



THE BALLROOM PROJECT: A DMX CASE STUDY

DMX SERIES – ARTICLE 3

Adapted from a talk given by Thomas Ladd and Simon Hicks at LEDucation 2022

NB: This article is the third in a three-article series aimed at construction and electrical engineering professionals who work in lighting installation but have not worked with lighting fixtures controlled by the DMX protocol. It does not cover DMX distribution over Ethernet.

We take a slow waltz through the various stages in the specification of a lighting project for a ballroom.

Learn the steps along the way, including how to wire up fixtures, how to control them, and the tasks involved in the installation and commissioning process.

The role: In this case study we assume the role of the installer, sales rep or controls supplier.

The task: It is our job to figure out how to make this system work as specified.

The project: The ceiling of a divisible ballroom. This is an example of a small lighting system, but what's done in this project can be scaled up and applied to much bigger DMX projects.

STEP 1: KNOW YOUR FIXTURES

The key to pulling together a DMX layout, and a solid control system, is to work backwards – from the fixtures to the control system. So, the first step is to know your fixtures: how and where a fixture connects to the DMX wiring, its profile and footprint are great places to start.

Finding out all you can about the lighting fixtures helps with the physical installation and, further down the road, when the lighting system needs to be programmed in order to control the fixtures.

WHAT WE LEARN FROM THE DATA SHEETS

At a first glance of the **cut sheet** and **load schedule** (see illustration on p2) we know

- which fixture types are to use DMX, and
- that fixture L3, the inner cove lights, has a remote junction box for power and data.

This tells us that, for the roughly 50 inches of linear product, we only need one point of contact on our DMX daisy chain. Really good information to know as you start to layout wiring.

But the fixture data sheets will not always tell us everything we need to know...

The key to pulling together a DMX layout, and a solid control system, is to work backwards – from the fixtures to the control system.

Fixture types observed:

L1 = Load Type DMX

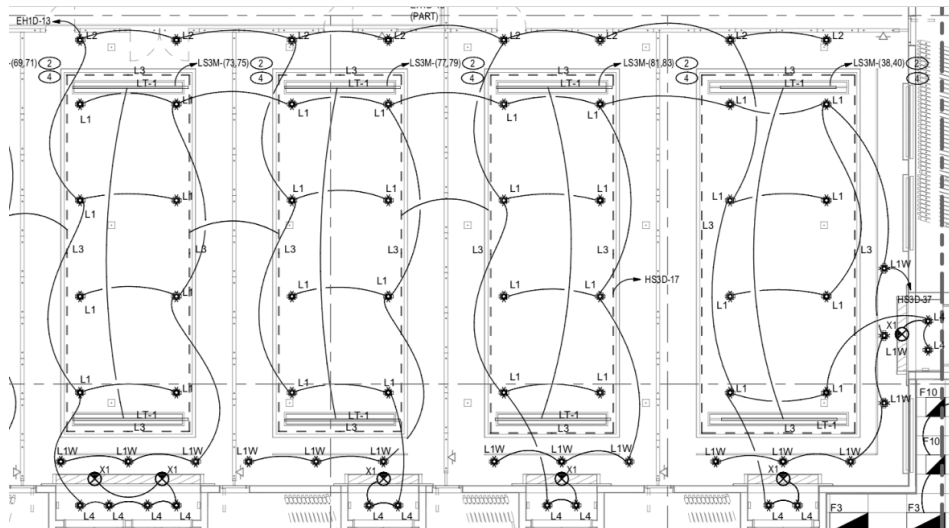
L1W = Load Type DMX

L2 = Load Type DMX

L3 = Load Type DMX

L4 = Load Type DMX

Data sheets have no mention of DMX characteristics. More info is needed.

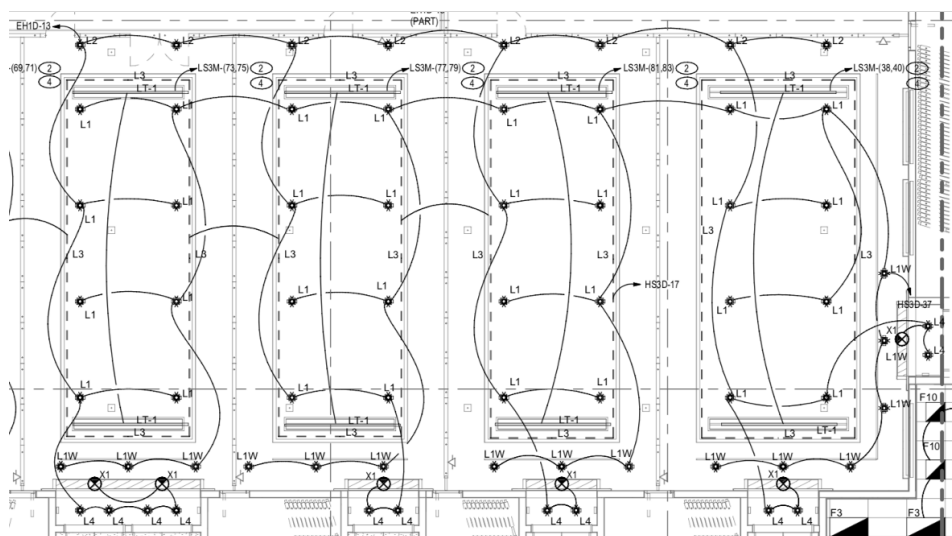


Reflected ceiling plan showing four areas of a divisible ballroom.

WHAT WE LEARN ON FURTHER INVESTIGATION

After making further enquiries about the fixtures, we now have additional information:

- L1, L1W, L2 and L4 are 2-channel tuneable white fixtures that accept DMX directly at the fixture. Its DMX profile is Ww, Cw.
- L3s are also 2-channel tuneable white fixtures (but, as we surmised before, an entire cove is fed from a special single junction provided by the manufacturer). DMX wiring only needs to connect to this one point and not to each of the cove fixtures individually. Also, while its DMX footprint is 2 like the others, its DMX profile is CCT, INT.
- Some of the fixtures are used for emergency. These take a little extra care when designing DMX wiring runs as these must go directly back to a UL924 DMX bypass unit. This unit, when sensing the loss of normal power, will bypass the DMX coming from the control system and provide new DMX to send the fixtures to an emergency lighting level.



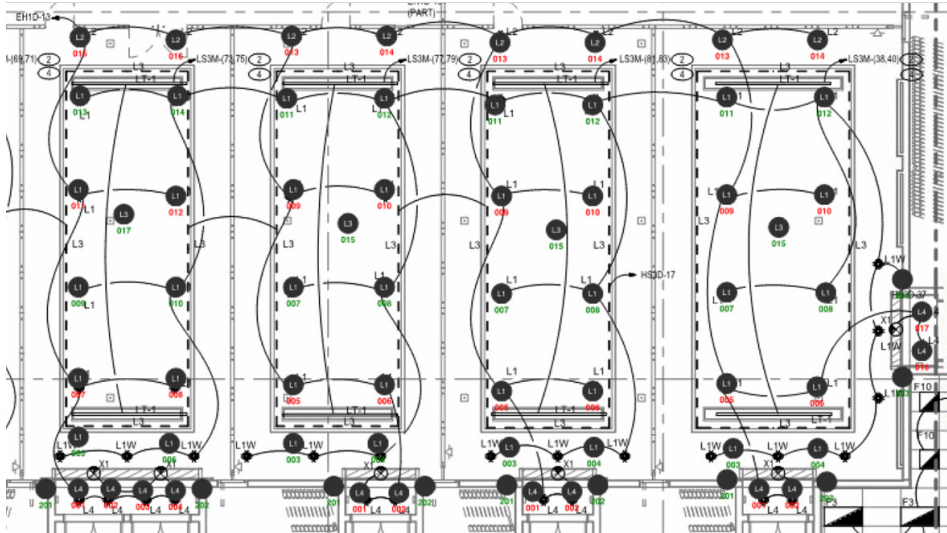
We ask the rep and the fixture manufacturers, and we learn fixtures are tuneable white, requiring 2 DMX channels

L1, L1W, L2, L4 = Ww, Cw

L3 = CCT, Int (every foot)

STEP 2: PLAN DMX WIRING RUNS AND DETERMINE CONTROL SYSTEM

The next step is to plan the DMX wiring runs, or at least calculate how many 'home runs' are needed. A home run is a daisy chain running back to the DMX output of a DMX controller, splitter or merger.



A simple PDF mark-up tool has been used to count fixtures, mark them as normal or emergency, and give every fixture a unique ID.

Observations:

We see 74 fixtures

We need multiple DMX home runs

36 fixtures are emergency

(2) Emergency DMX home runs

(2) Regular DMX home runs

NOTE:

DMX wiring does not need to follow the same path as the power wiring.

DMX fixtures can have unique addresses and be digitally grouped or zoned together.

For this ballroom project we have a count of 74 fixtures, which means at least three DMX runs are needed (74 divided by 32). However, 36 fixtures are emergency and need to wire back to those special UL924 bypass units. Therefore, two DMX home runs of emergency fixtures are needed, leaving 38 fixtures.

Following the 32-device rule, this means another two DMX home runs are required.

This also tells us that the **control system** must have at least 4 points to connect DMX to and a total of 148 channels of DMX control capability if every fixture gets a unique footprint of 2 addresses.

CHECK:

- ☐ Fixtures
- ☐ Wiring runs and termination
- ☐ Under 512 channels
- ☐ Correct number of DMX outputs
- ☐ Separated emergency from normal fixtures

Fixture ID	Type	Room Number	Fixture Profile	DMX Footprint	DMX Address	Zone	DMX Home Run	EM	Emergency DMX Transfer Unit	DMX FEED	Elec. Rm
B1A33-006	L1	101	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A33-007	L1	101	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A33-008	L1	101	Ww Cw	2		CC	DMX-A33			DMX 3	IDF Room C
B1A33-009	L1	101	Ww Cw	2		CC	DMX-A33			DMX 3	IDF Room C
B1A33-010	L1	101	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A33-011	L1	101	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A33-012	L1	101	Ww Cw	2		CC	DMX-A33			DMX 3	IDF Room C
B1A33-013	L1	101	Ww Cw	2		CC	DMX-A33			DMX 3	IDF Room C
B1A32-007	L1	102	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A32-008	L1	102	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A32-009	L1	102	Ww Cw	2		CC	DMX-A32			DMX 3	IDF Room C
B1A32-010	L1	102	Ww Cw	2		CC	DMX-A32			DMX 3	IDF Room C
B1A32-011	L1	102	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C
B1A32-012	L1	102	Ww Cw	2		CC	DMX-EM-013	Yes	EMERG-07-02	DMX 1	IDF Room C

TIP: Using an Excel spreadsheet to capture and manage data is a very useful resource – it helps ensure everyone is talking about the same fixture and helps with counts when ordering and for making sure DMX runs stay under the 32 device limit.

STEP 3: ASSIGN TASKS FOR INSTALLATION AND COMMISSIONING

The next step is to focus on the tasks that are part of the installation and commissioning process and be clear on who does what as the installation begins and the system gets brought online.

- The installer is a very important part of the process. Does the installer need a primer on DMX wiring? Ensure wire type, topology and termination is clear and specify that these are items he/she is responsible for.
- Who will be responsible for addressing the fixtures? If the fixtures are shipped pre-addressed, do they need to be installed in certain locations or in a certain order? The addresses may have to be physically set at the fixture by the installer or by the programmer via the controller.
- Once addressing is done, or is in progress, it's a good idea to test the DMX wiring runs for integrity, so you need to determine who will do this.

STEP 4: PREPARE TO DELIVER THE DESIGN

Most projects have some sort of narrative or vision of how the lighting system should operate and how the lighting should look. In preparing to deliver the design, you should:

- Acquire any updates to the design intent, control narrative and sequence of operations.
- Identify who will program the sequence of operation and design the lighting scenes according to the specifications.

In conclusion, each step has a varying level of importance depending on what stage a project is in, and most could be handled in due course as a project installation progresses, but to hit the mark when it comes to DMX success it helps to define a clear scope of work and schedule of responsibilities upfront. When everybody's dancing to the same tune there's less chance of taking a wrong step or of something important falling through the cracks.

READ PREVIOUS

ARTICLE 1

A RECIPE FOR DMX SUCCESS

What are the ingredients that make up a successful DMX project? We take you through the essentials and share the ultimate ingredient.



ARTICLE 2

THE BASICS OF A DMX SYSTEM

How does a DMX controller communicate with DMX fixtures? How do lighting fixtures need to be commissioned? How is the signal carried and what cable is needed? What's the cable topology? What is termination and why? Where can it go wrong? You'll find some answers here.

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