

SD-32

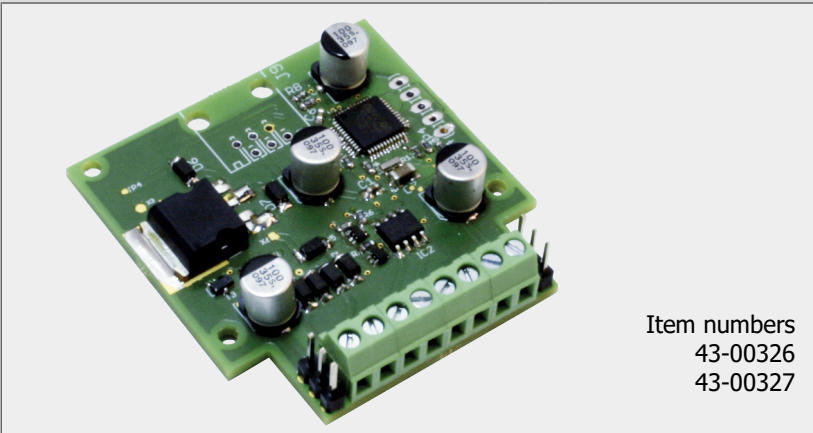
2-fold servo control for
analogue and digital model railways

analogue

MM

DCC

Manual



Item numbers
43-00326
43-00327

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Printing the manual

The formatting is optimised for double-sided printing. The standard page size is DIN A5. If you prefer a larger display, printing on DIN A4 is recommended.

Notes on RailCom®

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1. Getting started

The instructions will help you step by step with the safe and proper installation and use of your module. Before you start to put the module into operation, read this manual completely, especially the safety instructions and the section on possible errors and their elimination. You will then know what you have to pay attention to and thus avoid errors that sometimes can only be rectified with a lot of effort.

Keep the instructions in a safe place so that you can restore functionality later in the event of any malfunctions. If you pass the module on to another person, also give the instructions with it.

1.1. Contents of the package

- 1 ready-built and tested circuit board SD-32 (item no. 43-00236-01) or
1 module SD-32 in housing (item no. 43-00237-01)
- 3 push-buttons (one each with yellow, blue and black button)
- 1 protection resistor 220 Ω

1.2. Accessories

Connection cables

The use of stranded wire is recommended for making the connections. Stranded wires consist of several thin individual wires and are therefore more flexible than rigid wires with the same copper cross-section. Recommended cross-sections:

- connections of LEDs and push-buttons: $\geq 0.04 \text{ mm}^2$
- all other connections: $\geq 0.25 \text{ mm}^2$

Connecting the frog polarisation of turnouts

For the connection of the frog polarisation of turnouts with servo drive you additionally need per turnout:

- one monostable relay 1xUm (e.g. item no. 84-61010-01)
- one protection diode 1N400x, x = 2...7 (e.g. item no. 83-11200-10)

Special function "barrier mode"

When using the special function "barrier mode", you need a special amplifier module with loudspeaker (Sound-Booster, item no. 72-08017) for the acoustic warning signal. If the loudspeaker is connected directly to the output, noise will occur.

1.3. Intended use

The module is intended for use in model construction, especially in model railway layouts, according to the specifications in the manual. Any other use is not in accordance with the intended use and will result in the loss of the warranty claim. Intended use also includes reading, understanding and following all parts of the instructions. The module is not intended to be used by children under the age of 14.

1.4. Safety instructions

**Note:**

The module contains integrated circuits (ICs). These are sensitive to electrostatic charging. Therefore, do not touch these components until you have "discharged" yourself. For this purpose, e.g. a grip on a radiator is sufficient.

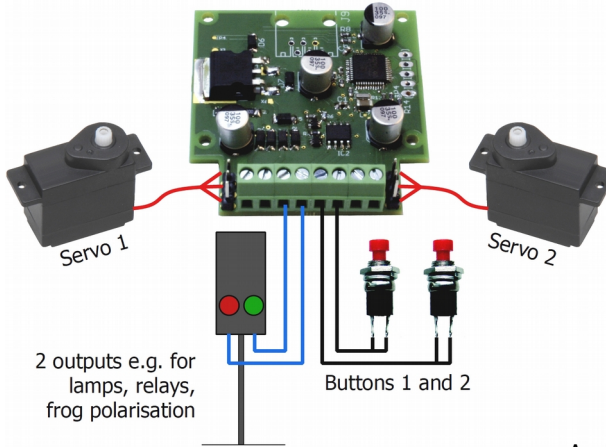
Improper use and non-observance of the instructions can lead to incalculable hazards. Prevent these dangers by carrying out the following measures:

- Only use the module in closed, clean and dry rooms. Avoid moisture and splash water in the environment. After condensation has formed, wait two hours for acclimatisation before use.
- Disconnect the module from the power supply before carrying out wiring work.
- Supply the module only with extra-low voltage as specified in the technical data. Use only tested and approved transformers / power supply units.
- Only plug the mains plugs of transformers / power supply units into properly installed and fused earthed sockets.
- When making electrical connections, ensure that the cable cross-section is sufficient.
- Heating of the module during operation is normal and harmless.
- Do not expose the module to high ambient temperatures or direct sunlight. Observe the information on the maximum operating temperature in the technical data.
- Regularly check the operational safety of the module, e.g. for damage to the connection cables.
- If you notice damage or if malfunctions occur, disconnect the connection to the power supply immediately. Send the module in for inspection.

2. Operation overview

In standard operation, the SD-32 controls the movements of 2 servos and 2 additional switching outputs that can be used to connect other accessories (e.g. lamps, 2-term light signals, solenoid accessories with limit switching, relays).

The servo control signals are sent continuously, i.e. the module controls the servo even when it is in rest position. Growling noises may occur.



Application example

Servos and outputs are controlled:

- in digital mode: either via DCC or Motorola turnout setting commands or via push-buttons
- in analogue mode: via push-buttons

As an alternative to standard operation, the special function "barrier mode" can be activated for both digital and analogue systems. In barrier mode, the complete procedure at a level crossing is controlled. The SD-32 not only controls the barriers, but also switches the light signal system (yellow and red warning lights) and the acoustic warning signal at a level crossing on and off.

2.1. Servo decoder for digital model railways

The SD-32 is used in digital model railways as a stationary 2-fold servo and 2-fold switching decoder. Servos and outputs can be controlled in digital mode either by turnout setting commands or by push-buttons. The settings can be made both by programming the configuration variables (CVs) with DCC control units and (with some restrictions) with the help of programming push-buttons. Setting options → Section 2.3.

Use with Motorola control units

It is not possible to set the (DCC) configuration variables with a pure Motorola control unit. The address must therefore be set with the programming buttons. The settings of the servos must also be made with programming buttons – as when used in analogue systems (→ section 2.2).

Control via digital turnout setting commands

The two connected servos and the accessories connected to the two switch outputs are switched via turnout setting commands, which are sent from the control unit in DCC or Motorola format to the four turnout addresses of the decoder. The decoder automatically recognises the data format in which the commands are sent. It is possible to switch the outputs mixed via DCC and Motorola commands as well as to control an output alternately in DCC and Motorola format.

Control via vehicle commands

The SD-32 can be controlled via a locomotive address instead of turnout addresses. The two servos and the two additional switching outputs of the decoder are then switched via the functions F1 to F4. This makes it possible to use the SD-32 also with digital control units that do not allow the control of turnout addresses. Note: Switching to the use of locomotive addresses is only possible with a DCC control unit.

Control with push-buttons

The movements of the two servos can be triggered with two push-buttons as an alternative to control via digital commands. If a CV is set accordingly, the movement can be interrupted by pressing a button and continued after pressing the button again.

The two switching outputs cannot be controlled separately via push-buttons. However, they can be set by CV programming so that they react together with the servos to the pressing of the two buttons. One servo is permanently assigned to each of the two outputs.

Switching servos and switching outputs together

For each of the two outputs it can be set separately in a CV whether it is switched over together with the assigned servo or not. The output is switched as soon as the servo has reached the middle between the two end positions. With this setting, e.g. the frog polarisation of turnouts can be realised. The relay required for this is not included in the scope of delivery.

Feedback via RailCom® (according to RCN-217)

The SD-32 is RailCom-capable, i.e. it sends RailCom messages via the rails to special RailCom detectors or the digital control unit. After a switching or setting command to its address, it sends:

- Status message, e.g. "Servo is in the correct position", "Have switched servo" or "Servo still needs to be switched" and / or
- Time message ("Need another 2 seconds to execute the positioning or switching command") and thus also acknowledges receipt of the command.

2.2. Servo module for analogue model railways

The SD-32 is used in pure analogue operation as a 2-fold servo module. The movements of the two servos are triggered independently of each other via two push-buttons. The accessories connected to the two switching outputs are switched together with the two servos. One servo is permanently assigned to each of the two outputs. The output is switched as soon as the servo has reached the middle between the two end positions.

The movement sequences for the two servos are set separately using programming buttons. Setting options → section 2.3.

2.3. Setting options for servos and switching outputs

For setting the servos and outputs are used:

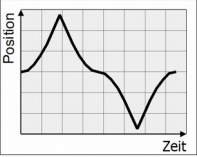
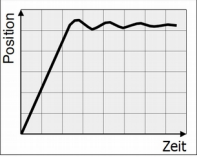
- in digital operation with DCC control units: either configuration variables (CVs) or programming buttons
- in digital operation with Motorola control units: programming buttons
- in analogue mode: programming buttons

	CV programming	Programming buttons
Movement curve (separate for each servo)		
Linear curve with constant speed	✓	✓
Seesaw	✓	---
Linear curve with bobbing when reaching the end positions / Version A	✓	✓
Linear curve with bobbing when reaching the end positions / Version B	✓	---
Motion sequence (separately for each servo)		
Start and end position	✓	✓
Speed of servo movement	✓	✓
Interruption possible with button (yes/no)	✓	---
Speed and deflection of bobbing	✓	---
Control of the switching outputs		
together with the assigned servo	✓	✓
independent of the servos	✓	---

2.4. Movement curves

The settings can be made

- by programming the configuration variables (CVs) with a DCC digital control unit or
- purely analogue using the programming buttons

	Curve 1 Linear movement between the two end positions with automatic stop when reaching an end position. Constant speed. With the standard setting, the sequence cannot be interrupted (application example: turnouts). It is possible to interrupt the sequence by pressing the button at any position and to continue it by pressing it again if a CV is set accordingly (application example: water cranes).
	Curve 2 Typical motion sequence of a child's seesaw. Note: The curve can only be set by programming a CV accordingly with a DCC control unit.
	Curve 3 Typical sequence of movement of wing signals and barriers with bobbing and automatic stop when reaching an end position. Version A: The signalman moves the lever in one go. Note: Speed and deflection for bobbing can only be set by programming a CV with a DCC control unit.
	Curve 4 Typical movement sequence of wing signals and barriers with bobbing and automatic stop on reaching an end position. Cannot be set with the programming buttons. Version B: The signalman cannot move the control lever in one go, which results in a short pause in the movement sequence.

2.5. Special Function Barrier Mode

In barrier mode, the complete procedure at a level crossing is controlled. The barrier mode is activated and deactivated by programming a configuration variable (CV) or purely analogue using the programming buttons.

Movement curve 3 is automatically set for both servos in barrier mode. Start and end position of the servo as well as the speed can be set by CV programming or by using the programming buttons.

In Barrier mode, the SD-32 not only controls the barriers, but also switches the traffic lights (yellow and red warning lights) and the acoustic warning signal at a level crossing on and off.

The sequence is started

- after sending a turnout setting command in DCC or Motorola format or
- at the push of a button. Alternatively (or in addition) to the push-button, the switch input can be triggered by a contact in the track (e.g. reed contact or Hall sensor).

Connection variants

1. two half or full barriers on one servo output
2. two half or full barriers at two servo outputs
3. four half-barriers at two servo outputs, whereby the two right and the two left half-barriers (seen in the direction of the crossing road traffic) are each connected to one servo output.

With a DCC control unit, the length of the pause between the lowering of the first and second barrier(s) can be set by CV programming for variants 2 and 3.

Sequence

One after the other, the following are switched on when the barriers are closed:

1. Yellow warning light and acoustic warning signal on. Note: An additional amplifier module with loudspeaker (Sound-Booster) is required for the acoustic warning signal.
2. Red warning light on and yellow warning light off.
3. First full barrier or right half barrier(s) closed (seen in the direction of the crossing traffic).
4. Second full barrier or left half barrier(s) closed.
5. Acoustic warning signal off.

After the opening of the barriers has been triggered, the red warning light is switched off and all barriers are opened.

2.6. Power supply

The SD-32 and the connected servos and other consumers are supplied:

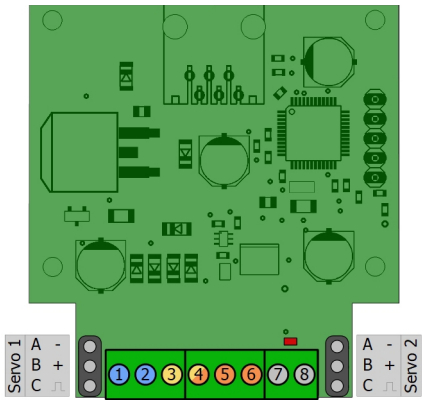
- in digital mode: with the digital voltage from the booster circuit, i.e. via the integrated booster of the digital control unit or a separate booster,
- in analogue mode: via an AC voltage transformer

3. Connections

Make the connections to:

- servos
- push-buttons. Note: Only connect the black programming button if you want to program the module.
- other consumers
- the control unit (only when used in digital layouts) or
- the power supply

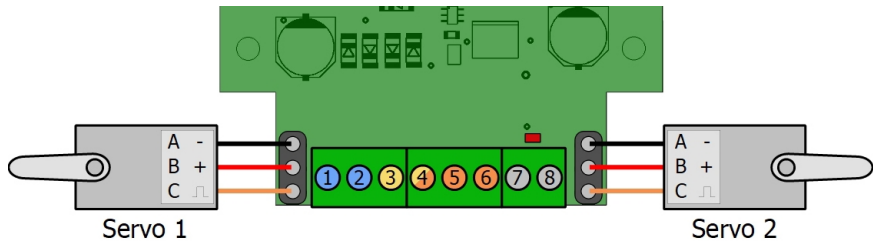
3.1. Connection assignment



1	Analogue mode: power supply / transformer (~) Digital operation: control unit / booster
2	Analogue operation: power supply / transformer (~) Digital mode: control unit / booster
3	Output AUX1
4	Output AUX2 or black programming button ⚠ Please note: The black programming button should only be connected for programming. As soon as you connect the button, you must disconnect the consumer from output AUX2.
5	Input 1: blue button 1 for servo 1
6	Input 2: yellow button 2 for servo 2
7	Return conductor for inputs 1 and 2 (connections 5 and 6)
8	Return conductor for outputs 1 and 2 / programming button (connections 3 and 4)

3.2. Connecting servos

To connect the servos, the SD-32 has two pin headers onto which you plug the connection sockets of the two servos. If you need to extend the connecting cables of servos, you should use 3-pin pin headers socket connectors spacing 2.54 mm (e.g. item numbers 85-11103-10 or 85-11203-10).



	A	B	C
Servo 1	GND (-)	VCC (+)	Signal
Servo 2	GND (-)	VCC (+)	Signal

Observe the maximum permissible total current and the maximum current per servo connection (see section 7. "Technical data"). If the current demand of the connected consumers is too high, the module can be irreparably damaged.

INFO: Servo connections

Connection	Short term	Identification symbol	Colour of connecting wire (deviations possible)
Voltage supply	"GND"	-	black or brown
	"VCC"	+	red
Impulse (signal)	"PW"		white or orange

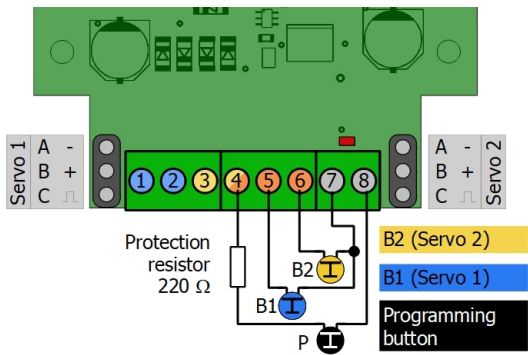
Tip: If the servo's connection socket is plugged onto the pin header the wrong way round, the servo will not be damaged during commissioning.

If the servo does not respond to keystrokes or digital switching commands, you can easily plug the socket in the other way round and thus test whether a connection socket plugged in the wrong way round is the cause of the malfunction.

3.3. Connecting the push-buttons

The SD-32 is equipped with terminals into which you plug and screw the connection cables of the push-buttons.

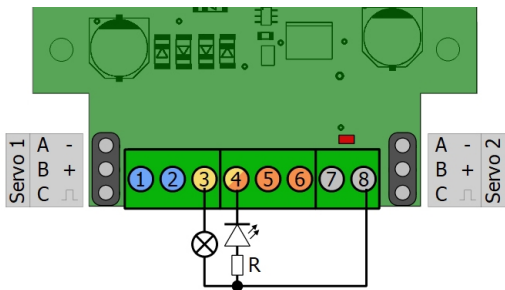
Note: Assign the button colours as indicated, as reference is made to the colours in this and subsequent sections.



1	Power supply
2	Power supply
4	Black programming button  Note: The black programming button must be connected via the protective resistor. It may only be operated in programming mode (when the LED on the board is flashing) and not during normal operation. It should therefore only be connected for programming. It must not be connected together with a consumer. Failure to observe these instructions may result in irreparable damage to the module during operation.
5	Input 1: blue button 1 for servo 1
6	Input 2: yellow button 2 for servo 2
7	Return conductor for inputs 1 and 2 (push-button 1 and push-button 2)
8	Return conductor for programming button

3.4. Connection of consumers

The SD-32 is equipped with terminals into which you plug and screw the connection cables of the other consumers (lamps, simple light signals, solenoid accessories with limit switching, relays).



1	Power supply
2	Power supply
3	Output AUX1: Exemplary connection of a lamp. Output AUX1 is switched together with servo 1 if nothing else is defined in CV 33.
4	Output AUX2: Exemplary connection of an LED. Note the polarity! The LED must be operated via a series resistor! Output AUX2 is switched together with servo 2, if not defined otherwise in CV 34.  Note: Before connecting a consumer to output AUX2, you may have to disconnect the black programming button beforehand.
8	Return conductor for outputs 1 and 2 (connections 3 and 4)

 **Observe** the maximum permissible total current and the maximum current per output (see section 7. "Technical data"). If the current demand of the connected consumers is too high, the module can be irreparably damaged.

 **Note:** Do not connect the inputs and outputs to a live line by mistake! The extreme overload that would suddenly occur would irreparably damage the module.

3.5. Power supply

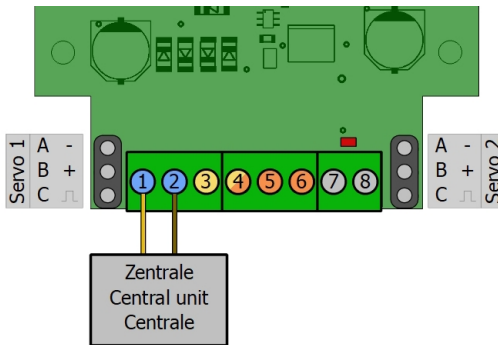
Connect the power supply to terminal blocks 1 and 2 of the SD-32.

- Digital mode: Power supply via booster circuit (the booster integrated in the control unit or a separate booster)
- Analogue operation: Power supply via an AC transformer (14 - 18 V)

! Note:

If a component becomes hot, immediately disconnect the SD-32 from the supply voltage. Danger of short circuit! Check the assembly.

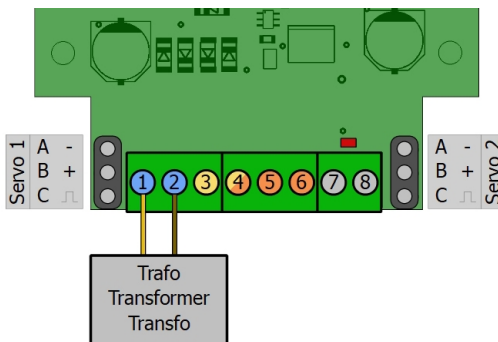
Digital mode: Power supply via booster circuit



! Note:

Switch off the power supply while connecting the decoder.

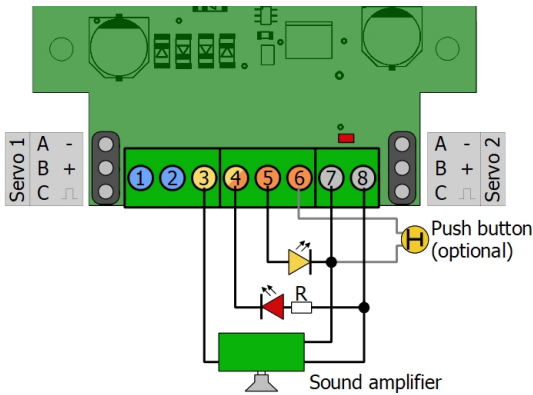
Analogue operation: Power supply via an AC transformer



! Note:

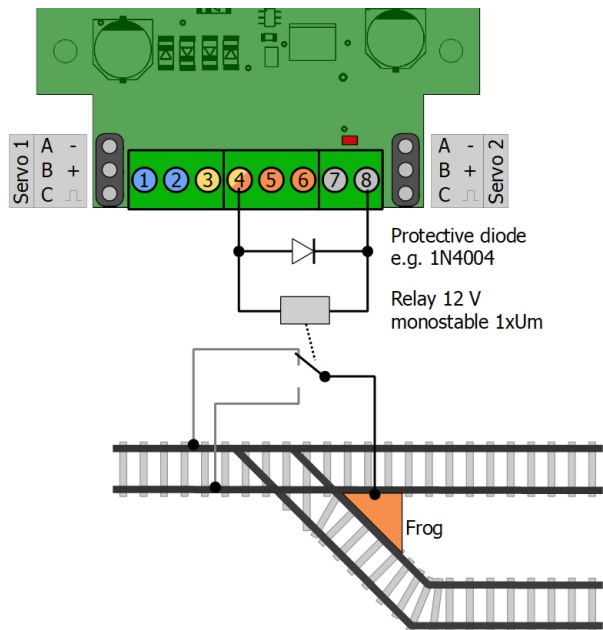
If you connect several devices to the same power supply, all connections must always have the same polarity. Otherwise, a short circuit will occur and the connected devices may be damaged.

3.6. Connection example 1: Barrier mode



1	Power supply
2	Power supply
3	Sound amplifier with loudspeaker (Sound-Booster)
4	Red warning light (lamp or LED) or black programming button (→ section 3.3)  Note: If you connect an LED, an additional series resistor is required! Otherwise the LED will be destroyed during operation.
5	Yellow LED as warning light (output AUX3). An additional series resistor is not required.  Note: If you connect a lamp instead of an LED, the module will be irreparably damaged!
6	Input 2: push-button (optional)
7	Return conductor for yellow LED and push-button (connections 5 and 6)
8	Return conductor for red warning light and sound amplifier (connections 3 and 4) or programming button (→ section 3.3)

3.7. Connection example 2: Frog polarisation



1	Power supply
2	Power supply
4	Relay (12 V monostable 1xUm) and protection diode (e.g. 1N4004)
8	Return conductor for relay (connection 4)

4. Settings

The SD-32 is adapted to the individual requirements

- by setting the configuration variables (CVs) with a DCC control unit. To do this, refer to the relevant section in the operating instructions for your control unit, which describes the byte-by-byte programming of the CV variables.
- **or** with the programming buttons. This procedure is used if you use a Motorola control unit or operate the SD-32 in a purely analogue environment. In DCC-controlled layouts, setting the module by push-buttons is often easier and faster than by CV programming.

Depending on the type of your model railway control system, you proceed as follows:

Digital layout with DCC control unit:

Setting configuration data	via CV programming	section 4.1.
Setting the address	with the programming buttons	section 4.2
	<i>or</i> via CV programming	section 4.3
Setting servos	with the programming buttons	section 4.5
	<i>or</i> via CVs	section 4.4
Activating / deactivating the barrier mode	with the programming buttons <i>or</i> via CV programming	section 4.6.

Digital system with Motorola control unit:

Setting the address	with the programming buttons	section 4.2.
Setting servos	with the programming buttons	section 4.4.
Activating / deactivating the barrier mode	with the programming buttons	section 4.6.

Analogue system:

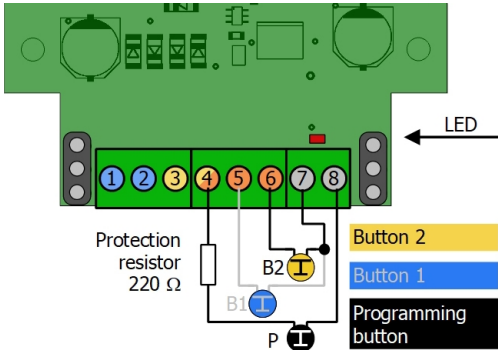
Setting servos	with the programming buttons	section 4.4.
Activating / deactivating the barrier mode	with the programming buttons	section 4.6.

4.1. Basic settings and configuration data
(only with DCC-control units)

CV name	CV- No.	Input value (default value)	Explanations and notes
Version	7	---	Only readable!
Manufacturer	8	(62)	Only readable!
Reset	8	0 ... 255	By entering any value, all settings are reset to the delivery status.
Configuration data	29	0, 8, 128, 136 (136)	RailCom on 0
			RailCom off 8
			Control via vehicle decoder addresses (locomotive addresses) 0
			Accessory decoder addresses (turnout addresses) 128
Hints: If you do not use RailCom when using a DCC control unit, it is recommended to switch it off in CV29. Whether you control the decoder in operation via accessory or vehicle decoder commands (turnout or locomotive commands) is irrelevant when setting the decoder address. If you have set "locomotive addresses" to control the decoder, you must also control the decoder via locomotive addresses in layouts that are controlled with a pure Motorola control unit.			

4.2. Setting the addresses with the programming buttons

The easiest way to set the address is to use the programming buttons. With Motorola control units, you can only set the address using the programming buttons.



To program the turnout address, carry out the following steps

1. Switch off the module.
2. If necessary, disconnect the consumers at connection 4 of the module (output AUX1) and connect the black programming button **P**.
3. Press and hold the black programming button **P** and the yellow button **B2** simultaneously and switch the module on again.
4. The LED on the board flashes and indicates the change to programming mode. Note: If the LED does not flash, the module is in normal mode. You must not press the black button then! In this case, switch the module off again.
5. At the control unit, enter an address from the quadruple module address block (e.g. turnout address "10" from the quadruple block 9 - 12) with which you want to switch servos and consumers.
6. Enter a switching command for the selected address.
7. As soon as the LED goes out, the module has adopted the new address.
8. Disconnect the black programming button **P** from the module if you do not want to make any further settings using the programming buttons.



Observe the instructions for the black programming button:

- It must be connected via the protective resistor.
- It may only be operated in programming mode (when the LED on the board is flashing) and not in normal operation. It should therefore only be connected for programming mode.
- It must not be connected together with a consumer.

Failure to follow these instructions may result in irreparable damage to the module during operation.

4.3. Setting the decoder address via CVs

Instead of setting the address using the programming buttons, you can alternatively set it by programming the CVs with a DCC control unit. The turnout addresses, via which the switching commands are sent, result as follows:

Decoder address x 4 = highest address of the quadruple accessory decoder address block

Note: For the control of the decoder in Motorola format "255" is the highest decoder address (= turnout address 1020).

Note: With some control units the numbering of the turnout addresses does not start with "1" but with "0". The addresses assigned to an address block are shifted accordingly.

CV	No.	Input value (Default)	Remarks and tips
Decoder address "Base value"	9	0, 1, 2, 3, ... 7 (0)	The "base value" of the decoder address results from multiplying the input value by 64.
Decoder address "Additional value"	1	1, 2, 3, ... 63 (1)	The decoder address results from the addition of the "additional value" to the "basic value" wet in CV9.

Value in CV9	0	1	2	3	4	5	6	7
→ Base value	0	64	128	192	256	320	384	448

Value in CV1	1...63	0...63	0...63	0...63	0...63	0...63	0...63	0...62
→ Adress	1 ... 63	64 ... 127	128 ... 191	192 ... 255	256 ... 319	320 ... 383	384 ... 447	448 ... 510

4.4. Setting servos via CVs

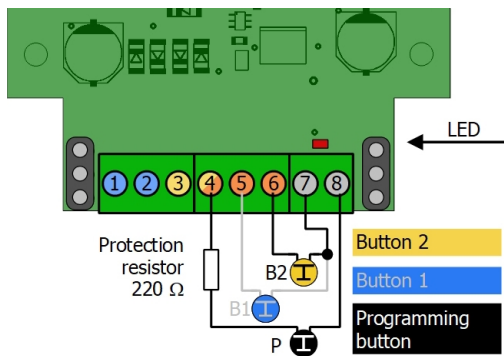
If connected servos twitch during CV programming, they have a (too) high inrush current. In this case you must disconnect the connection between servo and decoder during programming to prevent the voltage supply from collapsing.

CV name	CV-No.	Input value (default value)	Explanations and notes	alternatively with programming buttons
Settings for Servo 1	33	0...255 (2)	The motion sequence - <i>cannot</i> be interrupted. 0	---
Servo 2	34		- <i>can</i> be interrupted. 1	
			Outputs AUX1 and AUX2 are switched via their own turnout addresses. 0	---
			Output AUX1 is switched together with servo 1 <i>and</i> output AUX2 is switched together with servo 2 2	
			Bobbing (curves 3 and 4) at the left stop 4 at right stop 8	✓
			Short pause in the sequence when moving the control lever in the railway signal box (curve 4) 16	---
			Seesaw (curve 2) 32	---
			Barrier mode 128 (setting in common for both servos in CV 33)	✓
Servo 1	36	0...255 (10)	Speed	✓
Servo 2	40			
Servo 1	37	0...255 (124)	Left stop	✓
Servo 2	41		<i>Only for children's seesaw</i> (curve 2): highest point left curve part	
Servo 1	38	0...255 (152)	Right stop	✓
Servo 2	42		<i>Only for children's seesaw</i> (curve 2): highest point right curve part	
Servo 1	44	0...255 (127)	Speed for bobbing (curves 3 and 4)	---
Servo 2	45			
Servo 1	46	0...255 (30)	Deflection for bobbing (curves 3 and 4)	---
Servo 2	47			
Delay for barriers	48	0,1,2,3,4,5 (0)	Pause between closing the (half) barrier(s) 0 = maximum pause length 5 = without pause	---

4.5. Setting the servos with the programming buttons

If you use a Motorola control unit or if you use the SD-32 in a purely analogue environment, you must make the settings for the servos using the push-buttons. In DCC-controlled layouts, setting the servos by push-buttons is often easier and faster than by CV programming.

Note: Not all servo settings that are possible via CV programming can be set via push-buttons.



Observe the instructions for the black programming button:

- It must be connected via the protective resistor.
- It may only be operated in programming mode (when the LED on the board is flashing) and not in normal operation. It should therefore only be connected for programming mode.
- It must not be connected together with a consumer.
- Failure to follow these instructions may result in irreparable damage to the module during operation.

Starting the programming mode

1. Switch off the module.
2. If necessary, disconnect consumers from connection 4 of the module (output AUX1) and connect the black programming button **P**.
3. Press and hold the black programming button **P** and the yellow button **B2** simultaneously and switch the module on again.
4. The LED on the board flashes and indicates the change to programming mode. Note: If the LED does not flash, the module is in normal mode. You must not press the black button then! In this case, switch the module off again.
5. You can now make the various settings for the servos one after the other. Note: All eight steps must always be completed.

Setting the servos with the programming buttons

Step	Setting	Button	Effect
1	Servo 1 Left stop	B1 B2 P	→ Stop further left → Stop further right → Confirm settings + go to right stop of servo 1
2	Servo 1 Right stop	B1 B2 P	→ Stop further left → Stop further right → Confirm settings + go to speed for servo 1
3	Servo 1 Speed	B1 B2 P	→ faster → slower → Confirm settings + go to left stop of servo 2
4	Servo 2 Light stop	B1 B2 P	→ Stop further left → Stop further right → Confirm settings + go to right stop of servo 2
5	Servo 2 Right stop	B1 B2 P	→ Stop further left → Stop further right → Confirm settings + go to speed servo 2
6	Servo 2 Speed	B1 B2 P	→ faster → slower → Confirm settings + go to bobbing for servo 1
7	Servo 1 Bobbing	B1 B2 P	→ Bobbing on → Bobbing off → Confirm settings + go to bobbing for servo 2
8	Servo 2 Bobbing	B1 B2 P	→ Bobbing on → Bobbing off → Confirm settings + go to left stop of servo 1

Exiting programming mode

You can exit programming mode after each press of **P** (=confirm settings) by switching off the module. All settings made up to that point will be saved.

Disconnect the black programming button **P** from the module if you do not want to make any further settings using the programming buttons.

4.6. Activating and deactivating barrier mode

In barrier mode, movement curve 3 (with bobbing when reaching an end position) is automatically set. Before activating Barrier mode, you should set the end positions and the speed of the two servos (→ sections 4.4 and 4.5).

**Note:**

In barrier mode, input 1 (connection 5) is used as an additional (third) output. To prevent damage to the module due to accidental triggering of the blue button T1, no button may be connected to connection 5 as soon as the barrier mode has been activated.

(De)-activation via CV-setting

By entering the value "128" or "0" in CV 33 you activate or deactivate the barrier mode for both servos (→ section 4.4).

Activation with the programming buttons

1. Switch off the module.
2. If necessary, disconnect consumers at connection 4 of the module (output AUX1) and connect the black programming button **P**.
3. If necessary, connect a blue push-button **B1** to input 1.
4. Press and hold the black programming button **P** and the blue button **B1** simultaneously and switch the module on again.
5. Now switch the module off again. After you have switched the module on again, the two servos and the outputs are controlled in barrier mode.
6. Disconnect the black programming button **P** and the blue button **B1** from the module.

Deactivation with the programming buttons

1. Switch off the module.
2. If necessary, disconnect consumers from connection 4 of the module (output AUX1) and connect the black programming button **P**.
3. If necessary, connect a yellow push-button **B2** to input 2.
4. Press and hold the black programming button **P** and the yellow button **B2** simultaneously and switch the module on again.
5. Now switch the module off again. After you have switched the module on again, the two servos and the outputs are controlled in standard mode.
6. Disconnect the black programming button **P** and the yellow button **B2** from the module.

5. Operation

5.1. Control of the servos

With turnout setting commands

The two servos are assigned the first two turnout addresses of the 4-address block. After turnout setting commands in DCC or MM format (turnout straight ahead or on branch) the servos change between the end positions.

Alternatively, you can control the servos with locomotive commands if CV29 is programmed accordingly. In this case, switching the F1 and F2 functions on and off causes the end positions of the servos to change.

Note: It is not possible to interrupt and then continue the movement sequence with digital commands. This is only possible with the buttons.

With buttons

The two push-buttons **B1** and **B2** are permanently assigned to servos 1 and 2. When the buttons are pressed, the servos change to the other end position.

The direction of movement is determined by the length of the button press:

- short button press: direction of movement left
- long keystroke: direction of movement right

Interrupting the movement sequence

If the option to interrupt is set for the servos (CV 33/34 = 1), the movement sequence can be stopped or continued by pressing the buttons. Note: Interrupting the motion sequence is usually only useful when setting a linear motion sequence (curve 1). In pure analogue operation this possibility can only be used after the CV has been set accordingly with a DCC control unit.

5.2. Switching the outputs

Together with the servos

With the factory settings (CV 33/34 = 2) the outputs AUX1 and AUX2 are switched together with the servos 1 and 2 with turnout setting commands or the buttons T1 and T2. The outputs are switched as soon as the servos have reached the middle between the two end positions.

Separately with switch setting commands

Alternatively (CV 33/34 = 0) the two outputs can be switched independently from the servos with turnout setting commands in DCC or MM format (turnout straight ahead or on branch). The two outputs are assigned the last two turnout addresses of the address block of 4.

Alternatively you can switch the outputs with locomotive commands for the functions F3 and F4 if CV29 is programmed accordingly.

5.3. Control in barrier mode

If the barrier mode is activated in CV 33 or with the help of the programming button, the two servos are no longer controlled separately, but together. The barrier mode is designed in such a way that with one digital command or keystroke the complete scenario runs when closing or opening the barriers, including switching on and off the warning lights and the acoustic warning signal.

The sequence (closing or opening of the barriers) starts as soon as

- the yellow button **B2** has been pressed or
- a turnout setting command in DCC or MM format (turnout straight ahead or on branch) has been sent to the first turnout address of the address block of 4 or
- in case of control via vehicle commands, a switching command for function F1 of the locomotive address has been sent.

6. Checklist for troubleshooting and error correction



Warning:

If you notice a strong heat development, immediately disconnect the connection to the supply voltage. **Fire hazard!**

Possible causes:

- One or more connections are faulty. → Check the connections.
- "The module is defective. → Send the module in for inspection.

Connected accessories do not react to switching commands

Possible causes:

- The connection of the module to the control unit and / or the power supply is interrupted. → Check the connections.
- The connection of the module to the accessory is interrupted. → Check the connections.
- The control unit is not in operation. → Check whether the control unit is ready for operation.
- The accessory is defective. → Check the consumer.
- If only the consumers connected to the outputs do not react to digital commands: In CV 33 or 34 it is set that the outputs are switched together with the servos. → Change the settings in CV 33 or 34.

When programming with servos connected, the control unit sends an error message.

Possible cause: Some servos have such a high inrush current that the control unit detects an error when the decoder is switched on briefly while the programming command is being sent. → Disconnect the servo's connector plug during programming and test the settings in normal operation.

After programming the decoder does not react as desired.

Possible causes:

- The setting of the servos with programming buttons was not terminated correctly. → Always terminate the setting of the servos with programming buttons by switching off the power to the module.
- The values entered for the CV variables are inconsistent. → Perform a decoder reset and test the decoder with the default values first. Then reprogram the decoder.
- When programming via CVs, the decoder address is assigned. For switching the decoder, however, turnout addresses are used. → Enter the turnout address for switching.
Note: The decoder address multiplied by 4 results in the highest address from the block of 4 turnout addresses.
Example: Decoder address = 10 → associated turnout addresses: 37 to 40

6.1. Technical Hotline

If you have any questions about the use of the module, our technical hotline will help you (telephone number and e-mail address on the last page).

6.2. Repairs

You can send us a defective module for inspection / repair (address on the last page). Please do not send us your return freight collect. In the event of a warranty or guarantee claim, we will reimburse you for the regular shipping costs.

Please enclose the following with your shipment

- proof of purchase as evidence of any warranty or guarantee claim
- a brief description of the defect
- the address to which we should return the product(s)
- your email address and/or a telephone number where we can reach you in case of queries

Costs

The inspection of returned products is free of charge for you. In the event of a warranty or guarantee claim, the repair and return are also free of charge for you.

If there is no warranty or guarantee case, we will charge you the costs of the repair and the costs of the return. We charge a maximum of 50% of the new price for the repair according to our valid price list.

Carrying out the repair(s)

By sending in the product(s), you give us the order to inspect and repair it. We reserve the right to refuse the repair if it is technically impossible or uneconomical. In the event of a warranty or guarantee claim, you will then receive a replacement free of charge.

Cost estimates

Repairs for which we charge less than € 25.00 per item plus shipping costs will be carried out without further consultation with you. If the repair costs are higher, we will contact you and carry out the repair only after you have confirmed the repair order.

7. Technical data

Digital protocols

Data formats	Motorola DCC (according to NMRA and RCN standard)
Adress range Hint: The adress range to be used also depends from the control unit.	MM: 1020 turnout addresses DCC: 2040 turnout addresses or 510 vehicle decoder addresses (locomotive addresses)
Feedback format	RailCom (according to RCN standard)

Inputs and outputs

Standard mode	2 inputs for connecting push-buttons 2 outputs for connecting servos 2 switching outputs for the connection of other consumers
Programming mode	3 inputs for connecting programming push-buttons 2 outputs for connecting servos 1 switching output
Barrier mode	1 input for connecting a push-button 2 outputs for connecting servos 3 switching outputs: of which 1 output for connecting a sound amplifier (Sound-Booster, optional accessory) 1 output for connecting a lamp or LED 1 output for direct connection of an LED

Electrical properties

Power supply	Digital operation: Digital voltage of the booster circuit (12 - 24 volts) Analogue operation: 14 - 18 V alternating voltage
Current consumption	approx. 40 mA (without connected devices)
Maximum total current:	1,000 mA (continuous)
Maximum current per output	Outputs AUX1 and AUX2: 1,000 mA (2 s) 800 mA (continuous) Output AUX3 (only in barrier mode): max. 100 mA

Protection

Protection class

Ready-made module (without housing): IP 00

Meaning: No protection against foreign bodies, contact and water.

Ready device (in housing): IP 20

Meaning: Protected against solid foreign bodies with diameter ≥ 12.5 mm and access with a finger. No protection against water.

Environment



For use in closed rooms

Ambient temperature during operation

0 ~ + 30 °C

Permissible relative humidity during operation

10 ~ 85% (non-condensing)

Ambient temperature during storage

- 10 ~ + 40 °C

Permissible relative humidity during storage

10 ~ 85% (non-condensing)

Other features

Dimensions (approx.)

Circuit board: 48 x 52 mm

Ready device including housing: 70 x 60 x 25 mm

Weight (approx.)

Assembled board (ready-made module): 16 g

Ready device including housing: 33 g

8. Warranty, EU conformity & WEEE

8.1. Guarantee bond

For this product we issue voluntarily a guarantee of 2 years from the date of purchase by the first customer, but in maximum 3 years after the end of series production. The first customer is the consumer first purchasing the product from us, a dealer or another natural or juristic person reselling or mounting the product on the basis of self-employment. The guarantee exists supplementary to the legal warranty of merchantability due to the consumer by the seller.

The warranty includes the free correction of faults which can be proved to be due to material failure or factory flaw. With kits we guarantee the completeness and quality of the components as well as the function of the parts according to the parameters in not mounted state. We guarantee the adherence to the technical specifications when the kit has been assembled and the ready-built circuit connected according to the manual and when start and mode of operation follow the instructions.

We retain the right to repair, make improvements, to deliver spares or to return the purchase price. Other claims are excluded. Claims for secondary damages or product liability consist only according to legal requirements.

Condition for this guarantee to be valid, is the adherence to the manual. In addition, the guarantee claim is excluded in the following cases:

- if arbitrary changes in the circuit are made,
- if repair attempts have failed with a ready-made module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

8.2. EU Declaration of Conformity



This product fulfils the requirements of the following EU directives and therefore bears the CE marking.

2001/95/EU Product Safety Directive

2015/863/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

2014/30/EU on electromagnetic compatibility (EMC Directive). Underlying standards:

DIN-EN 55014-1 and 55014-2: Electromagnetic compatibility - Requirements for household appliances, electric tools and similar electrical appliances. Part 1: Emitted interference, Part 2: Immunity to interference

To maintain electromagnetic compatibility during operation, observe the following measures:
Only connect the supply transformer to a professionally installed and fused earthed socket.
Do not make any changes to the original components and follow the instructions, connection and assembly diagrams in this manual exactly.
Only use original spare parts for repair work.

8.3. Declarations on the WEEE Directive

This product is subject to the requirements of the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE), i.e. the manufacturer, distributor or seller of the product must contribute to the proper disposal and treatment of waste equipment in accordance with EU and national law. This obligation includes

- registration with the registering authorities ("registers") in the country where WEEE is distributed or sold
- the regular reporting of the amount of EEE sold
- the organisation or financing of collection, treatment, recycling and recovery of the products
- for distributors, the establishment of a take-back service where customers can return WEEE free of charge
- for producers, compliance with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive.



The "crossed-out wheeled bin" symbol means that you are legally obliged to recycle the marked equipment at the end of its life. The appliances must not be disposed of with (unsorted) household waste or packaging waste. Dispose of the appliances at special collection and return points, e.g. at recycling centres or at dealers who offer a corresponding take-back service.

Further Information and Tips:
<http://www.tams-online.de>

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