16 Channel, DMX to RC servo controller board

Features

- Allows DMX512 digital protocol to control 16 – RC type servos.
- 255 positions across the output range.
- All outputs on standard 3 terminal, .10” , “Futaba” style connectors.
- Address switch, address 512 channels.
- On board voltage regulator for controller power.
- Separate connectors for board power and servo power.
- 4 - Selectable output pulse widths for servo’s.
- 4 – High sped PWM current sink channels for LED’s.
- 2 – relay channels with current sink drivers on board.

Input Signal
Northlight SRV16 board accepts DMX512 current and legacy versions.
The SRV16 board can receive data at the full rate and is responsive to all 512 channels.

Output
16 RC PCM channels. Update rate @ 50Hz..
4 – LED driver pwm channels. Will sink up to 40mA per channel.
2 – Relay channels with on board current sink driver. Will sink up to 150 mA each at 5-12 VDC.

Address switch
9 position mini DIP switch.

Power requirements
5 to 12 volts DC @ 60 mA. for controller board.
Servo, LED, and relay power has separate connectors.

LED Indicators:
Green LED - DMX signal activity.
Blinking when no DMX is received.
Steady glow for good DMX.

Board connections

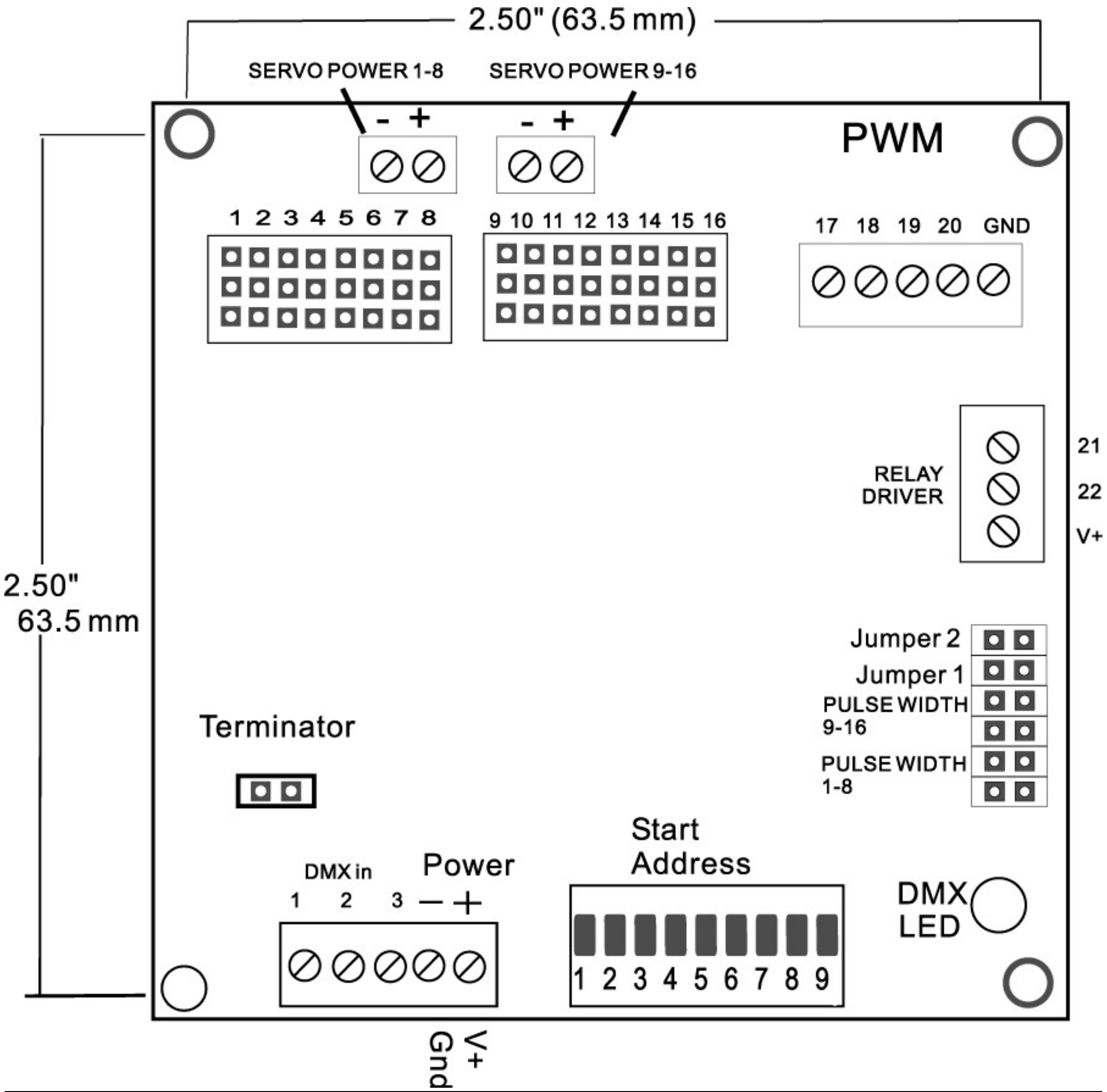
All connections use screw terminals, except servo's.

Physical Dimensions

2.75"L X 2.75"W +/- .10"

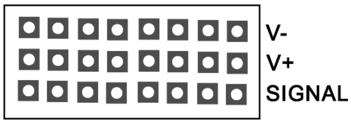
The **DMX input** pin numbers correspond to the XLR pin numbers.

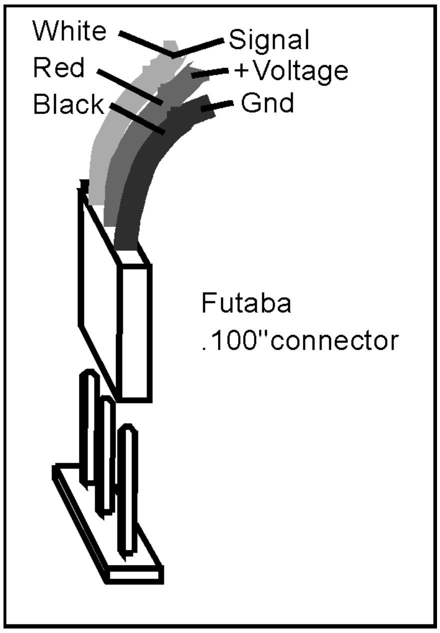
DMX512 ,Pin 1 is signal ground – not earth ground.



Servo connections

The servo power and signal pins are arranged as shown in the drawing.
This is standard for Futaba and most RC servos.
The power for the servos is separate from the controller power.
The – gnd is common to the controller power connector.





Futaba	Other color schemes:
1. White = signal	1. Orange = signal
2. Red = positive	2. Red = positive
3. Black = negative	3. Brown = negative

Using the SRV16

Power Input

5 to 12 volts DC @ 60 mA. for the controller only. On average the current consumption is around 50 mA.
There is a separate connector for the servo power supply. The voltage and current for the servos is dependent on the servo type and load.

Output Pulse Width

The default output is from 1 to 2 milliseconds @ 50 Hz. By using the configuration jumpers, the output pulse width can be increased or decreased. See the section on setting the pulse width for a chart of the settings. There are 255 discrete servo positions for all pulse widths.

DMX512 In

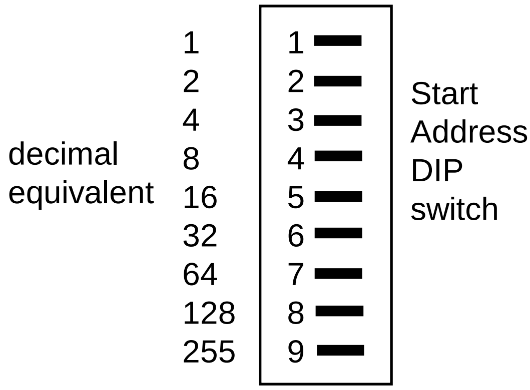
The DMX input pin numbers correspond to the XLR pin numbers.
Pin 1 is signal ground , not earth ground
Pin 2 is DMX512 -
Pin 3 is DMX512 +

Ground

The DMX512 signal ground is the common signal ground – not earth ground. Do Not connect DMX pin 1 to earth ground.
Do not connect the servo power supply to earth ground. This will connect the DMX pin 1 to earth ground, through the controller power supply.

Setting the Start Address

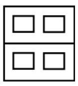
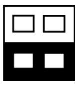
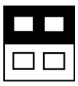
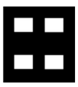
The individual switches are numbered 1 – 9, left to right.
Set the starting address to the first in a group of 22.
The address is entered on the DIP switches in standard binary code starting with 1.
See the chart of all 512 address switch positions at the back of this manual.
Each switch on the DIP switch, numbered 1-9, has a decimal equivalent.
To calculate the address on the DIP switch, just add up the decimal equivalents of the switches.
For example, to set the DMX output address to 9, set switch 1 and 4 to on. Switch 4 is equal to 8 and switch equals 1. Add them together to get 9.



Setting the Pulse width

The SRV16 board is capable of 4 pulse widths. The most common is a pulse of 1-2 milliseconds @ 50Hz. On most servos this produces around 90 degrees of movement. This is the default setting when shipped.
The maximum pulse width can produce over 90 degrees of movement. Some digital servos will prevent over 90 degrees of travel.
Be careful when using the longer pulse widths. If the servo “chatters” the pulse width is too wide.

The table below shows the 4 jumper settings.

Jumpers	Min pulse width	Max pulse width	Pulse range
1 0 	1.25 mS	1.75 mS	0.50 mS
1 0 	1.15 mS	1.85 mS	0.70 mS
1 0 	1.00 mS	2.00 mS	1.00 mS
1 0 	.85 mS	2.15 mS	2.12 mS

Using the configuration jumpers

There is 1 configuration jumper on the SRV16.

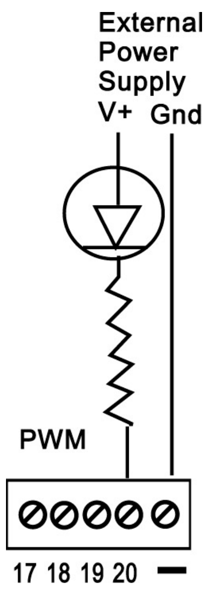
J1 – Determines the output in the event of DMX signal loss.
This function is not affected by the A2 setting.

Open(no jumper) – When the DMX signal is lost, the servo's will go to DMX zero position. This is the default setting.

Closed(jumper in place) – When the DMX signal is lost the Serv8 will hold and continue to output the last valid data.

Using LED's

The SRV16 has 4 low current PWM drivers. They use channels 17,18,19,20.
Each driver MOSFET can sink up to 40 mA of current.



The PWM drivers can accept a voltage up to 12 VDC.

LED's are current controlled devices. The more current passing through the LED the brighter it is. Standard LED's usually require 15 to 20 milliAmps(mA) to reach full briteness. High efficiency LED's may only require 5-10 mA. Blue and white LED's often require 30-50 mA to reach full briteness.
A minimum voltage is required before a LED will illuminate. This is refereed to as "VF" or the "forward voltage. On a standard LED the forward voltage usually varies from 1.2 to 2.7 volts. Blue and white LED's usually have a VF of 3.3v.
A resistor must be used in series with the LED to prevent excessive current flow. The value of the resistor is dependent on the power supply voltage, the amount of current required and the VF of the LED.
To calculate the resistor us the formula below:
Vs – Vf / If
Where Vs = power supply voltage
Vf is the forward voltage of the LED
If is the desired current.

Example: Red LED with forward voltage of 2VDC at 20 mA with 12 volt supply
12V – 2V = 10v
10V /.02Amps = 500
The correct resistor = 500 Ohms 470 is a standard value and close enough.
Resistors also have a watt rating. This the total power the resistor can handle without overheating.
Ohms law states the formula for watts is I(amps) X V(volts) = Watts.

In the example, .02Amps X 2volts(vF) = .04 watts. A standard ¼ watt resistor is fine for a single LED.
When using many LED's in an array a larger wattage resistor will probably be needed.

RELAY DRIVERS

There are 2 relay drivers. They use channels 21 and 22.
On the PCB the terminal marked V+ is directly from the + terminal on the power input for the controller. This there for wiring convience. The voltage must match the relay requirements.
Be aware that relay coils can pull considerable current. It is recommended to use a separate power supply for the relays such as the servo or LED power.

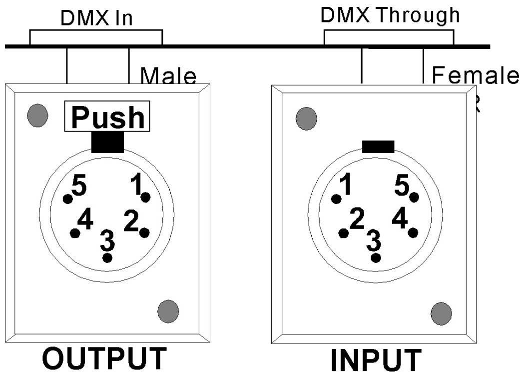
Setting up the DMX connectors

DMX512 protocol specifies that 5 pin XLR connectors be used. Female on the transmitter and male on the receiver.
When a 3 pin XLR is used it is wired the same as the first 3 pins on the 5 pin XLR.

The current DMX512 standards encourages one to provide passive loop through connectors.

The drawing shows a typical installation.

PIN	WIRE	SIGNAL
1	signal	ground/return
2	signal	data compliment (-)
3	signal	data true (+)
4	signal	spare data compliment (-)
5	signal conductor	spare data true (+)



Conductors 2/3 and 4/5 should be twisted together.
The drawing on right shows a typical installation.

Termination

A simple terminator consists of a 120 Ohm resistor connected across pins 2-3 of the DMX signal

The servo board provides an on board terminator using standard square pin connectors on .10" centers.
A toggle switch can be placed across the terminals for convenient front panel terminator selection.

The termination resistor should only be in when the servo board is the last device on the DMX link.

There is no specific orientation of the connector on the PC board.

The latest version of the DMX512 specifies that the terminator switch should be labeled "In" and "Out".

Trouble shooting

Basically the board is plug and play. When all connections are properly made, an variable pulse, proportional to the input signal will be present at the output pins.

Signal Ground/common
On the board, there is NO connection between chassis/earth ground and Signal/common ground. Do not install one.
On the DMX data cable, there is NO connection between the shield/XLR shell earth ground and the signal/common ground. Do not connect these together.

Termination: It is up to the user to determine the termination requirements. If the servo board is the last one on the DMX link, the built in 120 Ohm terminating resistor should be used.
It is possible to "over terminate". In other words make sure there is only 1 terminator on the end of the DMX line. Some devices have internal terminators, double check the settings.

No output
Check the signal wires as noted above.
Be sure the address is set to a valid address. The Serv8 start address should not be higher than the highest address received.

Other issues
First check the input signal integrity. There should be signal present on both Data lines for DMX512. Reverse the connections.
Make sure the pulse width is not to long for that servo. Servos will "chatter" if the pulse is to long.
A weak power supply can cause a similar problem. Remove any load from the servo. If it still chatters the problem is possibly not the power supply.

Misc
Good solid connections are a must. The mini screw terminals provide good connections. However the screws can be stripped by over tightening.
DMX512 signal wires should be twisted together all the way to the connector.
It is recommended that a separate power supply be used to power the Servo board. Occasionally unexpected problems can occur if power is "borrowed" from another source.

Using RC Servos

Remote control-style Servo motors have built-in amplifiers and position feedback sensors so that all they need is a power supply and the pulse width modulated control signal to operate. The pulse width for the control signal is usually between 1.0 milliseconds and 2.0 milliseconds at a frequency of 50 times per second.

A servo arm takes a certain amount of time to move from one position to another. This is the "slew" time. Most hobby servo's are pretty slow, usually in the range of .50 second to travel 90 degrees of rotation. Faster servos usually cost more and require more power.

Even the fastest servos can't move fast enough to keep up with the update rate of the SRV16 receiving DMX512.

The output 'swing' can be adjusted to allow more movement on most servo motors. This usually requires a pulse longer than the nominal 1 to 2 millisecond(MS). When going to the longer pulse widths, do so in steps. Overdriving the servo with too long a pulse can ruin the motor.

Servo motors require a separate, larger power supply. Typical Servo motors run on voltages of 3 to 24 volts DC, common hobby servo use 5 or 6 VDC, and depending on the Servo and its load, can draw several amps of current. Most small Servo motors are powered through the same three conductor 'F' or 'Futaba' connector that is used to send them their control signal. Some larger Servo motors have separate twelve or twenty-four volt power supply connections in addition to the three conductor control cable.

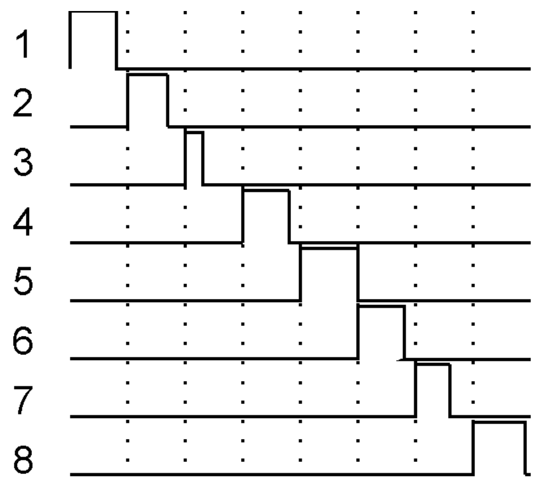
Servo PWM control signals

Most servos require a variable width pulse from 1 to 2 milliseconds(Ms) long, at a rate of about 50 times per second.

Northlights SRV16 outputs a pulse at about 50 HZ.

The servos are pulsed 1 at a time, in sequence, as illustrated in the drawing. Some servo controllers will start the pulse for the next servo immediately after completing the current pulse. This has the effect of varying the pulse rate, as determined by the pulse widths. This is an unacceptable situation as the motor behavior can be erratic.

The SRV16 always keeps the update rate constant, regardless of the actual motor pulse widths.



There is nothing to keep you from plugging these pins in backwards or with reversed polarity, so be careful when attaching the Servo.

Servo Motor Power: Screw terminals are used to connect the power supply for the servo motors. Five to six volts is typical for most small servo motors . The current draw on most Servo motors is at least an amp. Some larger Servo motors can draw far more. For most average sized Servo motors, if you allow half an amp per motor you will probably be safe. You can tell if you are drawing too much power if the Servo motors start interacting.

The servo connectors are male headers on .1" centers, arranged in the 'F' or 'Futaba' style. The three pins used by each Servo motor are as follows:

1) Ground (outside edge of the board): This is usually a black or brown wire. This pin is connected directly to the Servo motor ground screw terminal. All Servo motors use the same ground.

2) Servo motor Power(center pin): This is usually a red wire. This pin is connected directly to the Servo motor Power screw terminal. All Servo motors use the same power.

3) Control Signal(inside pin): This is usually white or orange wire. This is the pulse width

modulated control signal for the Servo motor.

Why ask WYE?

Wye(Y) splitters are NOT recommended for DMX512 systems. Wye splitters are simply a male inline XLR connector, parallel wired to 2 female inline XLR's. While convenient, Wye splitters cause unwanted signal reflections and possible ground loops, leading to signal degradation.

The best layout for DMX systems is a Daisy chain configuration, where the signal cable jumps from one device to the next, with no branching. Each chain can have up to 32 devices on it. When using an isolated splitter, each outputs can be a separate DMX daisy chain.

Termination

A common problem with DMX systems is improper termination.

A simple terminator consists of a 120 Ohm resistor connected across pins 2-3 of the DMX signal. More complex terminators utilize voltage spike protection and bi-color LEDs to indicate signal integrity.

Terminators are an impedance matching circuit required to damp signals that "reflect " from the end of an improperly terminated cable, causing signal degradation under certain conditions.

On devices the have a DMX thru , a male XLR connector with terminating resistor connected across pins 2-3 and installed on the DMX thru connector will suffice. Some devices with isolated outputs will not use a terminator on the DMX out. These usually have an internal terminator that is selected with a switch.

Wire Type

There is a difference between microphone cable and "Data" cable. Sure you can get away with mic. cable for short runs in many situations. However on longer runs or marginal situations mic. cable will let you down. You may have random errors or the system won't work at all. It comes down to insurance. If you want to insure the most reliable DMX signal distribution you need the most appropriate wire for the job. DMX512 requires wire suitable for RS-485, there is no way to get around that.

Twisted-pair cable is the most common wire type. You can use a range of wire gauges, most frequently use 22 – 24 AWG. The characteristic impedance of the cable should be 100 to 120 Ohms.

Some other requirements are, at least 1 twisted pair plus ground and shield. It should have low capacitance and overall braid and foil shield.

Warranty and Disclaimer

Warranty

Northlight Systems warrants this product against defects in materials and workmanship for a period of 1 year.

Returns Policy

If there is a defect, we will repair or replace the product at out discretion.

We offer a full refund on the purchase price if returned in original, unused and “like new”, condition in less than 30 days.
Return the product with a description of the problem. Free repairs are for defective parts or workmanship only.
Repairs due to improper hookup, over voltage, short circuits, physical damage etc., will be charged to the customer.

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Contact

Northlight Systems

Phone 480 429-0577
Info@NorthlightDMX.com

Address - Switches
1 =1
2 =2
3 = 1, 2
4 =3
5 = 1, 3
6 = 2, 3
7 = 1, 2, 3
8 = 4
9 = 1, 4
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Address - switches
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