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Museum Display

Problem: A museum display has a START button. When pressed, a pre-programmed sequence needs to be run which includes lighting changes and some motors that need to run at set times. At the end of the sequence we wait for another button press.

Solution: Our Model 4201 Converter/Controller is programmed to run in stand-alone mode and controls a standard multi-channel dimmer pack to which the lights and motors are connected. The channels that the motors are connected to are set to “non-dim”, this means they will act like relay outputs instead of dimmers.

It is not important which channels the lights and motors are assigned to, but if possible set the dimmers to start with channel 1 or 0 (check your dimmer manual for what your dimmer calls the first channel). Make sure the motor channels are set to non-dim, otherwise the motors or the dimmers may be damaged.

To keep this example simple, let's assume 4 channels total with lights on the first 3 channels and a motor on the 4th channel. There's no reason it HAS to be a motor, it could be anything you can control by turning the power on and off or it could also be one or more of the large number of items directly controllable by DMX (smoke machines, moving lights, strobes, sound systems, etc.). DMX512 has no built-in error checking, so NEVER use it to control anything that could cause bodily harm or property damage if the wrong instructions are received.

For the switch, it will be a simple contact closure (or a TTL level digital signal from some other equipment) and is connected to the terminal strip inside the 4201. One wire goes to the “G” terminal (ground) and the other goes to any of the 4 other inputs. For this example, we'll use the input labeled “7” (7 is the bit position we need to test to see if the switch is pressed). Note that this input is NOT electrically isolated (ground is shared with your dimmers and any computer plugged in to either the USB or RS-232 ports). This is normally not a problem, but in more complex setups you may need to isolate this signal. Contact us for more information.

Next write out a timeline of lighting looks (including motor state), when they should happen, and fade times between them for the entire time of the loop. Then assign each look to a preset

number which will be all we need to know to get that look again (once the presets are programmed into the 4201). There are 127 presets available, you can use them in any order. Be sure to include when to check for the push button.

Timeline

| Time (m:ss) | Function | House | Front | Back | Motor | Preset # |
|-------------|------------|-------|-------|------|-------|----------|
| --:-- | initialize | 100% | 0% | 0% | off | 1 |

(the above will happen once at power-up before the script starts)

Label 0 (labels tell where to start execution)

| | | | | | | |
|-------|---|------|------|------|-----|---|
| --:-- | wait here for START button to be pressed | | | | | |
| 0:00 | begin 5 second fade | 0% | 100% | 0% | off | 2 |
| 0:05 | fade ends (the next event can not start until the fade is done) | | | | | |
| 0:05 | wait for 30 seconds | | | | | |
| 0:35 | begin 10 second fade | 0% | 100% | 30% | off | 3 |
| 0:45 | fade ends | | | | | |
| 0:45 | begin 10 second fade | 0% | 0% | 100% | off | 4 |
| 0:55 | fade ends | | | | | |
| 0:55 | wait 5 seconds | | | | | |
| 1:00 | motor on | | | | on | |
| 1:00 | wait 20 seconds | | | | | |
| 1:20 | motor off | | | | off | |
| 1:20 | begin 2 second fade | 100% | 0% | 0% | off | 5 |
| 1:22 | jump to label 0 (wait for next button press) | | | | | |

Next we convert the presets into hexadecimal (see our other app notes for conversions). The house lights are connected to the first dimmer channel, the lights in the front of the display to the next, then the rear lights, then the motor. The dimmer rack may consider the first channel to be channel 1 and the 4201 a;ways calls the first channel zero. This isn't a problem, once the dimmer is set up we can forget about its numbers. So, for our purposes, House is channel zero, followed by Front, Rear, and Motor

For non-dim channels, you should only output 00 or FF (0% or 100%) to the channel. This way, if the dimmer is accidentally switched from non-dim to dim, the motor probably will not be damaged. We will control the motor separately from the fades, so it should always be set to zero in the presets (there are other ways to do this, see Fade with Masking in the 4201 manual).

| Preset | Data for the 4 channels (in hex) | | | |
|--------|----------------------------------|----|----|----|
| 1 | FF | 00 | 00 | 00 |
| 2 | 00 | FF | 00 | 00 |
| 3 | 00 | FF | 4D | 00 |
| 4 | 00 | 00 | FF | 00 |
| 5 | FF | 00 | 00 | 00 |

The first data column is channel 0, the second column is channel 1, and so on. If you have more than 4 channels, simply extend this table to the right. If you have more presets, extend the table

down. Presets are also numbered in hex, there are 127 available (1-7F hex) and can be used in any order, however keeping them sequential might make it easier to remember.

Note that preset #5 is the same as #1. We could have used #1 in both places, but there's no harm in using another preset and it allows more flexibility for future changes.

Next we write a script to handle the timing. Script commands we will use are:

- :0** label, can range from 0-FF, auto-exec script starts at :0
- TD** delay for a certain amount of time
- F** cross fade from the current levels to a preset (all channels fade together). Time is in **TENTHS** of a second (range 0-FFFF, about 109 minutes max).
- M#** Load a number into temporary storage
- MW** Copy the temporary storage to a channel (instantly change the level of 1 channel)
- J** jump to a label (with or without conditions)
- ;** end of command, all commands end with a semi-colon

The auto-exec script can be up to about 400 characters long, if you need more, you can use a Link command to use any spare preset(s) as additional space (511 additional characters per preset). See our manual for more script commands.

The initialization preset will be sent to the dimmers before the script starts, setting it up will be explained below.

The script will be entered as all one line, but each command will be shown below on a separate line for clarity. It is often best to compose the script in a text editor and then cut and paste it to your terminal program. You can even cut and paste from an e-mail.

The Script

- :0;** Label, all scripts need at least one label and the auto-exec script needs label zero to know where to start.

- J 0 8000 0;** Test the switch, if not pressed, jump to label zero. When the screw terminal labeled "7" is shorted to the ground terminal "G", bit 7 of the Flags will be set to one. This instruction tests only that bit and if it is zero, it jumps to label zero which just starts another test. When the bit goes high, the jump is not performed and the following commands will start executing.

- F 2 32;** Fade to preset 2 in 5 seconds. Fade time is in TENTHS of a second (32 hex = 50).

- TD 0 0 1E;** delay for 0 hours, 0 minutes, and 30 seconds (1E hex = 30)

- F 3 64;** Fade to preset 3 in 10 seconds (64 hex = 100)

- F 4 64;** Fade to preset 4 in 10 seconds (64 hex = 100)

TD 0 0 5; delay for 0 hours, 0 minutes, and 5 seconds (5 hex = 5)

M# FF; load Event (temporary storage) with FF hex

MW 3; Write the date in Event to channel 3 (turn on motor)

TD 0 0 14; delay for 0 hours, 0 minutes, and 20 seconds (14 hex = 20)

M# 0; load Event with a 0

MW 3; Write the date in Event to channel 3 (turn off motor)

F 5 14; Fade to preset 5 in 2 seconds (14 hex = 20)

J 0; As soon as the fade to preset 5 is done, jump to label 0. This will start the loop over (waiting for the START button).

Here's the script all as one line:

:0; J 0 8000 0; F 2 32; TD 0 0 1E; F 3 64; F 4 64; TD 0 0 5; M# FF; MW 3; TD 0 0 14; M# 0; MW 3; F 5 14; J 0;

The space after each semi-colon isn't needed, but it helps readability. If you are running out of room in the auto-exec script, leave out the spaces after the semi-colon and also after a command and the first number ("F 1 0" becomes "F1 0").

:0;J0 8000 0;F2 32;TD0 0 1E;F3 64;F4 64;TD0 0 5;M#FF;MW3;TD0 0 14;M#0;MW3;F5 14; J 0;

Connect the 4201 to your computer using either serial or USB cables (see the 4201 manual for details). You will then need a terminal emulator program such as HyperTerm for Windows or ZTerm for Mac. You could also check our Support web page for additional software that could replace HyperTerm or ZTerm.

Note that backspace DOES NOT WORK with the 4201. It may appear to work on your screen, but it hasn't done what you intended. If you make a typing mistake, simply press RETURN/ENTER and type the command in again. If the 4201 doesn't understand something, it will send an exclamation point ("!") to you.

Now that you can communicate with the 4201, there are a few set up things that should be checked. Press the RETURN/ENTER key and make sure you have a prompt (">"). If an auto-exec script is running, send an asterisk ("*") to abort the script and then try RETURN/ENTER again. The latest firmware revisions will also abort a script when first plugged into a USB port.

Next type the letter "I" and press RETURN/ENTER again. You should see copyright information along with some other settings. You should see that Handshaking is ON and that the number of channels is equal to or greater than the number of dimmer channels that you are using.

The number shown is in hex. In our case, any number over 4 will do (lower numbers speed up script execution, but for this application we aren't concerned with a tenth of a second here and

there). Also, the Playback Mode should be set to 1. This is the number of the preset used to initialize the lights/motor on power up.

To change the handshaking to ON, enter the following command:

H 1

Followed by pressing the RETURN/ENTER key and noting that you get the prompt back.

To change the number of channels to 4, enter the following command:

N 4

Followed by pressing the RETURN/ENTER key (ALL commands are followed by RETURN/ENTER).

To change the Playback Mode, enter the following command:

P 1

Followed by pressing the RETURN/ENTER key and noting that you get the prompt back.

Now enter the following command:

Z

This saves all the setup information so that the next time the 4201 is powered up, all these settings will be restored. You should not have to set these again unless you change the number of dimmers in your system.

If possible, hook up your dimmers and some lights. They don't have to be the display lights and motor, you can use any standard incandescent lights (some dimmers will have trouble with lamps smaller than 40W). This is just so you can see what's going on, and a light is a lot safer than having a motor run unexpectedly.

Now we're going to write the lighting levels into the presets. If you have a lot of channels and/or a lot of presets, this could take some time. Cut and paste is **HIGHLY** recommended.

If you have the dimmers and lights all connected, you'll see the lighting levels change as you type in the values. The simplest way to enter this is to first send the levels to the "Active Memory" also know as preset 0, basically this is what is sent out to the dimmers. When you have all the values for one look entered, we'll copy the Active Memory to which ever preset this look is to be saved in. This will erase all data in that preset, replacing it with the current levels your lights are displaying.

The commands we'll be using are:

W 0 Write levels into one or more channels starting with channel 0

C 0 1 Copy all the levels from Active Memory (preset 0) to some other preset (in this case, preset 1)

So, let's do preset 1:

W 0 FF 00 00 00

You remembered to press your RETURN or ENTER key at the end of that, right?

The lights plugged into the first channel should now be full on and everything else off. They

would have changed AS you typed the levels in. This is why backspace doesn't work, the 4201 executes commands as they're received to save time, so it can't undo what it's already done.

If you want to play with different levels before saving, simply reenter the line with the new levels. You can also change an individual channel by giving the W command with a different starting address. For example, if you want to just change channel A7 (hex) to a level of 23 (hex), you'd enter the command:

WA7 23

Once you're happy with the levels, copy them to preset 1:

C 0 1

This will copy all 512 channels, even if you're only using a few.

Now, go back to the W command and do the same thing for all the other presets.

Once you've finished all the presets, you need to write the auto-exec script and test it out. The simplest thing is to add the command to write the script to the beginning of the script in your text file, and then cut and paste the entire thing at once. So, the line would look like:

XW 0 :0;J0 8000 0;F2 32;TD0 0 1E;F3 64;F4 64;TD0 0 5;M#FF;MW3;TD0 0 14;M#0;MW3;F5 14; J 0;

Followed by the RETURN/ENTER key, of course. The "XW 0" at the beginning means Write the following to Script #0 (the auto-exec script). Note that you need a space after the zero and before the colon.

Now it's time to see if this all works. For now we'll start the script manually, but it will also start automatically the next time you power up the box (unless you power it by plugging it into a USB port, that will abort any script or fade running if you have the latest firmware). Make sure you have a switch hooked up to the terminal strip to start things going, or this could be quite boring.

Type the following and your script will be running:

XE 0

Followed by RETURN/ENTER. The command means Execute Script #0. The script will now be running. If an error is detected, a message will appear on your screen telling you where in the script the error is and the script will abort. You should fix the error, write it again, and then try running it again.

Don't forget to press your START button.

When a script is running, any commands you type will be held in a buffer until the script is done (in this case, never). If you type more than about 220 characters, the 4201 will tell your computer to stop sending, and you won't be able to type any more commands into the box. This means you won't be able to send the ABORT command to stop the script. If this happens, unplug the box power (and USB cable, if used) and then plug it back in. The script will start again but the buffer will now be empty.

To stop a script that is running, type an asterisk (“*”). That will halt any fade or script and discard anything that was in the buffer.

Now you can change levels in one or more presets and/or change the script. There is no need to re-enter all the presets and the script, they will all be saved from before. You only need to enter what you need to change.

Now we’re ready for the show. Unplug the 4201 from your computer, and if it isn’t connected to your dimmers and switch, go connect it. If the AC adapter is plugged in, unplug it, wait a few seconds, then plug it back in. The house lights should come on full, everything else off, and the 4201 will be waiting for the *START* button. Press the button and see how it looks.

As always, feel free to contact us with questions. If you purchase a 4201 from us, we’ll even program a simple script into it before shipping it to you, if you’d like.

Note that updating the firmware in the 4201 will erase the auto-exec script, all the settings, and preset #1. As long as the 4201 is working to your satisfaction, there is no need to update the firmware.