DIAGRAM (for RS-232 serial connection)

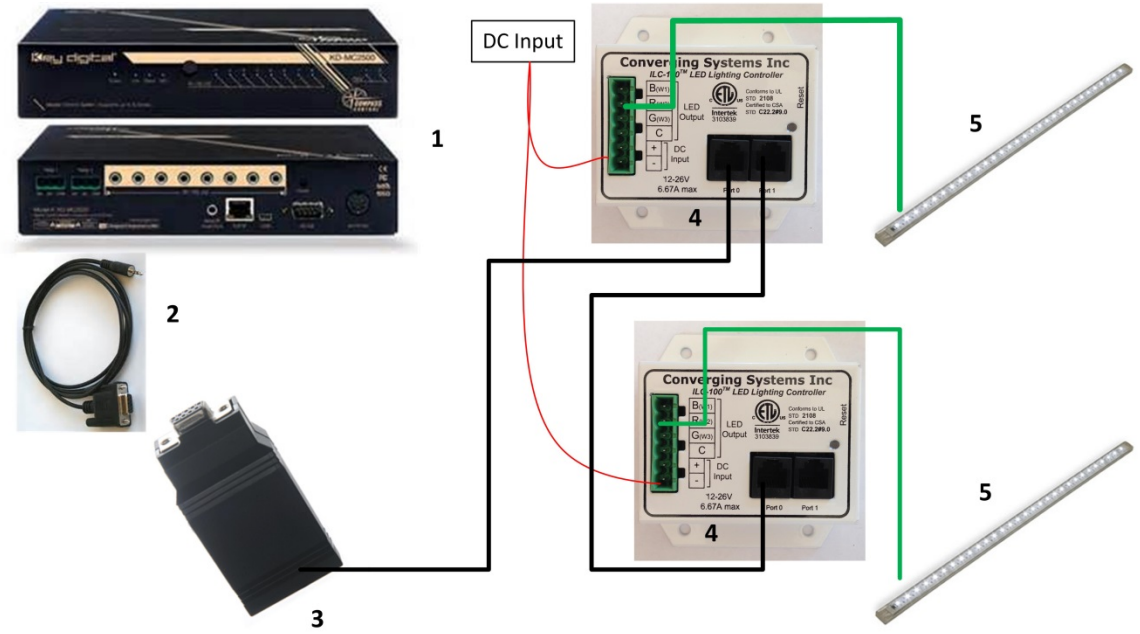

Figure 2

Wiring/Configuration Notes:

1. Maximum length of CS-Bus cabling from e-Node to the last ILC-100 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-100 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 Key Digital system = 254

BILL OF MATERIALS (for RS-232c connection)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	Key Digital Master Controller	Key Digital	KD MC-2500 KD MC-1000	Ethernet	various	
2	3.5mm to DB-9 (RS-232) cable	Key Digital	Included with Master	RS-232c	3.5mm to DB-9M	

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			Controllers			
3	IBT-100	Converging Systems	IBT-100	RS-232c	DB-9 (for Serial) RJ-25 for local bus	
4	Lighting Controller (or Motor Controller)	Converging Systems	ILC-100 or IMC-100 or (Stewart BRIC)	CS-Bus protocol	RJ-25 for CS-Bus communication	Must terminate beginning and end of bus with 120 ohm terminating resister on 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	

System Configuration/Programming

Before proper operation between the Converging Systems' controllers and the Key Digital' system can begin, it will be first necessary for most applications to configure the Converging Systems' products using the e-Node Pilot (PC-based) application (and the e-Node). In addition, communication parameters within the Key Digital software are also required. Refer to the specified instructions below for the particular subsystem for more information.

You may wish to go the topic that is most relevant for you (click on link).

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	Key Digital Programming User Interfaces	Section 5
Common Mistakes		Appendix 1
Color Space Issues		Appendix 2
Advanced Programming		Appendix 3
DMX Programming Support		Appendix 4

Background

The Converging Systems e-Node is an Ethernet communication device which can be used to connect the Key Digital Host to one or more Converging Systems motor and/or lighting controllers. Alternatively, the Converging Systems' IBT-100 serial interface device can be used alternatively to connect the same number of Converging Systems' controllers to a Key Digital processor in situations where Ethernet communication is not desired (but where bi-directional feedback is still required).

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 **ZGN** address) with either the e-Node (Ethernet) or the IBT-100 (RS-232c communication), and/or you desire ***bi-directional communication/feedback*** between your user interface (UI) and a particular motor or lighting controller, **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** and **turn on the NOTIFY command** which provides for that bi-directional communication.

Note: If you plan on utilizing the IBT-100 for serial communication and (i) ***you will not need*** more than one address other than the factory default **ZGN** address of 2.1.0 for lighting controllers or 1.1.0 for motor controllers, and (ii) ***you do not need bi-directional communication*** between the lighting load or the motor load and your User Interface, then you can proceed to the IBT-100 Set up Section and you may skip the (i) e-Node Programming section as well as (ii) the ILC-100/ILC-400 Programming sections below.

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

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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
- Powered up and connected ILC-x00 controller using straight thru (1-1) wiring using a 6-pin RJ-connector (Do not use 568A or 568B wiring and simply chop off the browns because this does not preserve twisted pairs on pins 1 / 2, 3 /4 , and 5/ 6 which is required).

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**

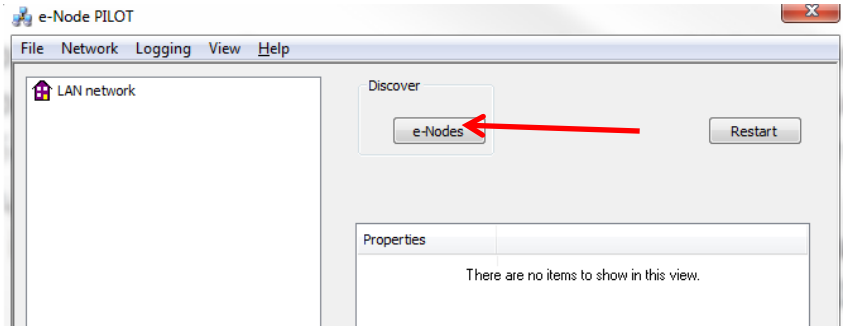
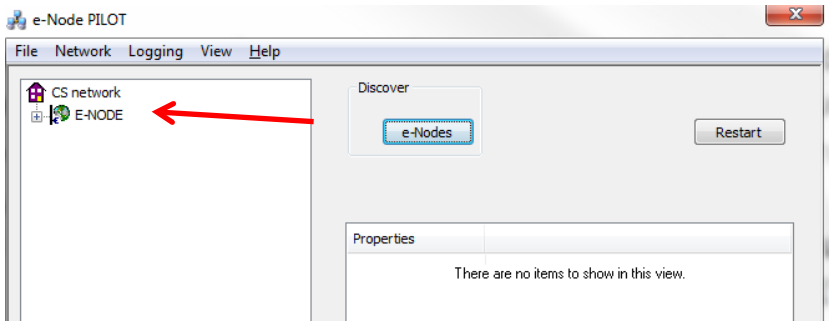
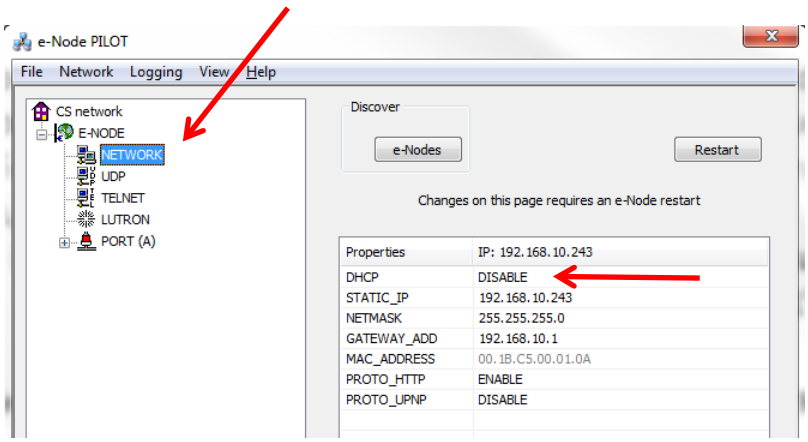
Suboptimal RJ-11 4P4C connection 4 wires		
e-Node Side	**ILC-x00 side**	**Color of wire**
Pin 1	**Pin 1**	**Orange**
Pin 2	**Pin 2**	**Blue**
Pin 3	**Pin 3**	**Blue/white**
Pin 4	**Pin 4**	**Orange/white**

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**.

Please follow the below steps under "**e-Node Programming**" when using the e-Node for Ethernet communication or to set-up specific loads (lighting or motor) with unique, non-zero, **Z**one/**G**roup/**N**ode or **ZGN** addresses.

e-Node Programming

Step	Setting	Choices
EN-1	**e-Node IP Address** setting Set up the e-node	Static or Dynamic Addressing -Launch the e-Node Pilot application.

	with an appropriate Static or Dynamic IP address. Refer to the separate "e-Node Quick Start Guide" on how to make such settings.	 -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:***

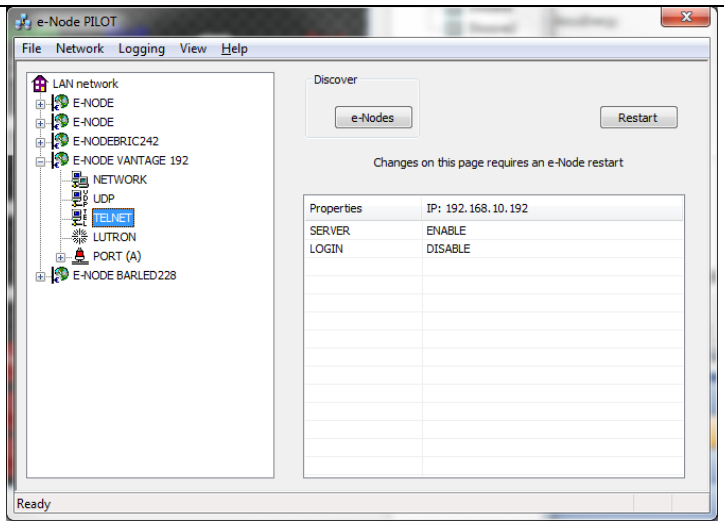
<table>
<tr><td></td><td></td><td>
<table>
<tr><td>STATIC_IP</td><td>xxx.xxx.xxx.xxx</td><td>Your new static IP address</td></tr>
<tr><td>GATEWAY_ADD</td><td>xxx.xxx.xxx.xxx</td><td>Typically the address of your network’s gateway</td></tr>
<tr><td>FINALLY and only after you have set the above variables,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

-Note: It is recommended that only STATIC addressing be used with the Key Digital processors.
</td></tr>
<tr><td>EN-2</td><td>TELNET Port (transmit and receive)</td><td>Depending upon the functionality of the Key Digital driver and the installer’s specific settings, the suggested communication protocol between Key Digital and the e-Node is Telnet Port 23 communication (with or without Login). You will need at minimum (i) to turn on Telnet within the e-Node, and (ii) to adjust secondarily the setting for Login as required by the Key Digital driver.

1) Select the View e-Node tab and select the Telnet tab. Set SERVER to ENABLE.

2) Login Settings.
a) If Telnet communication with Login <u>is supported</u>, set LOGIN to ENABLE and select the Restart button for the particular e-Node that you are utilizing to communicate with the Key Digital system.

b) If Telnet communication with Login is <u>unsupported</u>, set LOGIN to DISABLE and select the Restart button for the particular e-Node that you are utilizing to communicate with the Key Digital system.</td></tr>
</table>

IBT-100 Programming

All of the communication parameters to support the IBT-100 are built into the Key Digital driver and therefore no special programming is required of the IBT-100 serial adapter. However, certain features of the ILC-100/ILC-400 with respect to **NOTIFY** (which permits automatic signaling of color status upon color state changes) described above will need to be programmed using the e-Node. But in this case, after the specific lighting controllers are programmed, the e-Node will no longer be required for Key Digital to Converging Systems communication using the IBT-100.

RS-232C Interfacing Note: If you plan on simply using the IBT-100 for serial communication and desire to have multiple lighting loads (more than one ILC-100 with a unique **Z**one/**G**roup/**N**ode address you must set up your system using the e-Node as specified above as well as the particular lighting load as specified below. However, if you do not care about bi-directional feedback or support of multiple controllers address, no further set-up is required. However, this is not recommended.

ILC-100/ILC-400 Programming

Step	Setting	Choices
DV-1	**ILC-x00 Discovery** and **Address Setup**	More thorough documentation of this step can be found in the *e-Node Commissioning Guide* referenced

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in Step EN-1 above. However for document completeness, an abridge version of this guide is summarized below.

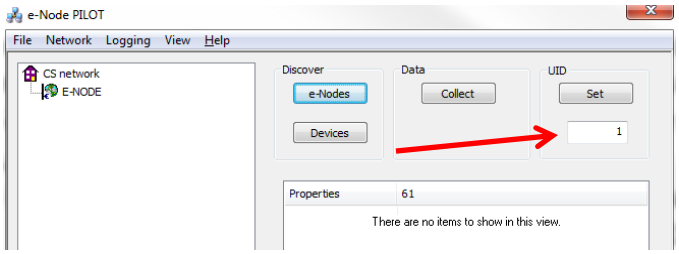
Background. From the factory the **ILC-x00** controllers do not have an assigned UID (unique ID) address. Units come equipped with a factory default address of **Zone**=2, **Group**=1, and **Node**=undefined or a 0. If you set up your Key Digital system to communicate with an ILC-x00 with an address of **2.1.0** the ILC-x00 will react but it will not provide feedback data which is required for automatic slider updates within the Key Digital systems. ***Therefore, it is advisable to set up a non-zero address for each ILC-x00 controller that is connected to either an IBT-100 or an e-Node.*** The directions below indicated how to perform this operation. (See **Step 2b** below as well as **Appendix 2** for more information on **Z**one/**G**roup/**N**ode addressing.)

Process.

(1) Power on the e-Node and any connected ILC-x00 controllers.

(2) Launch the Pilot application and select the Discover **e-Node** within the **View Map** tab.

(3) Now, under the **UID** window, select and enter a unique UID number/address (good to start with 1 and work upwards but never use a duplicate number) and select **Set**.



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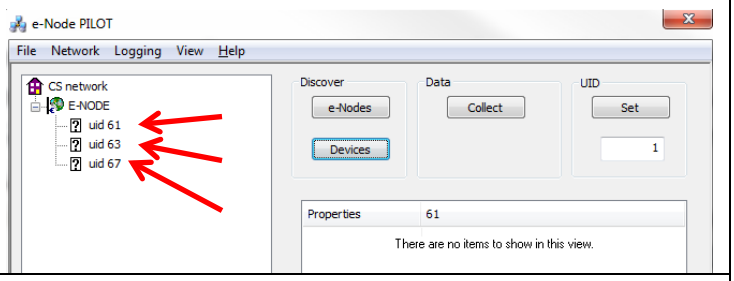
4) You will now need to hit the discovery button on your respective controller. Now close down the pop-

		up menu. 5) Now you will need to depress for approximately ½ second the "Discovery/Reset" button on an ILC-x00 controller for the unit to become programmed with the selected UID address. See the appropriate section for your particular device. • **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 -If you have more than one connected controller (ILC-100 or ILC-400) continue this process until you have **Discovered** all devices. In the example below, three ILC-100 devices have been Discovered or found. 
DV-2	Notify Mode	**Background.** Should you be implementing Color and Dimmer sliders within your project, the Key Digital system needs to receive color data back from the Converging Systems' controllers in order to update Key Digital's resources to automatically move the sliders and/or provide data within a data field. Converging Systems' lighting controllers can automatically notify the Key Digital system whenever

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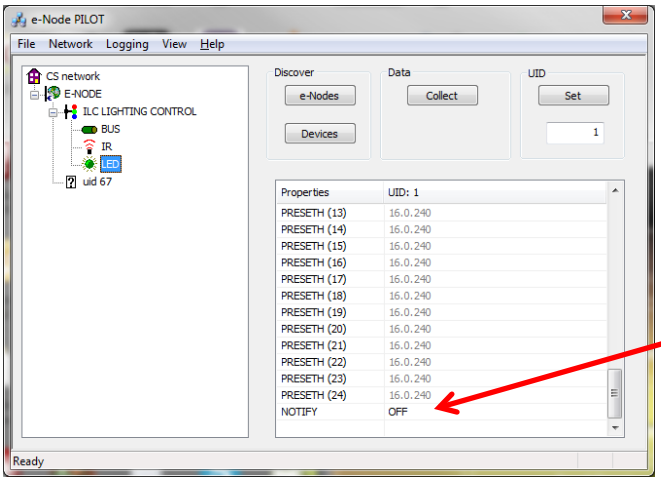
there is a color/lighting state change (recommended). Alternatively, the Key Digital driver can "Poll" the lighting device on a regular basis. This later approach is only recommended with older versions of Converging Systems' firmware that did not historically support the Nofity command.

In order to activate this NOTIFY feature within Converging System's controllers, ***it is necessary to first turn on the appropriate NOTIFY function within*** the targeted controller (under the LED entry). By default from the factory, **NOTIFY** is set to **OFF** to reduce the amount of bus traffic. It is recommended that one of these **NOTIFY** functions is utilized in any integration with Key Digital's products. These choices are as follows:

HSB color data	NOTIFY=COLOR
RGB color data	NOTIFY=VALUE
HSB and RGB color data	NOTIFY=BOTH*

*note: this feature is newly added in V3.14 of ILC-100 firmware. However, if is recommended to reduce bus traffic, that either HSB sliders (with **NOTIFY=COLOR** chosen), or RGB sliders (with **NOTIFY=VALUE** chosen) should be used on a user interface. If it is absolutely required that both RGB and HSD sliders are implemented within the Customer User Interface (and **NOTIFY=BOTH** is chosen), there may be cases where the preponderance of bus traffic received from the LED controller might interfere with valid commands transmitted onto the bus. Although this rare, it may occur.

Process. Within the e-Node Pilot application, select each controller (i.e. ILC Lighting Controller) that you wish to adjust from the **View Map** tab. Then open the **LED** tab. Find the **NOTIFY variable,** and set it to **OFF.** This will prevent the selected controller from broadcasting its status after every state change therefore reducing CS-Bus traffic.



Note: Prior to V 3.15 of the ILC-100 firmware, it is necessary to reboot the ILC-100 for this new setting to become active after it is changed. For versions 3.15 or later, simply changing this value within Pilot is sufficient.

Legacy Firmware Note: Earlier version of Converging Systems' color controllers did not support the **NOTIFY** function. In those cases, there is an entry within the Key Digital e-Node setup screens that can turn on alternatively the ability for the Key Digital software to automatically poll Converging Systems' controllers every x milliseconds to receive the necessary information to update Key Digital's resources (tbd).

With current Converging System' controllers, there really is no need to ever change this function for the Converging Systems controllers automatically broadcast current color state information ONLY upon a sate change to minimize traffic on the bus. You should only make these changes if you have a legacy version of ILC-100 firmware.

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Key Digital Programming

Within this section are details on how to perform the various types of driver download and GUI screen development required in order to introduce a new device into the Key Digital architecture. Many of these steps can be eliminated or simplified by simply downloading a special Key Digital Lighting Module which has been developed for Converging Systems' LED lighting products. See the special note in the below box on more detail on this exciting Module. However, depending upon whether you download the custom Key Digital Module using **Add Modules** or you decide to try your hand a custom programming, the following section can be used as a general reference for both tacks.

Availability of a Special Key Digital Converging Systems Lighting Module ("Add Module")

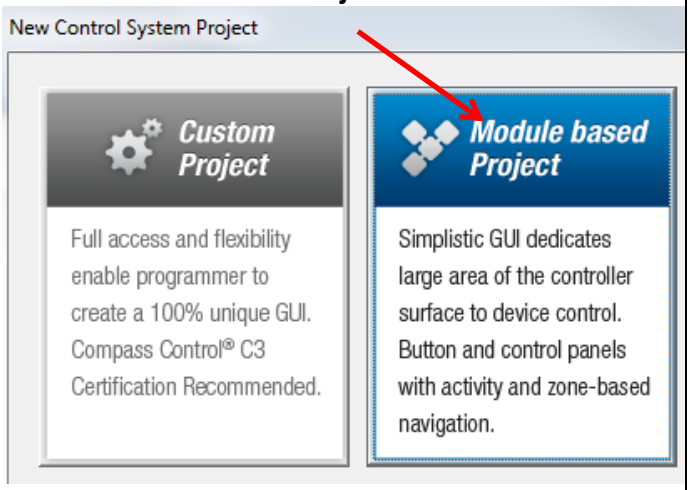
Key Digital has developed a special Converging Systems Lighting Module for use with Converging Systems lighting controllers. This Key Digital Module contains a significant amount of custom engineering designed to make the dealer installation process quite seamless. Advanced feedback and even a real-time color on-screen proofing widget are available to enable to you see the color that you have picked! Converging Systems recommends that dealers add this Module to reduce their programming time for a professional user interface.

This module is available for download within Compass Navigator under **Program/Add Modules** for authorized Key Digital dealers.

Below is a summary of those steps required to import the Converging Systems' e-Node Ethernet adapter/firewall and one or more loads (motors or lighting). Screen shots are provided for additional information. Typically, the following features are set-up within Key Digital Compass Navigator software.

1. Import Converging Systems Intelligent Lighting Controller into your project.

Step	Step	Detail
1a	You will need to decide if you want to (i) download the Converging Systems Module into a **Custom Project**, or (ii) download the Key Digital Module within a **Module based Project.**	When you create a new Project, choose between a **Custom Project** and a **Module based Project**. It is recommended for first time users wishing to test the functionality of the Converging Systems' system that you choose the **Module based Project.** -Let us proceed through the steps to create a

	Note: If you select the former case, you will ***not be*** able to modify the GUI; however, if you select the latter case, you ***will be*** able to modify the GUI.	**Module based Project**. If you choose to simply add the customized Module to an existing **Custom Project**, refer to the below directions for general directions which can be applied to your particular application. -Select **Module based Project** 
1b	Add Converging Systems' **Module** to your **Control Library**. **Note**: Make sure you download latest version from whatever source you have chosen.	-Select **Program/Add Modules,** and select the **Type** of Module you wish to download**.** Refer to the applicable section below. ***IP Communication (Telnet)****:* In this case, for the e-Node (IP) based communication device, select **TCP/IP** and search for **Converging Systems** and select the **CS-Bus** device. **Note**: You may need to select **Refresh** to locate the latest version of the Converging Systems' module.

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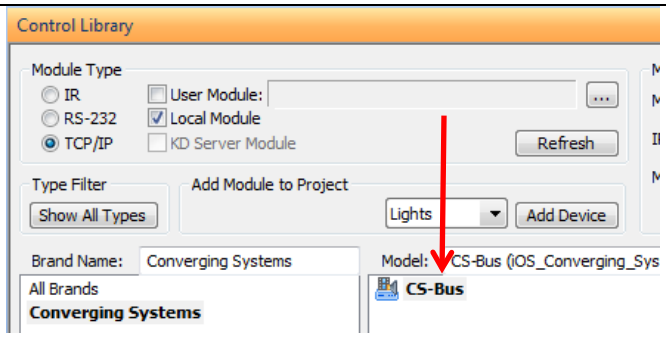
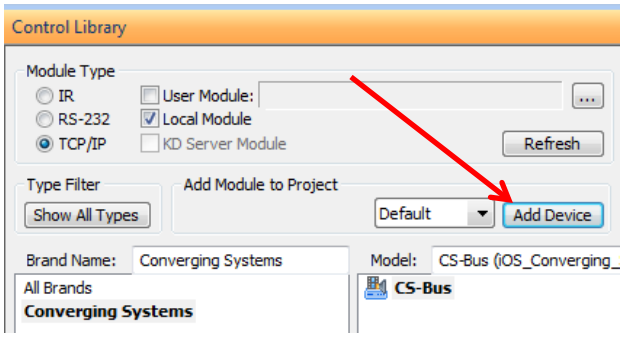
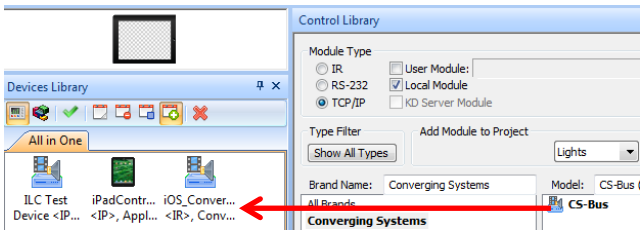
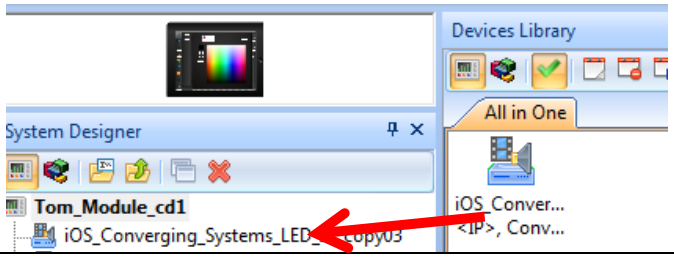
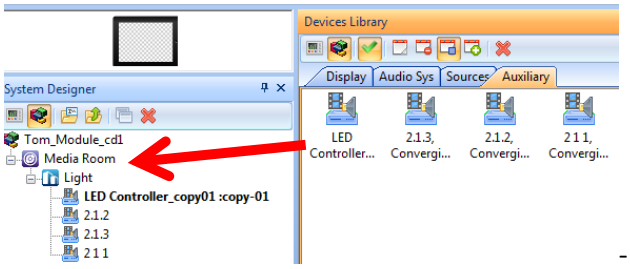
		 ***<u>Serial Communication</u>***: In this case, for the IBT-100 (RS-232) based communication device, select **RS-232** and search for **Converging Systems** and select the **CS-Bus** device. **Note**: You may need to select **Refresh** to locate the latest version of the Converging Systems' module.
1c	Next load this newly selected **Module** from your **Control Library** into your **Devices Library**	-Within the **Add Modules/Control Library window**, press the **Add Device** button  Or, drag this newly selected and addressed device into the **Devices Library**. 

1d	Next load this new device located in your **Device Library** into your Project itself within **System Designer**	-Select the **Controlling Flow** tab, select the **iOS Converging Systems** device within your **Devices Library** window and drag it into the **System Designer window** immediately underneath your **Project name.** 
1e	Finally, add this new device into the targeted **Zone**.	-Select the **Zone Construction** tab, select the Converging Systems' device within your **Devices Library/Auxiliary tab** and drag that device into your Project within **System Designer window** (and not under Master Controller). 
1f	Review Project thus far	-Select the **Program/Edit System** tab, and you should see the following: (a) Under **System Designer window**, the Converging Systems device will appear under the Project name (b) Under **Controller Design window** for your particular GUI, you should see a GUI page underneath the appropriate aspect ratio of the GUI device. (c) Under **Page Designer window**, you should see the details for the Module's GUI page.

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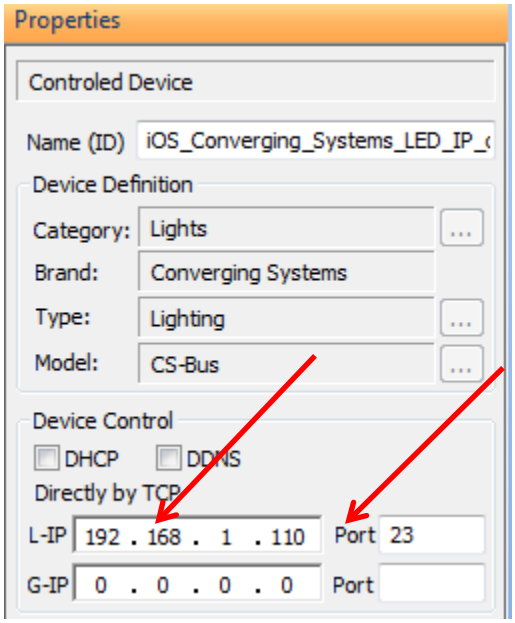
		(d) Under the **GUI representation window**, you should see a rendition of the GUI auto-generated. (e) Under the **Properties window**, you should see particular setup data for the particular device selected.

2. Set-up communication parameters for the Converging Systems Intelligent Lighting Controller-e-Node (IP) or IBT-100 (RS-232) device

Step	Step	Detail
2a	Set-up communication parameters for the Converging Systems interface (**e-Node IP device** or **IBT-100 serial device**) that will be used with one or more Intelligent Lighting Controller within **Program/ Zone Construction** tab	-Determine what will be the communication linkage that you will use to connect to the Converging Systems' device. Refer to the appropriate section below depending upon your choice. ***IP Communication (Telnet)***: - Left click on the applicable driver for Converging Systems and the **Properties** window will appear**.** Within the **L-IP** field, enter the IP address for the e-Node. -Within the **Port** field, confirm that the setting is entered as 23. 

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<table>
<tr>
<td></td>
<td></td>
<td>
- While still in the Properties window, enter Password the User Name and for your targeted e-Node. The default User Name and Password for the e-Node which are case-sensitive are as follows:
<table>
<tr><td>User Name</td><td>E-NODE</td></tr>
<tr><td>Password</td><td>ADMIN</td></tr>
</table>
Note: Make sure that you have LOGIN ENABLED for the e-Node which was set up previously via e-Node Pilot software. Update the above User Names and Passwords if those were changed within the e-Node Pilot software as well

-When finished proceed to the Step 2b1

<u>Serial Communication</u>:

- Left click on the applicable driver for Converging Systems and the Properties window will appear. Within the COM field, enter the Com Port that will be used for the IBT-100.

-Within the XYB field, confirm that the communication settings are set as follows.
<table>
<tr><td>Baud Rate</td><td>57600</td></tr>
<tr><td>Parity</td><td>N</td></tr>
<tr><td>Data Bits</td><td>8</td></tr>
<tr><td>Stop Bits</td><td>1</td></tr>
<tr><td>Flow Control</td><td>None</td></tr>
<tr><td></td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>2b1</td>
<td>Understand the addressing scheme that you wish to implement for the connection of specific loads that you want to connect to your particular communication device (eNode or IBT-100).</td>
<td>This information is only relevant for when you start adding buttons and sliders within the GUI section of your Key Digital project. All Converging Systems' devices (loads) that are connected to a communication device (eNode or IBT-100) will be addressed using a unique Zone/Group/Node addressing scheme (Z/G/N). Those addresses are referred to within Compass Navigator as Module Device ID.</td>
</tr>
</table>

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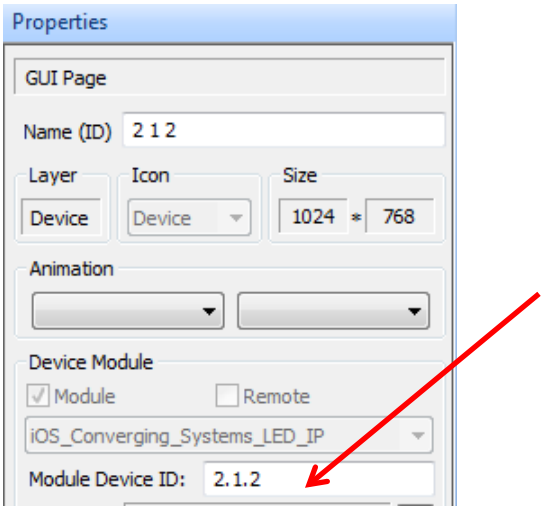
		YOU MUST HAVE PRE-ASSIGNED ZGN ADDRESSES TO ALL LOADS BEFORE PROCEEDING. See the Converging Systems' documentation on the eNode Pilot application for more information here. At this point it would be useful to write down a "map" of all interconnected loads and their re-assigned **ZGN Addresses**. From the factory, all lighting devices have a default address of **Zone**-=2, **Group**=1, **Node**=0 or undefined or wildcard. Once a device is programmed using the e-node Pilot application to a non-zero value, then **AND ONLY THEN** can those devices can be queried for color state data which is quite useful in auto-updating sliders and numerical readouts. **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. Please note-- no two controllers should be assigned the same Z.G.N. address. **Range of ZGN Addresses**: Enter a number between 1 and 254 for Zone numbers, Group numbers, and Node numbers. **Example**: If you have a device with a Z.G.N. address of 2.1.1. , then the Key Digital system can poll that device to determine its current lighting status. If you choose to enter a wildcard address of a 2.1.**0**. (that is a broadcast to all units with Z.G.N. addresses between 2.1.1. and 2.1.254.), only the unique color settings available from the device with an address of 2.1.1. or the first Z.G.N. unit in the series will be queried.
2b2	Enter appropriate	-Within the **Program/Edit System** window, select

	Zone/Group/Node ("**Z/G/N**") addresses into you relevant loads.	any Converging Systems load (i.e. LED Controller or Motor Controller). The **Controller Designer** window should populate. -Within the **Program/Controller Designer** window, select the applicable Converging Systems load (i.e. LED Controller or Motor Controller). The **Properties** window will open. -Within the **Module Device ID:** field, enter the applicable ZGN address in the following format Z.G.N For instance for a unit with a Zone=2, a Group=1, and Node=1, enter this data as follows:  -Proceed through all loads entered in similar fashion.
2c	Next Steps	You can either test your project at this point, or you can start customizing your Project. -If you wish to test your Project, proceed to **Step 4.** -If you wish to start customizing your project, proceed to **Step 3.**

3. Create a Custom Project with a few relevant Lighting control buttons and sliders.

Step	Step	Detail
3a	You can create a user interface	-Start a new Custom Project.

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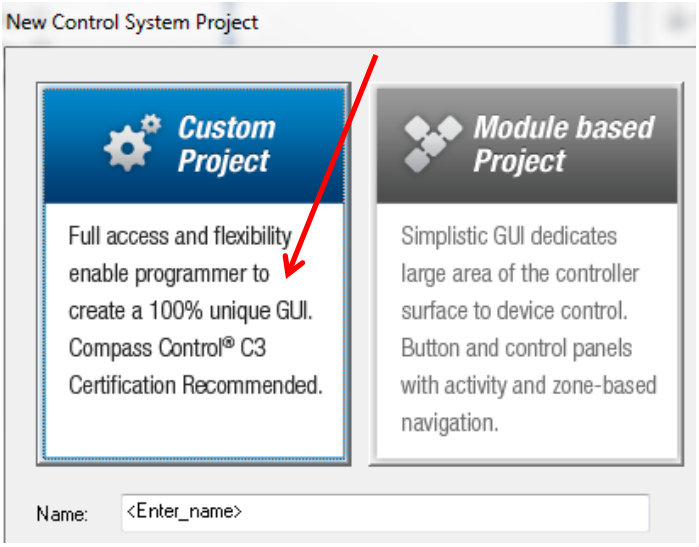
	(UI) for your system that is suited to your customer's requirements. This **Integration Note** will not focus on the creation of unique pages which potentially could "jump" to existing Key Digital custom Module GUI screens. **Note**: The Key Digital Module's accompanying GUI screens will save the installer much time in creating a world-class bi-directional lighting interface. This section is recommended only for those Key Digital dealers who have experience with Custom Projects.	 In this example, we will develop a simple set up page that will implement a few relevant lighting control buttons but will also call the Key Digital/Converging Systems custom Module .We will quickly demonstrate how these buttons and their underlying programming are created.
3b	Set up Converging Systems devices within your project (as described above within Programming Steps 1 and 2 above)	As a summary - Add Converging Systems' **Module** to your **Control Library** (see **Step 1b** above). - Next load this newly selected **Module** from your **Control Library** into your **Devices Library** (**see Step 1c** above). - Next load this new device located in your **Device Library** into your Project itself within **System Designer** (see **Step 1d** above). - Set up Communication parameters for your e-Node or IBT-100 (see **Section 2a** above). -Set up Zone/Group/Node addresses for your connected loads (see **Section 2b1/2b2** above).
3c	Now it is time to add a new	-Open up the **Program/Edit System tab**

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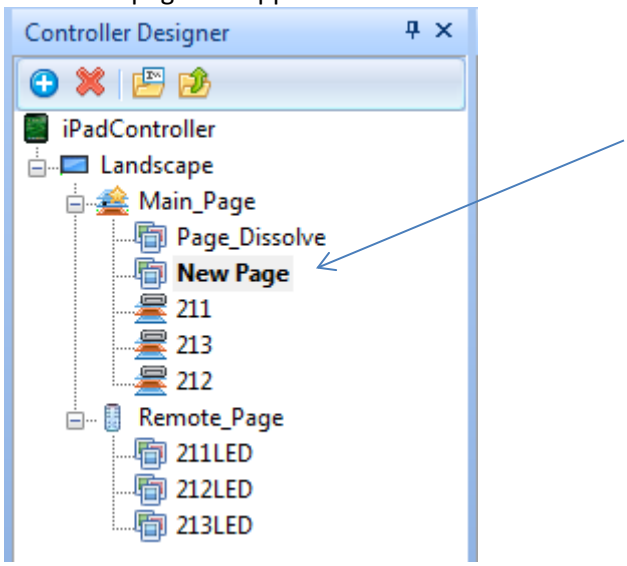
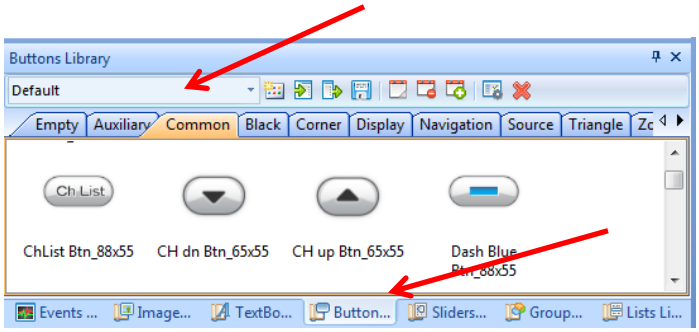
	GUI Page	-Within the **System Designer** window select the appropriate **iOS** device that you wish to program. -Within the **Controller Designer** window, select the  icon to add a new page. -That new page will appear as follows: 
3d	Now let us add a button for HUE UP and HUE Down	-Within the Program/Page Designer window, navigate to the **Button Library** at the bottom of the **Page Designer** window.  -At the top of the pop-up, select **Default**. -Within the default library, scroll over until you can select the **Navigation** tab.

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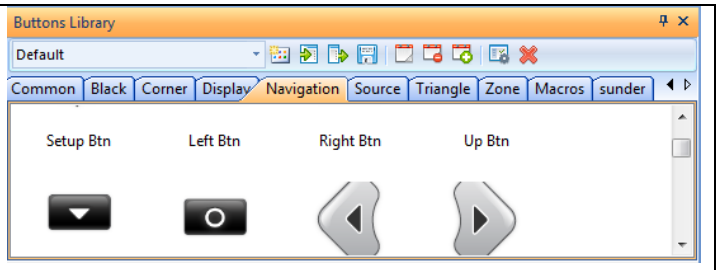
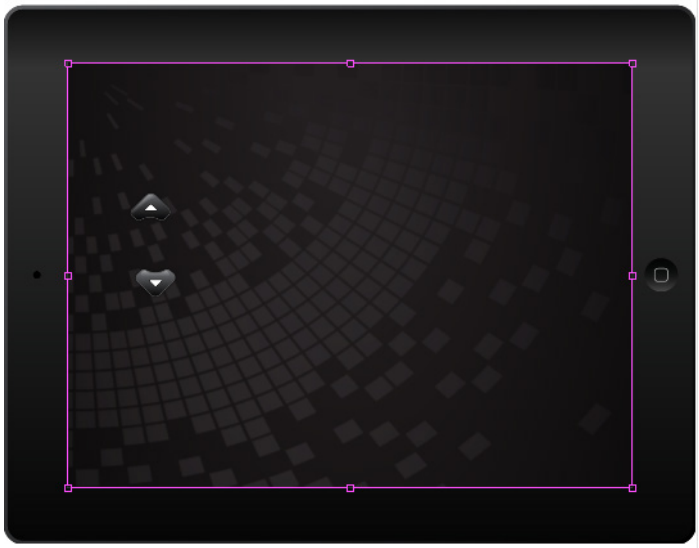
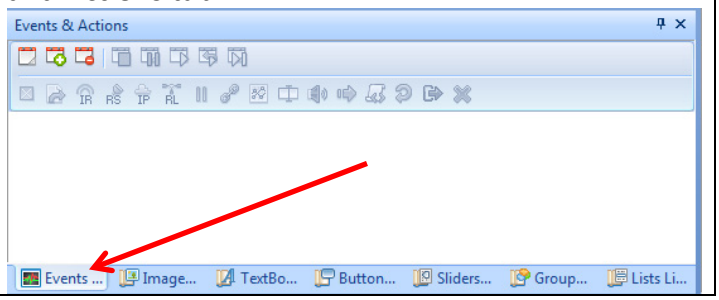
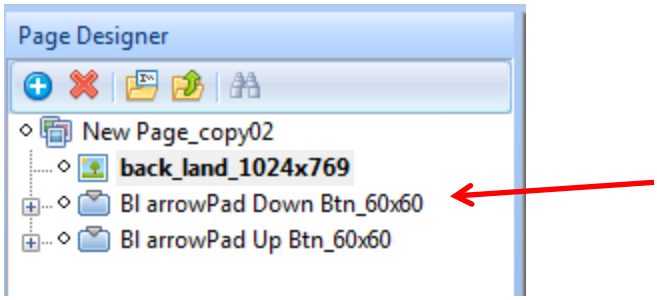
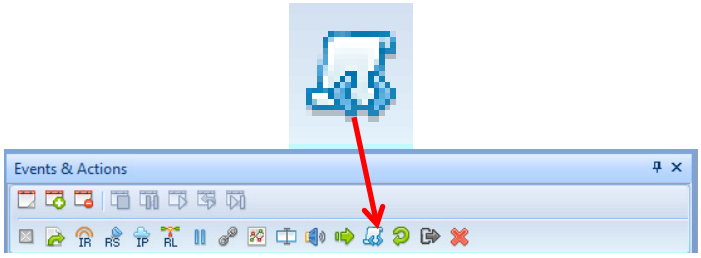
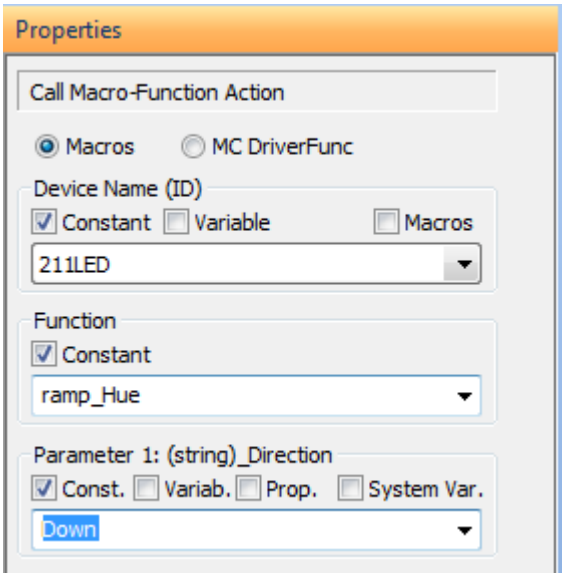
		 -Scroll throughout this library until you find an appropriate **UP Nav** button. Drag this button to a desired location on your new GUI page. Similarly find the matching **DOWN Nav** button. Drag this button to a desired location on the same page.  -Once you see these buttons on your page, you are now ready to program them to actually do something. Proceed now to the next step.
3b	Now let us program these buttons to appropriate actions. For this case and in this step, we will program the **Down** button to react on press (i.e. a press will cause the HUE_DOWN command to be	-Wtihin Program/Page Designer, select the **Events and Actions** tab 

	issued). In the next step, we will program the same **Down** button to react on a release (i.e. a release will cause the STOP command to be issued thus stopping the ramping process.	-Next, within the **Program/Page Designer** tab, select the button in the menu that you wish to program. Let's program the Down button first.  -Within the **Events & Action** window, select the **Bi-Directional Driver MacroFunction Execution** icon  -Select the Add New Event icon  And for this first case, select "down" from the **Create New Event** window and press **OK**. -For this "down" button, select the either the **IP** or the **RS** (serial) icon as appropriate and  -Under the **Propreties** windows, program this button as follows:



a. First select the **Macros** radial.
b. Under **Device Name (ID)** pick **Constant** and scroll downl to find the Z/G/N address for your controller.
c. Under **Function**, select **Constant**, and scroll down to find the appropriate function “ramp_Hue.”
d. Under **Parameter 1:** , select Const (constant) and pic the approprite direction “Down.”

Now, proceed to the next step to program a **STOP** for a button release.

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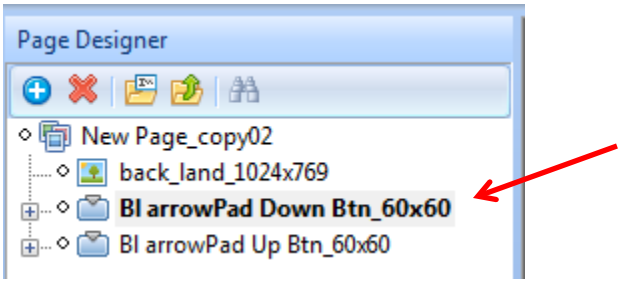
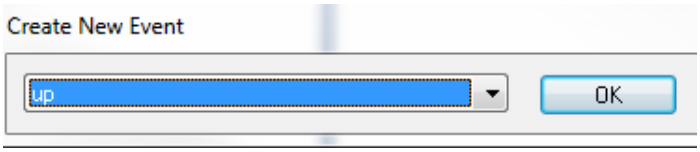
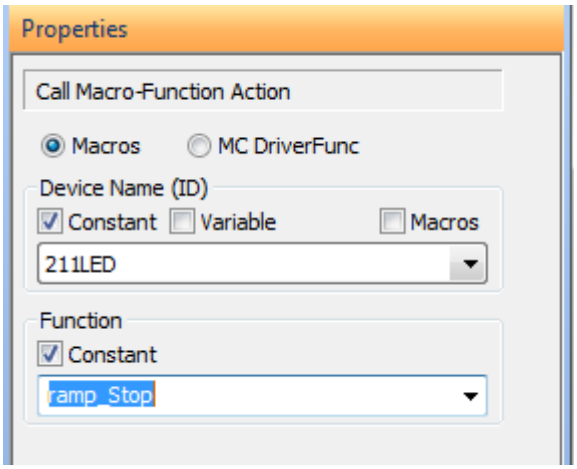
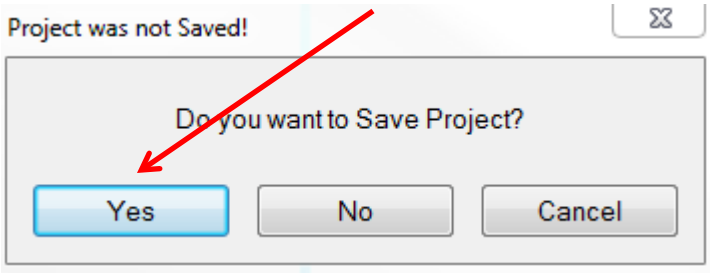
3c	Now let's program a button release state.	Provided the Arrow Down button is still highlighted within the **Program/Page Designer** window, you can add another event under **Events & Actions** as follows. If the button is not highllighted, select it and then proceed.  -Select the **Add New Event** icon  And for this second event, select "**up**" from the **Create New Event** window and press **OK.**  -Now repeat the steps above and create a similar button event for up within the **Properties** window. Following is what you will program for the **Button UP** or **Button Release** actions. 

3c	Continue dragging in new buttons and **assign Actions & Events** until your project is complete.	Complete programming and proceed to Step 4 below to Upload System Project.

4. Compile Project file and Test

4a	Compile and Upload Project File to Key Digital Server. Refer to the appropriate section to the right depending if you have created a **Module based Project** or a **Custom Project**.	*Module based Projects* -In you have programmed a **Module based Project**; you must first compile your project. Within the **Program** tab, select **Compile Project.** You will be prompted to Save the Project. Enter Yes and proceed.  -Next select the **Upload Systems Project** tab. Again you will be prompted to **Save** the Project and then you will receive the **Upload Project to Key Digital Server** prompt. Select **Upload Project** and proceed to Step 4b**.** *Custom Project* -In you have programmed a **Custom Project**, simply select the **Upload Systems Project** tab. Again you will be prompted to **Save** the Project and then you will receive the **Upload Project to Key Digital Server**

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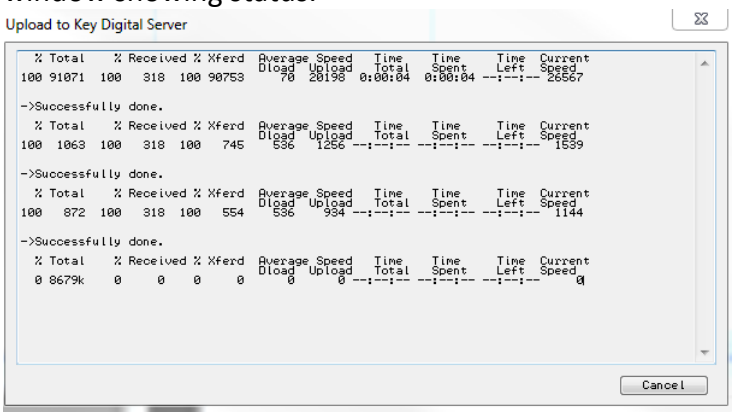
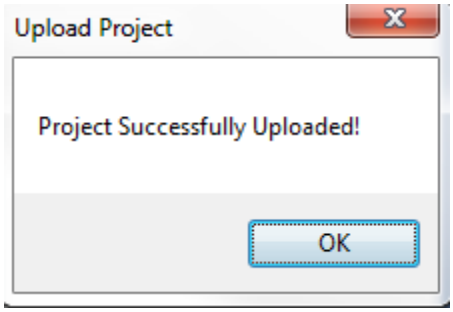
		prompt. Select **Upload Project and proceed to Step 4b.**
4b	Upload process.	In a few moments, you will see the status Upload window showing status.  -Once the project has been uploaded the Key Digital server you will receive a message that the Upload was successful.  **Make** sure you are connected to your Key Digital Master Processor and upload your System file. Right click on the top level **Group Page** within your project and select **Upload Group to Key Digital Touch App.**
4c	Download project to targeted iOS device.	-Make sure you are connected to your Key Digital Master Processor -Open the Compass Control iOS app and select **Registration/Update Project**. -When this download has completed, select the **Start** button and test project.

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Key Digital Programming-User Interfaces

The individual installer typically designs the User Interface (UI) for the particular needs of the end-user. Converging Systems may add from time-to-time new UIs with advanced functionality. Sample UI screens are pictured below.

LED CONTROL ENVIRONMENTS

The following illustrations provide some sample UI for LED control interfaces. Those available as part of the Key Digital Module are marked accordingly.

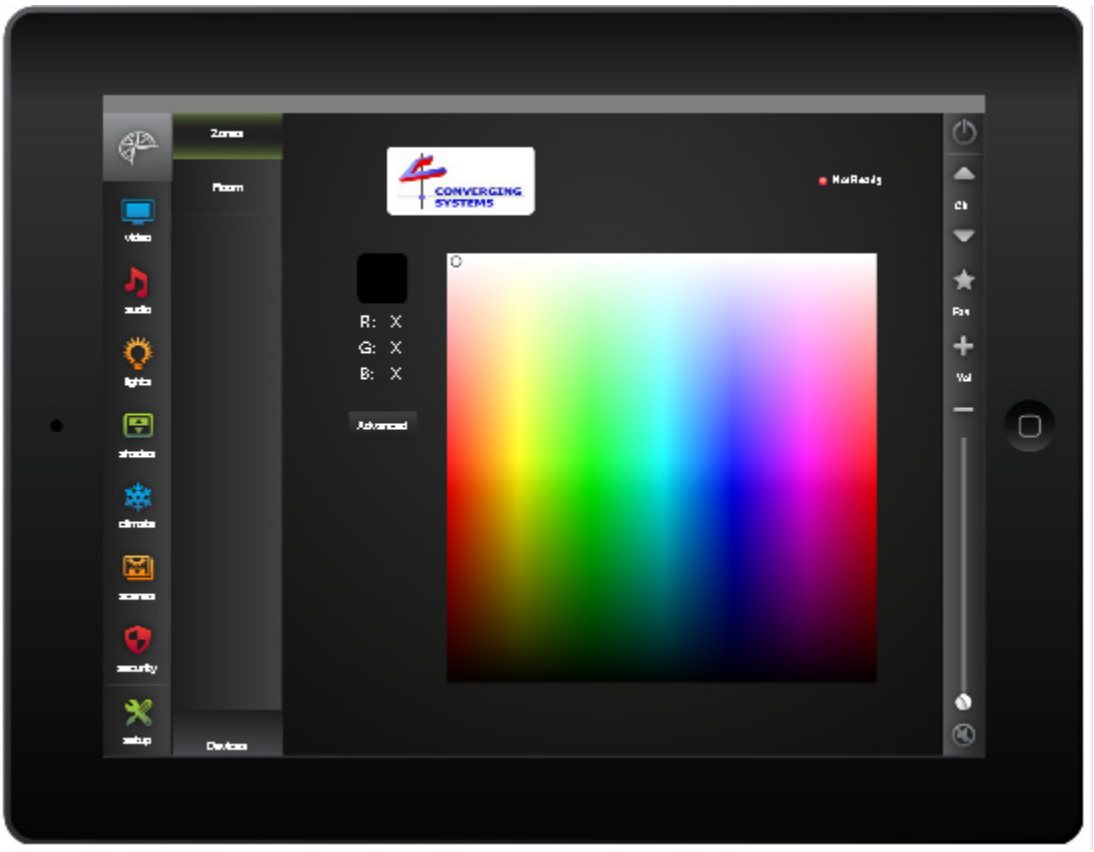

Figure 3 Key Digital Module GUI

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Figure 4 Key Digital Module GUI

Appendix 1

Common Mistakes

1. Forgetting to set the addresses for controllers (motor or lighting) from within Compass Navigator.

2. Forgetting to make sure that the alias name for the e-Node is E-NODE and the password for e-NODE is ADMIN. These are set within the Key Digital driver. If you want to change those alias names and passwords for the e-NODE make sure you change them within the Key Digital Compass Navigator. Make sure you obey Key Digital's maximum length for usernames and passwords and make sure you do not use any spaces in those names.

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Appendix 2

COLOR SPACE ISSES

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 4** 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 4

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Appendix 3

ADVANCED Key Digital 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.

	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.

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
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.

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Initial State of Light Output
(on Off condition)

Argument/Action Issued to a specific Z/G/N address of 2.1.1 to go to Red
#2.1.1.LED.VALUE=240.0.0;<cr>

RGB Command received by a unique Z/G/N address (2.1.1). Controller recognizes a color state change and transmits back its color state as
!2.1.1.LED.VALUE=240.0.0

3rd Party control system receives response beginning with "!" and updates its applicable color slider or other registers to received value

Argument/Action Issued to a specific Z/G/N address of 2.1.1 to go to Red (again)
#2.1.1.LED.VALUE=240.0.0;<cr>

RGB Command received by a unique Z/G/N address (2.1.1). Controller recognizes that this was not a color state change and no response is provided (to reduce bus traffic since no new status needs to be provided)

Nothing transmitted back to 3rd party control system

Argument/Action Issued to a **Group** Z/G/N address of 2.1.0 to go to Green
#2.1.1.LED.VALUE=0.240.0;<cr>

RGB Command received by a group Z/G/N address (2.1.0). All loads turns green but since command was transmitted to Group address, only Controller with first Node address greater than 0 (i.e. "1") within wildcard range will respond (i.e. 2.1.1 responds, but 2.1.2 to 2.1.254 do not respond)

!2.1.1.LED.VALUE=0.240.0 is received, but no other Z/G/N messages are received
Note: !2.1.0 LED.VALUE =0.240.0. is never received.

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Appendix 4

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 Key Digital 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 Key Digital device drivers already in existence for other 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 Key Digital System

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

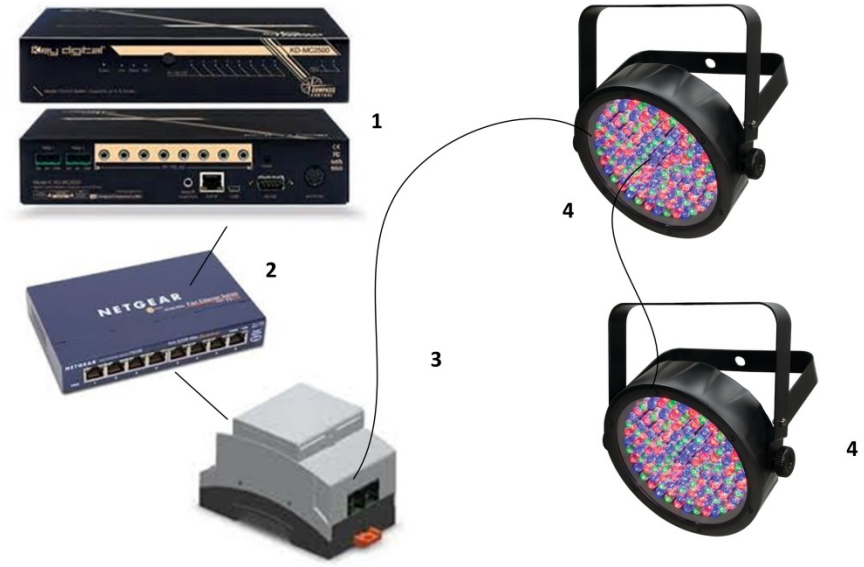

Figure 5

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 Key Digital system = 254

BILL OF MATERIALS (for IP control)

#	Device	Manufacturer	Part Number	Protocol	Connector Type	Notes
1	Key Digital HC-250 family processors	Key Digital	Various	Ethernet/USB/HDMI	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

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						resistor

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:

Pin	Signal
1	Not Used
2	DMX Ground
3	RS485 -
4	RS485 +
5	Not Used
6	Not Used

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 at the beginning of this Integration Note Step EN-1 and EN-2.

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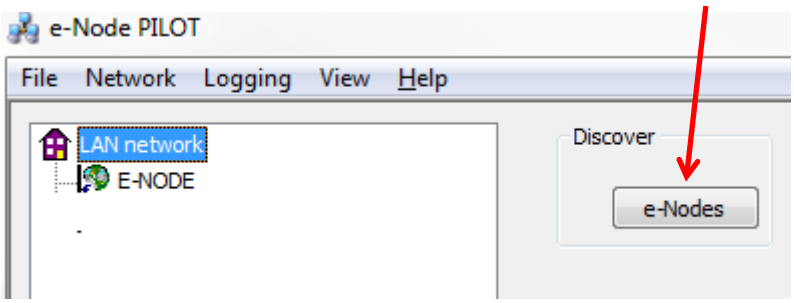
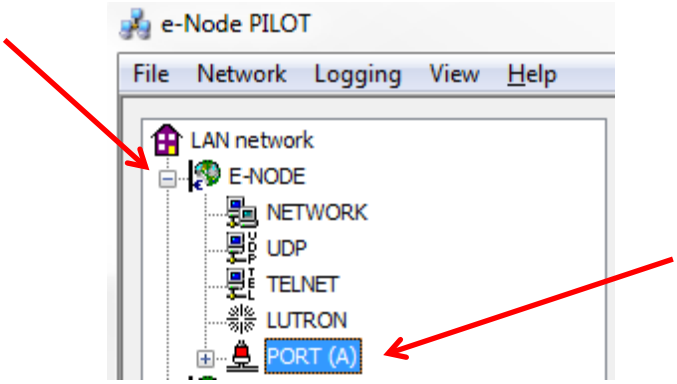
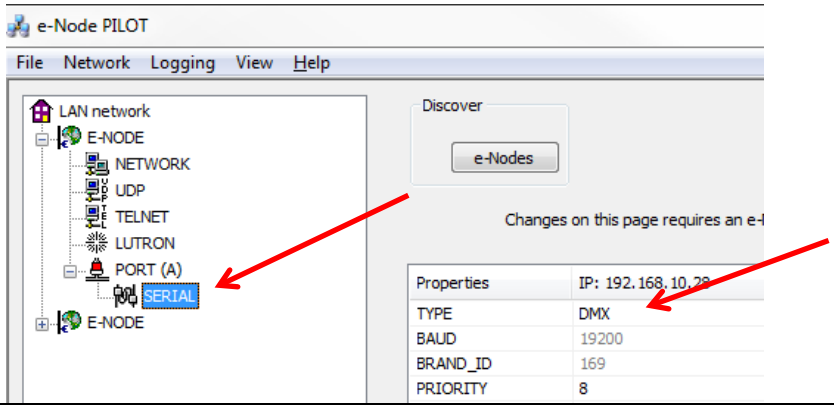
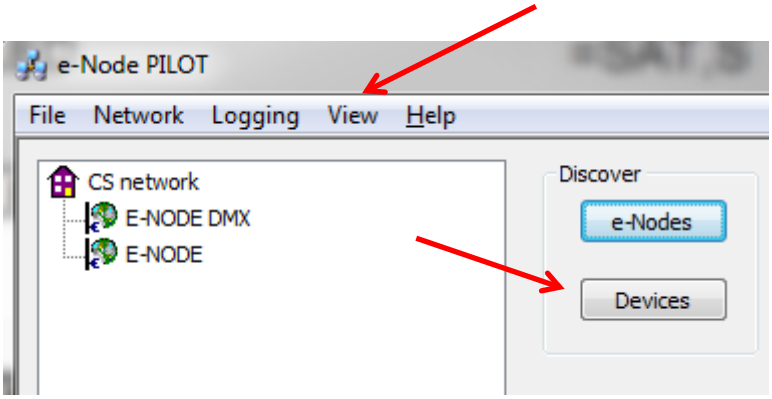
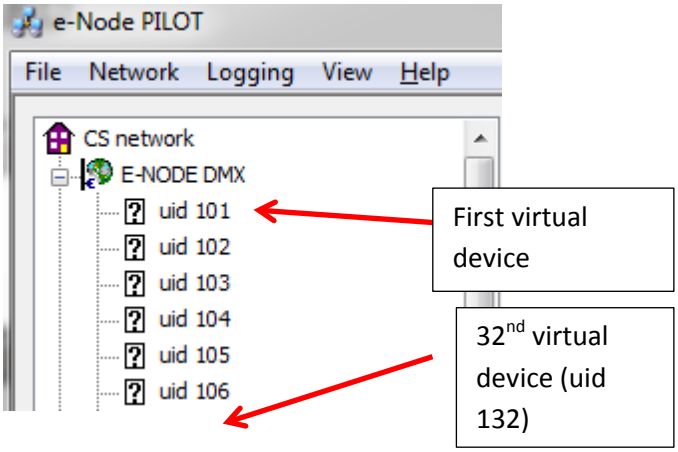
DMX-2	Verify the e-Node DMX is set to communicate to DMX fixtures	-Select the View e-Node tab and select the Discover e-Node button. Any e-Node(s) connected on the same network will appear as shown.  -Select the + mark in front of the e-Node/dmx that you wish to program to expose the sub-tabs.  -Expand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

		-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.

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DMX-4	Set up Device Addressing	The DMX data packet is mapped to CS messages by assigning a unique Zone. Group. Node number to three successive DMX channels. These are mapped as shown in the following table:

Fixture	DMX Channel Allocation	CS-Zone.Group. Node
1	1-3	2.1.1
2	4-6	2.2.1
3	7-9	2.3.1
4	10-12	2.4.1
5	13-15	2.5.1
6	16-18	2.6.1
7	19-21	2.7.1
8	22-24	2.8.1
9	25-37	3.1.1
10	28-30	3.2.1
11	31-33	3.3.1
12	34-36	3.4.1
13	37-39	3.5.1
14	40-42	3.6.1
15	43-45	3.7.1
16	46-48	3.8.1
17	49-51	4.1.1
18	52-54	4.2.1
19	55-57	4.3.1
20	58-60	4.4.1
21	61-63	4.5.1
22	64-66	4.6.1
23	67-69	4.7.1
24	70-72	4.8.1
25	73-75	5.1.1
26	76-78	5.2.1
27	79-81	5.3.1
28	82-84	5.4.1
29	85-87	5.5.1
30	88-90	5.6.1
31	91-93	5.7.1
32	94-96	5.8.1

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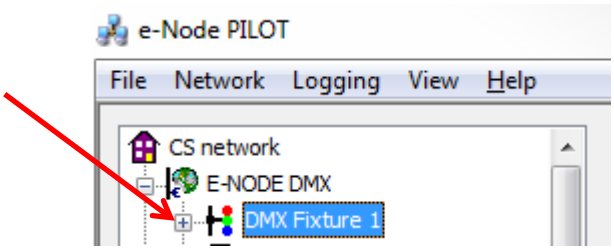
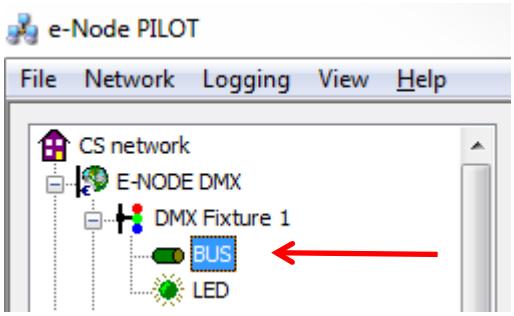
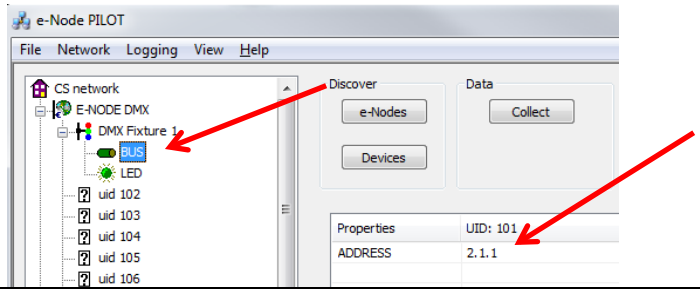
		-To see these entries, click on the ? in front of any particular uid listing which will expand its directory.  -After the directory is expanded, you will see these entries:  -If you desire to change any Zone/Group/Node address, click on the BUS entry, and change the address as appropriate. 
DMX-4	Proceed through standard Key Digital Programming.	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). -Proceed to standard Key Digital Programming (Steps 1 onwards above in the main body of this Integration Note). Note: the e-Node/dmx takes care of everything else!!!

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