



TechNotes-Primer on DMX Addressing

Revision 9/22/2022 Doc Release 1.0

From time to time, customers new to DMX lighting often encounter issues on how to set up and deploy DMX fixtures. Suppliers of these DMX fixtures/encoders should be the first source of contact for your troubleshooting, technical support and other wiring requirements (since Converging Systems does not manufacture this equipment). However, should those resources not be available, Converging Systems has put together this Technote to address common questions.

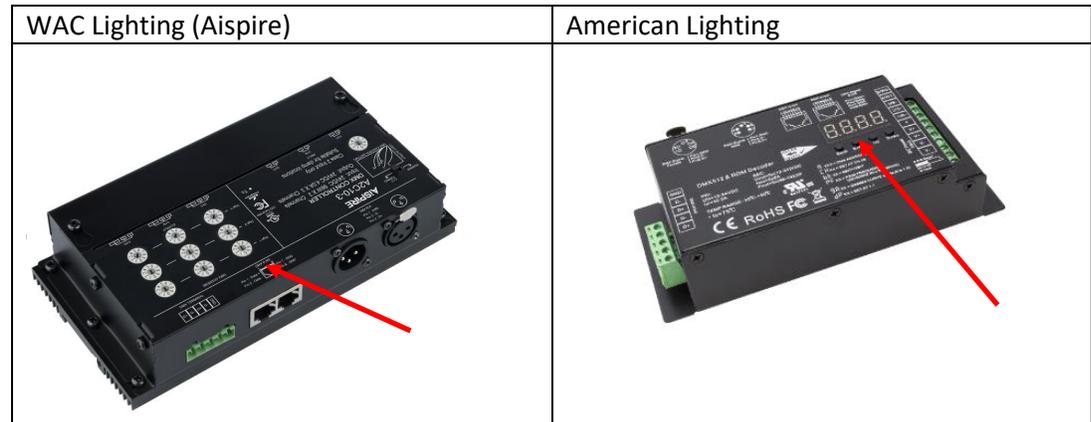
Introduction	
DMX (USIII DMX512-A) is a networking protocol that enables a universal DMX controller such as our e-node/dmx to control the features of industry compliant DMX products.	
The Physical Layer	<p>DMX-compatible products are connected to the e-Node/dmx controller using a DMX connection. These connections are typically a hardwired connection in the form of daisy chain. With this topology, the DATA or DMX OUT of one product (DMX decoder/or fixture) connects to the DATA or DMX IN of the next product and so on.</p> <p>Cabling typically consists of a run of shielded, 2- conductor twisted pair cable with one 3-pin or 5-pin XLR male connector on one end, and a similar 3- or 5-pin female connector on the other end.</p> <p>Alternatively, in some environments CAT5 or better cabling is recommended where the Signal Negative and the Signal Positive outputs run on a twisted pair (i.e., Blue might be Signal Negative while Blue/W might be Signal Positive). Alternatively, in some cases the Signal Negative and Common might be run on one twisted pair (i.e., Blue/Blue-White) while the Signal Positive and Common might be run on another twisted pair (i.e., Orange/Orange-White). Regardless of the topology, it is critical that twisted pair wiring or shielded wiring as specified by the fixture manufacturer is utilized.</p>
DMX Universe	<p>A DMX Universe is a set of DMX complaint products connected to the same DMX chain using the same set of 512 DMX channels. Each set of 512 channels is referred to as a DMX Universe.</p> <p>The e-Node/dmx supports the industry standard of supporting no more than 32 fixtures within the same DMX Universe. Should more than 32 fixtures need to be supported, separate runs of daisy chain DMX wiring should be run. See here for more information.</p> <p>More than one e-Node/dmx residing on the same DMX daisy-chain bus is not supported. Specifically, each e-Node/dmx is a master controller and no more than one master can exist on any one DMX daisy chain (powered on at the same time.)</p>
DMX Channels	<p>Each DMX channel can have a value in the 000~255 range. The e-Node/dmx is basically a color computer and a data navigator that takes high level CCT, color and brightness commands (and even motor commands) provided to the device over IP from our supported third-party lighting and automation platforms and translates that information as appropriate and then intelligently directs computed data to applicable (and supported) DMX channels within connected fixtures.</p>

DMX Commissioning	
<p>The DMX commissioning process consists of (i) determining how many DMX channels each product will need (at minimum) to provide necessary functionality, and then (ii) specifying the starting DMX address (not to be confused with Converging Systems' Zone/Group/Node addressing, and (iii) understanding the individual assignment fixtures features to fixture DMX channel number.</p> <p>NOTE: Without securing and understanding this information, no successful integration with the e-Node/dmx is possible. Converging Systems technical support cannot assist you in performing this work. Please secure this information before proceeding.</p>	
Personalities	<p>A DMX personality describes what DMX channel or channels will control the related functionality of the fixture. The installer must review the DMX fixture or decoder's documentation to understand the complete design of the device and the channel allocations.</p> <p>This is where things get interesting. Each manufacturer of a DMX fixture assigns a specific function (i.e., R, G, B, W) to a particular slot position (DMX Channel) In the simplest case, a monochrome DMX fixture might have just one channel which can accept a value in the 000~255 range. More sophisticated versions of DMX fixture might have 5, 15 or even hundreds of DMX channels. In a rather popular case with a 5-channel DMX fixture, four channels of the five are rather easy to understand (i.e., Red, Green, Blue and White) but in this case there is an interesting 5th channel that throws a curve ball to some dealers. <i>This 5th channel (which might be actually associated with a slot position of 1 or 2 or 3 or 4 or 5) actually controls brightness.</i> Converging Systems highly recommends that if there is such a brightness channel (regardless of the number of channels that your DMX fixture has), that a special feature available through the e-Node referred to as FULL is utilized. In this case the e-Node/dmx's sophisticated 32-bit microprocessor will handle the dimming in a much more precise fashion than the integrated hardware within the DMX fixture/decoder</p>
Starting Address	<p>In order for the e-Node/dmx to control a third-party DMX device, the installer must configure each DMX product's feature set (i) to select the number of channels required for the desired outcome, and (ii) to select the starting DMX address of the available channels.</p> <p>Only after these assignments are complete will the DMX device respond to commands from the e-Node/dmx or any DMX controller.</p> <p>Important: Do not confuse DMX Starting Address and subsequent auto-assigned Fixture DMX addresses with Converging Systems Zone/Group/Node (ZGN) addressing. The fixture's DMX address ranges from 000 ~ 512 and this how the e-Node communicates with the DMX fixture. Converging System's Zone/Group/Node addressing scheme is how third-party automation systems communication with the e-Node. Those lighting/automation platforms do not understand a DMX fixture's DMX address and should only communicate with the e-Node using ZGN addressing. See here for more information.</p> <p><u>Example.</u> -You have a fixture with a choice of 5 or 9 or 14 channels</p>

-You determine that in order to support your needs, you only need the 5-channel option—**so pick that now**

-Finally, your fixture demands that you either (i) physically set the **Starting Address** with the fixture’s built-in switches, buttons or dials or (ii) program (externally) the **Starting Address** with an RDM controller (i.e., Swisson or City Theatrical).

See the figure below for typical encoders and their means of setting Starting DMX Addresses.



For many decoders with a readout, this will be the readout for a DMX address of 001 or “1”

A.0.0.1

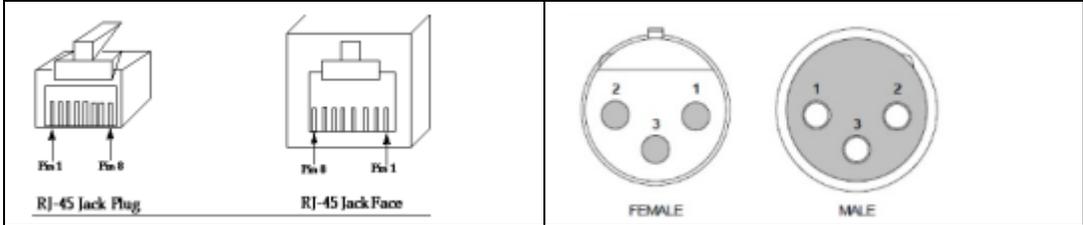
Here is what might the slot assignments might be after you set the Starting DMX Address at “1” (your fixture will be different)

Channel (slot) Function as an example only	DMX Channel Assignment 1
Dimming Channel	1
Red	2
Green	3
Blue	4
White	5

Overlapping Addresses

The installer must be diligent to assign starting address for each DMX product to avoid DMX channel overlapping. **Overlapping address will definitely cause issue with respect to proper control.**

There may be cases where you may want two fixture to behave identically. Provided those fixtures have the same channel allocation (i.e., the same functions to assigned to the same channels without exception), then it is acceptable to have more than one fixture assigned to the same starting DMX address.

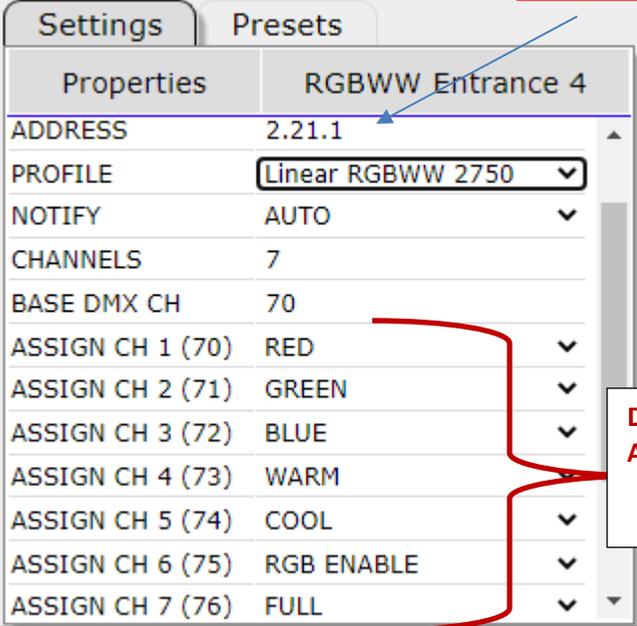
<p>Number of DMX Decoders</p>	<p>The EIA-485 standard which is the base for the USITT DMX512-A protocol, requires that no more than 32 products (decoders) be connected to one DMX bus. Although optically-isolated DMX splitter are available that enable the number of fixtures to exceed this 32-fixture limit, the e-Node/dmx can only support 32 fixtures (on one bus), so if more than 32 fixtures are desired, separate DMX buses need to be created for each additional e-Node/dmx added.</p> <p>Some vendors manufacture dmx hardware (decoders) that have the ability to remotely control slave/mirrored DMX fixtures connected to the same parent DMX decoder. Here the electronics in the parent DMX decoder count as 1 of the 32 total fixtures allowed and, in this case, there are still 32 decoders connected but certainly the possibility exist for more than 32 fixtures. But only 32 decoders can be addresses within the e-Node/dmx setup software.</p>																				
<p>DMX Data Cabling</p>	<p>USITT recommends limiting the total length of the DMX cable (from the e-Node/dmx to the last DMX product) not exceed 300-455 m (985 ~ 1,500). This is highly dependent upon many external factors, including the quality of the DMX decoder, outside interference, wiring and shield quality, etc. Consult your DMX fixture vendor for more information.</p>																				
<p>DMX Cable Connections</p>	<p>DMX fixtures typically have XLR, RJ-45 or Phoenix-type connectors. It is important to review your fixture’s documentation before creating a cable that connects to the e-Node/dmx.</p> <div data-bbox="391 913 1474 1138" style="border: 1px solid black; padding: 5px;">  </div> <p>This table below can be used to assist you with this process.</p> <table border="1" data-bbox="402 1228 1323 1522"> <thead> <tr> <th>E-Node RJ-45</th> <th>XLR connector</th> <th>Std RJ-45 DMX*</th> <th>Philips RJ-45</th> </tr> </thead> <tbody> <tr> <td>Pin 1 (485+)</td> <td>Pin 3</td> <td>RJ-45 Pin 1</td> <td>RJ-45 Pin 2</td> </tr> <tr> <td>Pin 2 (485-)</td> <td>Pin 2</td> <td>RJ-45 Pin 2</td> <td>RJ-45 Pin 1</td> </tr> <tr> <td>Pin 7 (Gnd)</td> <td>Pin 1</td> <td>RJ-45 Pin 7</td> <td>RJ-45 Pin 7</td> </tr> <tr> <td>(all other pins)</td> <td>N/C</td> <td>*Std wiring</td> <td>N/C</td> </tr> </tbody> </table> <p>*Use standard (straight) CAT 5 cable.</p>	E-Node RJ-45	XLR connector	Std RJ-45 DMX*	Philips RJ-45	Pin 1 (485+)	Pin 3	RJ-45 Pin 1	RJ-45 Pin 2	Pin 2 (485-)	Pin 2	RJ-45 Pin 2	RJ-45 Pin 1	Pin 7 (Gnd)	Pin 1	RJ-45 Pin 7	RJ-45 Pin 7	(all other pins)	N/C	*Std wiring	N/C
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DMX Addresses Versus Converging Systems Zone/Group/Node Addressing

Example

Here is an example of a DMX fixture with a starting address of 90 supported by the e-Node/dmx.

Note: DMX Address are not the same as ZGN addresses. Lutron/Elan/Control4, Crestron, etc. only understand ZGN addresses.

DMX Fixture Settings	e-Node Pilot Setting
Starting Address 90	 <p>The screenshot shows the 'Settings' tab for 'RGBWW Entrance 4'. The 'ADDRESS' field is set to '2.21.1', which is highlighted by a red box and labeled 'ZGN Address'. Below it, the 'PROFILE' is 'Linear RGBWW 2750'. The 'CHANNELS' are set to 7. The 'BASE DMX CH' is 70. The channel assignments are: ASSIGN CH 1 (70) RED, ASSIGN CH 2 (71) GREEN, ASSIGN CH 3 (72) BLUE, ASSIGN CH 4 (73) WARM, ASSIGN CH 5 (74) COOL, ASSIGN CH 6 (75) RGB ENABLE, and ASSIGN CH 7 (76) FULL. A red bracket groups these assignments and is labeled 'DMX Addresses'.</p>