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Intelligent Architectural Lighting

There are several types of architectural lighting controllers in use. Some can directly control lights, if you have that type you won't need our Converter/Controller. Others can execute small programs and output commands for each lighting level change for each channel. For these, see the "W" command in the 4201 manual, it may be all you need. Then there are those that can only output a fixed text string for each command. The example below covers those. If you don't have an architectural control, you can also control the 4201 with a rotary switch, toggle switches, buttons, etc. That is covered in another application note.

Problem: A building has an intelligent (computerized) architectural lighting control system. This system can not directly control DMX512 dimmers (or other DMX512 controlled devices). The system can, however, output simple fixed text strings through a serial (RS-232) port.

Solution: Our Model 4201 Converter/Controller is connected to the architectural system via the RS-232 connection. The 4201 supports 4 baud rates, 9600, 19200, 15400, 38800 which allows connection to pretty much any computer with a serial port. The 4201 can have up to 127 preset lighting levels (each preset supports up to 512 channels of lights) stored in non-volatile memory, ready to be called up with simple commands. Through masking (in our latest firmware), each preset can be used to control a subset of all the lights. Changes can be made as smooth fades taking up to 109 minutes or as short as milliseconds.

It is not important which channels the lights 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).

To keep this example simple, let's assume 4 lighting channels total. There's no reason these have to be lights, they could be anything you can control by turning the power on and off or they could also be one or more of the large number of items directly controllable by DMX512 (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.

Note that there is no electrical isolation between the ground on the RS-232 connection and the

dimmer ground. In some situations ground currents (“ground loops”) can cause erratic behavior or even damage to equipment. If you find you have a problem with this, you can either isolate the RS-232 or the DMX side of the 4201. Contact us for assistance.

If all you wish to do is raise/lower lights (up/down commands for one or multiple channels), see the “+” and “-“ commands in the 4201 manual, they may be all you need. Every time you send one of these commands, the selected channels will either increase or decrease by amounts you choose. Sending the command several times in a loop will make the lights ramp up or down smoothly. The lights will NOT wrap from full on to full off if you try to increment past full on or decrement past full off.

Lets assume you have some set lighting levels you’d like to be able to implement with simple commands. Write out a list of the lighting looks (final level of all lights for each command), 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. If some of your commands are only to change a subset of lights, you will need an additional preset for each subset.

For the example, we’ll assume the 4th light sometimes changes with the first three, and sometimes changes on its own. For these, the numbers in the other columns don’t matter (but still have to be there). You can use the same preset for some of the lights and later for all of them, the channels changed are selected later in the command.

Preset #	function	Levels for the 4 channels			
1	initialize	0%	0%	0%	0%
	(this preset will be sent to the dimmers once on power-up)				
2	all up	100%	100%	100%	100%
3	night light	20%	0%	0%	90%
4	lecture	20%	100%	0%	0%

We need to convert the presets into hexadecimal (see our other app notes for converting percent to hex). The dimmer rack may consider the first channel to be channel 1, the 4201 always calls the first channel as zero. This isn’t a problem, once the dimmer is set up we can forget about its numbers. So, for our purposes, our lighting channels are 0-3.

For any 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 or other device will probably not be damaged.

In order to be able to use subsets of channels, we need a preset for each of the subsets. In our case, that would be one to enable channels 0-2 and a separate one for channel 3. To enable channels to change, place non-zero numbers in those channel locations in the preset while the rest are set to zero.

Preset	levels for the 4 channels (in hex)				
1	00	00	00	00	
2	FF	FF	FF	FF	
3	33	00	00	E6	
4	33	00	00	00	
10	01	01	01	00	(enable channels 0-2)
11	00	00	00	01	(enable only channel 3)

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.

The initialization preset will be sent to the dimmers as soon as the 4201 is powered up, setting it up will be explained below.

You may load presets using your lighting controller if it's smart enough, or temporarily connect the 4201 to your computer and load them that way. To load them from your lighting controller, see the "W" command in the 4201 manual. We'll assume you're using your computer for now.

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. If there was an auto-exec script running, you probably don't want that for this application. Type "XW0" followed by RETURN/ENTER and that will erase the script.

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 most applications 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 on power up.

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

H 1 (your application might want this off, be careful)
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 final room lights, 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 if you're controlling any motors, etc., 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 00 00 00 00

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

The lights plugged into all the channels should now be off. If they were on, 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.

The presets you just stored will be saved through power up/down cycles. They will only be changed if you change them (preset #1 will be also erased if the firmware is updated).

When you have finished making all the copies, test that they all look ok. Enter the following to change all the levels to preset 2:

P 2

Remember to always end a command with the RETURN/ENTER key. The lights should have instantly changed to whatever levels are stored in preset 2 (in our case, all on). You can try this for the other presets you've stored, also.

The "P" command is a simple one you can use from your controller. It will change all the lighting channels to the new preset levels instantly. From C this would look like "P %X\r". The space after the P is optional, the '\r' is not optional. You may add '\n' if you wish, this will be treated as white space. Also, ALL NUMBERS ARE IN HEX, upper/lower case ok.

There is also a Fade command, the simplest form will fade all channels from their current levels to the new preset levels over some period of time you specify. The format of the command looks like:

F 2 10

Followed by a RETURN. The first number is the preset number to fade to, the second number is the length of time to take for the fade in TENTHS of a second, the example has 10 hex which would be 1.6 seconds. The valid range for the fade time is 0-FFFF (instant to over 109 minutes).

The command format in C would be "F %X %X\r". Note, the white space between the two hex numbers is NOT optional.

The more interesting form of the Fade command lets you specify which channels it applies to. This is done through what we call masking (see the 4201 manual). We saved two presets (10 & 11) to use as masks. To fade only channels 0-3 to preset 2 over 1 second, you would use this command:

F 2 A 10

And to fade only channel 3 you would use:

F 2 A 11

Simple, right?

When a fade or script is running, any commands you send will be held in a buffer until the fade

or script is done. If you send more than about 220 characters during this time, the 4201 will tell your computer to stop sending (RTS/CTS handshaking), and you won't be able to send any more commands to the box. This means you won't be able to send the ABORT command to stop the fade or 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, send an asterisk (“*”). That will halt any fade or script and discard anything that was in the buffer. Note: You can actually send the ‘*’ even if the buffer is full, but you'll have to ignore handshaking on your end for that one character.

Another command of interest would be the “W” command. This will let you write directly to the dimmers or to a preset. You may change preset values as often as you wish, but there are two cautions. Since presets 1-7F are stored in EEPROM, any writes to them are relatively slow (1-5mS per byte). Also, the EEPROM has a life of at least 1 million changes per location, this is not infinite. See the NV-RAM notes in the manual for more details.

As always, feel free to contact us with questions. If you purchase a 4201 from us, we'll even program a simple script and/or your preset levels 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.