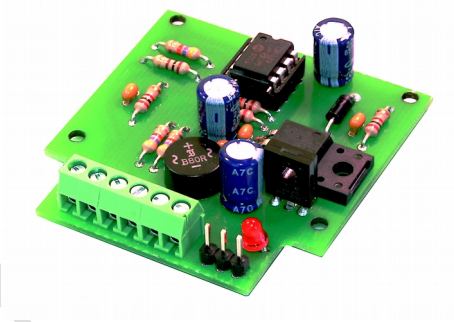
Manual

Servo control SAS

Item no. 55-010x5 | Art. 55-010x6 | Art. 55-010x7



For all kits and ready-built modules
of the SAS series

tams elektronik

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Subject to technical modification.

1. Getting started

How to use this manual

This manual gives step-by-step instructions for safe and correct assembly of the kit and fitting and connecting of the ready-built module, and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the checklist for trouble shooting. You will then know where to take care and how to prevent mistakes which take a lot of effort to correct.

Keep this manual safely so that you can solve problems in the future. If you pass the kit or the ready-built module on to another person, please pass on the manual with it.

Intended use

The servo control SAS is designed to be operated according to the instructions in this manual in model building and with model railways. Any other use is inappropriate and invalidates any guarantees.

The SAS should not be assembled or mounted by children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user.

Caution:

The SAS contains integrated circuits. These are very sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

Checking the package contents

Please make sure that your package contains:

- one kit, containing the components listed in the parts list and one PCB or
- one ready-built module or
- one ready-built module in a housing (complete unit),
- three push-buttons (2 x red, 1 x black),
- one manual.

There is no servo included in the package.

Required materials

For assembling the kit you need:

- an electronic soldering iron (max. 30 Watt) or a regulated soldering iron with a fine tip and a soldering iron stand,
- a tip-cleaning sponge,
- a heat-resistant mat,
- a small side cutter and wire stripper,
- as necessary a pair of tweezers and long nose pliers,
- electronic tin solder (0,5 mm. diameter).

In order to connect the module you need wire. Recommended diameters: $\geq$ 0,14 mm² for all connections.

If you want to control the SAS via a digital points decoder, you additionally need one or two relays (depending on the SAS version) → section 4.

2. Safety instructions

Mechanical hazards

Cut wires can have sharp ends and can cause serious injuries. Watch out for sharp edges when you pick up the PCB.

Visibly damaged parts can cause unpredictable danger. Do not use damaged parts: recycle and replace them with new ones.

Electrical hazards

- Touching powered, live components,
- touching conducting components which are live due to malfunction,
- short circuits and connecting the circuit to another voltage than specified,
- impermissibly high humidity and condensation build up

can cause serious injury due to electrical shock. Take the following precautions to prevent this danger:

- Never perform wiring on a powered module.
- Assembling and mounting the kit should only be done in closed, clean, dry rooms. Beware of humidity.
- Only use low power for this module as described in this manual and only use certified transformers.
- Connect transformers and soldering irons only in approved mains sockets installed by an authorised electrician.
- Observe cable diameter requirements.
- After condensation build up, allow a minimum of 2 hours for dispersion.
- Use only original spare parts if you have to repair the kit or the ready-built module.

Fire risk

Touching flammable material with a hot soldering iron can cause fire, which can result in injury or death through burns or suffocation. Connect your soldering iron or soldering station only when actually needed. Always keep the soldering iron away from inflammable materials. Use a suitable soldering iron stand. Never leave a hot soldering iron or station unattended.

Thermal danger

A hot soldering iron or liquid solder accidentally touching your skin can cause skin burns. As a precaution:

- use a heat-resistant mat during soldering,
- always put the hot soldering iron in the soldering iron stand,
- point the soldering iron tip carefully when soldering, and
- remove liquid solder with a thick wet rag or wet sponge from the soldering tip.

Dangerous environments

A working area that is too small or cramped is unsuitable and can cause accidents, fires and injury. Prevent this by working in a clean, dry room with enough freedom of movement.

Other dangers

Children can cause any of the accidents mentioned above because they are inattentive and not responsible enough. Children under the age of 14 should not be allowed to work with this kit or the ready-built module.

Caution:

Little children can swallow small components with sharp edges, with fatal results! Do not allow components to reach small children.

In schools, training centres, clubs and workshops, assembly must be supervised by qualified personnel.

In industrial institutions, health and safety regulations applying to electronic work must be adhered to.

3. Safe and correct soldering

⚠ Caution:

Incorrect soldering can cause dangers through fires and heat. Avoid these dangers by reading and following the directions given in the chapter **Safety instructions**.

- Use a small soldering iron with max. 30 Watt or a regulated soldering iron.
- Only use electronic tin solder with flux.
- When soldering electronic circuits never use soldering-water or soldering grease. They contain acids that can corrode components and copper tracks.
- Observe correct polarity orientation of the parts before soldering.
- Solder quickly: holding the iron on the joints longer than necessary can destroy components and can damage copper tracks or soldering eyes.
- Apply the soldering tip to the soldering spot in such a way that the part and the soldering eye are heated at the same time. Simultaneously add solder (not too much). As soon as the solder becomes liquid take it away. Hold the soldering tip at the spot for a few seconds so that the solder flows into the joint, then remove the soldering iron.
- Do not move the component for about 5 seconds after soldering.
- To make a good soldering joint you must use a clean and unoxidised soldering tip. Clean the soldering tip with a damp piece of cloth, a damp sponge or a piece of silicon cloth.

- Cut the wires after soldering directly above the soldering joint with a side cutter.
- After placing the parts, please double check for correct polarity. Check the PCB tracks for solder bridges and short circuits created by accident. This would cause faulty operation or, in the worst case, damage. You can remove excess solder by putting a clean soldering tip on the spot. The solder will become liquid again and flow from the soldering spot to the soldering tip.

4. Operation overview

The SAS controls a modelling servo. It has been designed to be controlled and adapted to individual requirements with push-buttons. This allows you to use the complete functional range in analogue layouts. It is possible to control the SAS via digital points (solenoid) decoders as well and so to integrate it in digitally controlled layouts.

Controlling the servo

The servo´s motion sequence is controlled by a micro controller. The several versions of the SAS generate typical motion sequences for different objects. With each of the versions SAS-4 and SAS-5 there are two optional variations.

The motions are released with push-buttons connected to the inputs of the module.

Controlling via a points decoder

In order to integrate the servo control into a digitally controlled layout, the SAS can be connected to a points (solenoid) decoder. Note: Points decoders designed for controlling switches with motor drives are not suitable to control the SAS.

Each input of the SAS is assigned to one points address and one switch stand. Generally a relay has to be switched into the connection between input of the SAS and points decoder output as a decoupling between analogue and digital system.

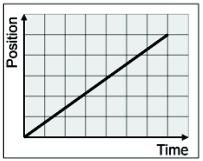
When controlling the SAS via a digital decoder, push-buttons can be connected in parallel, which allows you to release the servo motion both analogue and digitally.

Possible settings

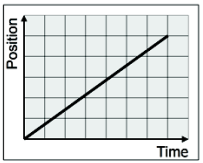
The motion sequences can be adapted to individual needs. By aid of programming push-buttons you can set:

- starting and end position of the servo (within the limits given by the maximum servo´s angle of rotation,
- servo´s rotational speed.

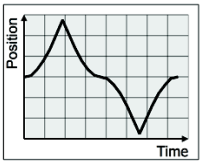
Servo control SAS-1 "Linear"

	Linear motion between the two end positions with automatic stop when reaching the end position. Constant velocity. Possibility to break the motion sequences at any time and position.
Releasing the motion	push-button 1 → direction 1 push-button 2 → direction 2 Operating a push-button once again allows you to break the motion sequence at any time and position. Operating one of the two push-buttons anew causes the motion sequence being continued in direction 1 or 2.
Digital Control	Points decoders + 2 monostable relays (1xUm, 12 V, e.g. item no. 84-61010-01) points address e.g. "branch" → direction 1 points address e.g. "straight" → direction 2
Applications	Water stand pipes, doors

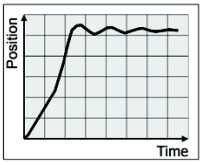
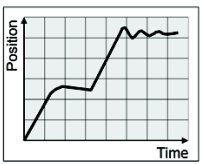
Servo control SAS-2 and 3 "points 1 and 2"

	Linear motion between the two end positions with automatic stop when reaching the end position. Constant velocity. No possibility to break the motion sequences.
Releasing the motion	Operating the push-button causes starting the motion into the opposite direction.
Frog polarisation	The SAS-3 contains an auxiliary PCB for the frog polarisation to be connected to the SAS.
Digital Control	Points decoders + 1 monostable relay (1xUm, 12 V, e.g. item no. 84-61010-01) points address e.g. "branch" → starting the motion
Applications	SAS-2: points without frog polarisation. SAS-3: points with frog polarisation. In order to avoid a short circuit when switching the points, the accessory PCB HST (included in the package) first switches the power off at the frog, then switches the points and finally switches the power on again at the frog.

Servo control SAS-4 "Seesaws"

	Typical motion sequence of a children´s seesaw. variant 1: automatic stop after 20 sequences. variant 2: infinite repetition of the sequence.
Releasing the motion	push-button 1 → 20 times repeat of the sequence, afterward automatic stop. Operating the push-button 1 once again during the sequence allows you to restart the complete sequence (20 times repeat). In order to break the sequence operate push-button 2. push-button 2 → infinite repetition of the sequence. In order to break the sequence operate push-button 2. Operating the push-button 1 during the infinite repetition allows you to start a 20 times repeat with an automatic stop at the end of the sequence.
Digital Control	Points decoders + 2 monostable relays (1xUm, 12 V, e.g. item no. 84-61010-01) points address e.g. "branch" → variant 1 points address e.g. "straight" → variant 2
Applications	children´s seesaw

Servo control SAS-5 "Signals and Barriers"

 	Typical motion sequence of semaphore signals and barriers with automatic stop when reaching the end position. variation 1: without encompassing of the signal box´s worker (top illustration) variation 2: with encompassing of the signal box´s worker (bottom illustration) No possibility to break the motion sequences.
Releasing the motion	Operating the push-button causes starting the motion into the opposite direction. Push-button 1 → motion sequence without encompassing of the signal box´s worker. Push-button 2 → motion sequence with encompassing of the signal box´s worker.
Digital Control	Points decoders + 2 monostable relays (1xUm, 12 V, e.g. item no. 84-61010-01) points address e.g. "branch" → variant 1 points address e.g. "straight" → variant 2
Applications	semaphore signals, barriers

5. Technical specifications

Caution:

The servo control SAS should not be supplied by the voltage supply for the digital system! For that reason you should use a seperate transformer for the SAS in digital controlled layouts.

Supply voltage	12 – 18 Volt a.c. voltage or 12 – 24 Volt d.c. voltage
Current consumption (without connected devices) approx.	5 mA
Max. current at the servo output	1.000 mA
Protected to	IP 00
Ambient temperature in use	0 ... +60 °C
Ambient temperature in storage	-10 ... +80 °C
Comparative humidity allowed	max. 85 %
Dimensions of the PCB (approx.) SAS HST	 48 x 52 mm 48 x 52 mm
Weight of the circuit (approx.) SAS HST	 17 g 25 g

6. Assembling the kit

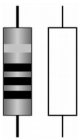
You can skip this part if you have purchased a ready-built module or device.

Preparation

Put the sorted components in front of you on your workbench.

The separate electronic components have the following special features you should take into account in assembling:

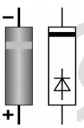
Resistors



Resistors reduce current. Their mounting orientation is of no importance. The value of resistors for smaller power ratings (beneath 0,5 W) is indicated through colour rings. Every colour stands for another figure. The colour ring in brackets indicates the tolerance of the resistor which here is of no importance.

Value:	Colour ring:
100 Ω	brown - black - brown (gold)
1 kΩ	brown - black - red (gold)
3,3 kΩ	orange - orange - red (gold)
47 kΩ	yellow - violet - orange (gold)

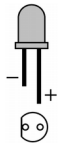
Diodes



Diodes allow the current to pass through in one direction only (forward direction), simultaneously the voltage is reduced by 0,3 to 0,8 V. Exceeding of the limit voltage always will destroy the diode, and allow current to flow in the reverse direction.

The diode type is printed on the body. Diodes must be mounted in a given direction. The negative end is marked with a ring. This is shown in the PCB layout.

Light emitting diodes (LEDs)



When operated in the forward direction the LEDs light. They are available in several different versions (differing in colour, size, form, luminosity, maximum current, voltage limits). The longer lead of wired LEDs is always the anode (positive pole).

Light emitting diodes should always be connected via a series resistor which limits the current and prevents failure.

Rectifiers

Rectifiers convert alternating into direct voltage, they have hardly no influence on the level of the voltage. They have four pins: two for the input voltage (a.c. voltage) and two for the output voltage (d.c. voltage).

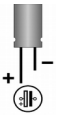
The pins for the output voltage are polarized. The pin connections are printed on the housing. As usual with wired components the longer connecting pin is the positive pole.

Capacitors

Among other things capacitors are used for filtering interference voltages or as frequency determining parts. Ceramic capacitors are not polarized, for that reason their mounting orientation is of no importance.

Normally they are marked with a three-digit number which indicates the value coded. Number 104 corresponds to a value of 100 nF.

Electrolytic capacitors



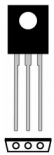
Electrolytic capacitors are often used to store energy. In contrast to ceramic capacitors they are polarized. One of the two leads is marked with a minus sign which indicates the mounting orientation. The value is given on the casing.

Electrolytic capacitors are available with different voltage sustaining capabilities. Using an electrolytic capacitor with a voltage sustaining capability higher than required is always possible.

Transistors

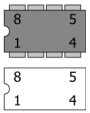
Transistors are current amplifiers which convert low signals into stronger ones. They have three contacts. As they are polarized, they have to be mounted in a certain direction.

BC-Types have a housing in form of a half cylinder (SOT-housing). The cross section is shown in the PCB layout which determines the mounting orientation.



The transistors IRLU 024N have a flat housing (TO-housing) with the type designation printed on the front side. The metallic rear is unlabelled, on the PCB layout the rear is marked by a thick line.

Integrated circuits (ICs)



Depending on the type, ICs fulfil various tasks. They are polarized and therefore have to be mounted in a certain direction. The most common housing form is the so-called "DIL"-housing, from which 4, 6, 8, 14, 16, 18 or more "legs" (pins) are arranged along the long sides.

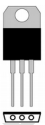
The mounting orientation is shown by a semicircular or circular marking at the end of the housing, which is also shown on the PCB layout.

ICs are sensitive to damage during soldering (heat, electrostatic charging). For that reason in the place of the ICs IC sockets are soldered in, in which the ICs are inserted later. The mounting orientation of the sockets is preset as well. The markings on the PCB, the socket and the IC must lie on top of each other after mounting.

Micro-Controller

Micro-controller are ICs, which are individually programmed for the particular application. When leaving the manufacturer´s works their memory is empty. The programmed controller normally are only available from the manufacturer of the circuit belonging to it.

Voltage regulators



Voltage regulators are ICs, which convert a variable, non regulated input voltage in a constant output voltage. They are produced in transistor housings with three connecting pins for input, output and earth.

With voltage regulators in a flat TO-housing the unlabelled rear is marked by a thick line on the PCB layout.

Relays

Relays are electronic switches, depending on their position the one or other (internal) connection is closed. Their mode of operation can be compared to that of a push-button switch, i.e. the connection is only closed as long as the voltage is applicated. Bistable relays keep their status after switching – comparable to a switch.

Relays which combine two switches in one housing are common as well (shortly 2xUM). The switching between the two connections can be heard clearly because of the resulting clicking sound.

The mounting orientation of the relays which are put in a rectangular box shaped housing is given by the layout of the pins.

Switches and push-button switches

By operating a switch or a push-button switch an electric circuit is closed. While switches keep their status after operating (like a light switch), push-button switches keep their operating position only as long as actually operated (like a bell push).

Terminal strips

Terminal strips are solder-in screw-type terminals. They provide a solder-free and safe connection of the cables to the circuit, which can still be separated any time. When several terminal strips have to be mounted side by side, they have to be put together before mounting.

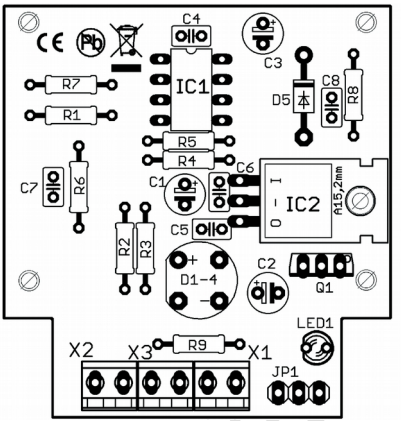
SAS: Parts list

Resistors	R1	100 Ω
	R4, R5, R6	1 kΩ
	R8, R9	3,3 kΩ
	R2, R3, R7	47 kΩ
Diodes	D5	1N400x
LEDs	LED1	rot
Rectifiers	D1-4	B80C800
Capacitors	C4, C5, C6, C7, C8	100 nF
Electrolytic capacitors	C1, C2, C3	220µF/25V
Transistors	Q1	IRLU 024 N
Micro-controllers	IC1	PIC 12F629P
IC-socket	IC1	8-pole
Voltage regulators	IC2	7805
Solder pin	JP-1	3-pole
Terminal strips	X1, X2, X3	6-pole

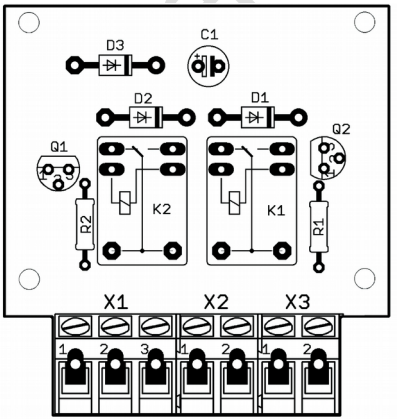
HST (SAS-3): Parts list

Resistors	R1, R2	3,3 kΩ
Diodes	D1, D2, D3	1N400x
Electrolytic capacitors	C1	100 µF/25 V
Transistors	Q1, Q2	BC547B
Relays	K1, K2	mono 1xUm/12V
Anreihklemmen	X1	3-pole
	X2, X3	2-pole

SAS: PCB layout



HST (SAS-3): PCB layout



Assembly

Proceed according to the order given in the list below. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter. Follow the instructions on soldering in section 3.

Caution:

Several components have to be mounted according to their polarity. When soldering these components the wrong way round, they can be damaged when you connect the power. In the worst case the whole circuit can be damaged. At the best, a wrongly connected part will not function.

Assembly of the SAS PCB

1.	Resistors	Mounting orientation of no importance.
2.	Diodes	Observe the polarity! The negative end of the diodes is marked with a ring. This is shown in the PCB layout.
3.	Voltage regulators	Observe the polarity! Before soldering, bend the voltage regulator´s pins to 90 degrees, so that you can solder it in corresponding to the PCB layout with the labelled front side facing upwards.
4.	Ceramic Capacitors	Mounting orientation of no importance.
5.	Light emitting diodes (LEDs)	Observe the polarity! With wired LEDs the longer lead is always the anode (positive pole).

6.	IC sockets	Mount the sockets that way, the markings on the sockets show in the same direction as the markings on the PCB board.
7.	Rectifiers	Observe the polarity! The pin connections are printed on the housing. The longer connecting pin is the positive pole.
8.	Transistors	Observe the polarity! With transistors for a high power rating in TO packages (e.g. MOSFETs) the labelled front side is marked by a beveled line in the PCB layout.
9.	Solder pins	
10.	Terminal strips	Put together the terminal strips before mounting them.
11.	Electrolytic capacitors	Observe the polarity! One of the two leads (the shorter one) is marked with a minus sign.
12.	ICs in DIL-housing	Insert the ICs into the soldered socket. Do not touch the ICs without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" when inserting them into the sockets. Check that the markings on the PCB, the socket and the IC show to the same direction.

Assembly of the HST PCB

1.	Resistors	Mounting orientation of no importance.
2.	Diodes	Observe the polarity! The negative end of the diodes is marked with a ring. This is shown in the PCB layout.
3.	Electrolytic capacitors	Observe the polarity! One of the two leads (the shorter one) is marked with a minus sign.
4.	Transistors	Observe the polarity! The cross section of transistors for a low power rating in SOT-packages is shown in the PCB layout.
5.	Relays	The mounting orientation is given by the layout of the pins.
6.	Terminal strips	Put together the terminal strips before mounting them.

Performing a visual check

Perform a visual check after the assembly of the module and remove faults if necessary:

- Remove all loose parts, wire ends or drops of solder from the PCB. Remove all sharp wire ends.
- Check that solder contacts which are close to each other are not unintentionally connected to each other. Risk of short circuit!
- Check that all components are polarised correctly.

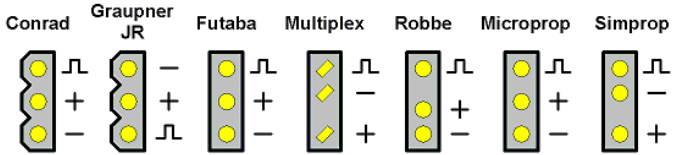
When you have remedied all faults, go on to the next part.

7. Connecting the SAS

7.1. INFO: Servo connections

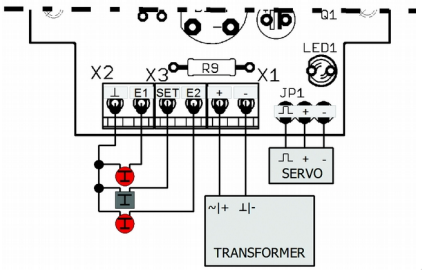
Connection	Short term	Identification symbol	Colour of connecting wire (deviations possible)
Voltage supply	"GND"	-	black or brown
	"VCC"	+	red
Impulse (signal)	"PW"	⎍	white or orange

The assignment of the servo´s electric connections is not standardised. Some examples of different manufacturers:



Note: The information refers to commercial servos at the time of the manual passing to press. Modifications on part of the manufacturers cannot be excluded.

7.2. Connecting the SAS



Connection diagram 1

First connect the three programming push-buttons, the servo and the voltage supply to all versions of the SAS.

- programming push-button "SET": black push-button
- programming push-button 1 and 2 (connections E1 and E2): red black push-buttons

Then check the servo and set the angle of rotation. Connect (with SAS-3) the HST-PCB or a points decoder if necessary **after** having performed a test and set the servo.

⚠ Attention:

When a component gets too hot, disconnect the module from the voltage supply immediately. Risk of short circuit! Check the assembly.

Connect the functional model only after having performed a test and set the servo. That is the only way to reliably avoid damages on the model.

Do not set the SAS-3 while the HST PCB is connected. Risk of short circuit! Disconnect the HST PCB if necessary or switch off the track voltage.

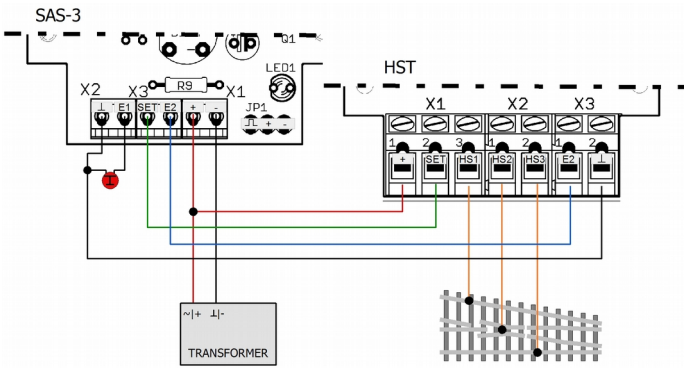
You can keep the three push-buttons connected. It is recommended to disconnect the push-button SET after final programming, in order to avoid unintended re-programming.

Assignment of the SAS-PCB (except SAS-3)

⊥	Return conductor for all push-buttons	
E1	Programming push-button 1 / Push-button 1	
	SAS-1	push-button 1→ direction 1
	SAS-2	push-button → both directions
	SAS-4	push-button 1→ 20-times repetition
	SAS-5	push-button 1 → without encompassing of the signal box´s worker
SET	Programming push-button "SET"	
E2	Programming push-button 2 / Push-button 2	
	SAS-1	push-button 2→ direction 2
	SAS-2	---
	SAS-4	push-button 2 → infinite repetition
	SAS-5	push-button 2 → without encompassing of the signal box´s worker
+ | -	Transfomer. Check the polarity with the connection to d.c. Voltage. When connecting the module to a.c. voltage the polarity is of no importance.	
⎍	Servo, impulse (signal)	
+	Servo, voltage supply (+)	
-	Servo, voltage supply (-)	

Assignment of SAS-3

SAS-PCB		HST-PCB	
♈	return conductor for all push-buttons	♈	earth connection
E1	programming push-button 1 / push-button 1	---	---
SET	programming push-button "SET"	SET	control input
E2	programming push-button 2 / ---	E2	control input
+	transformer	⎓	voltage supply
-		---	---
⎍	servo	---	---
+		---	---
-		---	---
		HS1	rail 1
		HS2	frog
		HS3	rail 2



Connections diagram 2: SAS-3 <--> HST

Attention:

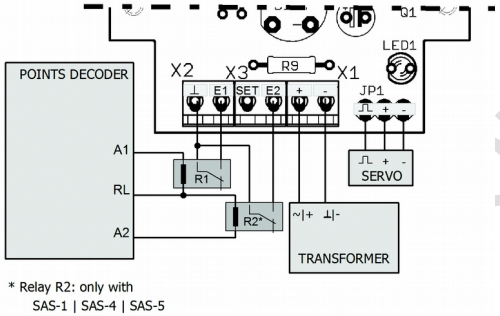
Before starting the operation, you should make sure the frog´s polarity corresponds to the tongue´s polarity. If not, exchange the connections HS1 and HS3. Otherwise a short circuit would occur when trespassing the tongue.

Attention:

Do not set the SAS-3 while the HST PCB is connected. Risk of short circuit! Disconnect the HST PCB if necessary or switch off the track voltage.

7.3. Connecting a points decoder

You can control the servo via a points decoder with points control commands (points straight / branch). It is possible to control the servo via push-buttons in parallel.



Connections diagram 2: SAS <--> Points decoder

Attention:

Generally, you should switch a monostable relay (min. 12 V) between the connection points decoder output and switching input of the SAS for decoupling digital and analogue system.

Relay	Connection to:
inductor (control voltage)	output A1 or A2 of the points decoder (points straight / branch) and corresponding return conductor of the points decoder (RL) SAS-2 and SAS-3: output A1 or A2 of the points decoder (points straight or branch) and corresponding return conductor of the points decoder (RL)
closing contact	inputs E1 or E2 of the SAS and return conductor of the SAS (⊥) SAS-2 and SAS-3: inputs E1 of the SAS and return conductor of the SAS (⊥)

8. Programming the servo control

You can set the velocity and the two end positions of the servo according individually to the needs by means of the three programming push-buttons (connection according to connections diagram 1).

⚠ **Attention:** Do not set the SAS-3 while the HST PCB is connected. Risk of short circuit! Disconnect the HST PCB if necessary or switch of the track voltage.

Starting the programming mode

SAS-1 SAS-4 SAS-5	Operate push-button SET. → The LED lights. → The servo automatically drives to end position A.
SAS-2 SAS-3	Operate push-button SET, keep it in that position and **at the same time** switch on the power supply. → The LED lights. → The servo automatically drives to end position A.

Programming

After starting the programming mode you always have to pass through all three programming steps. As long as the module is in programming mode, the LED lights.

Push-button	Effect
E1 or E2	programming step 1: By pushing E1 or E2 you can alter end position A. As soon as you have set the desired end position A, push SET.
SET	→ Saving the setting / finishing programming step 1.
E1 or E2	programming step 2: By pushing E1 or E2 you can alter end position B. As soon as you have set the desired end position B, push SET.
SET	→ Saving the setting / finishing programming step 2.
E1 or E2	programming step 3: By pushing E1 or E2 you can alter the velocity. As soon as you have set the desired velocity, push SET.
SET	→ Saving the setting / finishing programming step 3. The programming mode will be finished automatically, the LED goes off.

9. Check list for troubleshooting

- Parts are getting too hot and/or start to smoke.

  ⚠ Disconnect the system from the mains immediately!

  Possible cause: one or more components are soldered incorrectly. → In case you have mounted the module from a kit, perform a visual check (→ section 6.) and if necessary, remedy the faults. Otherwise send in the module for repair.

- The servo connected to the SAS does not move.

  Possible cause: The servo´s connections have been assigned incorrectly to the connection pins of the SAS. → Alter the assignment (where required plug the connector the other way around onto the pins).

  Possible cause: The voltage supply has been interrupted. → Check the connections of the transformer.

  Possible cause: The push-buttons have been connected incorrectly. → Check the connections of the push-buttons.

- When starting the programming mode the LED does not light.

  Possible cause: The LED is defective or (when using a kit) soldered faultily polarised. → Check the LED.

  Possible cause: The push-button SET is connected incorrectly. → Check the connections of the push-button.

Hotline: If problems with your module occur, our hotline is pleased to help you (mail address on the last page).

Repairs: You can send in a defective module for repair (address on the last page). In case of guarantee the repair is free of charge for you. With damages not covered by guarantee, the maximum fee for the repair is the difference between the price for the ready-built module and the kit according to our valid price list. We reserve the right to reject the repairing of a module when the repair is impossible for technical or economic reasons.

Please do not send in modules for repair charged to us. In case of warranty we will reimburse the forwarding expenses up to the flat rate we charge according to our valid price list for the delivery of the product. With repairs not covered by guarantee you have to bear the expenses for sending back and forth.

10. 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-built module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

11. EU declaration of conformity

CE This product conforms with the EC-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying standards: EN 55014-1 and EN 61000-6-3. To guarantee the electromagnetic tolerance in operation you must take the following precautions:

- Connect the transformer only to an approved mains socket installed by an authorised electrician.
- Make no changes to the original parts and accurately follow the instructions, connection diagrams and PCB layout included with this manual.
- Use only original spare parts for repairs.

2011/65/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS). Underlying standard: EN 50581.

12. Declarations conforming to the WEEE directive

This product conforms with the EC-directive 2012/19/EG on waste electrical and electronic equipment (WEEE).

Don´t dispose of this product in the house refuse, bring it to the next recycling bay.

Information and tips:

http://www.tams-online.de

Warranty and service:

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