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Single Servo Module with 3 positions for buttons or use with switching decoder

Servo-1
v2-2013



Degree of difficulty: **easy**
medium
difficult

Necessary skills:

- Very easy assembly and soldering of the PCB

The Single Servo Module is a very small switching module to control a servo motor with JST or JR connection. It is especially precise and reliable in steering. In addition to the two end and central positions one can adjust moving velocity (per direction), turn off behaviour and moving pause in central position for the servo motor.

Steering of the Single Servo Module is done by external buttons or alternatively directly in combination with a switching decoder **without the necessity of a relay in forehand.**

Additionally the Single Servo Module can steer an external relay which can be used for frog polarisation.

Although a housing for installation is available, alternatively the PCB size can be reduced to economise space under your model railway layout.

Possible applications are e.g.:

- Turnouts and semaphores
- Railway crossing gates (with post luffing)
- Opening and shutting gates
- Water crane with 3 positions
- Turning platform with 3 positions
- Any other forth and back movements

Special features

- For operation with buttons or operation in combination with a switching decoder without additional relay
- Isolated inputs by optocouplers
- Connecting a servo via JST or JR plug
- Precise and reliable controlling of the servo: no kick off during powering
- Various settings (Turn off the servo after switching, post luffing of railway crossing gates, etc.)
- PCB designed for housing
- PCB size-reducible
- External relay (e.g. for frog polarisation) controllable

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Accessory and expendabilities

The following equipment is available for the Single Servo Module:

Housing:

- **Housing for Single Servo Module: G 521** Art. 174

Expendabilities:

- **Programming mouse** Art. 291

To configure the positions of the Servo motor (mandatory).

Technical specifications

Size

50mm x 53mm x 20mm (for mounting in the housing)
36mm x 53mm x 20mm (for mounting without housing)

Power supply

The Single Servo Module requires a suitable external power supply. A regular model railway transformer can be used:

Alternating current: 10V – 18V
Direct current: 14V – 25V

The use our model with 14V AC, 70W is recommended.

Connections

- 1x 2 terminals for power supply
- 1x 4 terminals for buttons
- 1x JST-connector for servo motor
- 1x JR-pin header for servo motor
- 1x 3-pinned header for external relay
- 1x 5-pinned header for programming mouse

Indicators

LED: Programming the servo motor positions

Assembly notes

The Single Servo Module is assembled following the instructions on the next page. For soldering the components on the PCB a soldering station with the temperate set to approx. 420°C is needed together with 0.5 or 1.0 mm soldering wire with rosin flux. No special tools are required. Do not use soldering flux! Pay attention to solder speedy to avoid device damage by overheating.

Non-Use

When the module is not used it should be stored at a dry and clean place.

The Instruction

The full content of the instruction is important. Very important information is marked in **colours**; critical information is highlighted in **red**. A recommended value for any setting is marked with an (*).

Update

The heart of the Single Servo Module is a PIC that stores the software. A socket for the PIC provides easy access for the purpose of any software update.

Never use other PICs than those dedicated to this module. Disregarding may lead to destruction of the module and all term of warranty will become invalid.

Kit contents

Please first verify that the kit contains all the components listed below.

General parts:

- 1x circuit board (populated with SMD devices on bottom)
- 1x rectifier B80C1500
- 1x LED (red)
- 1x voltage regulator 78L05
- 1x resistor network 10kOhm
- 1x heat sink
- 1x metal screw
- 4x screws
- 4x spacer rings

Connectors:

- 1x terminal RM3.5 6-pinned
- 2x 3-pinned header RM2.5
- 1x 5-pinned header
- 1x JST-connector (RM1.5)

ICs:

- 1x 14-pin IC socket
- 1x PIC „SV-3IN-xx“

Transistors:

- 1x BD677

Capacitors (Marking):

- 2x electrolytic 47µF
- 1x electrolytic 1000µF (1000µF35V)

Assembly instruction

Assemble the kit in the order of these instructions. All components are placed on the top side of the PCB (marked “top”) as close to the PCB as possible and soldered on the bottom side of the PCB (marked “Bottom”). Use a bending tool (e.g. Conrad 425869 – 62) for bending. Cut the leads of components flush using a wire cutter after soldering.

When soldering, pay specific attention not to unsolder the pre-populated SMD devices on the bottom layer. Solder cleanly and precisely!

1. Socket for PIC, JST-connector

Pay attention to the orientation: Solder the notches according to the component layout diagram on the PCB.

Socket: Socket for IC1
SV1: JST-connector

2. Resistor network

Place the resistor networks according to their marking: the marking has to face to the IC socket.

RN1: 10kOhm (7A103)

3. LED

The cathode of the LED is to be placed to inner side of the PCB. The shorter lead of the LED is the cathode and the collar is also flat on the cathode side.

H1: red

4. Terminals, rectifier

Solder the terminals first. The rectifier should be soldered in the same height as the terminals. Especially take care for the polarity: The positive pole has to face to the hole in the PCB.

X1: terminals

B1: rectifier

5. Pin headers

Watch the polarity when soldering the 5-pinned header: The cladding must face away from the IC socket.

SV2, SV3: 3-pin header

SV4: 5-pin header with cladding

6. Transistor BD677 and voltage regulator

First use a piece of tape to insulate the heat sink and the PCB.

Before soldering the transistor, fix it to the heat sink using the metal screw. Watch the orientation: The transistor has to be mounted to the heat sink with its metallic side (metallic shiny or straight black without label). Solder the voltage regulator next.

T1: transistor

IC2: voltage regulator

7. Electrolytic capacitors, Watch polarity!

The negative pole of the electrolytic capacitors is mounted facing upwards. C1 is mounted in horizontal direction: Be sure to bend the leads without having them touching the heat sink.

C2-C3: 47µF

C1: 1000µF

8. Verification and mounting the PIC

After soldering all components on the PCB verify once more that they are placed according component layout diagram and that they are oriented properly. Check that all solder points on the bottom side of the PCB look correct. Note especially if there are any undesired solder bridges between solder pads.

After the verification the PIC can be mounted:

IC1: PIC „SV-3IN-xx“

Component layout diagram

Populated PCB



Description of operation

The Single Servo Module is controlled directly via buttons to be connected or it can be plugged to the output of a switching decoder alternatively.

The Single Servo Module supports settings of 3 different positions (end position straight and turn out, as well as central position), moving velocities, turn off behaviour as well as an option for post luffing which all can be configured according to the  adjustment of the servo settings.

Power supply and wiring

The Single Servo Module must be fed by an adequate transformer. Plug the transformer to the terminals "ACIn" of the terminal block X1.

Connecting servo motors

On the left side of the Single Servo Module there are a polarity proof JST connector and a JR pin header available to plug a servo motor to.

Connecting servo motors to the JR pin header:

Pin	Signal	Modelcraft	EMAX
1	PWM	Orange	Orange
2	+5V	Red	Red
3	GND	Brown	Brown

Watch out the correct polarity when using the JR pin header! Inverting the connection may cause damage to the servo motor and to the Single Servo Module!

Connecting a programming device

To adjust the servo settings a programming device (programming mouse) must be plugged to the Single Servo Module. For that purpose the 5-pinned header with cladding is available.

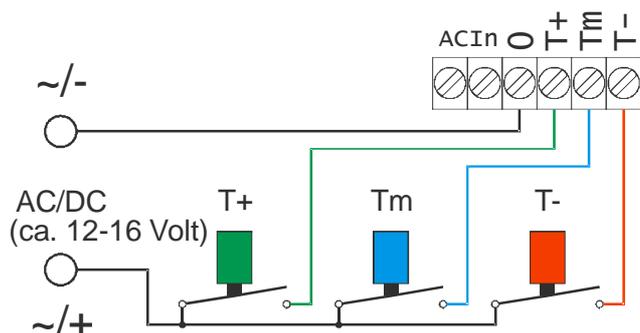
Pin assignment for the programming device

5 (down)	LED (cathode)
4	Button to start programming
3	Button T-
2	Button T+
1 (up)	Power supply (+5V)

Connection of buttons

To switch the positions of the connected servo motor via buttons, the right terminals of block X1 are used: Plug the powered buttons (as usual for track layout switch boards) here according to the sketch  Wiring scheme of buttons.

Wiring scheme of buttons



Connection of a switching decoder

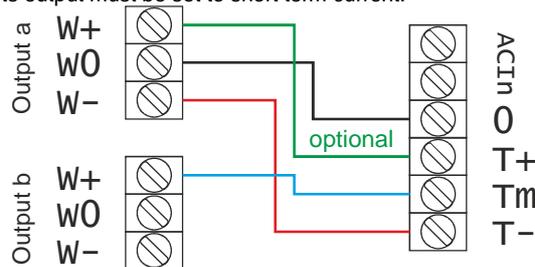
In alternative to connecting buttons the Single Servo Module may also be connected to the output of a switching decoder.

This is especially useful if e.g. one or only a few magnetic devices are to be replaced by servo motors: The switching decoder can further be used by simply inserting the Single Servo Module in between.

Respectively the switching decoder is connected instead of buttons as depicted in  wiring scheme of switching decoder.

Wiring scheme of switching decoder

When using a switching decoder to control the Single Servo Module, its output must be set to short term current.



Connection of an external relay

The Single Servo Module offers connectivity for an external bistable relay (12-16 Volt) which can be used e.g. for a frog polarisation. For this purpose pin header SV3 is available.

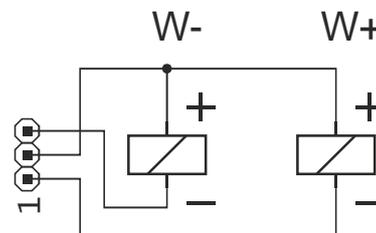
With  inactive button Tm the Single Servo Module puts out a switching pulse of ca. 50 ms to switch the relay.

The polarity depends on the standard position of the turnout – refer to the  connection scheme for an external relay.

Connecting an external relay

- 1 (down: W+) Relay contact turn out position
- 2 (center: UB) Powering voltage
- 3 (up: W-) Relay contact straight position

Connection scheme for an external relay



Installation site

The module should be located in a dry, ventilated and clean area being easily accessible and lying beside or next to the model railway layout.

The module must be kept free of coarse dirt or electro conductive parts falling down.

The heat sink on the module may heat up and may thus not be placed in a confined site (e.g. between Styrofoam).

The module may be arranged without a housing needed. In that case the module shall be put on an insulating sub floor by means of the plastic spacer rings and screws delivered.

For an extra space effective installation without housing the PCB edges may be broken away. By doing so the PCB width is reduced to 36 mm only.

Keep all electro conductive tools, assembly kits and cables away from the module during operation.

A negligently and by external circumstances caused short-circuit (impinging on the module from above or from the bottom) may destroy the module. If that happens, all terms of warranty will become invalid.

Installation of the servo motor

Before installation of the servo motor it is strongly recommended to have it moving to the central position to ensure a correspondence with the servo's mechanical central position.

To facilitate installation you may keep the **Prog** button pressed when turning on the power supply (the programming LED will not light up). That induces the servo motor to move to its absolute central position (not the central position configured by programming!) and stay there until pressing the **Prog** again to start configuring the servo motor positions, or until pressing one of the controlling buttons not entering position configuration and to move to normal operation instead.

Configuration of the servo positions

For configuring the servo positions (programming) an external programming device (e.g. Stärz Programming Mouse or Rautenhaus Programmer SLX861, with buttons **T+**, **T-** and **Prog**) is to be plugged to the 5-pin header with cladding.

Overview of the standard settings

By pressing the **Prog** button, step by step the following settings can be configured. Changing a setting is achieved by pressing the buttons **T+** or **T-** respectively.

Setting	LED-display
Central position (**) In dependence of the extended settings, here you configure the position where the relay shall be switched, the position that shall be taken when pressing Tm or the position that shall be reached at post luffing of railway crossing gates, respectively.	continuously on
End position straight (**) Here you configure the position that shall be reached when pressing T+ .	Long on, short off
End position turn out (**) Here you configure the position that shall be reached when pressing T- .	Short on, long off
Moving velocity In this setting the servo motor continuously moves from one end position to another while the moving velocity can be adjusted.	Fast blinking
Turn on and off behaviour/Optimisation	Variable blinking:
Normalised, active: When turning on the power supply, the servo is normalised, which means it moves to its last stored position. After each steering the servo motor stays active. In this setting, the servo motor may create humming in end positions.	Blinking once
Normalised, passive: When turning on the power supply, the servo is normalised but after each steering it is turned off.	Blinking twice
Not normalised, passive: When turning on the power supply, the servo is not normalised and it is turned off after each steering.	Blinking 3 times
Normalised, passive, smoothed Like "Normalised, passive", but still some servos react with a little kick off. This setting removes this kick off for many servos.	Blinking 4 times

Pressing the **Prog** button again terminates the configuration mode. Having the programming device still plugged, one can now switch between both end positions to verify the settings and to readjust them directly if necessary by pressing the **Prog** button again and to start over with the configuration cycle.

On  active button **Tm** the controlling positions are a bit different: if pressing **T+** in position turn out, first the central position is taken, also if pressing **T+** in position straight, whilst pressing **T-** directly moved to end position turn out.

Reset to factory default settings

The Single Servo Module can be reset to its factory default settings by pressing the **Prog** button for ca. 3 seconds until the LED lights up as confirmation and turns off after reset.

Extended settings

In addition to the standard settings the following extended settings can be made:

Pause in central position

A pause of up to 1.2 seconds can be adjusted in steps of 0.02 seconds (20 ms).

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This is useful for e.g.:

- Turnouts: re-grabbing switchstand, 200-500ms (*)
- Semaphores: re-grabbing switchstand, 200-500ms (*)
- Crossing gates: Catching the gates when closing 200-300ms (*)

To adjust this extended setting, enter the configuration of the moving velocity (press the **Prog** button 4 times until the servo moves back and forth).

Now, hold button **T+** and press the **Prog** button repetitively to increase the pause by 20 ms for each press until you reach the desired pause length. Then, release the button **T+**.

To reduce the pause in steps of 20 ms, hold button **T-** and press the **Prog** button repetitively until reaching the desired pause length or pause is deactivated. Now, release the button **T-**.

You may now leave the configuration (pressing the **Prog** button until the LED turns off) or you may proceed to the next extended setting.

Distinguished moving velocities

One can adjust the moving velocity individually for the both moving directions.

This is useful for e.g.:

- Semaphores: Lift up slower then downwards
- Scything: Pulling back slowly

To adjust this extended setting, enter the configuration of the moving velocity (press the **Prog** button 4 times until the servo moves back and forth).

Now, hold button **Prog** and press the **T+** button repetitively to increase the velocity for moving back for each press until you reach the desired velocity. Then, release the button **Prog**.

To reduce the velocity for moving back, hold button **Prog** and press the **T-** button repetitively until reaching the desired velocity or velocities for back and forth are equal again. Now, release the button **Prog**.

If you want to increase the velocity for the forth moving instead, keep pressing **T-** (with button **Prog** held).

Similarly you can reduce the velocity for moving forth by repetitive pressing of the **T+** button until both velocities equalise.

You may now leave the configuration (pressing the **Prog** button until the LED turns off) or you may proceed to the next (extended) setting.

Active/Passive button **Tm** or post luffing

Per default the button **Tm** is passive, which means when passing the central position, the relay is switched, but pressing button **Tm** has no effect, respectively the central position can not be taken. With activated button **Tm** the central position is taken when pressing it, but switching the relay is deactivated instead.

A second alternative is to enable post luffing (e.g. of railway crossing gates) in one end position (straight or turn out).

You can either activate the button **Tm** (in setting central position) or post luffing (in setting end position straight or turn out). Both is not possible.

(**) To activate the button **Tm** (in the central position setting) or to enable the post luffing (in an end position setting), respectively, hold the **Prog** button and press button **T+** until the LED blinks for confirmation.

(**) To deactivate the button **Tm** (in the central position setting) or to disable the post luffing (in end position setting), respectively, hold the **Prog** button and press button **T-** until the LED blinks for confirmation.

Maintenance and care

Dust clumping together can, in combination with condensating liquids, become conductive and deteriorate the functionality of the module. It is therefore important to remove dust regularly by blowing it off or vacuuming the module.

CAUTION: A liquid cleaning of the part is prohibited!