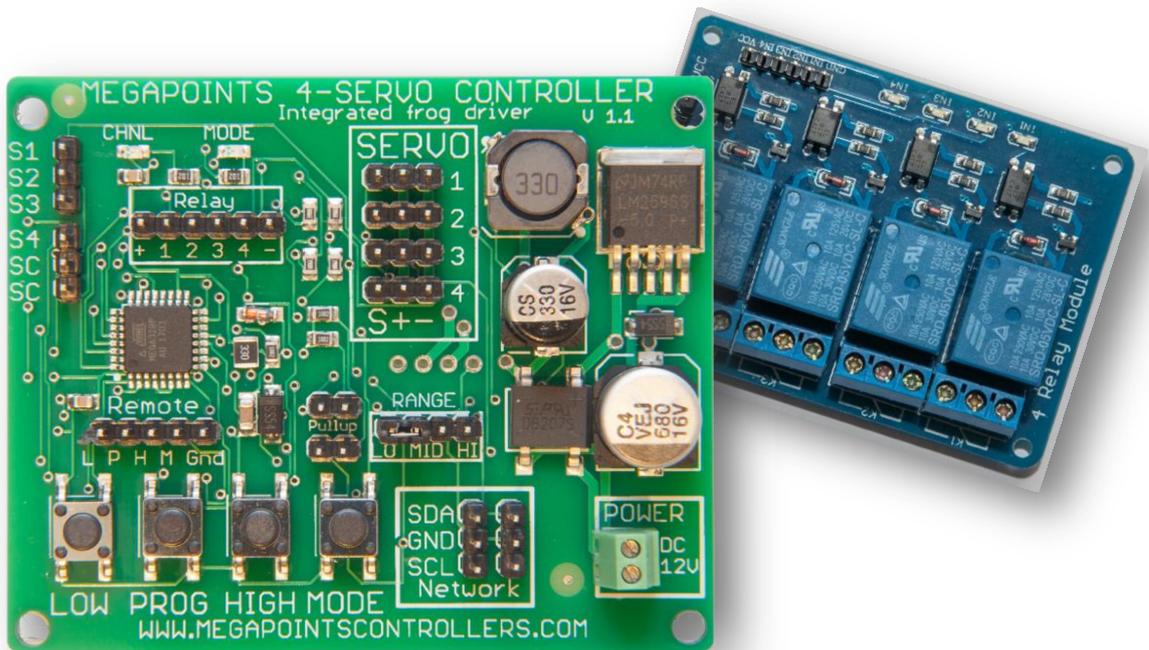# MegaPoints Servo 4R Controller

A flexible and modular device for controlling model railway points and semaphore signals using inexpensive R/C servos and relays.

User guide

Contents

Introduction

The MegaPoints Servo 4R Controller is a sophisticated microprocessor controlled device capable of managing up to 4 inexpensive servos for points or semaphore signals independently and in a scale like manner for digital and analogue installations. Each of the servos can be individually configured and have their movement limit set for each direction.

The Servo 4R includes a 4-way relay module capable of switching turnout frogs in conjunction with turnout blade operation. When turnouts are thrown the corresponding relay will switch at the centre point of turnout movement. This also takes into account any end point adjustments the user may have made ensuring the relay is thrown midway.

If semaphore mode is selected for any channel, the relay will be thrown at the point the semaphore signal leaves the clear position. As well as switching turnout frog polarity, relays can also be used to control section power on the track or to drive an asymmetric DCC track feed for automatic brake control.

MegaPoints Controllers use static sensitive components that must be handled with care.

Avoid touching any components or the circuit printed on the bottom of the board.

Avoid placing the board on any metallic surfaces including track.

Servo Controller 4R - What's Included
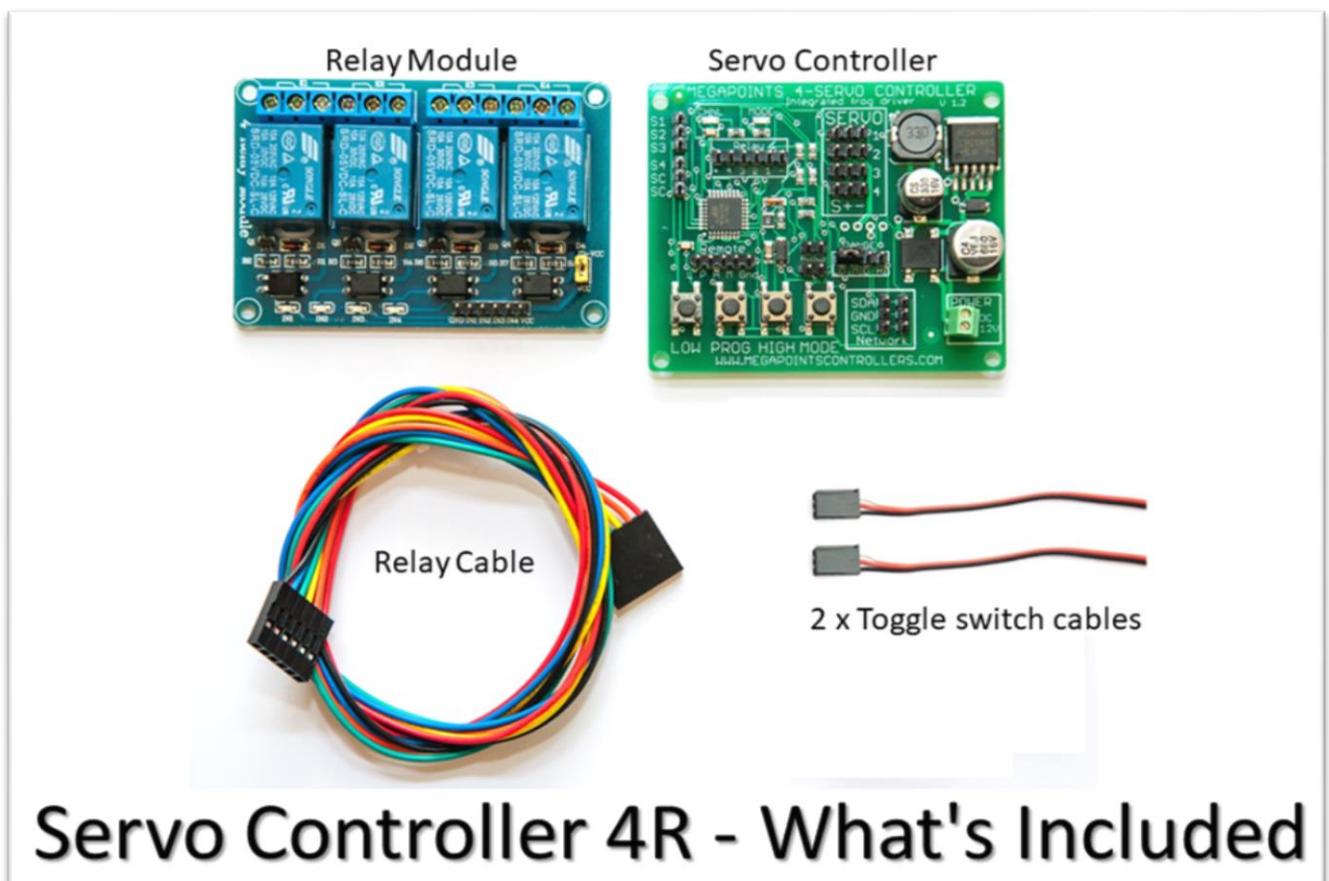
Before starting

Connect the board to a **_regulated_** DC power supply in the range of 9 – 13.8 volts. 12 volts are ideal. Your power supply should be capable of supplying a minimum of 1.5 Amps per Servo 4R Controller. See the FAQ section of the web site for power supply recommendation.

Quick setup guide

We recommend you become familiar with the units operation before installing on any layout. Each servo output has been set to move approximately 90 degrees during manufacture. If fitting servos beneath the track we highly recommend the use of a thinner flexible piano wire. This allows the piano wire to flex and in most cases removes the need to adjust the range of motion making installation fast and simple.

For baseboards up to 10mm we recommend 0.64mm piano wire. It offers an excellent combination of springiness while getting the job done. If you choose to leave the over centre springs in place (its personal choice) or use thicker baseboard a slightly thicker piano wire may be required. Like most things in model making, some trial and error may be required.

If you are familiar with servos this section will get you up and running quickly. It is recommended you initially hook up the board, servos and switches on a bench to become familiar with its operation.

1. Connect servos to connectors on right side of board (*1-4*).
2. Connect switches to S1-S14 using supplied cables (*left side*).
3. Connect switch common to SC (*left side*).
4. Apply DC regulated power to the power socket (any polarity) and the CHNL LED will begin to flash indicating run mode.
5. Operate your toggle switches to move the servos.

IMPORTANT: Servos operate differently from coil type points motors traditionally used in model railway layouts. This is because servo motors are constantly powered and draw current based upon the servo load. It is therefore important that if the servo end points are set, care is taken to ensure the servo moves freely to each end point and does not suffer from any binding or mechanical restriction. Ultimately the end point of the servo must be set by the electronics and not by driving a servo under load into a mechanical limit. Over driving a servo or leaving it under constant load will shorten the servo life and increase current drain.

Use of suitably flexible piano wire removes the need for adjustment as it flexes.

Web site

Check out our web site (*megapointscontrollers.com*) for instructional videos, updates, further ideas and examples of installation.

If using the Servo Controller in a networked environment we suggest also reading the Networking Guide from our web site for additional information.

How do I ...?

Connect the relay module

The servo controller comes with a six pin cable. Connect one end to the relay module ensuring the black outer lead connects to the GND pin (*marked on the relay module*). Ensure the other end connects to the six pin connector with the black outer lead connecting to the "-".

Connect frogs to the relay

If connecting relays to frogs, connect the centre (*common*) to each frog and the normally open and normally closing terminals to each stock rail. If you get this the wrong way around and a short circuit occurs when passing over the frog, swap the two outer connectors around (*normally open/normally closed*).
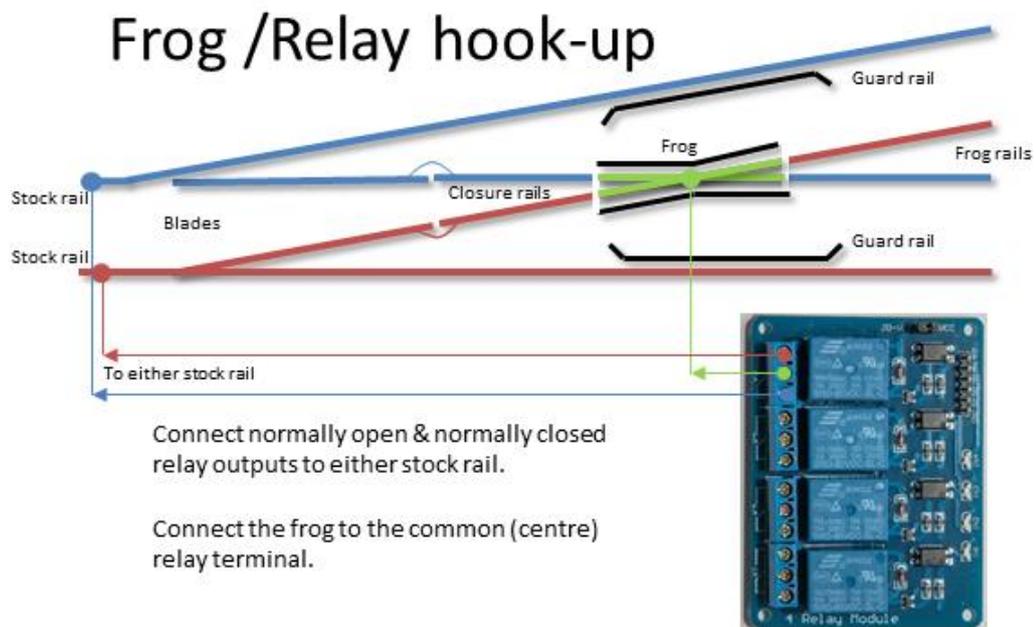
Connect to three way points

Three way point frog wiring using relays.
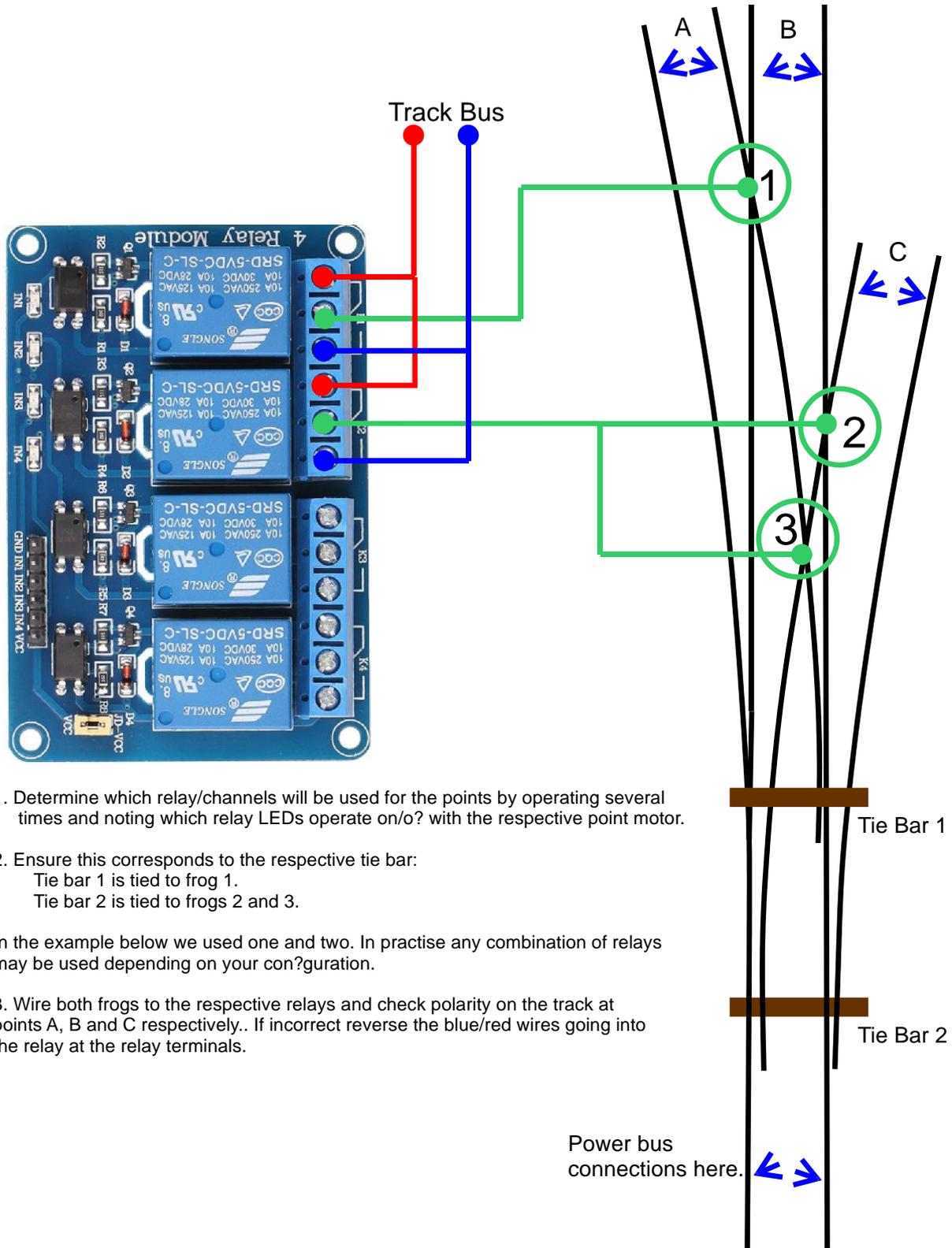
1. Determine which relay/channels will be used for the points by operating several times and noting which relay LEDs operate on/o? with the respective point motor.

2. Ensure this corresponds to the respective tie bar:
     Tie bar 1 is tied to frog 1.
     Tie bar 2 is tied to frogs 2 and 3.

In the example below we used one and two. In practise any combination of relays may be used depending on your con?guration.

3. Wire both frogs to the respective relays and check polarity on the track at points A, B and C respectively.. If incorrect reverse the blue/red wires going into the relay at the relay terminals.

Adjust the movement range of any servo

Enter programming mode by pressing the PROG button once. At this point, all servos will jump to their mid point position. You will also observe the CHNL and MODE LEDs flashing.

The CHNL LED indicates which of the four channels is being programmed. To advance to the next channel press the PROG button once. You should now see the CHNL LED flashing in bursts of two to indicate channel two. To finish programming press the PROG button through to channel four and then one more time to exit programming mode and return to normal running.

To adjust the movement for any channel, enter programming mode and select the appropriate channel. Confirm this by counting the CHNL LED flashes.

Press and hold the LOW or HIGH buttons until the servo has moved to the wanted position.

Press PROG to advance to the next channel and save the current channel settings.

Adjust any further channels as necessary.

Press PROG until you leave the programming mode and enter back into normal run mode (identified by only CHNL LED flashing about once per second.

The unit will now respond to switch commands.

Change the direction of a servo

Enter programming mode and select the channel you wish to adjust by following the instructions from the previous step.

Press the MODE button once. This will advance the mode from 1 to 2.

Adjust any further channels as necessary.

Press PROG until you leave the programming mode and enter back into normal run mode (identified by only CHNL LED flashing about once per second.

The unit will now respond to switch commands.

Here's a summary of the four modes:

MODE	Description
1	Turnout – normal direction.
2	Turnout – reverse direction.
3	Semaphore with bounce (normal direction).
4	Semaphore with bounce (reverse direction).

Set semaphore mode with bounce

Follow the procedure above selecting modes 3 or 4. If your semaphore signal bounces at the wrong end of movement select the other mode.

Factory reset the unit

To factory reset the unit do the following:

- Remove power from the unit
- Hold down BOTH middle buttons and apply power
- When the MODE LED starts flashing release the buttons
- After about 6 seconds the MODE LED will stop flashing and the CHNL LED will return to a running 1 second flash.
- You have now factory reset the unit.

Install a servo under turnouts

The attraction of R/C style servos is their scale like speed, adjustability, flexible mounting options and low cost. Servos can be mounted on the top of the board using pushrods or flexible Bowden tubes, or hidden underneath using piano wire to fit Peco style points. However you choose to mount your servos it is important you centre the servo before committing it to the layout as you would using solenoid point motors.

1. To mechanically centre a servo connect it to the Servo Controller and press the PROG button. This will place the selected channel into the centre (first push is channel 1).
2. Without moving or rotating the servo output shaft, locate the output arm to the centre of the range of motion. This is usually along the vertical axis.
3. Once the servo is fitted you can optionally press (and hold) the Low or High buttons to accurately set the end points or range of motion while in programming mode.
4. Press the PROG button to advance to the next servo. After the 12th servo has been selected the unit will exit programming mode.

The above procedure only needs to be completed once during installation. All end points, speeds and directions of travel will be remembered by the controller when switches off.

Additional advice

Keep the servo output arm short. Points typically do not require a large range of motion. Aim for 90 degrees of movement on the servo horn. It is therefore better to have the servo shaft rotate more by having a shorter output arm. Use the inner most hole when several are available. This increases the servo resolution and controllability while maximising the output torque. If the arm is too long, the servo range of motion will be small and accuracy will be impaired.

Servo installation images
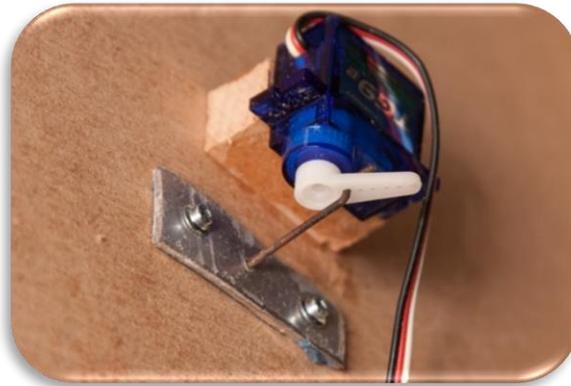
In the above image thin aluminium plate was used as a pivot for 1.2mm diameter piano wire connecting the servo to the points.

Below, aluminium channel provides the most flexible and easiest under baseboard mounting method. See web site for videos and channel specifications.
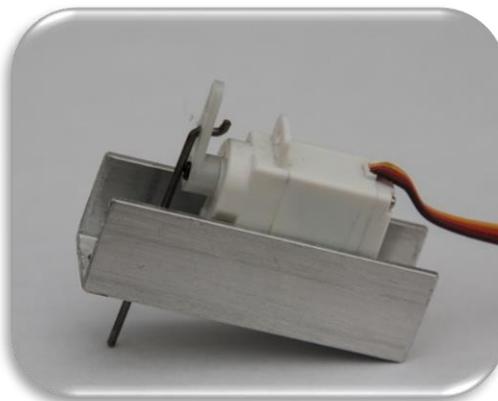
Install a servo under a semaphore signal

Navigate to the videos section and under the "Servo Controller" section look at the videos under the heading "Dapol OO gauge semaphore signal modification". These detail semaphore modification and servo installation.

Set switch input mode

If you've had the unit in network mode and want to change back to toggle switch inputs via S1-S4 do the following.

- Turn off power to the unit.
- Press and hold the HIGH button while applying power.
- Release the HIGH button as soon as power has been applied.
- Observe the CHNL LED flashing to indicate switch input mode.

NOTE: The set mode survives power cycles and remains unchanged until you change it.

Set network input mode

If you wish to control the unit from a DCC module, MiniPanel, MultiPanel or master Servo 4R you must set the input mode to network. Follow this procedure:

- Turn off power to the unit.
- Press and hold the LOW button while applying power.
- Release the LOW button as soon as power has been applied.
- Observe both CHNL and MODE LEDs alternate flashing for about 3 seconds. This indicates network mode has been set.

NOTE: The set mode survives power cycles and remains unchanged until you change it.

Change the network address

Network address setting has been simplified from previous servo controller editions. To change the network address, first ensure the unit is in network mode. This can be confirmed by powering the unit on and observing the alternate flashing of both LEDs for about 3 seconds. After this sequence completes the current network address will be flashed on the CHNL LED once before entering the normal run mode.

To increment the network address, press the HIGH button for approx. 1 second. When both LEDs illuminate, release the button. The board will restart and flash out the new address to confirm it has been set.

To decrement the network address, press the LOW button for approx. 1 second and follow the procedure above.

The network range can be set from 2 to 17.

Change the network range

The address range 2-17 is selectable with each address comprising a block of 12 channels to maintain compatibility with our existing 12 channel servo controller. You can select the first, second or third block of four within any address of 12 by moving the jumper on the RANGE selector. Therefore three Servo 4R units can occupy the same network address with each unit set to LO, MID and HI respectively. The following chart summarises the channels:

| Range	Channels
LO	First 4 (1-4)
MID	Mid 4 (5-8)
HI	Last 4 (9-12)

Install pull-up jumpers

Pull-up jumpers extend the range of the network and should be fitted to any two devices on the network. No more than two devices should be jumpered. Jumpers are supplied as part of the starter kit. If installing, ensure a pair are fitted.
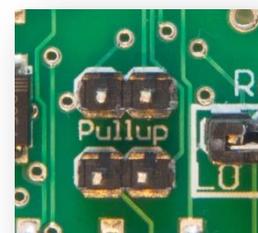
Make a remote setup cable

Just above the four setup buttons you will observe the 5 pin remote setup connector. This is an optional feature and allows you to place the board in an inaccessible location yet retain the ability to reconfigure all settings remotely.

Each of the four setup buttons are connected to the corresponding pin on the connector (*left to right*). The right most connector is the common ground.
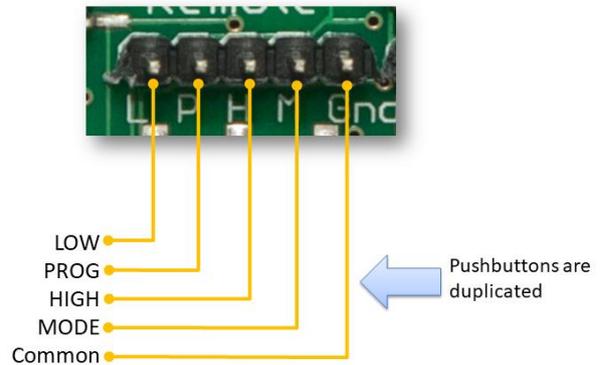
Use a pair of standard servo extension leads with plugs fitted or make your own to suit your requirements. Connect each of the left four cables to one connector of a pushbutton and connect the other pushbutton connector to each other and the common ground. Each pushbutton will mimic the four setup buttons on the board (*LOW, PROG, HIGH, and MODE*).

Reference section

Hooking up

MegaPoints Servo 4R Controller – Wiring Example
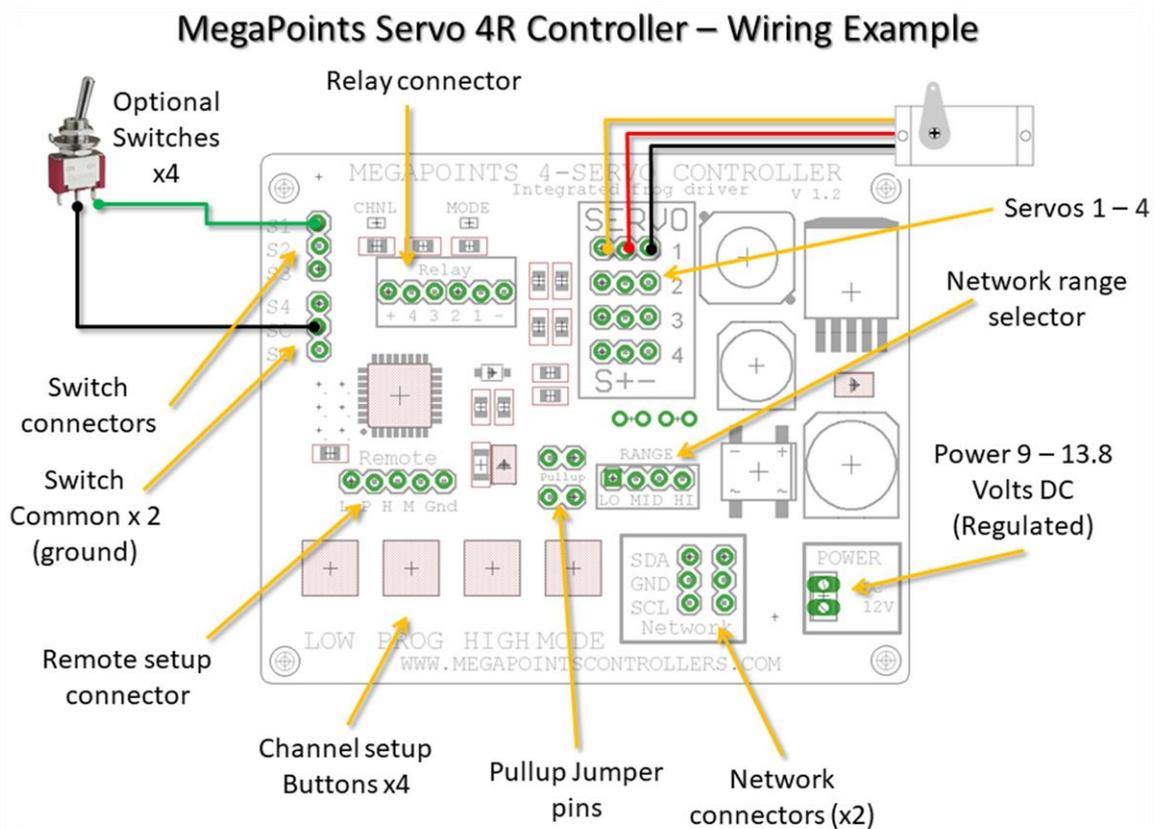
Servo connectors

Each servo can be plugged into the connector on the right side of the board. Ensure the signal wire (*usually white or yellow*) is towards the middle of the board (*left side of connector*) and the negative wire (*black or brown*) is towards the outer edge. Servo cables can easily be extended with a servo extension cable or by soldering cable to a recommended maximum length of 5 meters.

Switch connectors

The unit is supplied with 2 cables with plugs on one end. Connect these to the switch inputs on the left side of the board. Extend the cable as necessary to the switches installed on your control panel. The SC (*switch common*) should be wired to the common of all toggle switches. When the circuit is closed the servo will move to the high position.

Initial set-up

The Servo Controller is ready for use out of the box. Just hook it up to a regulated DC power source (9 - 13.8 Volts, min 1.5 Amps).

Power connection

Connect a <u>regulated DC power source</u> of at least 1.5 Amps capacity to the power connectors (*located on the lower right side of the board*). Polarity does not matter.

Servo connection

Plug in servos to the connectors on the right side of the board (*numbered 1 – 4*). The signal (*white or yellow wire*) should be towards the inside of the board. Black or negative is to the outer edge.

Switch connection

Connect a single wire from a toggle switch or lever to the single connector posts on the left side of the board (*labelled 1 – 4*).

Connect a common connection to the SC connector on the lower left of the board.

When the switch cable is pulled low to the supply voltage the servo will move to the opposite end of its motion. Disconnecting or breaking the connection will cause the servo to move back.

Using high power or digital servos

The MegaPoints Servo Controller is designed to use low cost 9 gram analogue servos. These offer an excellent performance at their price point and are absolutely fit for purpose. There are extreme use cases where it is required to deviate from the recommended servo range. Possible reasons may include:

- Using digital servos to eliminate the switch on kick when power is applied because the device being operated is too delicate or small to tolerate the movement.
- Using waterproof servos in an all weather installation such as in a garden.
- Using high torque servos for a larger or non model railway application.

There is no use case for improving resolution with an expensive digital servo. You are more likely to experience the opposite as the microcontroller may jitter by as much as 8 µsec as stated in its data sheet so plan and test carefully when deviating (*or contact me for advice*).

Warning: Do not attempt to connect a conventional relay directly to the output of a MegaPoints Servo Controller. You WILL damage the unit and this is not covered by our warranty. Only connect MegaPoints Controllers Relay Boards as these are isolated and current limited.

Specifications

The MegaPoints Servo 4R Controller was lovingly designed and crafted in the United Kingdom by railway enthusiasts, for railway enthusiasts.

Channels   4 servo / points outputs, each with the following independent settings:
- High and low end point adjustment
- Reverse
- Semaphore bounce (*upper and lower quadrant*)

Power supply   9 – 13.8 Volts regulated DC.

Current   Less than 220 mA + servo load. 1.5 Amp peak.

Expansion   Yes, via 2 x network connectors (*on lower right of board*).

Appendix

Summary of menu commands

Condition	Explanation
Boot up.	These are features accessed by holding a button or combination as power is applied to the board.
Normal	These functions are accessed by pressing a button during normal use.
PROG	Feature available while in programming mode.

Condition	Button	Purpose
Boot up	LOW	**Slave enable** Turns the unit into a slave controller. Can now be connected to a master unit and will only accept commands from the master. Local switch reading is now disabled. The YELLOW and RED LEDs will flash alternately for 3 seconds to indicate slave mode is set. Subsequent power on of the board will also result in the YELLOW and RED LEDs flashing to remind you the board is slaved.
Boot up	HIGH	**Master enable** Disable slave controller mode.
Boot up	LOW & HIGH	**Safe reset** RED LED flashes for about 5 seconds during the reset. After resetting, all end points and servo directions are reset back to the (*centre*). Slave controller mode is disabled. As the end points of all servos have been reduced to 0, no servos will move until the end points have been individually programmed. This feature ensures all servos are correctly centred and prevents the servo from over driving or stalling against a hard mechanical limit.
Boot up	PROG & HIGH	**Normal reset** Perform a factory reset. As above (Factory Reset) but with endpoints for each servo adjusted to provide approx. 90 degrees of servo movement. You must ensure servos can move freely of performing this reset and will not hit a hard mechanical limit.
Boot up	HIGH+MODE	**Toggle servo pulse mode** Holding HIGH+MODE will cycle the servo pulse state around the listed modes. 1. Pulses always ON. 2. Pulses OFF, signal line low. 3. Pulses OFF, signal line high. ** Default mode ** Pulses are disabled approx. 500 milliseconds after the servo reaches its set end point.
Boot up	MODE	Inverts all switch inputs (S1 – S12).
Normal	S 1 - 12	Operate the points corresponding to switch number.
Normal	PROG	**Programming mode** Enter servo programming mode. The RED LED illuminates in programming mode. Solid means a servo is operating normally, flashing indicates it has been reversed.
PROG	PROG	**Advance to next servo** While in programming mode, subsequent presses of the PROG button

		moves you onto the next servo to be programmed. As each servo is selected, it will jump to its centre position. The yellow indicator will flash in groups. The number of flashes indicates which servo is being programmed, so 6 flashes means servo channel 6 is currently being programmed. After the 12th servo has been selected, the next press will end programming mode.

PROG	MODE	Cycles through channel modes and is indicated by the number of flashes on the right LED during programming mode. The MegaPoints Servo Controller currently supports six modes of operation. Before pressing the MODE button, count the number of flashes on the right LED first to determine the current programmed mode.
		
		Channel modes:
		        1 flash – Points, normal direction.
		        2 flashes – Points, reversed direction.
		        3 flashes – Semaphore, normal direction.
		        4 flashes – Semaphore, reversed direction.

PROG	LOW	Moves a servo slowly to a new low end point. Release button to stop.
PROG	HIGH	Moves a servo slowly to a new high end point. Release button to stop.

Expansion diagram

This diagram shows the expansion possibilities for the MegaPoints system when used in conjunction with the MultiPanel and expansion boards. See web site for up to date product details and expansion options.
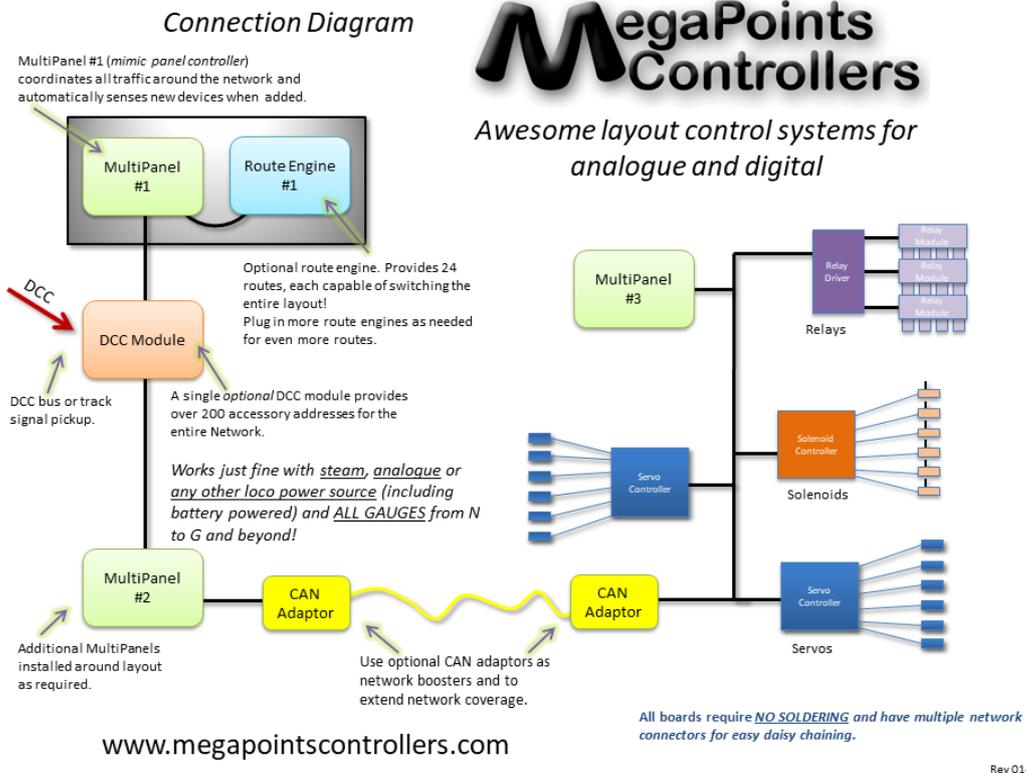
Custom built mimic panels

We design and build great looking mimic panels to your design. Check out our web site for examples and further details.

Contacting us

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Phone: 07846 409320

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If you have any product improvement suggestions we'd be very pleased to hear from you.

NOTE: We operate on a policy of continuous improvement. Colours, specifications and even the placement of components may vary from time to time. Documentation will continue to be updated to reflect changes or answer frequent customer questions.