

## DMX512-A PROTOCOL

### 1.1 DMX512-A Protocol Specifications

DMX512-A is an acronym for Digital Multiplex, a communication protocol used to remotely control lighting dimmers and intelligent fixtures. It is designed to provide a common communications standard between these lighting devices regardless of the manufacturer. The 512-A after the DMX refers to the number of control channels used on one network segment (often called a 'universe') of devices. In a simple dimming system, one channel controls the intensity of the fixture. A single intelligent fixture such as the araya<sup>5</sup> requires several channels to control its various parameters (one channel each for DIM, CCT, SAT, HUE).

#### DMX512A Specifications:

- DMX 512-A (Controller).
- A universe is 512 Channels.
- DMX value is between 0 and 255, where 0 is off and 255 is full on.
- The maximum number of devices in a daisy-chain wire run is 32, which include the controller and opto-splitter.
- The maximum network wire run is a distance of up to 1600 feet for non-RDM systems and up to 1000 feet for RDM systems.
- One device functions as the master (DMX controller) on a network, while the rest function as slaves (mergers, splitters, intelligent fixtures, etc.).
- Only the controller (master) transmits over the network, and all fixtures receive the same data.
- The final device in the daisy-chain must be terminated with a 120 ohm resistor between DMX+ and DMX- pins.
- It is recommended that the terminator for the final device be located in the control panel, if it falls within the recommended wiring distance.
- All wiring must be in a continuous run and daisy-chained.
- Star wiring is only allowed in conjunction with an opto-splitter.
- Do not run DMX control cable in close proximity to AC power lines. EM spikes from switching of high-current devices such as HVAC equipment or generators will induce noise into the DMX cable.
- The shield must be carried through between modules and properly grounded at one point only.
- Connections to DMX512-A-RDM accessory board: wire size to be 24AWG, and solid or stranded cables may be used. Stranded wire used must be tinned or installed with ferule connector.

#### RDM

DMX512-A control protocol that enables Remote Device Management for two-way communications for configuration, monitoring and system setup. Allows two way communication between lighting controller and the fixtures. Allows for remote setting of DMX start addressing. RDM signals are sent back the other way, but not constantly. Controller can ask one or more devices for query feedback. RDM packets are inserted in-between the existing DMX data packets being used to control the lighting. The DMX Control Console will broadcast up to 512 channels over one DMX cable (max. run of 1000 feet for RDM). Some of these channels may not be used, but will still be transmitted, as required by the protocol. It must be set to a desired channel (001, 002, 003, 004, etc.) to control the connected light fixture. This is usually accomplished using RDM. This desired 'channel' is commonly known as the DMX address. When addressing fixtures, it is not recommended to skip addresses.

When RDM is not available with the control system, it is permissible to use the Lumenetix commissioning tool (the araya<sup>5</sup> Tunable Color 2.0 iOS App) to set the address of the slots. The instructions to configure the DMX channels can be found in the separate araya<sup>5</sup> Tunable Color Instruction Manual.

The DMX512-A interface follows the ANSI E1.11-2008 (R21013) standard. Four address slots are allocated to each interface board and control the Dim level, CCT, Saturation and Hue of the araya<sup>5</sup> modules connected to the board.

#### Default DMX512-A Slot Allocation:

Slot	Function
1	Dim Level
2	CCT
3	Saturation Level
4	Hue

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### 1.2 DMX512-A Electrical Specifications

Parameter	Range	Remarks
ESD Protection	±15KV (air), ±8KV (conducted)	Per IEC 61000-4-2
Termination	Recommended	The DMX512 bus termination rules apply
Directionality	Receive only	
Frequency stability	±20ppm	
Load per port	1/256	1/8 of Nominal RS-485
Isolation	3KV <sub>rms</sub>	

### DMX512-A Control Systems (recommended list)

Choreo  
 Cognito  
 Crestron Greenlight System  
 Entec  
 ETC Mosaic  
 ETC Paradigm  
 Fresco  
 Interactive Technologies  
 Lutron HomeWorks QS  
 Lutron Quantum  
 Nicolaudie  
 Pathway Connectivity  
 Pharos  
 Traxon Ecue  
 Vantage Controls

\*Recommendations are subject to change. Consult your Lumenetix representative for the most updated list.

### DMX512-A Recommended Internal / Field Wiring

#### TMB Cable ProPlex DMX

**PC224T:** 2-pair DMX512 cable, overall foil and braid shielding with drain wire. UV and fungus resistant. Fully rated for installations, yet easy handling for light duty portable applications.

**PC224TW:** Same as above, with white jacket.

#### For use as DMX in/out under one jacket:

**PC244T:** Two individually shielded pairs and drain wires. UV resistant. Color coded foil shielding for easy reference.

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### 1.3 DMX512-A Recommended Field Wiring

Liberty 24-2P-485 (Non-Plenum), 24 AWG, 2 pair dual 120 ohm, 11.2 pf/ft low capacitance (Wago, XLR and PHX connectors)

Liberty 24-2P-P485 (Plenum), 24 AWG, 2 pair dual 120 ohm, 11.2 pf/ft low capacitance (XLR and PHX connectors)

Belden #9842 (Non-Plenum), 24 AWG, 2 pair dual shielded 120 ohm, 12.8 pf/ft low capacitance (XLR and PHX connectors)

Belden #89842 (Plenum), 24 AWG, 2 pair dual shielded 120 ohm, 12.8 pf/ft low capacitance (XLR and PHX connectors)

Please refer to wire manufacturer’s lighting catalog for and/equals as required by code.

#### Category Wire or Equal

The Entertainment Services and Technology Association (ESTA) does not define a maximum run length for DMX over Cat5 since many factors will affect the maximum run length, such as number of devices, number of splices in the cable, the strength of the DMX transmitter(s), if Remote Device Management (RDM) is being used, and sources of interference. ESTA does state (again, in ANSI E1.21-2):

“A properly selected and installed DMX512 cable should provide acceptable signal strength for runs of 300m (1000ft). Please note that the technical requirements, such as run-length and topology for other networking technologies, such as Ethernet, should be considered if using the installed cable for another networking technology in the future is anticipated.”

Cat5 or equivalent is not preferred as a portable cable since it is not as rugged as other DMX cables. Male RJ45 connectors are especially prone to breakage over repeated re-connections.

#### LUMENETIX RECOMMENDATION:

CAT 5E -150 FEET

CRESTRON

DM-CBL-8G-NP

DM-CBL-8G-P

CAT 7- 330 FEET

CRESTRON

DM-CBL-ULTRA-NP

DM-CBL-ULTRA-P

#### DMX512-A Recommended Field Connectors (or Equal)

WAGO 221

PHOENIX CONTACT

XLR NEUTRIK

CRESTRON

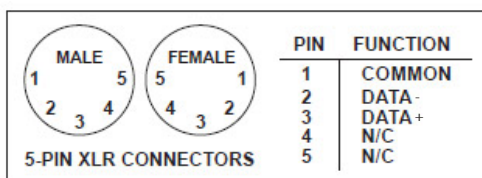
RJ45 DM -8G-CONN

RJ45 IDC DM-CONN

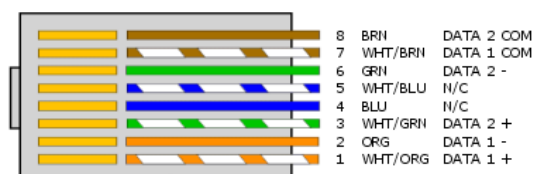
#### DMX512-A Wiring Connections

Signal	Description	Pin Colors (4-Pair Cable)	Pin Colors (2-Pair Cable)	3-pin XLR connector	5-Pin XLR connector	5-Pin PHX connector
Signal Common		White/Brown and Brown	White/Blue and Blue	1	1	1
Data (-)	Primary Data Link	Orange	Orange	2	2	2
Data (+)	Primary Data Link	White/Orange	White/Orange	3	3	3
Data2 (-), or not used	Optional Secondary Data Link				4	4
Data2 (+), or not used	Optional Secondary Data Link				5	5

#### XLR Connectors (5-Pin)

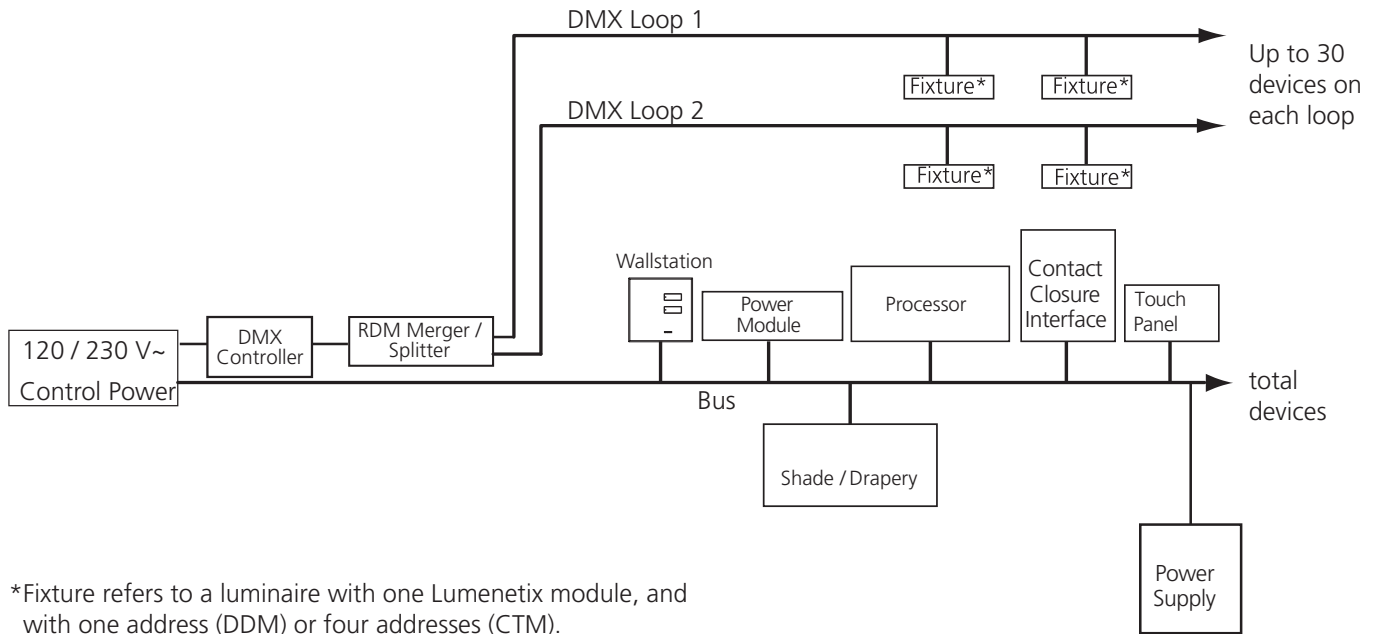


#### RJ-45 Connector Pin-Out (T568B)



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### 1.4 DMX512-A Controller Example



### DMX512-A Drain Wire Connections

Drain wire connections are required as follows.

#### Shielding

To add another level of protection from electromagnetic noise, a grounded shield is added over the twisted pair wires. When this is enclosed in a protective jacket, to avoid ground loops and electromagnetic contamination of the ground system, all control ground wiring, including cable shields and drain wires, should be treated like sensitive current-carrying conductors. All control ground wires should be insulated (not bare) and the same wiring practices should be observed with ground wires as with other sensitive signals. Care must also be taken when designing control wiring to ensure that each shield is connected to only a single ground point. You should establish this point at a central location, like a control panel or cabinet, and avoid all connection to grounds in the field. A control ground is sometimes referred to as an isolated ground (an oxymoron) for this reason, but the term single-point ground is more accurate.

#### Method-1

A typical two-pair shielded cable can be prepared for termination to the terminals with the drain wire cut off. This is usually done at the field end of the cable where no shield grounding is desired. You will then use insulating tape or heat-shrink tubing to protect the cable from contamination and to prevent accidental grounding of the shield or drain wire. An accidental ground at this point would almost certainly create an undesirable ground loop.

#### Method-2

A typical two-pair shielded cable can be prepared for termination to the terminals with the drain wire cut off. The drain wire, which is an uninsulated conductor, is sleeved with a insulating tubing to prevent accidental grounding. The crimp-on lug is valuable in this instance to retain the tubing. Insulating tape or heat-shrink tubing is again used to protect the cable from contamination and to prevent accidental grounding, since any accidental connection between the drain wire and a chassis, frame, or enclosure would almost certainly create a ground loop.

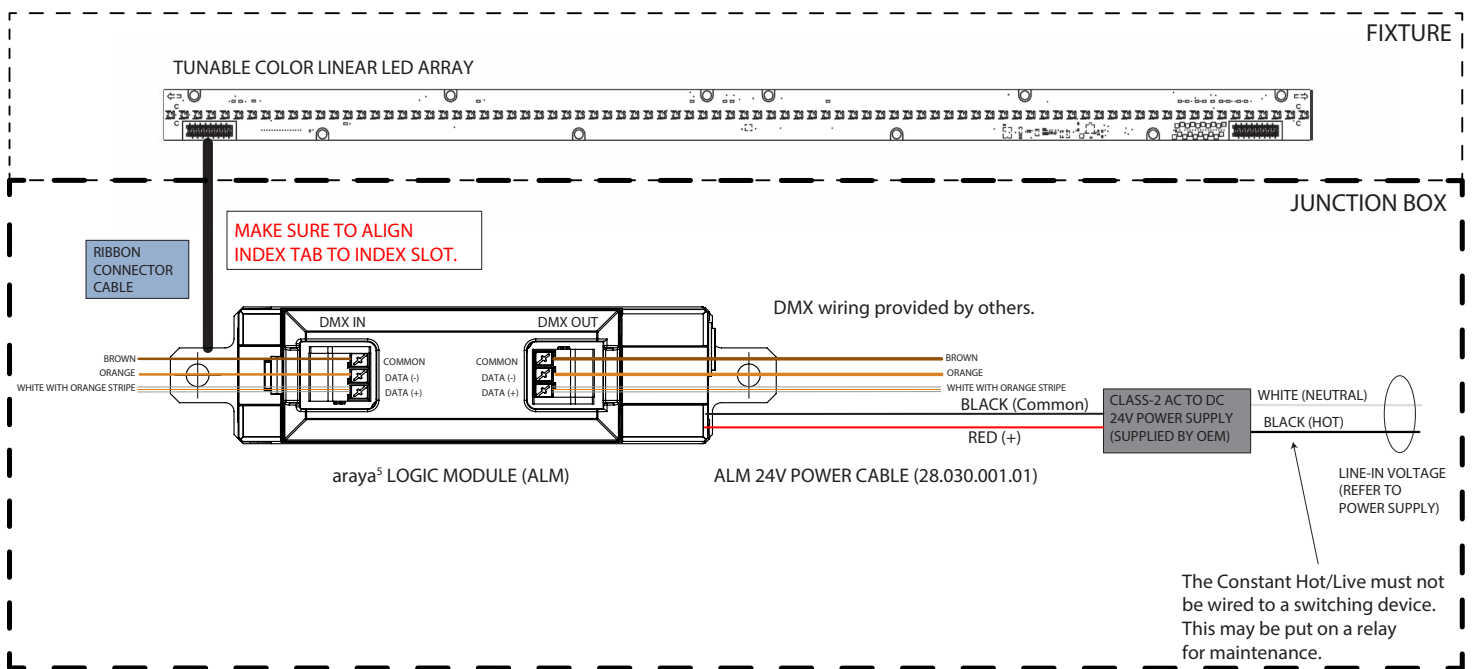
## DMX512-A WIRING DIAGRAMS

### 2.1a DMX512-A-RDM Accessory Card Wiring Diagram araya<sup>5</sup> Logic Module (ALM) with Linear Arrays

**Notes:**

1. 24V power (red/black) is Class-2 rated.
2. Adapter is configured at factory for DMX inputs.
3. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter's 4, 6, 8, or 16 output ports generates an independently protected DMX signal.

DMX SLOTS SET BY RDM OR  
BY TUNABLE COLOR 2.0 IOS APP  
  
(MAX. OF 8 MODULES CAN BE  
COMMISSIONED AT A TIME)



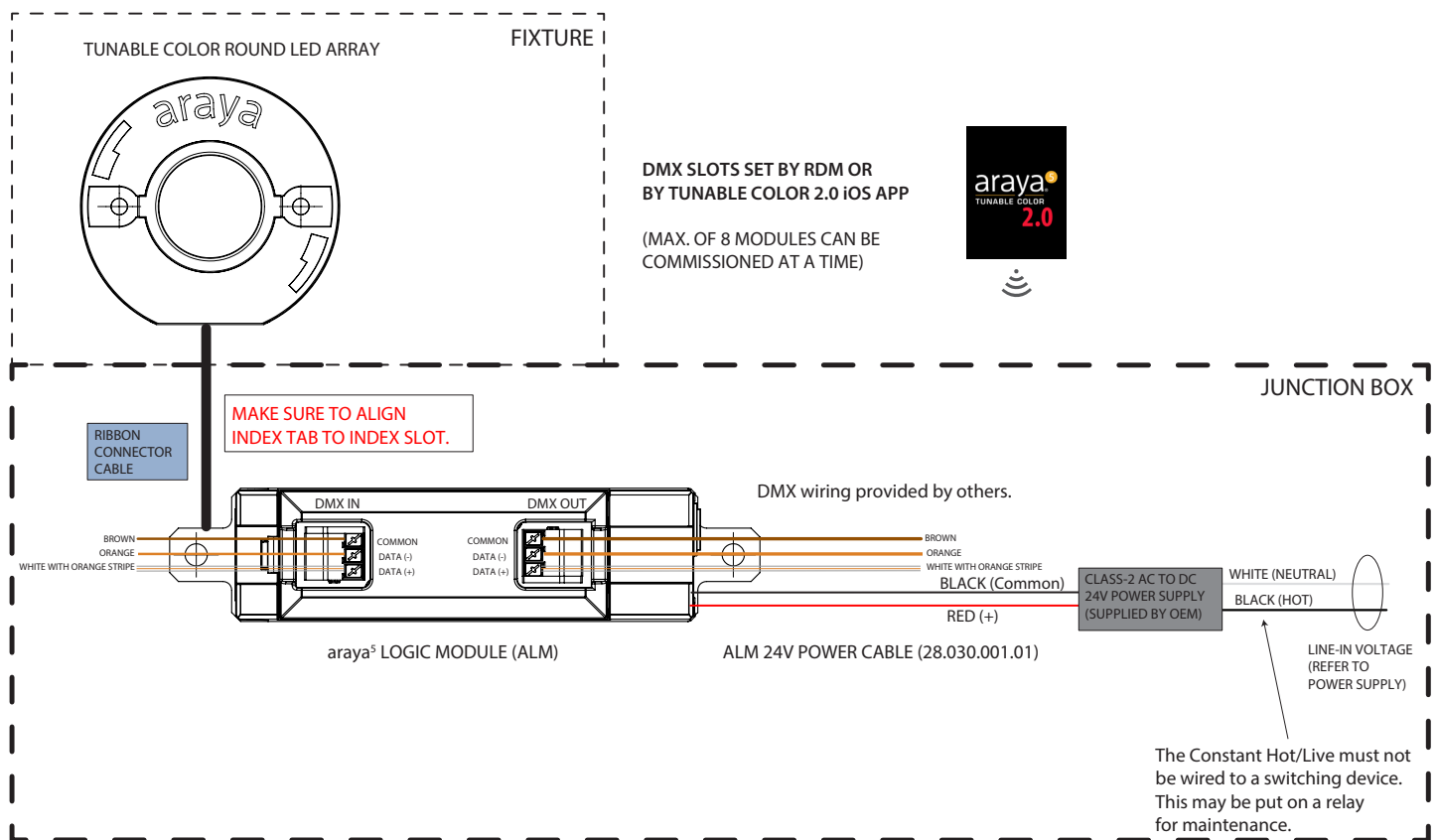
**NOTE: BLUETOOTH OPERATION IS FOR COMMISSIONING THE MODULES ONLY, NOT FOR CONTROLLING THEM.**

## DMX512-A WIRING DIAGRAMS

### 2.1b DMX512-A-RDM Accessory Card Wiring Diagram araya<sup>5</sup> Logic Module (ALM) with Round Arrays

**Notes:**

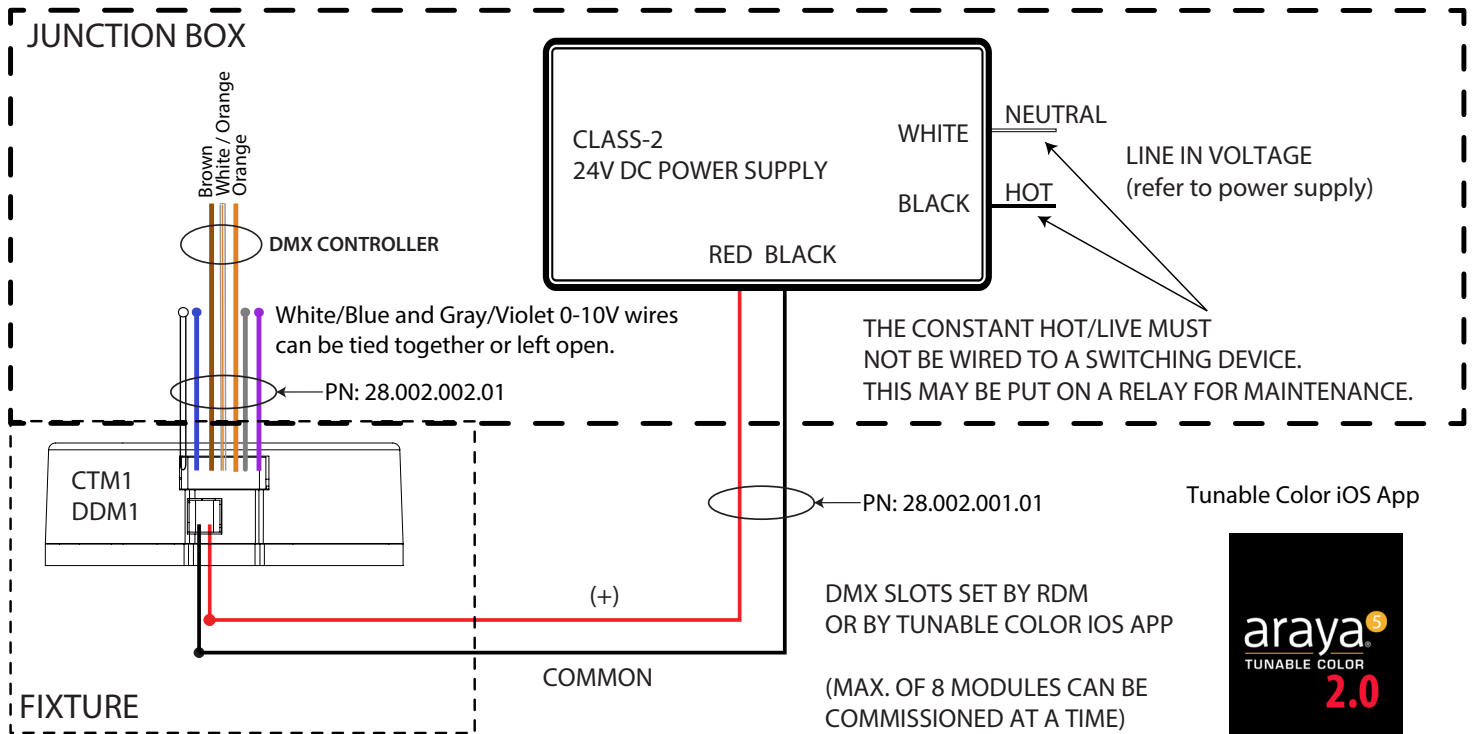
1. 24V power (red/black) is Class-2 rated.
2. Adapter is configured at factory for DMX inputs.
3. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter's 4, 6, 8, or 16 output ports generates an independently protected DMX signal.



**NOTE: BLUETOOTH OPERATION IS FOR COMMISSIONING THE MODULES ONLY, NOT FOR CONTROLLING THEM.**

## DMX512-A WIRING DIAGRAMS

### 2.2a CTM1C / DDM1C (24V; Bluetooth-integrated)



### Lead Color and Input

Lead Color	Input
Red	Power 24V DC (+)
Black	Power Common (-)
Violet	0-10V Dimming (+); Left Open
Gray	Signal Common for 0-10V Dimming (-); Left Open
Blue	0-10V Color (+); Left Open
White	Signal Common for 0-10V Color (-); Left Open
Orange	Data (-)
White with Orange Stripe	Data (+)
Brown	Digital Common

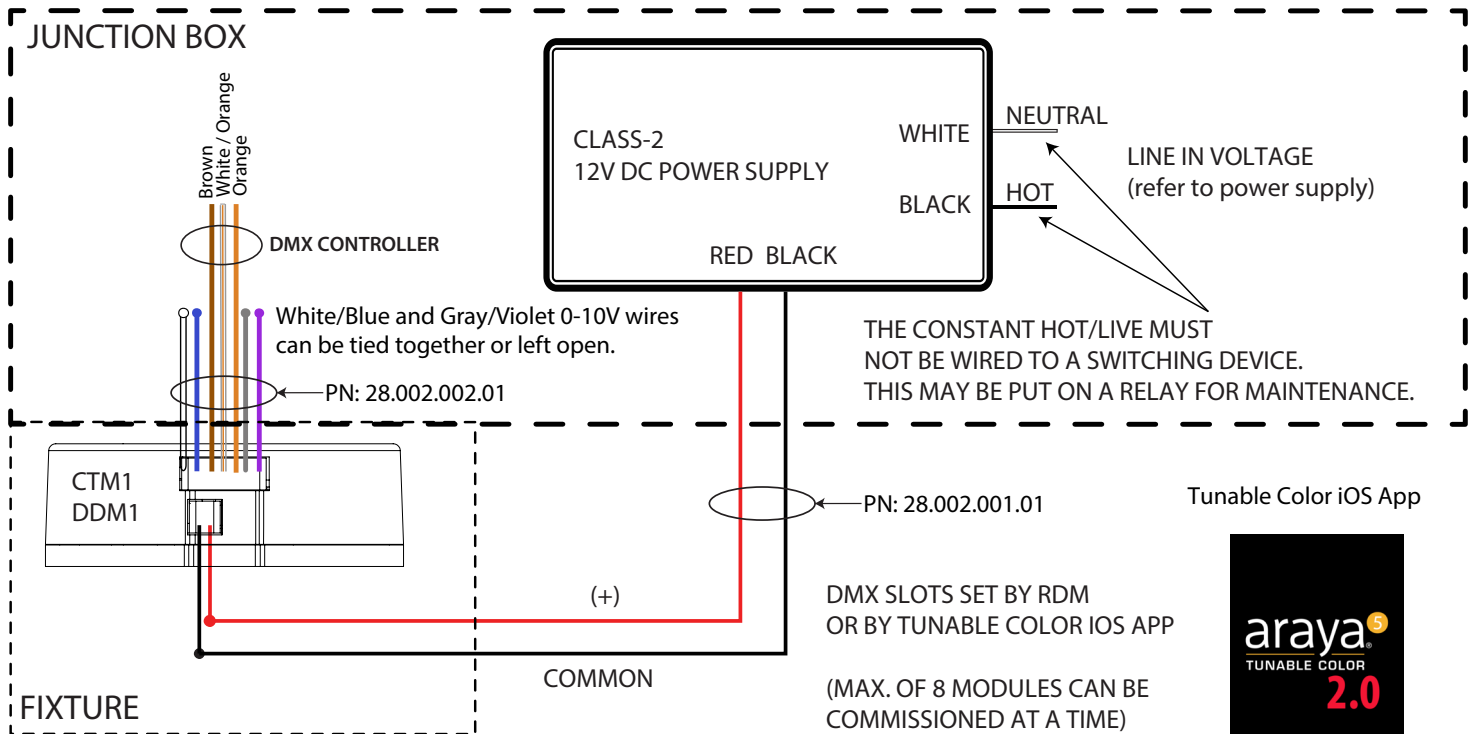
Lumenetix part #s:  
28.002.001.01 (2-wire power cable assembly)  
28.002.002.01 (7-wire control cable assembly)

### Notes:

1. The DMX channels can be set by RDM or by using the araya<sup>5</sup> Tunable Color iOS App.
2. Maximum of 8 modules can be commissioned at a time using the app.
3. Bluetooth operation should be used only for commissioning modules, NOT controlling them.
4. The DMX control system should first be powered OFF, and only modules that are connected to the DMX system should be powered on.
5. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter's 4, 6, 8, or 16 output ports generates an independently protected DMX signal.
6. See araya<sup>5</sup> Tunable Color Instruction Manual for more details.

## DMX512-A WIRING DIAGRAMS

### 2.2b CTM1C / DDM1C (12V; Bluetooth-integrated)



### Lead Color and Input

Lead Color	Input
Red	Power 12V DC (+)
Black	Power Common (-)
Violet	0-10V Dimming (+); Left Open
Gray	Signal Common for 0-10V Dimming (-); Left Open
Blue	0-10V Color (+); Left Open
White	Signal Common for 0-10V Color (-); Left Open
Orange	Data (-)
White with Orange Stripe	Data (+)
Brown	Digital Common

Lumenetix part #s:  
28.002.001.01 (2-wire power cable assembly)  
28.002.002.01 (7-wire control cable assembly)

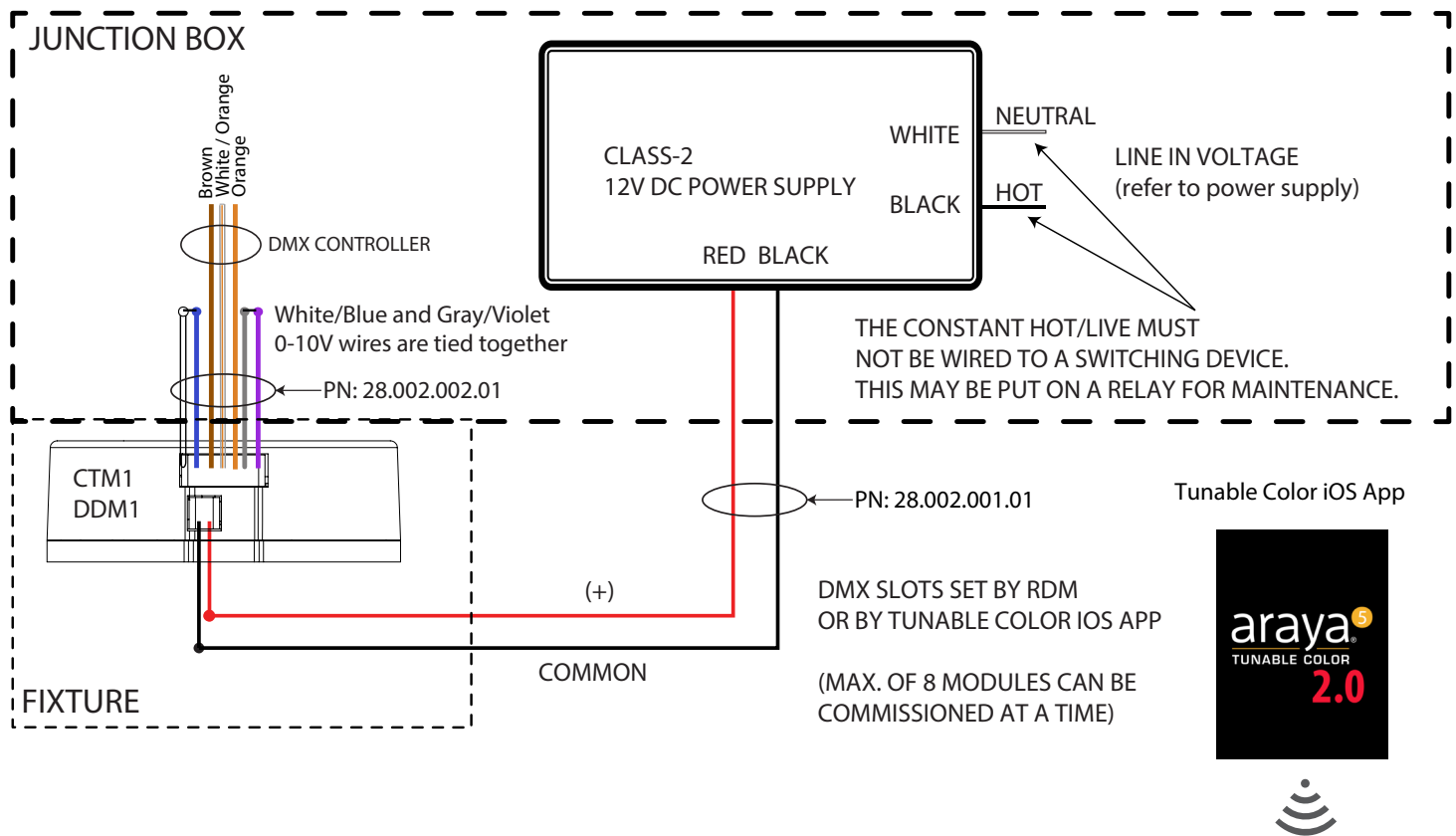
### Notes:

1. The DMX channels can be set by RDM or by using the araya<sup>5</sup> Tunable Color iOS App.
2. Maximum of 8 modules can be commissioned at a time using the app.
3. Bluetooth operation should be used only for commissioning modules, NOT controlling them.
4. The DMX control system should first be powered OFF, and only modules that are connected to the DMX system should be powered on.
5. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter's 4, 6, 8, or 16 output ports generates an independently protected DMX signal.
6. See araya<sup>5</sup> Tunable Color Instruction Manual for more details.



## DMX512-A WIRING DIAGRAMS

### 2.3 CTM1B / DDM1B (12V; Bluetooth-integrated)



### Lead Color and Input

Lead Color	Input
Red	Power 12V DC (+)
Black	Power Common (-)
Violet	0-10V Dimming + (Tied to Gray Common)
Gray	Signal Common for 0-10V Dimming (-)
Blue	0-10V Color + (Tied to White Common)
White	Signal Common for 0-10V Color (-)
Orange	Data (-)
White with Orange Stripe	Data (+)
Brown	Digital Common

Lumenetix part #s:  
28.002.001.01 (2-wire power cable assembly)  
28.002.002.01 (7-wire control cable assembly)

### Notes:

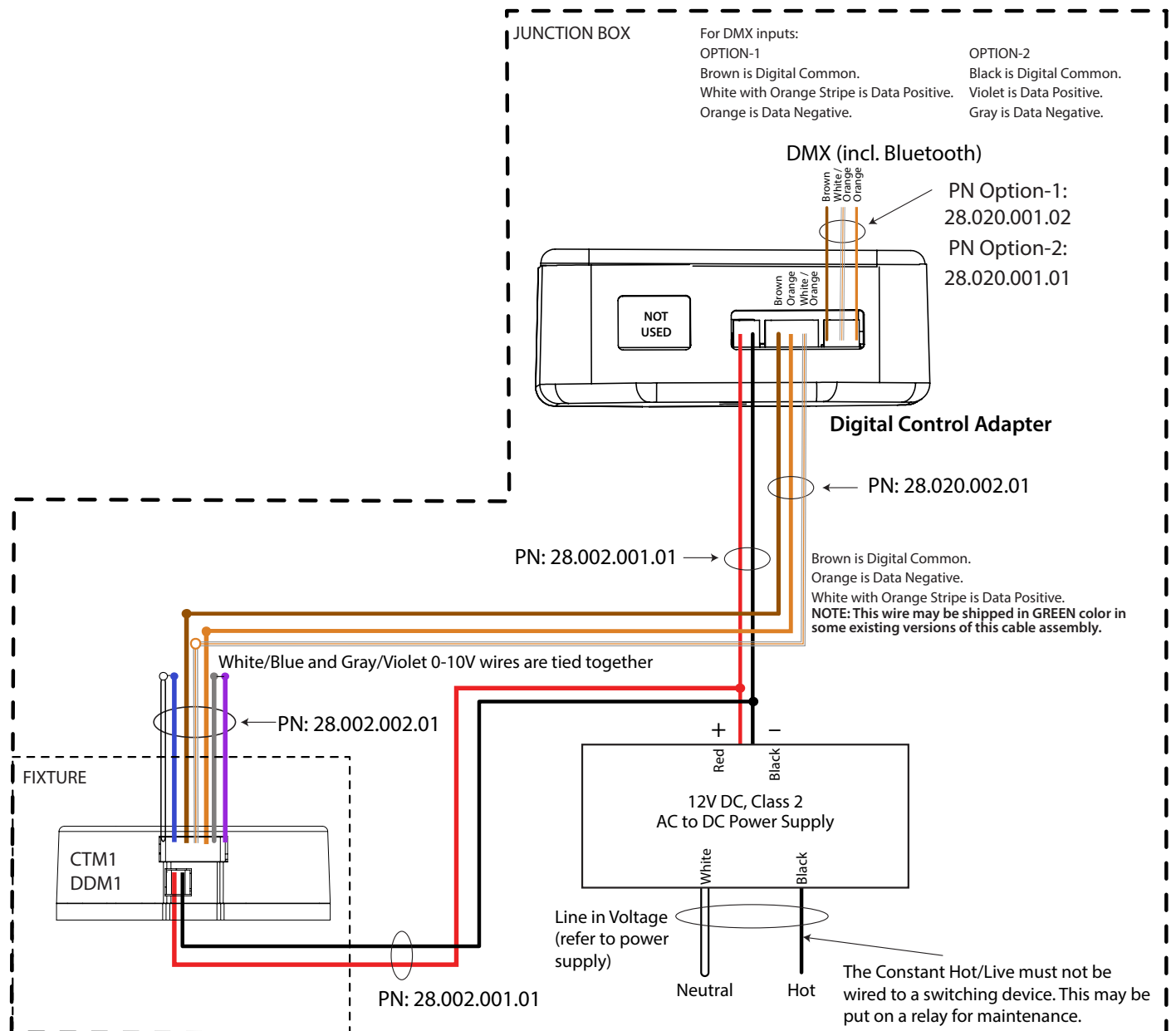
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4. The DMX control system should first be powered OFF, and only modules that are connected to the DMX system should be powered on.
5. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter's 4, 6, 8, or 16 output ports generates an independently protected DMX signal.
6. See araya<sup>5</sup> Tunable Color Instruction Manual for more details.

## DMX512-A WIRING DIAGRAMS

### 2.4 DMX Input; Digital Control Adapter (DCA) DDM1 / CTM1 — 12V

**Notes:**

1. 12V power (red/black) is Class-2 rated.
2. Module Data +/- (white with orange stripe/orange) to araya<sup>5</sup> modules is Class-2 rated.
3. Adapter is configured at factory for DMX (including Bluetooth) inputs.
4. DCA may be installed in the luminaire only.
5. CAUTION: The power cable should ONLY be plugged into the 2-pin power receptacle provided. Insertion of the cable into any other slot will damage the Digital Control Adapter unit.
6. LX Output used with this system.



## DMX512-A WIRING DIAGRAMS

### 2.5 DMX Input; Digital Control Adapter (DCA) DDM0 / CTM0 — 24V

**Notes:**

1. 24V power (red/black) is Class-2 rated.
2. Module Data +/- (white with orange stripe/orange) to araya<sup>5</sup> modules is Class-2 rated.
3. Adapter is configured at factory for DMX (including Bluetooth) inputs.
4. DCA may be installed in the luminaire only.
5. CAUTION: The power cable should ONLY be plugged into the 2-pin power receptacle provided. Insertion of the cable into any other slot will damage the Digital Control Adapter unit.
6. LX Output used with this system.

