

Introduction

DMX is a commonly used protocol used for controlling lighting and special effects (such as fog machines).

The DMX “fixtures” communicate via an EIA-485 (RS-485) bus. An Ethernet “node” (Ethernet to DMX EIA-485) is required for so RAPIX Zone Controllers can send messages to DMX fixtures.

A full description of DMX is beyond the scope of this document. For an introduction, refer to <https://en.wikipedia.org/wiki/DMX512>

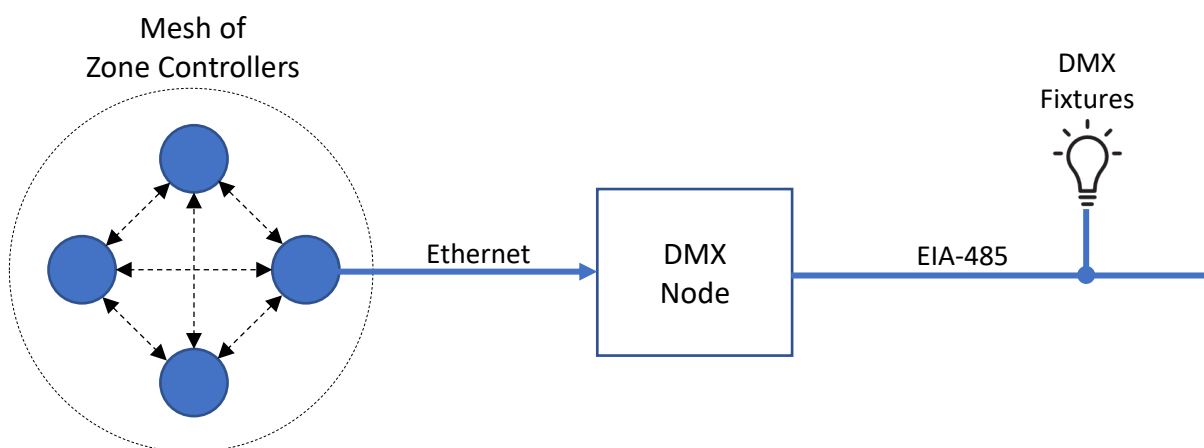
Each DMX network is known as a “Universe”. Each DMX Universe contains 512 channels, each with an 8-bit value (0 to 255), which most often controls the lighting level of the channel.

A DMX fixture can use one or more channels. For example, a colour lighting fixture may have 4 channels used as follows:

- Channel 1: dimming. This sets the overall lighting level.
- Channel 2: red. This sets the red component of the RGB colour.
- Channel 3: green. This sets the green component of the RGB colour.
- Channel 4: blue. This sets the blue component of the RGB colour.

RAPIX DMX System Architecture

RAPIX Zone Controllers form a mesh to allow them to exchange information about zones and scenes, so they can all maintain a model of the whole system. Any Zone Controller can connect to a DMX Node.



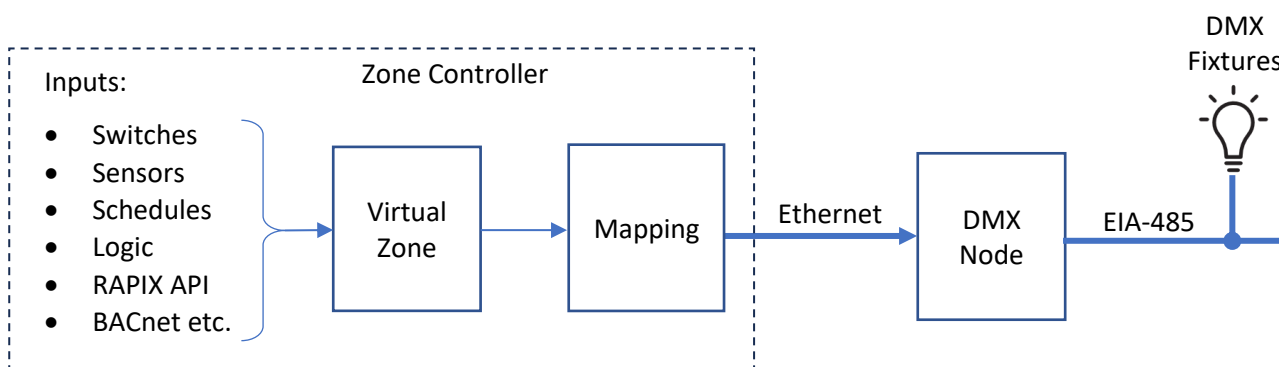
Two types of DMX Nodes are supported:

- Art-Net (versions 1 to 4)
- sACN

The RAPIX Zone Controller sets the value of each channel in the DMX Universe. The value for a channel will be one of:

1. Constant (fixed) value
2. Zone level
3. Zone colour component
4. Operating Property value
5. Value selected by a Flag

A common requirement is to control a DMX fitting's lighting level or colour. The simplest way to do this is by mapping a RAPIX Zone to one or more DMX channels. Anything that controls the Zone level or colour will then control the DMX channel(s). If the Zone is only used for controlling DMX channels, then a "virtual" Zone should be used. Refer to Application Note APN-RAPIX-028 for details of using virtual Zones.



Controlling a DMX lighting fixture via a virtual zone

RGBW Colour Control

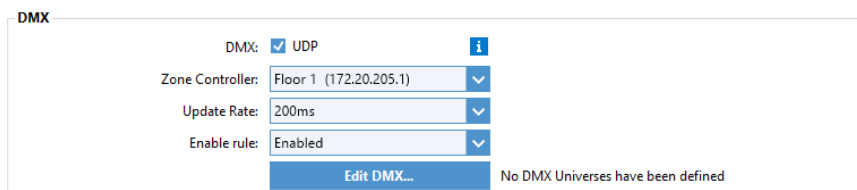
The mapping of a Zone's level and colour to DMX depends on whether the DMX fitting has a "dimming" channel or not. If the DMX fitting has a dimming channel, then this is controlled by the zone's level. If the DMX fitting does not have a dimming channel, then the zone's RGBW colour components are "scaled" (multiplied) by the zone's level. An example is shown below.

Zone Property	DMX Fitting with dimming channel	DMX Fitting without dimming channel
Level = 50%	Dimming = 127 (50% of 255)	-
Red = 200	Red = 200	Red = 100
Green = 150	Green = 150	Green = 75
Blue = 100	Blue = 100	Blue = 50
White = 50	White = 50	White = 25

Configuring the DMX settings using RAPIX Integrator

To configure the DMX settings for the RAPIX Lighting Control System:

1. Run the RAPIX Integrator Software
2. Select the **Site** view
3. Select the **Interfaces** tab



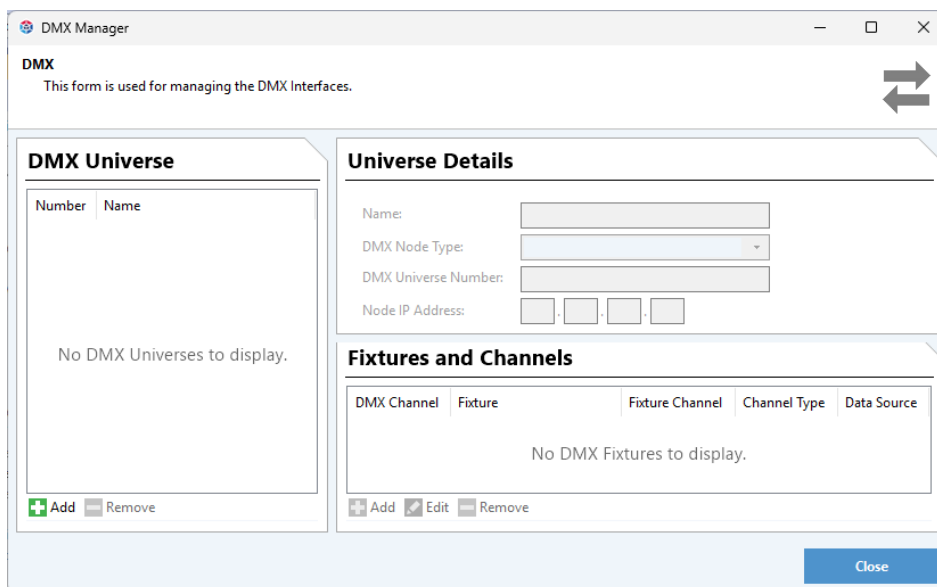
DMX Settings.

The DMX settings are described in the table below and are discussed in detail in the previous sections.

Setting	Purpose	Default Value
Zone Controller	The Zone Controller that will be the DMX source. Avoid using the Zone Controller with the lowest IP Address, if possible, as it will be the “master” and will be the busiest of the Zone Controllers.	-
Update rate	The rate at which the DMX channel values are updated.	250ms
Enable rule	A rule that can be used for dynamically enabling/disabling DMX	Enabled

DMX Settings

Click on the **Edit DMX** button to open the DMX Manager form:



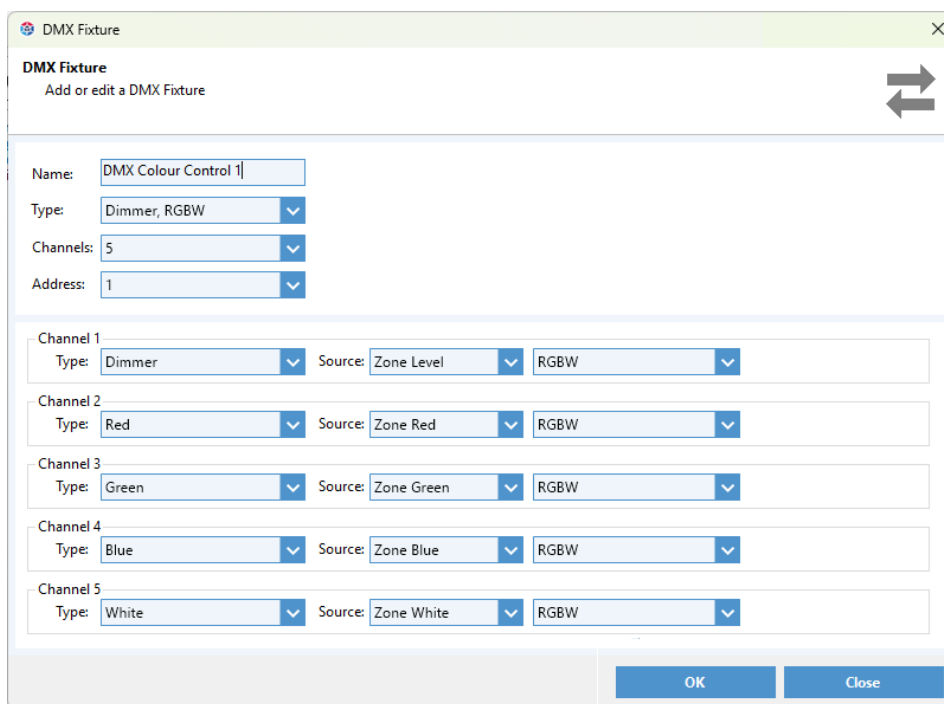
The DMX Manager Form

To add a DMX Universe:

1. Click on the **Add** button.
2. Enter a name for the Universe.
3. Select the DMX Node Type.
4. Select the DMX Universe number.
5. If using an Art-Net node, enter the Node IP Address.

To add a fixture to a DMX Universe:

1. Select the DMX Universe in the list.
2. Click on the Fixtures and Channels **Add** button.
3. The DMX Fixture form will be shown. On the form:
 - a. Enter a name for the fixture.
 - b. Select a fixture type, or select the number of channels.
 - c. Select the fixture starting address (in the DMX Universe).
 - d. For each channel, select:
 - i. The channel type (this is for your own information – it doesn't change anything)
 - ii. The source of data for the channel (e.g. RAPIX Zone)
 - iii. The source details (e.g. the RAPIX Zone name)
 - e. Click on **Add** or **Add and Close** when finished.
4. The fixture and its channels will be displayed on the DMX Manager form.



The screenshot shows the 'DMX Fixture' dialog box. The title bar says 'DMX Fixture' with a close button. Below the title bar, it says 'DMX Fixture' and 'Add or edit a DMX Fixture'. There are two arrows (one pointing right, one pointing left) on the right side of the dialog. The form contains the following fields:

- Name:
- Type:
- Channels:
- Address:

Below these fields, there are five channel configuration sections:

- Channel 1: Type: Source:
- Channel 2: Type: Source:
- Channel 3: Type: Source:
- Channel 4: Type: Source:
- Channel 5: Type: Source:

At the bottom right, there are two buttons: 'OK' and 'Close'.

The DMX Fixture Form showing a DMX fixture being mapped to the RAPIX virtual Zone “RGBW”

Run-time Execution

After the configuration has been set using RAPIX Integrator software, it needs to be transferred to the Zone Controllers.

After the configuration has been transferred, the Zone Controller that was configured as the DMX source will connect to the DMX Node(s).

Configuring DMX Nodes

For specific details on how to configure a DMX Node, refer to the manufacturer's documentation.

Art-Net Nodes

Art-Net nodes need to have their DMX universe set. The same universe number needs to be used when configuring the DMX settings in RAPIX Integrator.

The IP Address of the Art-Net node needs to be set. The IP Address will need to be on the same subnet as the RAPIX Zone Controller.

sACN Nodes

sACN nodes need to have their DMX universe set. The same universe number needs to be used when configuring the DMX settings in RAPIX Integrator.

An sACN node does not need to have an IP Address set. It will receive multicast packets on multicast address:

- 239.255.0.X (where X is the universe number 1 to 255); or
- 239.255.X.Y (where X is the most significant byte of the universe number (256 – 32768), and Y is the least significant byte)

Testing and Debugging

If DMX control is not working correctly, the first step should be to confirm that the DMX node and fittings are configured correctly. To do this, use a DMX controller such as the free QLC+ tool (<https://www.qclcplus.org/>) to check that the DMX channels can be controlled.

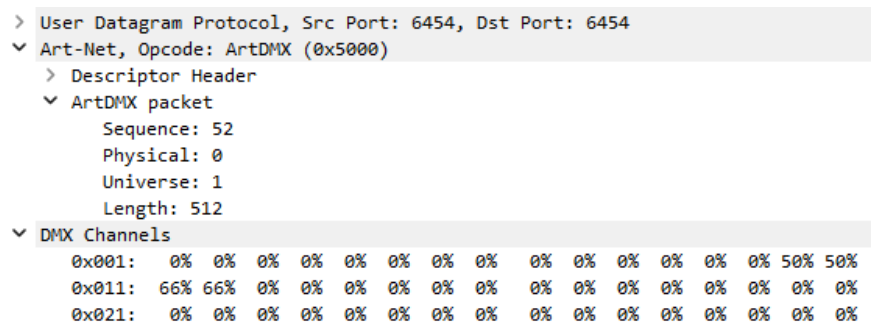
If another tool can control the DMX channels, the next step in debugging is to check whether the Zone Controller is sending the expected messages. If it is, then the problem may be with the Ethernet infrastructure.

Wireshark

The simplest method for verifying the DMX messages is to observe the packets using Wireshark, or a similar tool. For details of installing and using the Wireshark tool, refer to their website, <https://www.wireshark.org/>

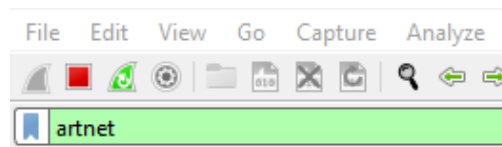
Art-Net

Art-Net DMX packets are decoded in Wireshark to allow you to see the value of each channel:



Example of decoded Art-Net packet for universe 1

To view just Art-Net packets, set the filter to “artnet”:



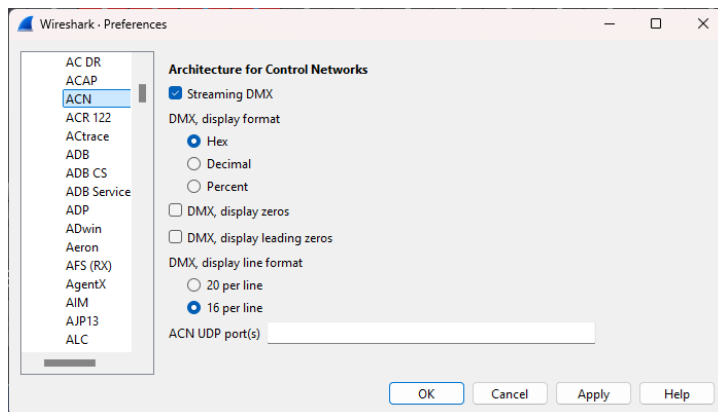
The Wireshark filter set to show Art-Net packets

However, unless the Art-Net packets are being broadcast (they are normally “unicast” to the node’s IP Address), you will not be able to observe them on your computer. To be able to view the packets, temporarily re-configure the settings as follows:

1. Change the “Node IP Address” setting to be the IP Address of your computer. This will instruct the Zone Controller to send the packets to your computer instead of the Art-Net node.
2. Transfer the project to the Zone Controller.
3. Run WireShark. You should be able to see the ArtNet packets.
4. Change the “Node IP Address” setting back again when finished.

sACN

To view sACN packets, it may be necessary to enable the “Streaming DMX” option in the preferences form:



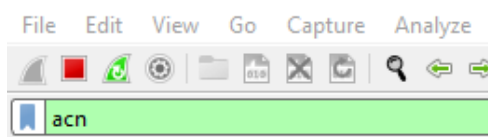
The Wireshark preferences form

The sACN packets will then be decoded for you:

```
> User Datagram Protocol, Src Port: 56139, Dst Port: 5568
  Architecture for Control Networks
    Size of preamble: 16
    Size of postamble: 0
    Packet Identifier: ASC-E1.17
  PDU: Root DMX, Src: fb3c1065-a17f-4de2-9919-ac1a3dae36f0
    > Flags: 0x70
    Length: 622
    Protocol ID: Ratified DMX Protocol (4)
    CID: fb3c1065-a17f-4de2-9919-ac1a3dae36f0
  PDU: Streaming DMX, Universe: 3, Priority: 100
    > Flags: 0x70
    Length: 600
    Vector: Streaming DMX (2)
    Source: Q Light Controller Plus - E1.31
    Priority: 100
    Sync Universe: 0
    Seq No: 200
    > Options: 0
    Universe: 3
  PDU: Set Property
    > Flags: 0x70
    Length: 523
    DMP Vector: Set Property (2)
    > Address and Data Type: Range, array of equal size data items
    First Property Address: 0 (0x0000)
    Increment: 1
    Count: 513
    Start Code: 0 (0x00)
    Data:  1  2  3  4  5  6  7  8 |  9 10 11 12 13 14 15 16
    001-016: C8  1  5  A BA BE .. | .. .. .. .. ..
    016-032: .. .. .. .. .. | .. .. .. .. ..
    032-048: .. .. .. .. .. | .. .. .. .. ..
```

Example of a decoded sACN packet for Universe 3

To view just sACN packets, set the filter to “acn”:



The Wireshark filter set to show (s)ACN packets

Change History

Rev	Date	Updated By	Comment
1	8 Dec 2025	DS	First Release.
2	16 Dec 2025	DS	Added details of Art-Net version.
3	2 Mar 2026	DS	Added details of “scaled” colour components. More details about debugging DMX.

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