

Components & Planning

DMX 512: DMX stands for Digital Multiplexing. It is a digital protocol used to control and automate lighting systems. The system has 512 addresses in a “Universe”, or group, on a single cable run. Each address is a digital data channel for control signals.

Lighting System Type: The light source is the basis for selecting all other components. The lighting system will be made with selected LED tape or fixtures. Multiple output channels may be available for 1 to 5 channel operation. Lighting loads will be powered directly by the Decoder power output channels. Consider the purpose of the lighting and how many fixtures or length of LED tape will be required. For low voltage Class 2 systems, the loads will need to be put into 96W sections or less. Basic lighting systems with multiple channels discussed here can be thought of as a single unit where color chosen is uniform through the entire light source at the same time. Lighting with individual, addressable pixels (different colors in different parts of the light at the same time) is not discussed here and is a different type of system.

Decoders: These devices take in the DMX signal from the Master (wall) Controller and convert the data signal to the proper power output for each LED channel (Red, Blue, Bright, Dim, etc.). GM Lighting Decoders have a 3-digit display showing the address assigned to the Decoder. Check Decoder instructions for wiring more than 32 Decoders continuously in a run.

Master Controls: Typical wall controls offered by GM Lighting are pre-programmed with simple functions, dimming, modes and zones. Zones on the wall controls cover multiple data addresses and output channels on the Decoder. A 4 channel Decoder with an address setting of 001 will align addresses (001, 002, 003, 004) with Zone 1 on the Master Control wall plate. This is the default setting. Other Zones can be set up to correspond to other addresses. The Wall controls discussed here are basic controls. More advanced controls requiring programming of modes for color sequences is possible but beyond the scope of this document. More advanced Master Controls would replace the Wall Control but the same Decoders can be used.

Decoder Settings: The Decoders have basic settings to select addresses, and other advanced features. You may set different addresses depending on how big your system is.

- Unless you are connecting the Decoder to a more advanced Master Control, other than the GM Lighting wall controllers, leave all DIP switches at factory settings. (down)
- Usually, address 001 is all that needs to be selected for simple systems with 1 Zone at the Master Control (wall control). In this case, zone 2, zone 3 and beyond will not function since the addresses would not exist.

Multiple Zones: For connecting Decoders to different Master Control Zones follow these steps.

- Determine how many channels you are controlling with your Master control. (ex RGBW = 4)
- Select addresses that are multiples of the number of channels you are controlling for each zone. This allows a different set of addresses to be used for each fixture group without overlapping addresses. Wiring connections for multiple zones are not affected within the same Universe.

Decoder Channel settings for multiple Zone settings

Typical use	# of Channels on Master Control	1 st Decoder Group Address	2nd Decoder Group Address	3rd Decoder Group Address	4th Decoder Group Address
Single Color	1 (mult of 1)	001	002	003	004
Tunable White	2 (mult of 2)	001	003	005	007
RGB	3 (mult of 3)	001	004	007	010
RGBW	4 (mult of 4)	001	005	009	013
RGB +Tunable White	5 (mult of 5)	001	006	011	016
	Group of Channels (above) Controlled by Zone (below)	Zone (below) will control Channel Group starting at Channel (above)	Zone (below) will control Channel Group starting at Channel (above)	Zone (below) will control Channel Group starting at Channel (above)	Zone (below) will control Channel Group starting at Channel (above)
	Wall control Zone	1	2	3	4

Notes: Assuming 1 Universe. Decoders set to 8 bit. Each decoder group can have 1 or more Decoder. More than 1 Decoder can have the same address. Addresses shown prevent overlap of data signals.

Layout: This step involves knowing where the LED light sources, Decoders, Wall controls and power supplies will be located and mounted. All controls and power supplies should be in a location that can be easily accessed for installation and maintenance. Routing of all data and power cables will need to be planned for length and connections. Knowing how sections will be separated for Class 2 groupings will assist in this step. Plan to avoid mounting or routing any of the DMX system parts or cables near electrical devices or appliances that may emit electromagnetic noise. (HVAC, motors, microwaves ovens, washing machines, and power lines for these devices.)

Data Cables & Terminator Resistors

DMX rated cable: Always use DMX rated cables for data connections to prevent malfunctions. The system could be unresponsive or flicker if the data signal is not getting to the Decoders from the Master Control.

XLR cables: GM Lighting Decoders can accept 3 pin XLR connectors. 5-pin XLR connectors are available, but are not compatible with GM Lighting Decoders unless you use a 5 to 3 pin adapter. Cables should be shielded and have a male connector at one end and female connector at other end. Be sure that the cables are DMX rated with an impedance of 120 Ohms. Audio or microphone cables also use XLR connectors but have a lower impedance closer to 45 Ohms. The low impedance audio cable can degrade the digital signal making the DMX system malfunction. XLR cables are used when a more durable cable is required.

Ethernet Cable: Ethernet cables are a cost-effective way to make connections. Ethernet cables with a CAT5, CAT5e, or CAT6 rating are suitable for DMX use. These cables provide shielding to noise and have the data bandwidth and impedance to handle DMX signals over long runs. These cables use RJ45 connectors, at both ends, which are accepted by GM Decoders for all inputs and outputs.

DMX rated cable: An alternative is to use shielded data cable rated for DMX use. The cable can have 2 wires with an impedance of 120 Ohm and have a shielded foil wrap with data ground wire (3rd wire). Note that this is a “signal ground” wire which is NEVER TO BE CONNECTED TO building “earth ground”. This would be a shock hazard and could damage the controls. Strip wire ends and connect to screw terminals on DMX equipment. There are no connectors.

Terminator Resistor:

Use a Terminator resistor at the end of a single DMX run. From the Master Wall Control, data cables go in and out of each Decoder. On the last Decoder, farthest away from the Master Wall Control, connect a Terminator resistor to the last output. At the screw terminals, use a 120 Ohm, ¼ watt resistor. It must be connected between the +Data and -Data terminals. This prevents the data signal from reflecting back into the line which can distort the signal and create various malfunctions.

- Use 1 Terminator resistor on the Decoder output farthest from the Master Control.
- Do not use a resistor on any other upstream Decoders.
- GM Lighting Decoder data output terminals are all connected. A resistor, XLR plug or RJ45 jack with Terminator resistor are also acceptable to use even if different cables are used. (pick one)
- Do not install more than one Terminator resistor on the last Decoder.

DMX Planning – Summary

***It is highly recommended that a qualified DMX installer be used to ensure proper installation and operation of the system. Consult with qualified personnel during the planning stage to ensure the correct components are chosen for a smooth installation.

1. Select a Luminaire/Light Source for each application. Determine the number of channels.
(ex RGBW = 4) Determine total Luminaire wattage and operating voltage.
2. Select a Decoder with same number or greater number of channels as the Luminaire.
3. Select a Master Control with the same number of channels as the Luminaire.
4. Determine settings to enable the Decoder to work properly with eh Master (wall) Control. List Decoder addresses to align with Wall Control Zones.
5. Select power supplies of proper input voltage, output voltage and power for Decoders and Master (wall) Controls.
6. Determine which type of data cables and connectors will be used (ex Ethernet, XLR 3-pin Cables)
7. Determine preliminary layout of the run from Master (wall) Control to the Decoders to the Luminaires.
8. Determine where power supplies will be mounted.
9. Determine final layout of Lighting System in the space. List Zones and Class 2 power sections. Specify locations for mounting components and routing cables. Avoid putting DMX devices or cables near electrical noise producing appliances.

Trouble Shooting Tips

Possible causes and solutions to malfunctions including no output or flickering or wrong output.

Fixture & Power Supply: Check LED tape or fixture individually for problems.

- Check that building power is working.
- Check power supply output for proper voltage and power rating.
- Check polarity of power supply input and output connections.
- Check LED load by connecting power to each channel directly with a known good power supply of the same voltage and power rating required.

Cables: Check each cable individually for problems.

- Check to see that a DMX rated cable is being used.
- Check for damaged cables or connectors.
- Swap out each cable one at a time with known, good cable.
- Test cable with a cable tester.
- Replace any bad cables/connectors.

Decoder & Master Control: Check each unit individually for problems. Modify and check result.

- Break run into smaller sections to troubleshoot.
- Check individual Decoders for function. Add one Decoder, at a time, back into run with good cables to determine location of failure.
- Check polarity of DMX data connections.
- Check Decoder output channel connections for proper LED color lead input.
- If Master Control appears to not respond properly, replace with unit known to be good.
- If there are more than 32 Decoders in a single run, consult instructions for modified wiring connections to boost signal.

EMI Noise: Check location of DMX data cables, Decoders Master Control or Power supplies

- Are cables running new line voltage power lines, electrical devices or appliances? If so try moving cables and check results.
- Check to make sure DMX rated cables with 120 Ohm impedance are used. Replace any cable without proper data ground shield or impedance. Check results.
- Are power supplies properly grounded to Earth, electrical ground? Repair any disconnected ground and check results.
- For bigger problems, a line filter may be required on the appliances. This would require consulting with an expert knowledgeable in EMI issues and resolution.