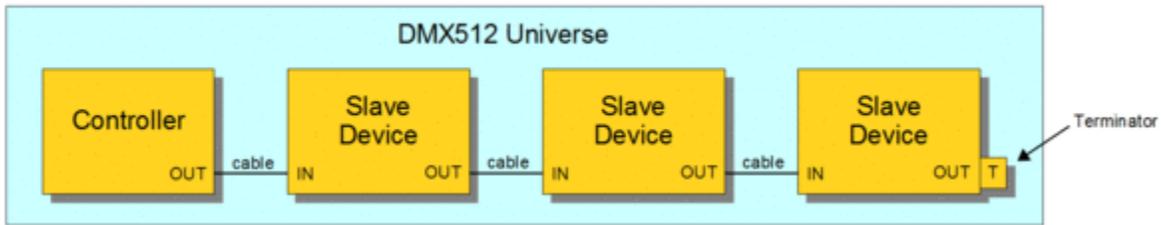


Lighting Basics – basic “under-the-hood” understanding of DMX

At the most basic level, a lighting system has only two types of devices: fixtures and controllers. Fixtures are slave devices that respond to commands sent to it by a controller. Communication is accomplished with a standard synchronous serial protocol called Digital Multiplex (DMX). DMX is structured into groupings of 512 channels called universes. CBC's lighting system is simple enough to fit within a single DMX universe. There are two DMX modes to choose from, Highest Takes Precedent (HTP) and Latest Takes Precedent (LTP). Given that all of our lighting fixtures are intensity only, we utilize the HTP (LTP is required colored and moving light rigs). DMX is a one-way commanded system; there is no feedback mechanism from the fixtures. You cannot query the fixture for its status for instance. The only way to determine what a fixture is being commanded independent of the controller itself would be to inspect the DMX command stream in between the controller and the fixture. Each fixture is allocated a specific number of DMX channels to control its device parameters. Each DMX channel has 8-bits (0 to 255) of control where 255 = 100% intensity.



Given that background on DMX, you can see how it supports a daisy chain type of wiring scheme. All fixtures in that universe receive the entire 512-channels of DMX commands but only responds to the channels that it is addressed to. That fixture then passes on the entire DMX command stream to the next fixture which repeats this until it is terminated.

CBC's Fixtures and DMX Configuration

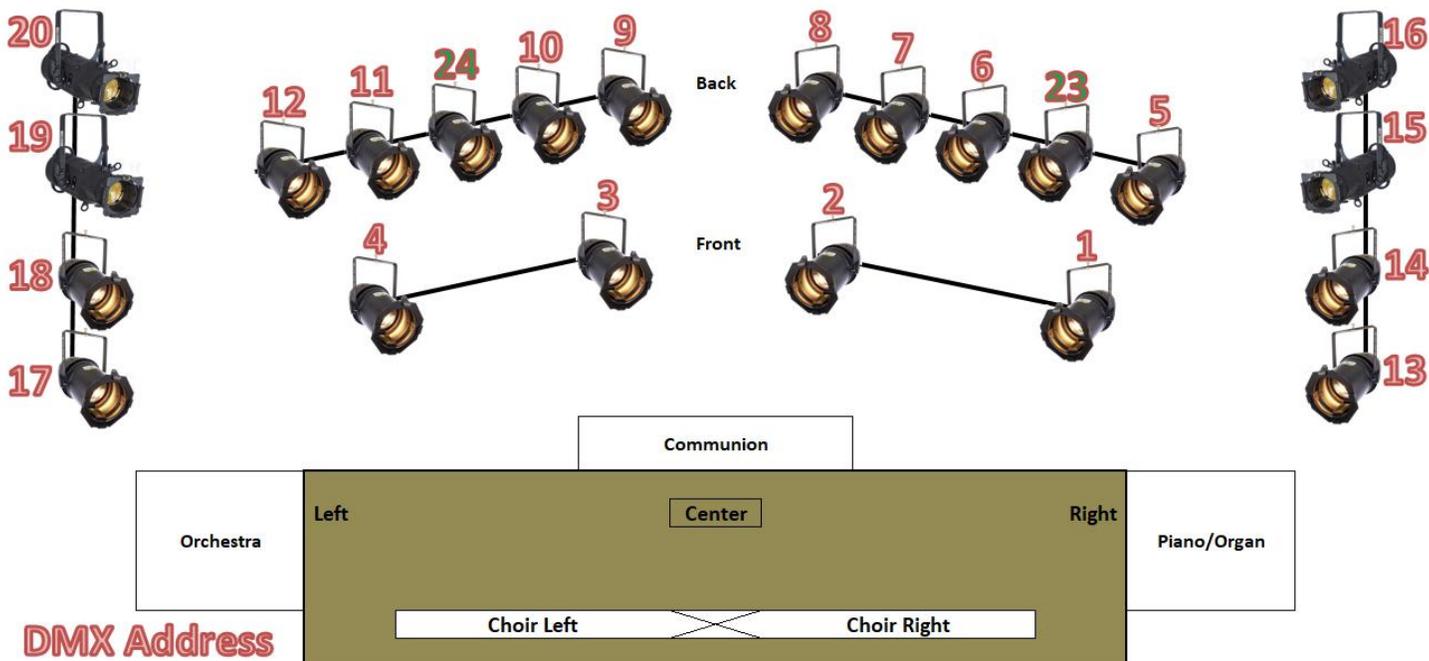
CBC has a configurable 4-port DMX interface device that can split the DMX output. CBC has separate DMX cable runs to left and right sides of the auditorium from this DMX interface. Additionally, this DMX device is a Power-Over-Ethernet device that supports Art-Net. Art-Net is a packetized extension of the DMX protocol which uses Ethernet traffic to generate a DMX command stream. It is configured to merge Art-Net with one DMX physical input so you could have both a physical controller and a network controller simultaneously. The merged or combined DMX output of these two devices would be commanding over DMX independently and would not have knowledge of the other.

Port 1 = DMX in (merged with Art-Net)

Ports 2-4 = DMX Outputs



The image on the next page depicts all of our current DMX fixtures and their associated DMX addresses. All (14) fixtures in the ceiling are LED PAR64 lights in single channel mode ([American DJ PAR Z100 3K](#)). The (4) LED PAR64s on the side walls are nearly identical fixtures of a different brand ([Stairville Z100M 3K](#)). Additionally, we have (4) LED ellipsoidal (aka LEKO) fixtures on the side walls ([Varytec LED Profile 150](#)). The DMX addressing scheme of these lights is referred to as the “Patch” by the control software.



CBC Control Equipment & Configuration

In order to achieve the most flexible and extensible lighting control system, CBC utilizes Obsidian Control Systems software product, Onyx. Onyx is professional grade control software that happens to be free for a small number of universes. Onyx can utilize Art-Net for DMX commanding which enables it to run on any computer at church. Similarly, it can synchronously share control with other computers running Onyx as well as mobile devices using the customizable TouchOSC app. Onyx interfaces with the Elation M-Play expansion console via USB for regular operation. We group fixtures in Onyx to create logical playback scenes such as Choir, Stage Segments, etc as shown on the right. These are placed onto faders on the M-Play where they can be toggled on or off and fine tuned with the touch sensitive fader controls. The M-Play has different layers or “banks” to allow for many possible layout options. Cuelists allow for complex scene progressions (i.e. cues) to be preconfigured and played back which is ideal for plays or special events.



Playback Scene Configurations

DMX Addr	Aim Point (Stage View)	Choir	Stage Right	Center	Stage Left	Communion	Baptistry
1	Choir, Right	100%					
2	Choir, Left	100%					
3	Choir, Right	100%					
4	Choir, Left	100%					
5	Stage, Right		100%				
6	Stage, Center			100%			
7	Invitation					60%	
8	Stage, Left				100%		
9	Stage, Right		100%				
10	Invitation					60%	
11	Stage, Center			100%			
12	Stage, Left				100%		
13	Stage, Center			50%			
14	PAR 2 - C						
15	LEKO 1 tbd						
16	LEKO 2 tbd						
17	Stage, Center			50%			
18	PAR 2 - D						
19	LEKO 1 tbd						
20	LEKO 2 tbd						
21							
21							
23	Baptistry						100%
24	Baptistry						75%

Onyx Elements

Building Blocks

The best way to understand how Onyx works is with a building block analogy. The foundation is the **Patch** which is simply a list of all fixtures, names and their associated DMX address tables. **Groups** are logical associations of fixtures. For example, a choir group would contain all fixtures used to illuminate the choir, in our case that would be fixtures 1 to 4. **Presets** are stored which are a stored set of parameters. In our case, the only parameter we use is intensity. Presets can also be stored with a Group filter applied. A choir preset would then be the Choir group + Intensity setting. Groups and Presets are not used to manage lights during a live show, rather they are used to build playbacks. **Playbacks** are additional programming controls used for live show output. By using groups/presets to record your various playbacks, you can adjust all of playbacks that use them at once if you update the group/preset. This is very powerful.

Playbacks

There are multiple playback types such as *Cuelists* (red), *Submasters* (green), *Inhibits* (yellow-greenish), *Overrides* (purple), etc. The colors noted here are the colors used in Onyx and the M-Play faders for each type. Each type has slightly different behaviors and are well documented in the Onyx help. These playbacks can then be stored on M-Play fader buttons where the touch fader adjusts the degree to which the stored effect is applied. We primarily use Cuelists for faders 1-11, 13-24.



The Inhibit type functions similarly to a grand master; it doesn't add intensity but it limits the intensity output (think of it as a master dimmer control or mute). Setting the Master Inhibit fader to 0% is an easy way to ensure there is no output and as such is the configuration to leave the console in when you end a service. The Master Inhibit fader and its playback button are shown in the figures on the right. The left one is at 100% so the lights are allowed to operate at full power. The one on the right is at 0% so all DMX output is suppressed. You can easily tell this is the case as the Master Inhibit playback button illuminates red when it is at 0%.

Cuelists

Cuelists are playbacks that have multiple playback states called cues. The Cuelists used on the faders generally only have a single cue since we use the toggle function in tandem with the fader. The toggle button only turns on/off the first cue in a cuelist. The one exception is CBC's "Main Cue List" which is intended for complex scene progressions with many cues such as for plays. In the "Cuelist Values" view shown below, our Main Cuelist has four example cues. Each of the items shown (i.e. name, delay, fade, comment, etc) can be modified as needed. The active cue in the list is highlighted in blue and the actual output that will result when the selected cue is run is shown in the side panel on the right. When running events using the Main Cuelist, this is the ideal view for it. You can also link cues, have sub-cues, time phase cues and create cue macros. As you can see, this is a very powerful, yet simple tool to use.

Note: when using the Main Cue List, turn all other cuelists and submasters off.

ONYX Standalone GM:100% FM:100% CL 106 Main Cue List

No	Name	Trigger	Delay	Fade	Fademode	Path	Comment
1	Enter Center Stage	Go	0s	2.50s	Default		Show Prep Example
2	Scene 2	Go	0s	2.50s	Default		Show Cue Example
3	Musical Scene	Go	0s	2.50s	Default		Run when music starts
4	Cue 4	Go	0s	2.50s	Default		End Show

PAR Z100 1 Ch

Number	Intensity
6	Stage Center
11	Stage Center
23	Baptistry
24	Baptistry

PAR 64

Number	Intensity
13	Stage Center
17	Stage Center

Cuelists Macros

Cuelists also have the ability to incorporate Onyx macros. The macros perform the functions listed in the dropdown menu shown on the left side of the following figure. The example below is a Cuelist named “Full Stage Scene” which has a standard Cue named “Full Stage Preset” followed by a macro cue named “Full Stage Scene.” The first Cue runs a transition to the values assigned in the Preset for those lights for the fade period or 3 seconds. This Cue will make all the desired DMX adjustments but does not update the fader levels on the Cuelists used on the console. To do that, we add the second Cue. As you can see, there are several macro actions listed here in this Cue. “Set CL Value” changes the cuelist fader to the desired level (i.e. Stage Right = 90%). This will truly result in the M-Play fader level changing on the console. Multiple macro actions are added to this cuelist to create the desired scene. Cue 2 is set to Follow (or begin immediately after the prior queue) with 0 delay.

Full Stage Scene = Stage Right 90% + Stage Center 100% + Stage Left 90% + Invitation 90%

Note: Scene is not an Onyx term. It is coined here to describe a series of Cues and macro actions design to produce a physical lighting scene with a single button. The Scene is designed to make the working faders reflect the preset.

The screenshot shows a lighting console interface for a Cuelist named "Full Stage Scene" (Cuelist 74). At the top, there are controls for "SET CL VALUE", "CL 3 Stage Right", and "90%". Below these are buttons for "DELETE MACRO", "DEL ALL MACRO", and "APP". The main area is a table with the following columns: No, Name, Trigger, Delay, Fade, Fademode, Path, and Comment.

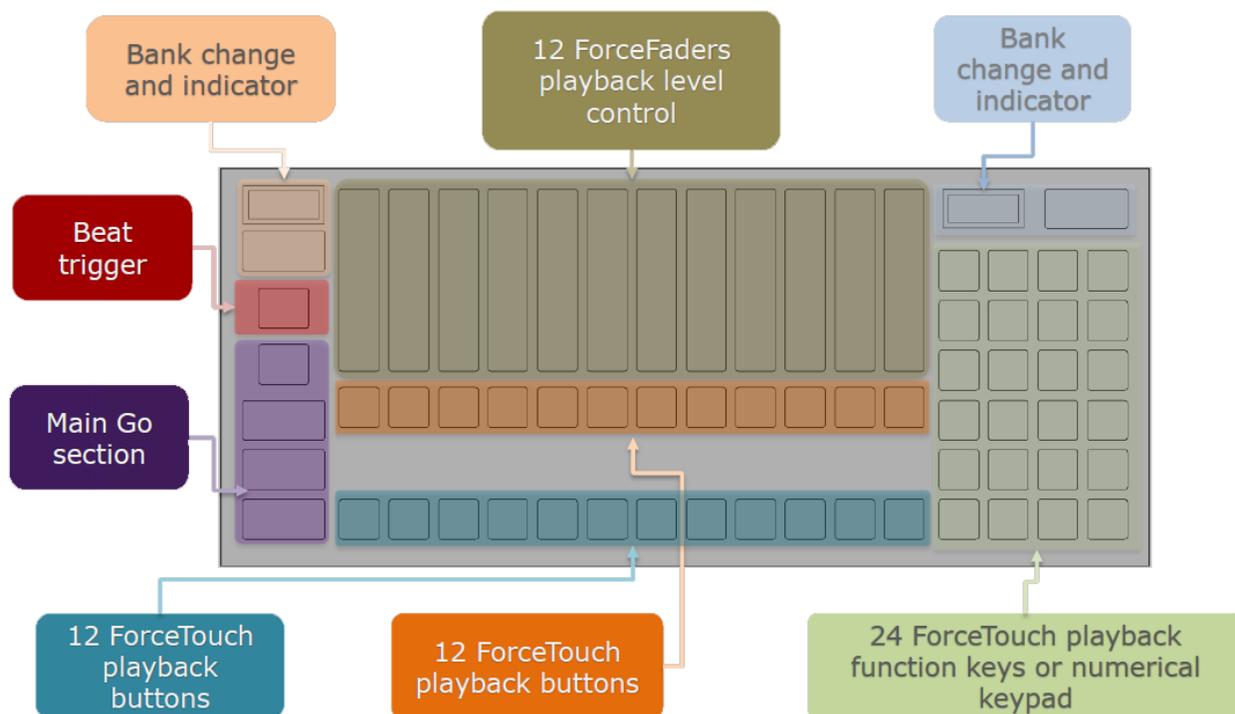
No	Name	Trigger	Delay	Fade	Fademode	Path	Comment
1	Full Stage Preset	Go	0s	3s	Default		
>>2	Full Stage Scene	Follow 0s	0s	0s	Default		
	MACRO	SET CL VALUE Cuelist 3 "Stage Right"			FaderValue 90%		
	MACRO	SET CL VALUE Cuelist 4 "Stage Center"			FaderValue 100%		
	MACRO	SET CL VALUE Cuelist 5 "Stage Left"			FaderValue 90%		
	MACRO	SET CL VALUE Cuelist 7 "Invitation"			FaderValue 90%		
	MACRO	SET CL VALUE Cuelist 12 "Master Inhibit"			FaderValue 100%		

M-Play Overview

Fader Playback Section

The diagram below depicts the layout of the M-Play. The center section has 12 faders, and 2 rows of 12 playbacks. The row of playback buttons directly under the faders are tied to the fader and can be configured to perform various functions in Onyx. We configure these buttons as a **Toggle** for Cuelists and as a **Flash** for Submasters. When pressed, the toggle button enables the playback, turns green during the playback transition and then turns red once fully enabled. Pressing the toggle button again will disable the playback output. The 12 playbacks shaded in blue below can be programmed to do something completely different or could be used to trigger a different effect on the same playback above. We use several of these to apply what we are defining as lighting “scenes” which are just multiple fader settings stitched together like Warmer, Full Stage and All OFF. These “scenes” are created by creating Cuelist macros that set fader levels and activates cuelists. The top left bank change indicator shows what bank the middle fader section is on. We currently use (4) fader Banks.

Bank 1: Main Banks used 99% of the time. **Bank 2:** Contains our side light cues. **Bank 3/4:** Contain 24 Submasters



Keypad Playback Section

The 24 playback buttons on the right side of the M-Play (shown in green above) can be independently switched to a different bank from the fader group. If both sections are on the same bank, the 2x12 buttons in the middle will do the exact same thing as the 4x6 buttons on the right. Generally, you would keep these on its own bank to maximize utility. The fader playbacks provides all the functionality we need; therefore, we don't currently use the keypad playbacks.

Main Go Section

The two buttons in the far bottom left of the M-Play are the **Go** and the **Pause/Back** buttons (shown in purple above). The Go button simply activates or resumes the next cue in the selected Cuelist. Similarly, the pause/back button will freeze the cue where it is on first press. If pressed again, will play the previous cue in the playlist.

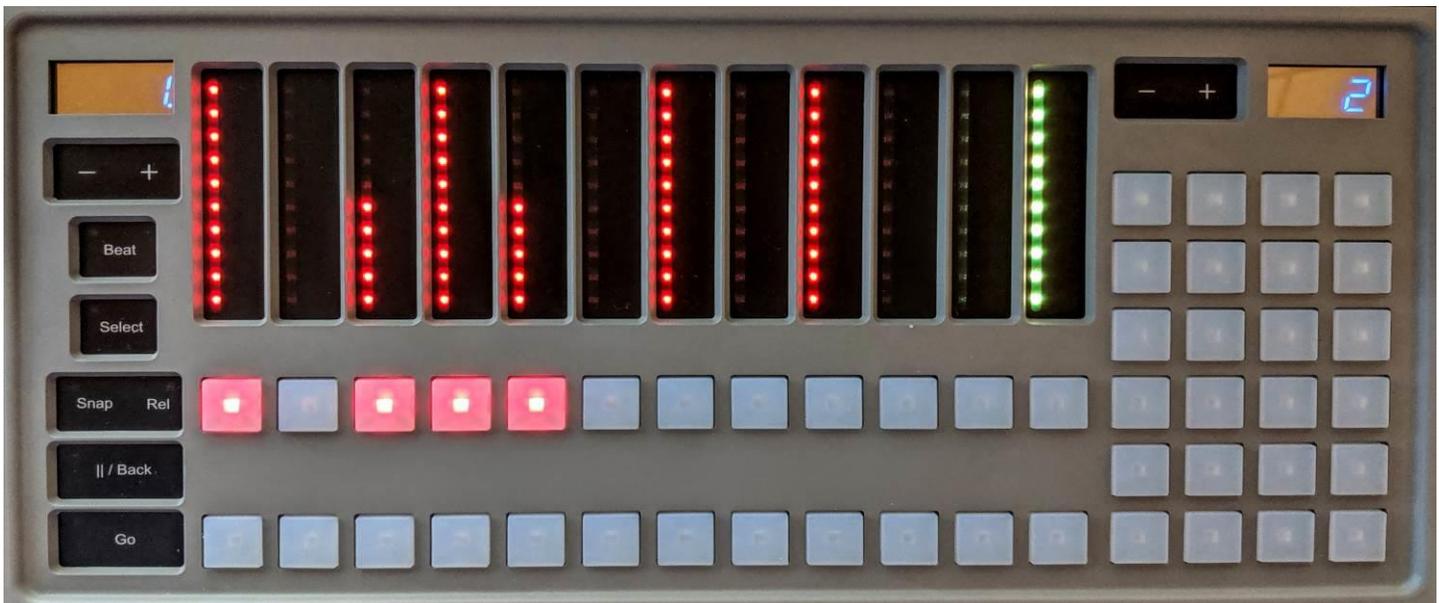
While these buttons can control any selected cuelist, CBC configured it to only control the “Main Cuelist” which we use for any custom sequential cues. This section is perfect for plays or other performances where you can pre-arrange all light progressions and just step through them in sequence with the Go button.

Onyx + M-Play Integration

The first image below shows Bank 1 of our M-Play setup in Onyx. The first row of buttons are the cuelists linked to the M-Play faders. The second row of buttons are the playbacks that are linked to the lower row of buttons under the faders (blue ForceTouch buttons on the M-Play diagram above). Generally speaking, the lower row is where we put macro scenes discussed previously like “Full Stage”, “Warmers”, “All OFF.”

Bank 1	1	1	2	3	4	5	6	7	8	9	10	11	12	
	Choir		Stage Right	Stage Center	Stage Left		Invitation		Baptistry				Master Inhibit	
	-/1	100%	-/1	100%	-/1	100%	-/1	100%	-/1	100%	-/1	100%	100%	
	13	14	15	16	17	18	19	20	21	22	23	24		
				Full Stage Sc							Warmer Scene	All OFF Scene		
				-/1	100%						-/1	100%	-/1	100%

The second image is a picture of the M-Play console which is slaved to the Bank 1 playbacks.. This shows that the Choir, Stage R, Stage C and Stage L cuelists are all active as indicated by the red button just below the fader while fader controls the intensity of the preset stored in that cue. The Choir and Stage Center lights are at 100% while the side stage lights are at 50%. The Invitation and Baptistry Cuelist faders are at 100% as well, but their cues are not active so these lights are off. The Master Inhibit is at 100% so it is allowing the full output to pass. As you can tell, it is very easy to visualize what is happening on stage.



Remote PC Control

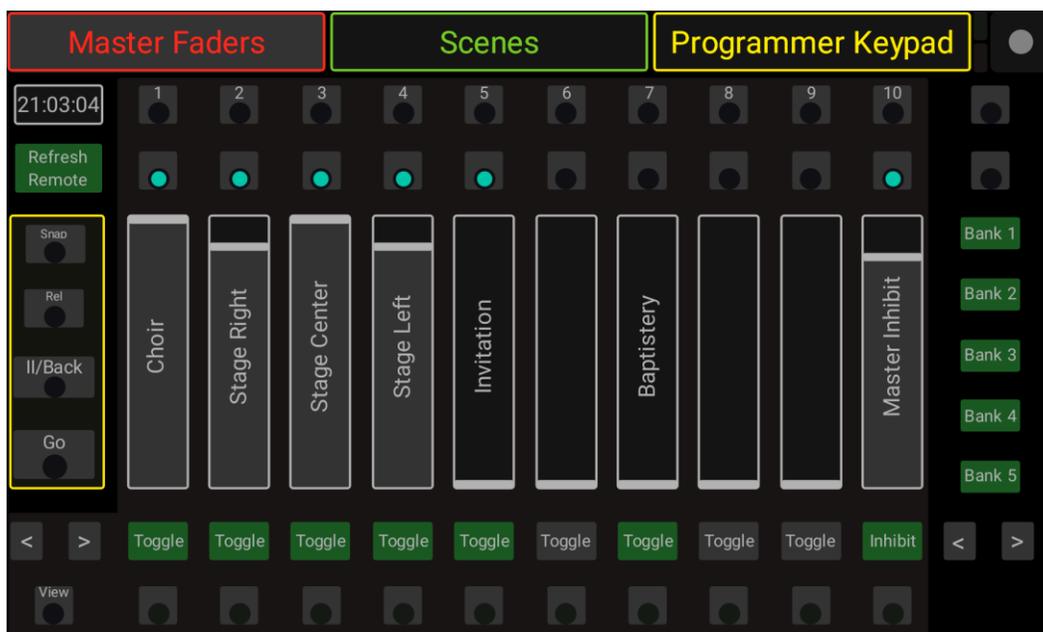
Onyx has a very robust set of options for remote control. For PCs, the best way to remotely control Onyx is to install a local instance of Onyx on that computer. When Onyx loads, select the “Join” option and then select the Onyx instance you want to remotely control. It will appear as a red icon with the computer name. Once connected, Onyx functions 100% the same and both instances remain completely in sync. The only way you can tell the remote control is connected is by looking at the top left corner of the screen and Onyx will show either “Standalone”, “Master” or “Slave” indicating it is in remote control mode. “Standalone” indicates you instance of Onyx has a show running with no remote controllers connected. “Master” indicates your Onyx instance is hosting another remote control device. And “Slave” indicates your Onyx instance has joined as a remote control device to a Master show.



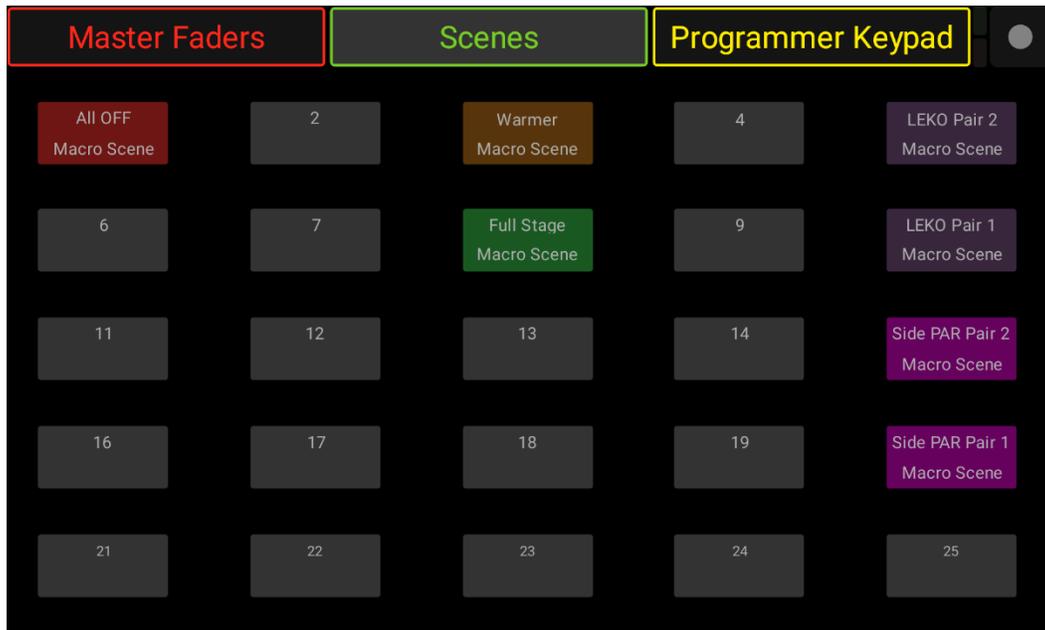
Remote Mobile Control

Onyx has two methods of remote control via mobile devices, an Onyx Remote Controller for iOS and a TouchOSC app for Android & iOS. CBC uses TouchOSC as it works identically on both platforms and allows customization of the layout with an editor. This provides a completely synchronous remote experience; moving a fader or pressing a playback on the M-Play will be reflected in the app and vice versa. The CBC Custom Layout has three tabs: Master Faders, Scenes, and the Programmer Keybad (not included in the Basic layout version). The first row of LEDs in the app indicate when a cue is transitioning (same as the M-Play button turning green). Once the transition is complete, that LED goes off and the LED on the row just below it lights up (same as the M-Play button turning red). See the screenshot of CBC’s TouchOSC layouts below. Note that the playback name is conveniently displayed on the faders themselves.

To connect TouchOSC to Onyx, you need to configure the device in the Onyx OSC settings. The device needs to have a fixed IP address on the network and you must assign a unique TCP/IP port them to connect to on the network (Port 9000 in the example on the right). In the app, enter the IP address of the Onyx PC and the ports configured in the prior step. Once connected, press the “Refresh Remote” button a time or two to get it to synchronize the console state.



The Scene tab contains the first (25) items in Onyx’s Playback section. Some of these scenes are also copied to the lower playback buttons on the M-Play underneath the faders (blue ForceTouch buttons in the M-Play diagram above).



Advanced Info for Programming:

One quirk is that TouchOSC only controls the main console playback section (10 faders) in Onyx and the M-Play controls the submaster playback section (12 faders) in Onyx (technically the M-Play/M-Touch devices are console wing devices, not true consoles). For this reason, we need to copy any playbacks from the M-Play submaster bank to the main bank at the bottom of Onyx for the TouchOSC app to see and control them. Once you know this, it actually is convenient as you can customize the playbacks for the app a little bit separate from the M-Play. Also, if you copy the playback from the M-Play to the Main playbacks, Onyx treats them as one playback that can be controlled from either location so the faders and all associated statuses remain in perfect sync. Additionally, you can assign unique functions to each of the two buttons above and the two buttons below the faders in the Master Faders tab in TouchOSC for each playback.

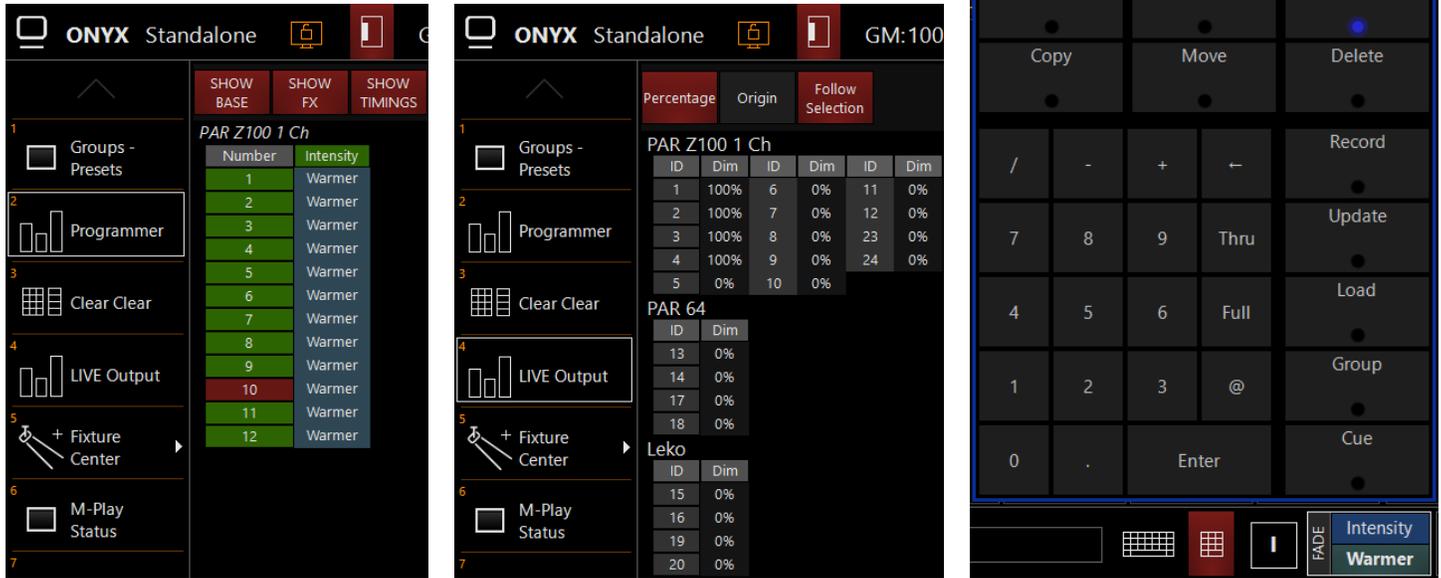
Onyx Programming

The Onyx help section and [Youtube Playlist](#) is excellent for learning programming; therefore, only a few jump starters are provided here. Programming is done from the Onyx software and not the M-Play. The basic building blocks were covered in previous sections, but in summary, the basic flow is: **Fixtures → Patch → Group + Preset → Playback**

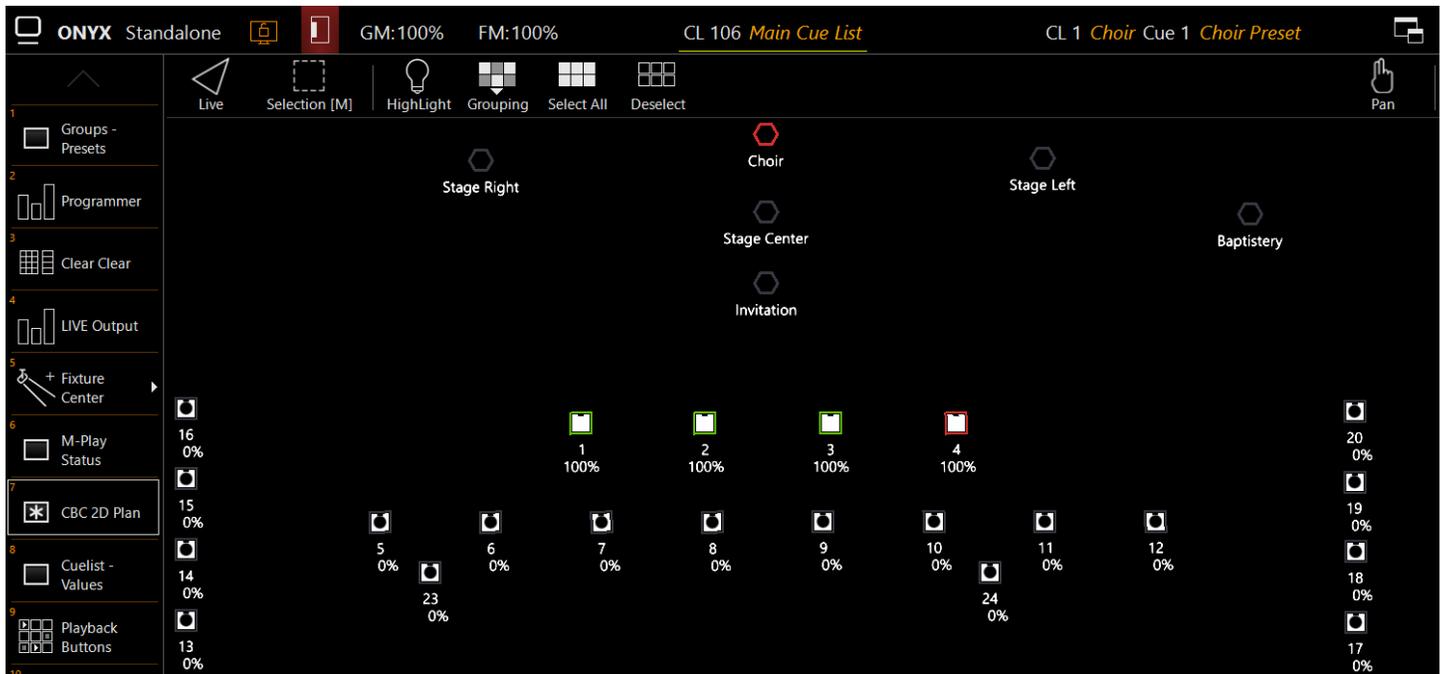
To save a playback select a Group(s) and Preset(s). Then go to the Programmer View to verify the configuration. To store it, navigate to the view where you would like to record it. Then click the Programmer Keypad button (highlighted in red in the screenshot below), click record, select the button you want to save it to and then press Enter on the keyboard.

You can also, copy, move, delete, etc in the same manner. Clear the programmer by pressing Clear Clear when done programming each item.

Once stored, you can test your new button by activating it and then going to the LIVE Output view which shows the actual DMX output by DMX address.



Additionally, you can see the output graphically from the CBC 2D plan below. The fixtures and groups are displayed on a 2D layout and the fixtures represent output on a grayscale from black (0%) to white (100%) intensity.



Equipment List – <S:\Technology\Infrastructure\Lighting Equipment>

- (12) [American DJ PAR Z100 3K \(PAR 64\)](#) – configured for single channel operation
- (4) [Stairville Z100M 3K \(PAR 64\)](#)– we a primary and a backup unit
- (4) [Varytec LED Profile 150 \(LEKOs\)](#)
- (2) [DMXking eDMX4 Pro \(5-pin\)](#) – we a primary and a backup unit
- (1) [Elation M-Play](#) (aka Onyx NXplay, originally Martin M-Play)

Software List

- [Obsidian Onyx Controller Software](#)
 - Intended to run on the Media PC where we typically control lighting
 - Onyx is configured to run automatically and run the last show file when the PC restarts
 - Show Files:
 - Onyx Show Files: <S:\Media {Working}\avteam\Lighting Configs\Onyx>
 - *CBC Show:* [CBC.OnyxShow](#)
 - [Obsidian Onyx Training Video Playlist](#)
 - *Recommended:* 1.1, 2.4&2.5 (Patching), 3.2-5 (Groups), 4.11-16 (Presets), 6x (Everything Cuelists)
 - Misc: Onyx can be controlled completely via command line as well. Custom scripts and even Midi macros can be created to provide advanced levels of automation.
- [TouchOSC](#)
 - TouchOSC Layouts: <S:\Media {Working}\avteam\Lighting Configs\TouchOSC>
 - *iOS:* [M-Play CBC iPad.touchosc](#) (default layout from TouchOSC)
 - *Android:* [M-Play CBC HD.touschosc](#) (modified version of the iPad layout for 1920x1080 screens)

Install/Wiring Notes

Ethernet-to-DMX adapters are used from the eDMX4pro to each of the side wall lights and from there, a 5-pin DMX cable connects the left and right halves of the ceiling stage lights respectively.

- The 5-pin DMX cable runs connecting the lights on the side walls to each ceiling side is different.
 - The window side is a female cable end.
 - The office side is a male cable end.
 - Adapters are used to change genders on the cable that is backwards.

All ceiling stage lights are 5-pin DMX connectors.

All side stage lights are 3-pin DMX connectors.

Future Planning

The 100 Amp DMX dimmer unit in the Computer Equipment Room that used to run all our ceiling stage lights prior to installing LED lights is still available for use. We may put each of the house light circuits on a dimmer channel so we can control house lights via DMX as well. There is already an Ethernet cable from the eDMX4pro unit to this dimmer pack.

We could also install any mood/effect lights on the stage itself if desired. We already have an Ethernet cable from the eDMX4pro unit run underneath the stage that we could use for this.