



ServoDMX

OPERATING MANUAL



Check your [firmware version](#). This manual will always refer to the most recent version.



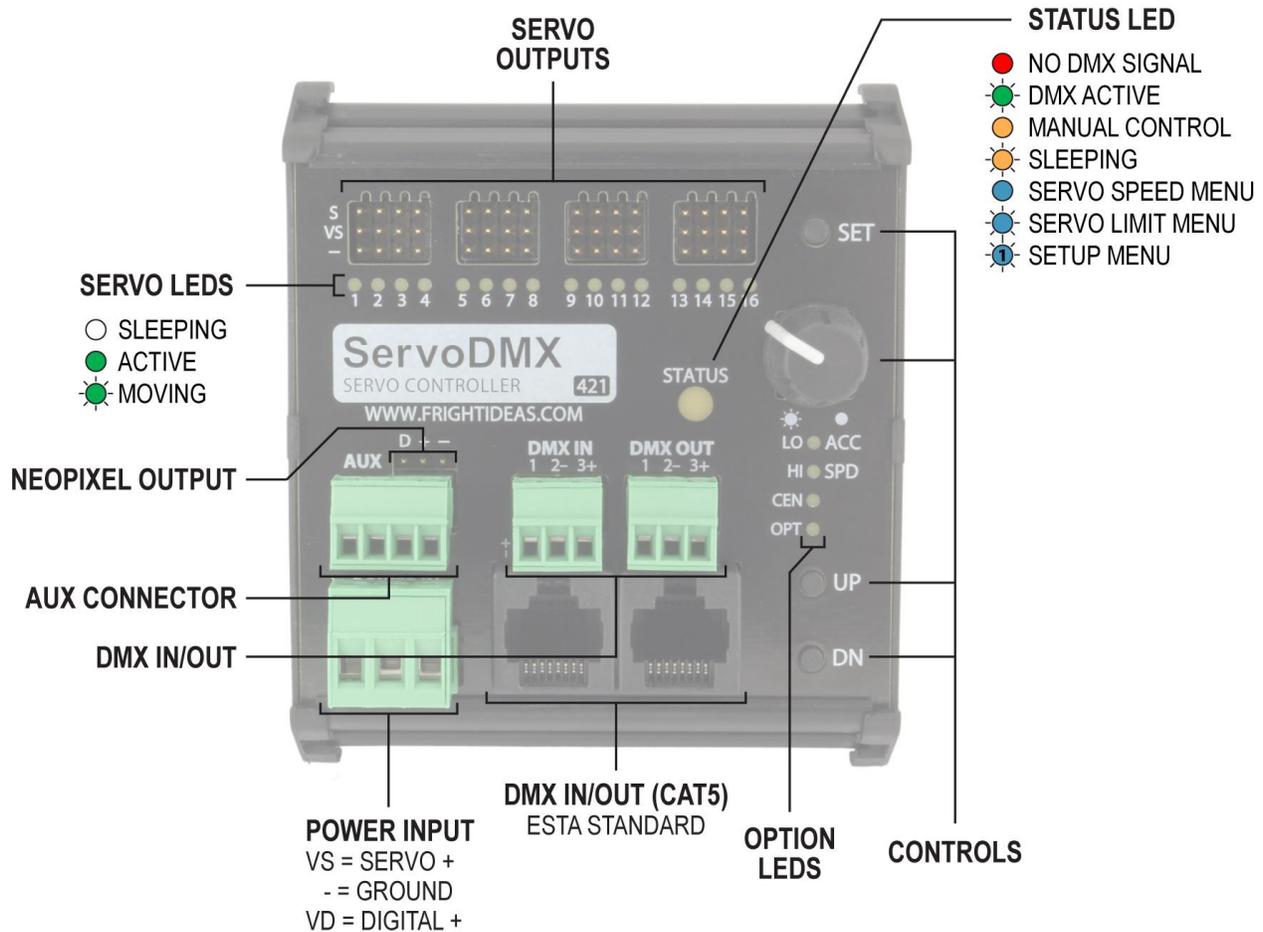
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Getting Familiar with your ServoDMX

Connections and Controls



CONNECTIONS AND CONTROLS	
Power Input	There are separate connections for Servo power and Digital power if required.
DMX In / Out	Terminal block connections for DMX Input and Output.
DMX In / Out CAT5	CAT5 DMX In / Out connections. Uses standard DMX over CAT5 pinouts.
Option LEDs	These LEDs indicate which option is being adjusted during servo setup.
Controls	Connect to an accessory board to provide indication via lights, servos, more.
Status LED	The Status LED indicates the current state of the ServoDMX. The possible states during normal operation are shown above.
Servo Outputs	16 servo outputs. Some outputs may be disabled, depending how many were paid for at the time of purchase.
Servo LEDs	The Servo LEDs show the state of each servo. They are also used to represent setting values in some of the menus.
NeoPixel Output	The NeoPixel output on a 3 pin servo header.
AUX Connector	Terminal block connection for the NeoPixel output and an audio input.

Checking your Current Firmware Version

It's important to keep your firmware up to date to fix any bugs, get all the latest features, and to stay current with this manual. This manual will always refer to the most current firmware. If you're trying to use it as a guide for a different version of firmware you may find things don't make sense.

To know if a firmware update is required you need to know the current version running in your unit. You can determine that by watching the LEDs at boot or using the ServoDMX 421 Utility in Director. Watching the LEDs is the fastest way if the device is easily accessible. If your version is different from the one that's available, you should update. You can see what the current version is and find out what's change online at help.frightideas.com/421.

Determining the Firmware Version via the LEDs

The ServoDMX shows its current firmware version as it's booting up. See the [Boot Sequence](#) table for more information.

Determining the Firmware Version using the ServoDMX Utility and a Director Connect

You'll need a Director Connect to use this option. The Director Connect should be connected to a Flex or FlexMax, and the ServoDMX should be connected to the DMX terminals.

- 1) Pull down the Connect menu and select *ServoDMX 421 Utility*.
- 2) Enter the DMX Address of the ServoDMX you want to check.
- 3) Click the *Get ServoDMX Info* button. A box should pop up showing the current version as well as some other info.

Upgrading your Firmware

The firmware update process is different depending on if you are using our Director software or not.

Using our Director software with a Director Connect

Use the same ServoDMX 421 Utility you used to check the firmware version. Instructions are at the top of the form.

Using our Update Utility on a PC, Mac, or Linux

We have a utility that can be used with Generic DMX Interfaces and Enttec Pro's. It works on Windows, Mac, or Linux. We will post it for download soon. Please feel free to contact us through our website if it's not posted yet.

You can always download the latest firmware from help.frightideas.com/421.

Connections

Power Supply Inputs

The ServoDMX has two power supply inputs, one for the servos and one for the digital logic. In many cases these inputs are connected to the same power supply, but in some cases separate supplies may be required.

Servo Power (VS)

This power is sent directly to the Servos. Generally, that power supply will be 5 or 6 volts, but can be up to 7.5 volts. The input is reverse-polarity and over-voltage protected, so if you mistakenly connect a 9 or 12 volt power supply to this input the ServoDMX will not let that voltage reach your servos and cause damage.

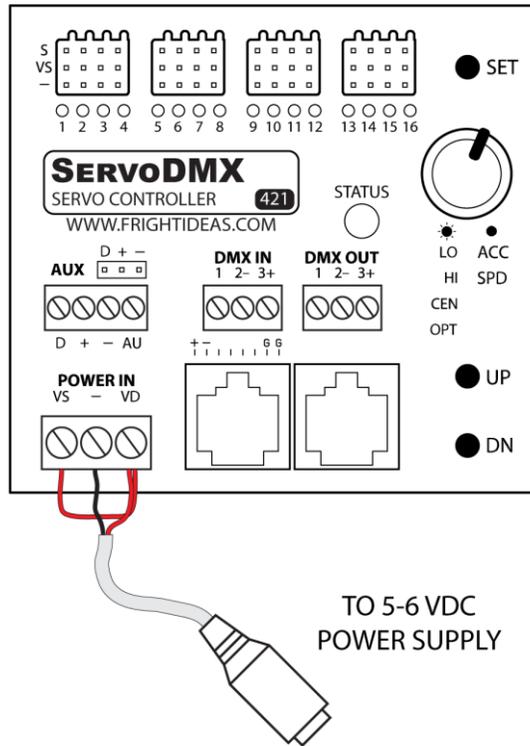
If required by the servos, this input can handle 10 amps steady. Short peaks above 10 amps will also be fine. If you're using a power supply larger than 5 amps, please make sure you connect the power supply wires directly to the terminal block. Do not go through a 2.1mm barrel connector adapter or pigtail.

Depending on the rating and quality of your power supply, distance from the ServoDMX, and gauge of the wires, the voltage the ServoDMX receives will drop during periods of high current. This will occur when multiple servos are under strain and moving at the same time. This may not affect the servos in a noticeable way, but if it drops too low there won't be enough voltage for the digital logic. If the voltage dips below 4 volts the ServoDMX could reset or act strange. This is the reason for the separate Digital Power input.

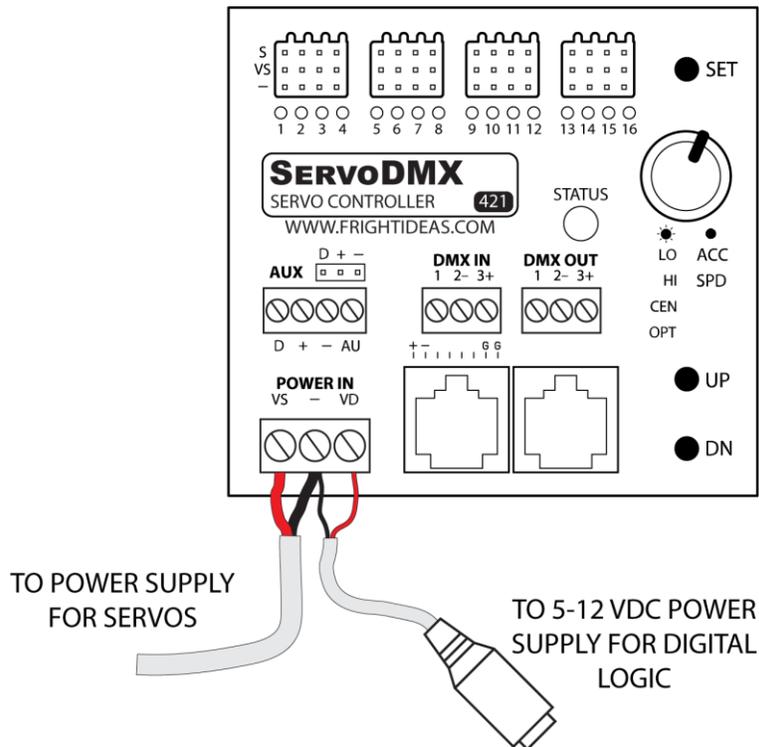
Digital Power (VD)

This input powers the microprocessor. Its input voltage range is 5 to 12 volts. It will require at most 100mA of current, but generally much less than that. This input is reverse-polarity protected, but not over-voltage protected.

If you are having issues with the ServoDMX resetting, it may be wise to have a separate 9 or 12 volt power supply connected to this input.



Wiring Diagram Showing a Shared Power Supply



Wiring Diagram Showing Separate Power Supplies

DMX Connections

The diagrams below illustrate a typical programming setup using our Director software and Director Connect. Once the prop or scene has been programmed the animation is loaded into the controller and the computer and Director Connect can be removed.



Typical Real-Time setup using a Flex/FlexMax with RJ45 DMX Jacks

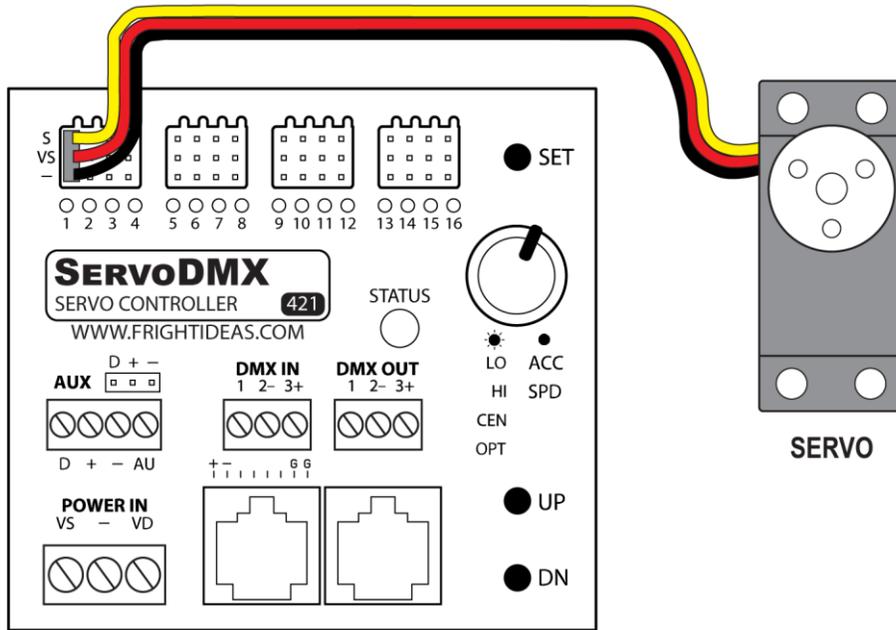


Typical Real-Time setup using an older Flex/FlexMax with DMX Terminal Blocks

Servo Outputs

Servos plug into the servo headers at the top of the ServoDMX. Make sure the negative wire, which is usually black or brown, is on the bottom.

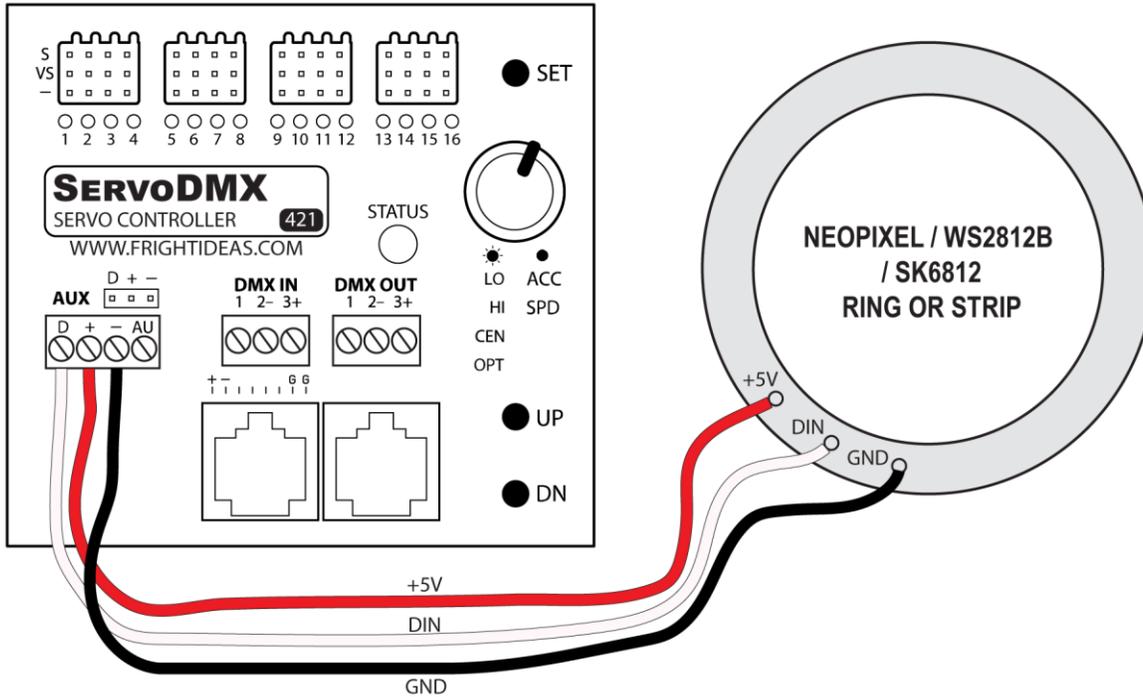
If you purchased an 8 or 12 output model, only that number of servos will be enabled. If your ServoDMX was included with a prop, like a talking skull, it may only have 5 servos enabled.



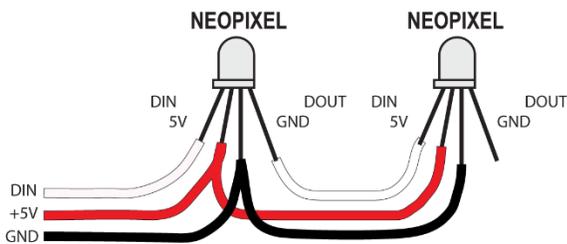
NeoPixel Output

NeoPixels, also known as WS2812B or SK6812 LEDs, are RGB LEDs that are available in many shapes and sizes. They are a great way to add multi-color lights to your character or display. The number of NeoPixels channels is limited to 8. You can control the color and brightness of each NeoPixel channel via DMX.

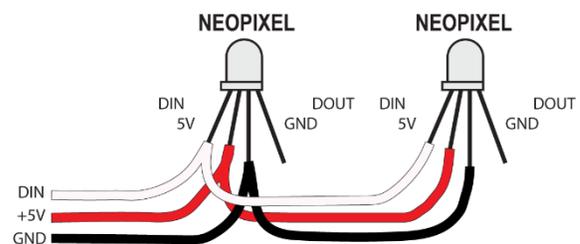
NeoPixels must be wired into the AUX terminal block as shown below. The same connections are also available on the 3-pin header just above the AUX connector, if you prefer to use those.



If you want multiple NeoPixels to do the same thing, you can wire them in Parallel. Then a single set of 3 DMX channels will control them. If you want to control each NeoPixel you can wire them in series. Then each successive set of 3 DMX channels will control the next NeoPixel. The diagram below shows NeoPixel LEDs. For more information on how NeoPixels are addressed on the DMX bus see [DMX Channel Layout](#).



NeoPixels in Series



NeoPixels in Parallel

Audio Input (AutoTalk)

The ServoDMX also has an audio input that can be used to automatically sync a servo's movements to an audio signal. This is usually used to move a mouth in sync with a vocal track.

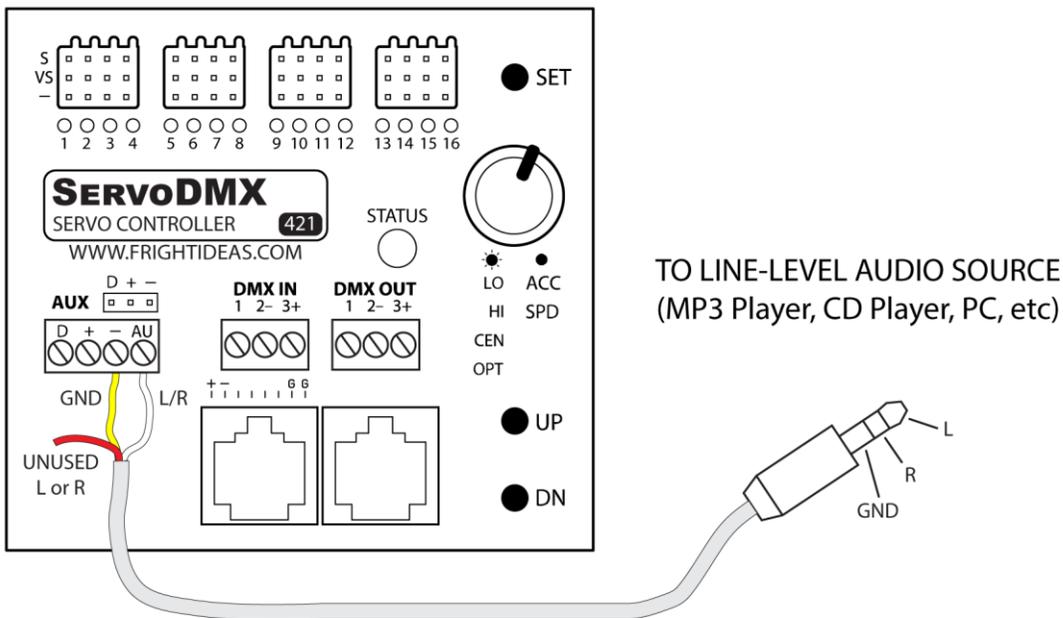
Connect the servo you want the audio to control to Servo Output 1. Then set the Operating Mode to DMX with AutoTalk. You can adjust the audio sensitivity in the Option Menu.

Audio Notes

Make sure the audio signal you feed into the ServoDMX only has a vocal track. Normalize the signal so that it's rail to rail in your audio editor. Not to the point of distortion, but just before. If you also have sound effects or music, that must be present only in the other channel that's not connected to the ServoDMX.

Audio Connections

To connect the audio signal to the ServoDMX you need a 3.5mm or RCA cable with one end cut off. Connect the audio cable to the AUX connector as shown below.



AUDIO CONNECTIONS	
AUX Connector	Audio Cable Signal
(-) Terminal	Ground
(AU) Terminal	Left or Right Signal

Boot Sequence

As the ServoDMX boots up it displays some useful information on the STATUS and Servo lights.

STATUS LED STATES AT BOOT UP	
Status LED	Boot Sequence Step
	Step 1 - Servo Voltage Check The first thing the ServoDMX does is check to see if the servo voltage is too high. If it is, the Status LED will blink red rapidly to let warn you. This voltage will not actually make it to your servos to cause damage. Simply connect a power supply that is below the maximum servo voltage.
	Step 2 - Current Version Display As long as your servo voltage is below the maximum this is the first indication you will see. At this time, it will indicate the current firmware version on the Servo LEDs. It will show two patterns. If it turns on the 1 LED, followed by the 2 & 3 LEDs, that would be version 1.23. If it flashes the 2 LED followed by the 1 and 5 LEDs, that would be version 2.15.
	Step 3 – DMX Address The Mode LED will turn blue and indicate the current DMX address. Each digit of the DMX address will be shown on the Servo LEDs. 10 is equivalent to 0. If the address is 9, just the 9 light will flash. If the address is 64, 6 will flash, followed by 4. If the address is 207, 2 will flash, followed by 10, then 7.
	Normal Operation After displaying the DMX address the servos will start up as described below. The Status LED will change to one of the states in the Operation section.

Servo Startup

After the ServoDMX boots up it will start to enable the servo outputs one by one. It does this to make sure the power supply isn't overloaded by turning them all on at once.

If you know certain servos will always sag into a certain position when they are powered off, set that position as the Startup Position. This will prevent the servo from jerking to center at start-up, and instead allow the ServoDMX to move it into position using your Speed and Acceleration limits. For more info see the Installer Setup section of the [ServoDMX Setup Menu](#).

Operation

Normal Operation

After start-up is complete the ServoDMX will move the servos to the positions in the DMX signal. If there is no DMX signal the status light will turn solid red and the servos will stay where they are.

As the positions in the DMX signal change, the ServoDMX will move the servo towards the position while taking any servo limits, maximum speed, and maximum acceleration settings into account. It will do this at close to 15 bit resolution. So even though the DMX position signal coming in is 8 bit, all servo movements between positions are calculated at 15 bit. This, combined with the acceleration and speed controls, have a dramatic effect on how smoothly the servo moves.

System Sleep

If the DMX signal is not present for the length of the System Sleep Timer, all servo power will be removed to let the servos rest. The Status light will start to blink orange. Once a DMX signal comes back the ServoDMX will return to Servo Startup in the Boot Sequence.

STATUS LED DURING NORMAL OPERATION	
Status LED	Description
 STEADY	Good DMX Signal The Mode LED will flash steady green when a DMX signal is present.
	No DMX Signal The Mode LED will stay solid red when no DMX signal is present.
 SLOW BLINK	Sleeping If the Sleep Timer has expired the device will power off the servos and enter sleep mode. It will wake up again once one of the servo positions change, or one of the controls are touched.
?	Button Pressed or Knob Turned The buttons and knobs can be used to enter menus or adjust servo settings and positions. See the Controls section for more information.

Controls

During Normal Operation, you can use the controls as described below.

IDLE CONTROL OPTIONS	
Status LED	Description
	<p>Manual Servo Control</p> <p>The UP/DN buttons can be pressed at any time during normal operation to select a servo you'd like to control manually. The Status LED will light solid orange in this mode. Once a servo is selected, you can rotate the knob to control the servo's position. If needed, repeat with other servos. This can be very useful for troubleshooting servos or posing a prop into a certain position. If a DMX signal is present the ServoDMX will return to normal operation after about 5 seconds of inactivity. If there is no DMX signal the servos will stay in this position indefinitely.</p>
	<p>Virtual Servo Center</p> <p>Hold UP and tap SET to reset ALL servos to their virtual center positions. This is the calculated center position between the limits you have set, including any center adjustment you have applied. This is the position the servos would hold if the DMX signal is exactly 50% (128).</p>
	<p>True Servo Center</p> <p>Hold UP and SET for 5 seconds to turn on all servos and move them to their true mechanical center. The ServoDMX will output a 1.5ms pulse on all outputs in this mode. This is the servo's true center position regardless of whatever limits you have set. The ServoDMX will stay in this mode until you tap SET to return to the Idle menu.</p>
	<p>Set Servo Speed / Acceleration</p> <p>First select the servo you'd like to adjust using the UP/DN buttons. Then tap SET to enter the servo Speed / Acceleration adjustment menu. The Status LED will turn solid blue. Select the servo you'd like to adjust using the UP/DN buttons, then tap SET. Continue reading at Servo Max Speed and Acceleration Menu.</p>
 STEADY BLINK	<p>Set Servo Limits / Center / Sleep Mode</p> <p>First select the servo you'd like to adjust using the UP/DN buttons. Then hold SET for 2 seconds to enter the servo limits menu. The Status LED will start flashing blue. Use the UP/DN buttons to select which option you'd like to adjust. Continue reading at Servo Limits / Options Menu.</p>
 x1	<p>ServoDMX Setup Menu</p> <p>Hold DN and tap SET to enter the menu where all the global settings and DMX address are set. Continue reading at ServoDMX Setup Menu.</p>
	<p>Reset Selected Servo's Settings</p> <p>Make sure the servo you'd like to reset to defaults is selected. If you rotate the knob it should move. Then hold SET for 5 seconds until the status light turns red to reset the selected servo to defaults. All limits and options including speed and acceleration will be reset to default.</p>

Settings

Servo Limits / Options Menu

To adjust a servo's limits, first select the servo by pressing UP / DN. Once you have the correct servo selected, hold the SET button for a few seconds. The STATUS light should start blinking blue and the LO light on the right side will start flashing, indicating you are adjusting the servo's low limit. The servo will also move to the currently set low limit position.

Rotate the knob to adjust the currently selected option or leave the knob alone to keep the previous setting. Use the UP/DN buttons to select a different option to adjust. As each option is selected, the servo will move to that position.

To exit the option menu and save any changes, tap SET.

SERVO POSITION LIMITS, CENTER POINT, AND OPTIONS	
Option LEDs	Description
LO  HI <input type="radio"/> CEN <input type="radio"/> OPT <input type="radio"/>	<p>Low Position Limit</p> <p>When the LO light is flashing, the knob will adjust the servo's low limit. This is the position you want the servo to be in when the DMX value is 0.</p>
LO <input type="radio"/> HI  CEN <input type="radio"/> OPT <input type="radio"/>	<p>High Position Limit</p> <p>When HI is flashing the knob will adjust the servo's high limit. This is the position the servo will be in when the DMX value is 255.</p>
LO <input type="radio"/> HI <input type="radio"/> CEN  OPT <input type="radio"/>	<p>Center Adjustment</p> <p>This is the position the servo will be in when the DMX value is 128. By default, this is the position directly between the Low and High limits.</p> <p>In some cases, you have more mechanical freedom in one direction than the other. This would naturally locate DMX 128 off-center. Or you may want to make a slight tweak to the center position of a set of eyes or head, without having to shuffle between the Low and High limits multiple times.</p> <p>Use the knob to adjust the servo's center point. This will not change your Low or High limits. Instead, the ServoDMX will use scaling to make sure DMX value 128 lands in this position. Note that NO adjustment at all, is represented by lights 8 and 9 being on.</p>
LO <input type="radio"/> HI <input type="radio"/> CEN <input type="radio"/> OPT 	<p>Servo Options</p> <p>Rotate the knob to select your setting.</p> <p> Servo Sleep Enabled (Default) 1 2 3 4 The servo signal will stop if the servo position hasn't changed. This will usually let analog servos relax so that they last longer.</p> <p> Servo Sleep Disabled 1 2 3 4 The servo signal will remain on regardless of the servo's activity. Use this for movements where the servo must remain active at all times to hold its position.</p>

Servo Max Speed and Acceleration Menu

To adjust a servo's maximum speed or acceleration, first select the servo by pressing the UP / DN buttons. Once you have the correct servo selected, tap the SET button. The STATUS light should turn solid blue and the LO / ACC light on the right side will turn on, indicating you are adjusting the servo's acceleration.

If you do not have a DMX source connected, the servo will start jumping between its low and high limits at full speed. It will do this so you can see how your changes affect the movement. If you have a DMX source connected, use it to move the servo to see how your changes affect the movement.

NOTE: You should set your limits before trying to adjust speed or acceleration.

SERVO ACCELERATION AND SPEED LIMITS	
Option LEDs	Description
<input checked="" type="radio"/> ACC <input type="radio"/> SPD	Max Acceleration Rotate the knob to adjust the acceleration limit of the selected servo. You can use this to make sure the servo never changes speed or direction too fast, regardless of what the DMX signal tries to make it do. Limiting the acceleration of servos also has a dramatic smoothing effect on the movement. If you can limit the acceleration even a little bit, it will make the servo movements much less jerky.
<input type="radio"/> ACC <input checked="" type="radio"/> SPD	Max Speed Rotate the knob to adjust the maximum speed of the selected servo.

ServoDMX Setup Menu

The setup menu is where you'll set the DMX Address, how many servos you'll be using, servo start-up positions, and more.

The menu is up to three levels deep. When you enter the menu, you'll start at the top left which is one blue blink. If you press UP/DN you'll move up or down to the next blue colored menu option. If you instead press SET, you'll enter the selected option and the Status LED will change green. You can now press UP/DN to select an option within that menu.

If you press DN all the way to the bottom of the selected menu the Status LED will turn red. If you tap SET here you will return to the previous menu. TIP: If you hold SET for two seconds while any exit option is selected you'll exit the entire setup menu and return to normal operation.

Entering the menu

To Enter the menu hold DN and then tap SET (while still holding DN)



Option Menu

Press SET here to enter the Option Menu, then use the UP/DN buttons to select one of the menu items shown in green below. Note that some options shown below will not be available in all Operating Modes.



Set DMX Address

Tap SET here to set the starting DMX address.



First Digit

Rotate the knob to select the first digit of your DMX address on the Servo LEDs. Tap DN to enter this digit and move to the second digit below.



Second Digit

Select the second digit and press DN as you did for the first. If your second digit is 0, select 10. If your DMX address is less than 10 and has no second digit, wait here until the STATUS light turns blue and you're moved to *DMX Address Playback*.



Third Digit

Select third digit and press DN. If the third digit is 0, select 10. If your DMX address is less than 100 and has no third digit, wait here until the STATUS light turns blue and you're moved to *DMX Address Playback*.



DMX Address Playback

If your DMX address was accepted it will be played back on the Servo LEDs just like it does when the ServoDMX boots up.



DMX Address Error

The STATUS light will turn red for a few seconds if your selected DMX address was too high.



AutoTalk

The ServoDMX can automatically move a mouth servo based on a line-level audio signal connected to the AUX connector. This is often used in combination with the Random Movement option below to bring a character to life with just a simple audio track. It can also be used in combination with DMX if you'd like audio to control the mouth and DMX to control the rest. See Operating Modes for more information.

NOTE: The audio channel (left or right) connected to the ServoDMX must contain only speech. There cannot be any sound effects or background music, otherwise the mouth will move to those too. Put those in the channel that is not connected to the ServoDMX.

If this is a character you built yourself, make sure you have set the servo limits. Also, you can adjust this servo's acceleration and max speed while the audio is playing. Usually the acceleration should be left at 16. But there will be a sweet spot between the AutoTalk sensitivity and servo speed that yields the best results. If you purchased a character that included the ServoDMX, these settings have already been set for you.

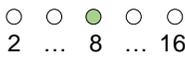
Rotate the knob to adjust the sensitivity. Ideally while your audio is playing.



1

AutoTalk Disabled

The AutoTalk feature will be disabled, regardless of the operating mode.



Sensitivity Adjustment (8 is default)

This profile is designed to make it



Random Movement when NOT Talking

Some control profiles support random movement. This allows the ServoDMX to intelligently move a character when a DMX controller is not desired. The character will start to move to demonstrate how much movement your current setting represents.

Use the knob to select one of the options below.



1

No Random Movement

There will be no random movements made when the character is not talking.



Amount of Random Movement when NOT Talking

Select a value from 2 to 8 to set how much random movement you want. 2 would be the least amount of movement, 8 would be the most.



Random Movement when Talking

This option allows you to define how much the character should move when it's talking. The character will start to move to demonstrate how much movement your current setting represents.

Use the knob to select one of the options below.



Amount of Random Movement when Talking

Select a value from 1 to 16. 1 would be the least amount of movement, 16 would be the most.



Random Movement - Eye Color & Brightness

Choose the color and brightness of the LED eyes when Random Movement is active. DMX will control the color and brightness when it is in control.

- 1 ... 16

Eye Color and Brightness

Rotate the knob between 2 and 12 to select from a variety of color and brightness values.



Random Movement - Eye Mode

Choose how the LED eyes will behave when Random Movement is active.



Throb Quickly to Audio

1

The LED eyes will fade in and out in sync with the audio coming into the AUX connector.

- 2 ... 15

Fade Out Delay

When the character starts talking, the LED eyes will fade into your selected color and brightness. They will stay on for a bit, then fade back out once the character stops talking. Select a value between 2 and 15 to determine how long you'd like them to stay on (in seconds) before they fade out.



Eyes Always On

16

Select 16 if you'd like the RGB eyes to maintain your selected color and brightness the entire time Random Movement is enabled.



Return

Press SET here to return to the previous menu or hold SET for 2 seconds to Save and Exit.



User Setup Menu

Press SET here to enter the User Setup Menu.



Operating Mode

The current operating mode will be displayed on the servo LEDs. Rotate the knob if you'd like to change it.



DMX Only (Default)

1 2 3 4 No random movements will be attempted after start-up. Only a valid DMX signal can move the servos.



DMX Control with AutoTalk

1 2 3 4 No random movements will be attempted after start-up. When the DMX value for the mouth servo has been at zero for a few seconds, the AutoTalk feature will take control of the mouth. The DMX signal can regain control by setting the DMX value for the mouth channel to anything other than zero.



Automatic Movements with AutoTalk, DMX Override

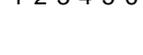
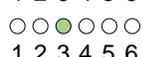
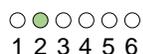
1 2 3 4 If the selected Control Profile supports automatic movement the ServoDMX will power-up in a fully automatic mode. After a short delay, it will randomly move the character to give it some life, and any audio detected at the AUX input will move the mouth. As soon as a DMX signal is detected the ServoDMX will cease all automatic movements and let DMX take over control. If the DMX signal disappears again the ServoDMX will resume automatic movements.

Use this mode if you have no interest in controlling your character via DMX, or if you want it to move randomly until a DMX signal is detected.



System Sleep Timer

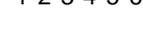
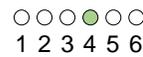
This option will cut power to all the servo outputs if none of the servos have changed position for the time specified below. This is useful if you'd like to ensure the servos will be able to rest if the DMX controller or audio player is powered off but the ServoDMX is not. Once the DMX / Audio signal is detected again the ServoDMX will soft-start the servos one by one as it does at boot-up. After that they will resume normal operation.



Never (Default)

5 Minutes

10 Minutes



15 Minutes

30 Minutes

60 Minutes



Replace a Servo

This menu should only be used if you need to replace a servo. Your replacement servo may not allow you to position the horn or linkage exactly as the previous servo did. For example, if you swap out a mouth servo. The horn position on the new servo may either close the mouth too far, or leave a small gap when it should be closed. This option will let you trim the servo's position slightly to compensate for that difference.



Select Servo to Replace

Use the knob to select which servo you'd like to replace. Tap DN to select the reference position below.

Reference Position

The servo will now move to a reference position. This is the endpoint or center point that would be easiest for you to use as a reference point to tweak the position.

For example, if we continue with the mouth example above, this would be the mouth closed position which is likely full left or right. You'd select that option here and then move to the option below to trim the servo's position so that the mouth is perfectly closed. For other movements, like an eye or head turn, it would be easier to trim at the center position where you would just make sure the movement is centered.



Use the knob to select one of the positions below, as shown on the servo leds.

1 2 3 Reference to full left (1ms pulse width with default limits)

1 2 3 Reference to center (1.5ms pulse width with default limits)

1 2 3 Reference to full right (2ms pulse width with default limits)



Trim

Adjust the trim.



Return

Press SET here to return to the previous menu or hold SET for 2 seconds to Save and Exit.



DMX Channel Resolution

If you need fine control of the servo's position, and your DMX output software or controller supports 16-bit channels, you may benefit from switching to 16-bit mode. In this mode each servo requires two DMX channels, one for course position and one for fine. The 2-3 least significant bits are discarded as the internal servo pulse engine supports about 13-14 bits depending on the servo's limits.

Even without this mode enabled the servo pulse resolution is at least 13 bits during speed and acceleration operations. It's only your control of the final position that is improved. How much more resolution you will gain in the real-world depends on your servos. Many budget servos barely support 9 or 10 bits, regardless of what their spec sheet may claim. Your mileage may vary.

Note that this mode is only supported for the Standard control profile. It is not supported with the 3-axis profile.

1 2 3 4 5 6 8-Bit (Default)

1 2 3 4 5 6 16-Bit



Return

Press SET here to return to the previous menu or hold SET for 2 seconds to Save and Exit.



Installer Setup Menu

Press SET here to enter the Installer Setup Menu.

NOTE: This menu will only be visible if the Installer Lock has NOT been enabled.



Control Profile

Here we have profiles that determine how the ServoDMX should interpret the DMX data.



Standard (Default, No Random Movement support)

1 2 3

In this profile the DMX channels directly control the servo positions. This profile does not support any random movements. It can be combined with AutoTalk to move Servo 1 based on an audio signal. See Operating Mode.



3 Axis Head with Tilt Servos (Random Movement supported)

1 2 3

This profile is designed to make it easier to control a head that uses left and right tilt servos for both tilt and up and down movements. Rather than you having to manage both tilt servos on your own, one DMX channel is assigned to up and down, another to tilt. The ServoDMX does the necessary math to figure out what the tilt servos must do to achieve your desired movement based on those two DMX channels.



Number of Servos

Set this to the number of servos you need to control. This will affect how many DMX channels must be allocated to this device. The number of DMX channels required = Number of Servos + (Number of NeoPixels Channels x 3).



All the servo outputs are controlled via DMX.



Number of NeoPixel Channels

Set this to the number NeoPixel channels you require. This will affect how many DMX channels must be allocated to this device. The number of DMX channels required = Number of Servos + (Number of NeoPixels Channels x 3).

If you have multiple NeoPixels but want them all to be the same color, you may be able to wire them up to use a single NeoPixel channel. See [NeoPixel Output](#) for wiring details.

	No NeoPixel Channels		3 Channels		6 Channels
1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9	
	1 Channel		4 Channels		7 Channels
1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9	
	2 Channels		5 Channels		8 Channels
1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 9	



Servo Startup Positions

When the ServoDMX starts the servos, it sends a pulse that will send them to their virtual center position. If the servo is not already in this position because it moved when the ServoDMX was off, it will race to this position at top speed. This may not be desirable if the servo is moving a large or heavy object.

To help prevent the servos from jerking at start-up like this you can tell the ServoDMX where the servo will most likely move to once power is removed. Once set, the ServoDMX will send this position to the servo at power-up instead of asking it to move to center. As long as the servo is at or close to this position the jerking will be minimal. From there, all future movements will be restricted by any speed / acceleration limits you have set.



Select Servo

Use the knob to select the servo you'd like to adjust the start-up position for. Tap DN to go to the option below to set the start-up position.



Set Start-up Position

The servo will move to its current start-up position. By default, this is the center point between the limits you have set. Rotate the knob to change the position. This should be the position the servo will move to when power to the ServoDMX is removed. Press UP to select another servo, or DN to go to the *Return* menu.



Return

Press SET here to return to the previous menu or hold SET for 2 seconds to Save and Exit.



Relay Outputs

Any of the servo outputs can be set to behave in an on/off mode. In this mode, the signal pin on the servo connector will go to 4.7 volts when the DMX signal goes above 128, and down to 0 volts when it's less. This allows the output to be used to control **very low current** (10mA or less) digital outputs.

Note that this pin is NOT capable of much current, so it cannot be used to directly drive almost any load. It can however be used to turn on amplified relays such as a [Pololu 2480](#). The contact of the relay can then be used to drive a proper load.

When the Status LED is blinking as shown to the left, any Servos that are currently lit are in relay mode. One of the lights will also blink about once a second, this indicates which servo is selected. If you'd like to enable or disable relay mode on one of the outputs, first rotate the knob to select that servo, then tap SET to toggle the relay mode.



Max Servo Voltage

Here you can select the maximum voltage allowed by your servos. If the servo voltage is higher than this value, the ServoDMX will blink red quickly at boot to let you know. The high voltage will never reach your servos.

Note that the servo voltage is only checked at bootup. If you somehow increase the servo voltage while the ServoDMX is already running, that voltage will reach the servos.

If you set this voltage too low by mistake and trip the warning, you can bypass it by holding the DN button for 10 seconds. This will allow you to get back into this setup menu to increase it. The servo voltage must be below 9 volts for this to work. Make sure all Servos have been disconnected from the servo connectors before doing this if indeed the voltage is too high for them.

● ○ ○ ○ ○ ○ ○ ○ 1 2 3 4 5 6 7 8	5 Volts	○ ○ ○ ○ ● ○ ○ ○ 1 2 3 4 5 6 7 8	7 Volts
○ ● ○ ○ ○ ○ ○ ○ 1 2 3 4 5 6 7 8	5.5 Volts	○ ○ ○ ○ ○ ● ○ ○ 1 2 3 4 5 6 7 8	7.5 Volts
○ ○ ● ○ ○ ○ ○ ○ 1 2 3 4 5 6 7 8	6 Volts	○ ○ ○ ○ ○ ○ ● ○ 1 2 3 4 5 6 7 8	8 Volts
○ ○ ○ ● ○ ○ ○ ○ 1 2 3 4 5 6 7 8	6.5 Volts (Default)		



Return

Press SET here to return to the previous menu or hold SET for 2 seconds to Save and Exit.



Save and Exit

Press SET here to exit the menu and return to normal operation.

Settings Protection

Protection Options

There are two levels of settings protection: Write-Protection and an Installer Lock.

Write-Protection is what most end-users should use. It's meant to protect your settings should the device be in an environment where other people might be pressing the buttons. When write-protection is enabled, the buttons and knob can be used to move servos but will not change any settings or enter any menus.

The Installer lock is used if you are installing the ServoDMX in a prop you are creating and then selling that prop to someone else. Once the lock is engaged the servo limits and speeds, as well as the Installer Menu, are locked. This is often necessary to ensure the servos are not damaged. The lock can be removed, but this changes the lock code, which would reveal to the installer the settings have been changed, often voiding any warranty you may have on that prop.

Entering the Protection Menu

Hold the UP button while powering up the device to enter the protection menu. The Status LED will represent the state of protection currently enabled. Power off and back on to exit the menu.

STATUS LED STATES IN PROTECTION MENU	
	Settings Protection Disabled.
	Settings Protection Enabled.
	Settings Protection Disabled. Installer Lock Enabled.
	Settings Protection Enabled. Installer Lock Enabled.

Toggling Write-Protection

Enter the Protection Menu as described above. Then hold the DN button for a few seconds to toggle the write-protection state. The Status LED will change to green or red once the change has been made. To exit this menu, reboot the controller.

Disabling the Installer Lock

To disable the installer lock you should contact your prop's manufacturer.

Factory Reset

Hold both UP and DN at boot for 10 seconds. The Status LED should start flashing red. Keep holding until it changes to solid red, then you can let go. The device will factory reset itself and then reboot.

If the light turns solid yellow instead of flashing red your ServoDMX is installer locked. You must remove the installer lock before you can factory reset.

DMX Information

Setting the DMX Address

You can set the DMX address in the [Options](#) menu. If you are using our Director software, it might be easier to use the *ServoDMX 421 Utility* in the Connect menu.

DMX Channel Layout

8 Bit Mode (Default)

The ServoDMX will occupy 1 DMX channel per enabled servo, and 3 DMX channels per enabled NeoPixel. For a fully provisioned ServoDMX with all 16 outputs and NeoPixels enabled, the channels would be assigned as follows...

DMX Channel	Function
1	Servo 1 Position
2	Servo 2 Position
...	
15	Servo 15 Position
16	Servo 16 Position
17	NeoPixel 1 Red
18	NeoPixel 1 Green
19	NeoPixel 1 Blue
20	NeoPixel 2 Red
...	
38	NeoPixel 8 Red

16 Bit Mode

In this mode each servo requires two DMX channels. The NeoPixels still consume 3 channels each.

DMX Channel	Function
1	Servo 1 Position Course
2	Servo 1 Position Fine
3	Servo 2 Position Course
4	Servo 2 Position Fine
...	
30	Servo 16 Position Course
31	Servo 16 Position Fine
32	NeoPixel 1 Red
...	
53	NeoPixel 8 Red

Important Notes

If you don't have all the servos enabled the first NeoPixel will shift down, as it always follows the last *enabled* servo channel. If you have no NeoPixels enabled then those won't consume any channels. In this case your next fixture's starting DMX address should immediately follow the last enabled servo address.

Specifications

Electrical

Servo Voltage (VS)		
	Maximum Input Voltage NOTE: Do NOT exceed your servo's rated voltage as this voltage is passed through to the servos. Most servos max out at 6 or 7.2 volts.	14V
Digital Voltage Input (VD)		
	Input Voltage	5V - 14V
Servo Pulse		
	Voltage	5V
	Width (default)	1.002ms – 2.016ms
	Width (min / max)	0.553ms – 2.461ms
	Resolution (default pulse width)	About 13 bits 8048 steps at 126ns/step
	Resolution (max pulse width)	Above 13 bits 10370 steps at 184ns/step
	Jitter	None

Troubleshooting

Status LED Error Codes

The ServoDMX does some checks at start-up. If it finds any errors, it will blink the Status LED red in different patterns. Please see the table below to determine the reason for the error code.

STATUS LED ERROR CODES	
Status LED	Error and Remedy
 NO BLINKING	No DMX Signal The Mode LED will stay solid red when no DMX signal is present.
 STEADY BLINK	Servo Voltage Too High The servo voltage is above the maximum set in the Installer Setup Menu. Simply connect a power supply that is below the maximum servo voltage.
 x2	Undervoltage Error The servo voltage is less than 4 volts. Check your servo voltage.
 x3	Provisioning Required If you are seeing this at bootup the ServoDMX was shipped without being provisioned for the number of servos you ordered. Please contact the seller.
 x4	Missed Firmware Packet A firmware packet was missed during a firmware upload. Try the update again.
 x5	Bad Firmware Signature The firmware validation failed the signature check. Please re-upload the firmware.
 x6	Bad Firmware Sum The firmware validation failed the validity check. Please re-upload the firmware.