Electric Actuators

Linear Actuator
Type SAM -01 to SAM -52

Fig. 1 · Type SAM -20 Linear Actuator, rated travel 30 mm, nominal thrust 6 kN

Mounting and Operating Instructions

EB 8330 EN

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Contents

• Safety instructions

The actuators described below are part of a power plant installation for industrial applications. They are designed in accordance with the generally applicable technical regulations.

The connection and start-up of the linear actuators requires expert knowledge on the installation of power systems and equipment (according to DIN VDE 0100), on accident prevention regulations and the special start-up conditions for linear actuators.

These measures require qualified personnel.

According to these Mounting and Operating Instructions, qualified personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards, e. g.

- *training/instruction or authorization to activate/deactivate, isolate, ground, and mark devices/systems according to the safety engineering standards,*
- *training or instruction in accordance with the safety engineering standards regarding maintenance and application of suitable safety equipment,*
- *first aid training.*

Symbols in these Mounting and Operating Instructions

Please observe the following special symbols used in these Mounting and Operating Instructions.

NOTE!

Here, you will find supplementary details, information and tips.

Certain safety related information or instructions are brought to your attention.

CAUTION!

*Indicates a potentially hazardous situation which, if not avoided, may cause **property damage**!*

WARNING!

*Indicates a potentially hazardous situation which, if not avoided, could result in **property damage** or even **personal injury !***

Electrical or live parts are unprotected and freely accessible. Risk of death!

DANGER!

Electrical power or live parts are freely accessible.

*If instructions as per these Mounting and Operating Instructions are not followed, **death** or **serious injury** and **property damage** may result!*

DANGER!

During installation and operation, suitable power supply systems must be used to ensure that hazardous voltages are prevented from energizing the device in standard operating mode or in case of a faulty system or system parts.

Otherwise, personal injury and/or property damage may result.

Any hazards which could be caused by the process medium, the signal pressure and moving parts of the control valve are to be prevented by means of appropriate measure.

The proper and safe operation of this device depends on the proper shipping and appropriate storage including attachments and installation as well as careful operation and maintenance.

You are required to ensure the following:

- *Only qualified individuals must be assigned to work on this device.*
- *These individuals are required to read and have understood the Mounting and Operating Instructions supplied with this product as well as the product information.*
- *These Mounting and Operating Instructions must always be available. Make sure that the respective individuals strictly observe the instructions listed for any work to be performed.*
- *Where applicable, tools and measuring instruments must be used properly and in accordance with their intended purpose. If required, use your own protective gear.*
- *Work on this device or near this device must not be performed by unqualified personnel.*

1. Principle of operation

The Type SAM ... Electric Linear Actuators are equipped with reversible a.c. or three-phase a.c. motors. The rotary motion of the motor is transferred to the actuator stem via a gear unit and the corresponding transfer elements where it is converted into a linear "On-Off" motion.

In case the electrical power fails, you can operate the actuator manually.

Special features

- Nominal thrust from 2 to 25 kN
- Rated travel 15, 30, 60 or 120 mm
- Speed of response 13.5 to 50 mm/min
- A.c. motor 230 V~, 50 Hz
  or
  three-phase a.c. motor 400 V~, 50 Hz
- Degree of protection IP 65

1.1 Application

The linear actuators operate the final control elements which require a linear travel motion from 15 to 120 mm and a positioning force in the range of 2 to 25 kN.

The shut-off force of the actuators is adjusted permanently. The travel, however, can be modified at a later date.

1.2 Versions

The electrical components are located separately from the gear underneath the sealed cover where they are protected from dust and can be easily accessed when the cover is removed.

The **basic version** of the device comprises:

– Two torque *switches DE-S1* and *DE-S2*. They switch off the motor when the force adjusted in the actuator is counterbalanced by a corresponding force. Thus, they protect the final control element from damage, and the actuator from overload.
– One travel *switch WE-S3* for limitation of the travel in the opening direction.
– Two travel *switches WE-S4* and *WE-S5* for indicating intermediate and positions of the final control element.

The following components can be installed **optionally**:

– A fourth travel *switch WE-S6* for indicating certain control element positions.
– One or two *potentiometers* or one *electronic position transmitter ESR* for analog remote transmission of the final control element's position.
– One *heating resistor* to prevent the formation of condensation water underneath the cover when the humidity is high and the ambient temperatures fluctuate considerably. At an inside temperature of >60 °C, the heating resistor deactivates the heating via a temperature relay; it reactivates the heating at a temperature of <40 °C.
– One electronic positioner for the analog control 0 (2) to 10 V / 0 (4) to 20 mA (only for 230 V, 50 Hz AC motors).

1.3 Function

The rotary motion of the motor is transferred to the gear wheel with a female thread via the gearing.

The piston rod with the matching male thread engages the female thread. An anti-rotation device secures the rod and prevents it from rotating.

The piston rod performs a linear motion, either pulling or pushing, when the female threaded gear wheel is turned via the motor gear.

1.3.1 Electrical equipment

The electrical equipment is located underneath the removable housing cover.

In addition to the torque switches ***DE-S1*** and ***DE-S2*** as well as three travel switches ***WE-S3, S4*** and ***S5***, the actuator can be equipped with the following switching elements and measuring instruments:

– One travel switch ***WE-S6***

– Two potentiometers ***POT R1*** and ***POT R2***

– One electronic position transmitter ***ESR***

– One ***positioner***

The axial movement of the actuator stem is transferred via adjusting lever and slider to the driving lever. The driving lever then produces a proportional rotary motion via gear wheel as a measure for the two *R1* and *R2* potentiometers or the *ESR* positioner. The cam discs located on the axis of the gear wheel operate the switches *WE-S3, WE-S4, WE-S5* and *WE-S6* .

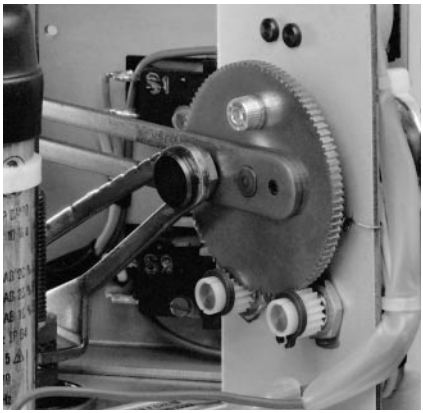


Fig. 2 · Function of switches and potentiometers, travel transmission

- DE-S1, DE-S2, WE-S3

DE-S1 switches off the motor depending on the torque when the actuator stem extends (final control element "CLOSED") .

DE-S2 switches off the motor depending on the torque when the actuator stem retracts (final control element "OPEN"), provided that the final control element can be subjected to load in "ON" position.

NOTE!

*The **switching points** of **DE-S1** and **DE-S2** are factory default and cannot be modified.*

WE-S3 switches off the motor depending on the travel when the actuator stem retracts (final control element "ON"), provided that the actuator stem has completed its travel as indicated in the ordering text.

- WE-S4, WE-S5, WE-S6

The travel switches ***WE-S4, WE-S5*** and sometimes ***WE-S6*** are not adjusted. If required, they can be adjusted/retrofitted as limit or signal switch (see section "7 Adjustment and calibration").

- POT R1, POT R2, ESR

The actuators can be equipped with two potentiometers ***POT R1*** and ***POT R2***
or
- with the Types SAM -20 to SAM -52 - with a ***position transmitter ESR*** that has an output signal of 4 (0) to 20 mA.

Both versions enable the analog remote transmission of the valve travel.

The potentiometers and the electronic position transmitter are adjusted to the required travel. They can be readjusted (see section "7 Adjustment and calibration").

Fig. 3 · Switches and potentiometers

- Positioner

In combination with three-phase synchronous a.c. or brake motors for 230 V, 50 Hz, a ***positioner*** may already be installed as factory default (see section "9 Positioner").

Input signals:

– 4 (0) to 20 mA

or

– 0 to 10 V

When the actual value deviates from the set point, a manipulated variable is generated to control the actuator.

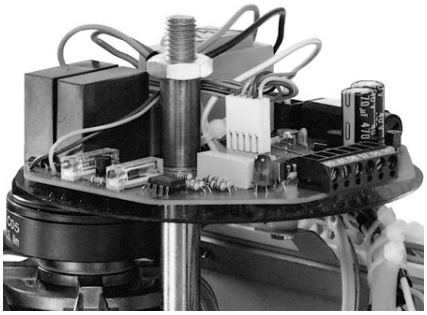


Fig. 4 · Positioner

2 Technical data

Table 1 · Mechanical data

Type SAM ...		-01	-10	-11	-12	-13	-20	-21	-22	-23
Nominal thrust	kN	2	2	3.5	4.5	6	6	8	12	15
Rated travel	mm	30								
Speed of response	mm/min	15	17 · 25 · 50			17 34	13.5 · 25 · 50			13.5 22 · 40
Transit time at rated travel	s	120	106 · 72 · 36			106 53	133 · 72 · 36			133 82 · 45
Adjusted travel	mm	15								
Transit time	s	60	53 · 36 · 18			53 26	67 · 36 · 18			67 · 40 22.5
Mounting position		Arbitrary, however, motor not vertically suspended.								
Actuator stem		No mechanical limit stops, anti-rotation device: tongue and groove								
Handwheel		Side-mounted handwheel								
Connecting thread		M 30 x 1.5								
Degree of protection		IP 65 according to DIN 40050								
Perm. ambient temperature		–20 to +60 °C								

Table 2 · Electrical data

Electrical connection		Inside terminal strip or terminal strip in terminal box, attached to actuator or as compact switch								
Connected load		Single-phase a.c. 230 V, 50 Hz · Three-phase a.c. 400 V, 50 Hz								
Operating mode acc. to VDE 0530 Part 1, section 4		Duty cycling S4 -30% ED-600 c/h								
Power consumption										
Type SAM ... Actuator		**-01**	**-10**	**-11**	**-12**	**-13**		**-20**	**-30**	**-21** **-31**
Speed of response [mm/min.]		15	17 · 25		50	17 · 34		13.5 · 25		
Nominal current [A]	Motor 230 V~/50 Hz	0.029	0.16		0.18	0.16 · 0.18		0.1 · 0.225		
	Motor 400 V~/50 Hz	0.015	0.11		0.08	0.11 · 0.08		0.062 · 0.11		
Motor type		Synchronous motor								
Temperature monitor		Not required, only on request								

Mechanical data

-30	-31	-32	-33	-40	-41	-42	-50	-51	-52
6	8	12	15	15	20	25	15	20	25
60							120		
13.5 · 25 50			13.5 22 · 40	25 · 50			25 · 50		
266 · 144 72			144 · 72				288 · 144		
30							60		
133 · 72 36			72 · 36				144 · 92		
Arbitrary, however, motor not vertically suspended									
No mechanical limit stops, anti-rotation device: tongue and groove									
Side-mounted handwheel									
M 60 x 1.5							M 100 x 1.5		
IP 65 according to DIN 40050									
–20 to +60 °C									

Electrical data

Inside terminal strip or terminal strip in terminal box, attached to actuator or as compact switch									
Single-phase a.c. 230 V, 50 Hz · Three-phase a.c. 400 V, 50 Hz									
Duty cycling S4 -30% ED-600 c/h									
-22 -32	**-23 -33**	**-23 -33**	**-20 -30**	**-21 -31**	**-22 -32**	**-23 -33**	**-40 -50**	**-41 -51**	**-42 -52**
13.5		22	50			40	25 · 50		
0.145		0.225	0.7			0.7	0.66 · 0.93		
0.85		0.11	0.29			0.29	0.4 · 0.7		
Synchronous motor			Asynchronous motor [1]						
Not required, only on request			Bimetallic-element switch						

[1] Actuators attached to a positioner require a brake motor

Table 2 · Electrical equipment

Switching and signalling equipment			
Torque switches ***DE-...***			
	Switch *DE-S ...*	Two switches *S1 and S2* · *Max. 250 V AC*	
Travel switches ***WE-...***			
	Switch *WE-S ...*	One switch *S3* in opening or closing direction Two switches *S4 and S5* to signal intermediate or final positions Switch *S6* as signal switch (optional) [1]	
	Load	cos φ = 1: max. 5 A · cos φ = 0.8: max. 3 A · Lightbulbs: max. 2 A	
Potentiometer ***R***			
	Potentiometer *R ...*	One or two potentiometers *R1 and R2*: 110 Ω, 200 Ω, 1 kΩ	
	Load	Max. 1.5 W · Slider current max. 30 mA	
Electronic position transmitter ***ESR*** [2]			
Connection		Four-wire/three-wire connection	Two-wire connection
	Supply voltage U_H	18 to 30 V DC	18 to 30 V DC
	Max. load R_L	50 · (U_H – 2.5) Ω	50 · (U_H – 12) Ω
	Output signal	0 to 20 mA or 4 to 20 mA	4 to 20 mA
	Current consumption	Max. 30 mA	
Electronic positioner [3]			
Input and output signals		4 (0) to 20 mA or 0 to 10 V	
Heating resistor		With temperature monitor · 24/110/230 V DC/AC · 15 W	

1) Only for Type SAM-20 to -50: Provided S6 is connected, only one potentiometer (R1) can be connected in plug-type connections.
2) Only for Type SAM-20 to -52, optionally with potentiometer R1/R2 or position transmitter ESR
3) Only for brake motors or synchronous motors for 230 V, 50 Hz; for three-phase a.c. motors, external reversing contactors are required.

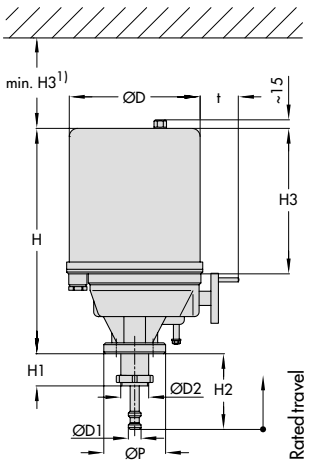
3 Dimensions

Table 3 · Dimensions in mm and weights

Type	SAM -01 . . . -13	SAM -20 ... -23	SAM -30 ... -33	SAM -40 ... -42	SAM -50 ... -52
Rated travel mm	30	30	60	60	120
H	262 (277) [1]	300 (323) [1]		377 (417) [1]	
H1	34	34	54	54	92
H2 max.	90	90	165	165	315
H3	160 (175) [1]	175 (198) [1]		187 (227) [1]	
∅ D	145	184		216	
∅ D1	16	16	22	40	40
∅ D2 Thread	M 30 x 1.5	M 30 x 1.5	M 60 x 1.5	M 60 x 1.5	M 100 x 2
∅ P	74	130			
t	~ 40	~ 60			
Weight approx. in kg	5	6	7	15	19

[1] Values in parentheses for linear actuators attached to positioners

Dimensional drawing



[1] Minimum clearance to ensure that the cover can still be removed after the actuator has been installed.

Fig. 5 · Dimensions of linear actuators Type SAM-01 to SAM-52

4 Installation

4.1 Installation requirements

Prior to installation, make sure that the following requirements are met:

– Proper voltages and control signals required to operate the actuator are available.
– Electrical lines are de-energized.
– Pipelines are depressurized and cold.

Choose the attachment position of the linear actuator so as to ensure the following:

– The actuator can be easily accessed.
– There is sufficient space to remove the cover (see "3 Dimensions").
– The actuator is protected against excessive heat radiation.
– The ambient temperature is in the range from -20 to +60 °C.

If installed outdoors, the actuator must be protected with an additional cover, e.g. against humidity (rain, snow), heat (direct sunlight), cold (frost), excessive draft, dust, etc.

When ambient temperatures are subjected to strong fluctuations and if the humidity is high, we recommend installing a heating resistor to minimize the formation of condensate in the housing (see "8.1 Heating").

If installed in an environment with a high pollutant concentration, (e.g. in areas with a high traffic volume, industrial areas, near coastal regions), the external actuator parts must be made of non-corrosive material and be coated with a special finish.

4.2 Mounting position

The mounting position is arbitrary, however, the linear actuator must not be vertically suspended.

When mounted with the actuator stem in horizontal position, the yoke must be mounted such that its two rods are positioned vertically one on top of the other.

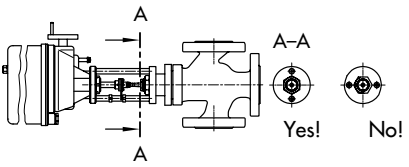


Fig. 6 · Mounting position with horizontal actuator stem

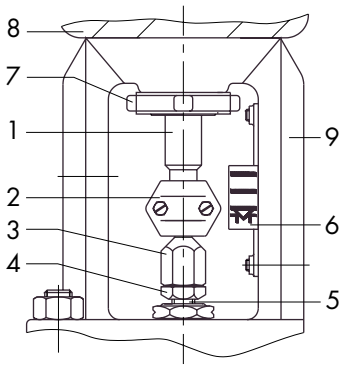
4.3 Attaching the actuator to a control valve

On delivery, the actuator stem is extended to the lower final position.

Prior to assembly, check the following:

– Does the technical data of the linear actuator match the application requirements?
– Is the valve complete (yoke on the actuator or on the valve)?
– Are the coupling parts aligned?
– Is the linear actuator ready - with ring nut and coupling parts for attachment to the valve?

– If required, are additional accessories already installed in the actuator?
– Does the operating voltage to be connected match that of the actuator?
– Does the data on the name plate match the motor data?
– Does the adjusted travel of the actuator or the travel to be adjusted also match the valve travel?



1	Actuator stem	6	Travel indicator scale
2	Coupling	7	Ring nut
3	Coupling nut	8	Actuator
4	Lock nut	9	Yoke
5	Plug stem		

Fig. 7 · Assembly (detail)

Procedure
– Insert plug stem (5) into the valve as far as it will go.
– Move actuator stem (1) to mid-position (see "4.4 Manual operation").
– Place actuator (8) on the valve bonnet and secure with ring nut (7) (allow to fall over the stem when placing).
– Push plug stem (5) up, connect coupling nut (3) and actuator stem (1) via the coupling halves (2) and tighten with screws.
– Move actuator stem (1) to the final position by turning the handwheel clockwise.
– Align travel indicator scale (6) with the tip of the coupling (2) and screw tight.
– Tighten the plug stem (5) with the lock nut (4) against the coupling nut (3).

CAUTION!
Do not press valve plug or final control element onto the seat and turn.
This could cause the final control element and the actuator to be damaged.

The linear actuator can be attached similarly to other final control elements, e. g. butterfly valves with attached pedestal.

4.4 Manual operation

In case the energy supply fails, or when installing and adjusting the actuator, the actuator stem can be "retracted or extended" manually

CAUTION!

Do not operate the handwheel when the motor is in motion.

*Do **not** override the adjusted travel range with the handwheel. Observe the rated travel, otherwise the actuator could be damaged. This applies especially to an uninstalled actuator.*

Use the disengaging stem to unlock the motor and actuator stem and move the stem using the side-mounted handwheel.

– If the actuator is installed vertically, push down the disengaging stem in the direction of the extending actuator stem.
– Turn the handwheel alternately counterclockwise/clockwise, until it engages noticeably.
– If the direction of rotation is clockwise, the actuator stem extends.
  If the direction of rotation is counterclockwise, the actuator stem retracts.

The linear actuator then switches automatically back to motor operation as soon as you release the disengaging stem.

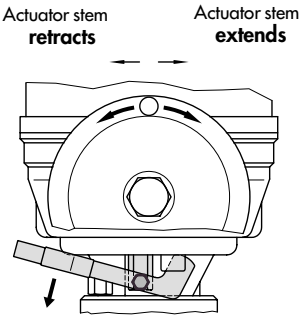


Fig. 8 · Manual operation

5 Electrical connection

DANGER!

The connection and start-up of the linear actuators requires expert knowledge on the installation of power systems and equipment (according to DIN VDE 0100), on accident prevention regulations and the special start-up conditions for linear actuators.

This type of work must be performed by qualified personnel only (see p. 3 "Safety instructions").

- *Be sure to disconnect the voltage prior to connecting the actuator to the power supply. Ensure that the voltage cannot be switched on again accidentally!*
- *When installing the local lines and establishing the connection, you are required to observe the DIN-/VDE regulations as well as the regulations of your local energy supplier.*
- *Be sure to check that the mains supply voltage and the system frequency match the data on the name plate of the linear actuator as well as the actuator's name plate.*
- *The cross section of line must be sized in accordance with the respective power consumption of the linear actuator and the required line length. Minimum cross section of lines: 1.5 mm^2 or according to the local regulations. Cross sections of lines that are not large enough are often the cause of supposed "malfunctions".*
- *Fuse of the system: max. 6 A*
- *Upstream controllers or switching devices must be sized sufficiently. If required, install a coupling relay between them.*
- *Isolation of the system's power supply; to isolate and disconnect the power supply line from the actuator for maintenance and calibration purposes, the proper stop controls must be used which guarantee an all-pole disconnection (except earth) when switched off. These stop controls must be lockable when switched off and guarded against being switched on unintentionally.*
- *Use appropriate power supply systems which ensure that no hazardous voltages may reach the device in standard operation or in case of fault.*

If you do not observe these safety regulations, death, severe physical injury or considerable property damage may occur.

5.1 Removing the cover

WARNING!

Before you remove the cover and when you perform any maintenance or calibration work, you must first disconnect the power supply.

Protect the actuator against being switched on again unintentionally!

– Unscrew cap nut.
– Remove seal ring.
– Hold the cover and slightly turn while removing.

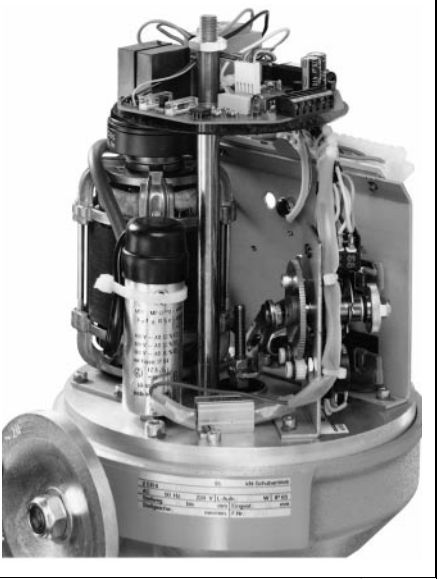


Fig. 9 · Type SAM-20 Actuator, cover removed

DANGER!

Linear actuators with the cover removed may only be operated for short periods, e.g. for test runs or essential calibration work on electric components such as potentiometers, limit switches or position electronics. During these activities, hazardous energized, uninsulated, moving and rotating parts are easily accessible. If the calibration is performed improperly or without the required caution, death, severe physical injury or property damage may result.

This type of work may only be carried out by qualified personnel (see p. 3 "Safety instructions").

The operation of the actuator with the cover removed for a purpose other than the one described above, is prohibited.

5.2 Establishing the connection

NOTE!

For the electrical connection, refer to the circuit diagram displayed inside the lid!

When installing electric lines, you are required to observe the regulations governing power plant installations!

Especially with 24-V-actuators, you should make sure that the line cross sections are sufficiently sized and that there is enough reserve capacity left in the transformer.

– Route and secure the lines in the actuator such that they are protected from moving or rotating parts and cannot be damaged when removing or replacing the cover.

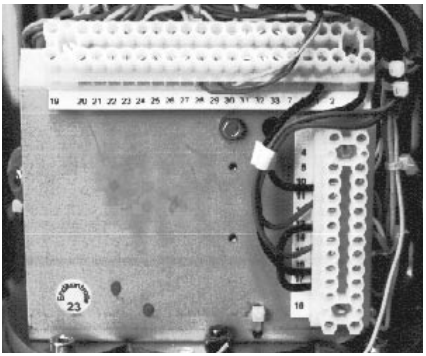


Fig. 10 · Terminal blocks for electrical connection

5.4 Start-up

The following applies for a first working simulation:

– Use handwheel to move actuator stem towards the center of the travel.

– Connect grounding contactor to grounding contactor clamp ⏚ .

– Connect supply voltage.

WARNING!

The actuators must only be adjusted electrically or manually within the given travel.

If you adjust the travel to a value exceeding the given values, the actuator may be damaged!

A.C. motors

N ≙ clamp **1** **L** ≙ clamp **3**

The actuator stem extends from the actuator and moves to **"CLOSED"** position (closes).

N ≙ clamp **1** **L** ≙ clamp **2**

The actuator stem retracts into the actuator and moves to **"OPEN"** position (opens).

Three-phase a.c. drive motors

External reversing contactors should be used.

L_1 ≙ clamp **1**; L_2 ≙ clamp **2**; L_3 ≙ clamp **3**

WARNING!

With the wrong direction of rotation, even correctly wired torque switches cannot switch off the motor. When "testing" the operating direction, use short-term commands only.

Switch on the supply voltage, thus issuing the short-term command "OPEN/CLOSED" .

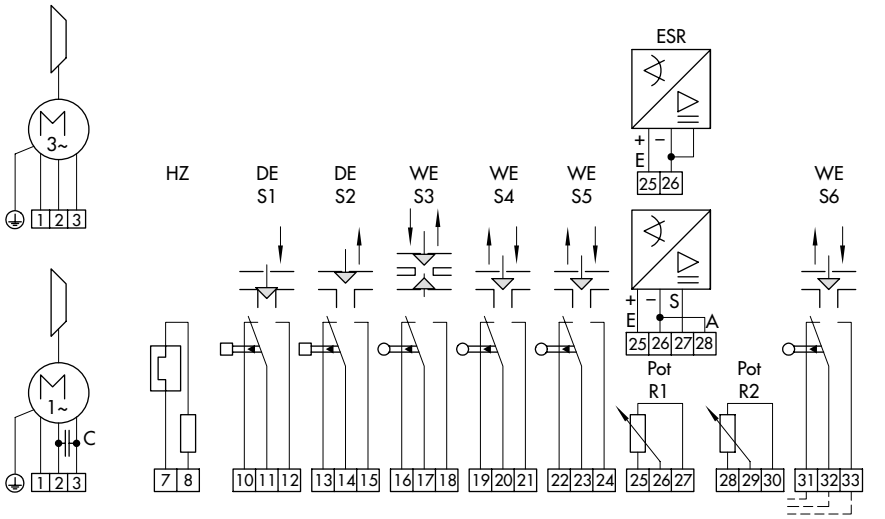
– Check, whether the actuator stem moves in the right direction.

– If the actuator stem does not move in the right direction, switch motor connections 2 and 3, and repeat test.

Connection diagram Types SAM-01 to -52

Switches and potentiometers
If a fourth *WE S6* is installed:
Only 1 potentiometer *POT R1* is possible for plug-type connection!

The travel *switch S3* must be adjusted so that it limits the travel of the final control element in the operating direction by switching off the motor (see section "7.4 Limit switch WE-S3").
Do not exceed the travel adjusted at the linear actuator!



With brake
Without temperature monitor TW

HZ Heating resistor
DE-S ... Torque limit switches
WE-S ... Travel limit switches
ESR Electronic position transmitter

2) Resistor Type SRH 25 (3.3 kΩ) is connected upstream at a speed of response of 50 mm/min.

Fig. 11 · Connection diagram of the Type SAM-01 to Type SAM-52 Linear Actuators

6 Connection examples

Connection example 1 (three-way valve)

- Operation with single-phase alternating current (three-step control)
- Final switch-off via switch *DE-S1* (limitation in closing direction "CLOSED") and *DE-S2* (limitation in opening direction "OPEN"), load-dependent

NOTE!

If you want to operate the actuator with only two torque switches DE-S1 and DE-S2, the associated valve must be designed to accept the forces of the actuator.

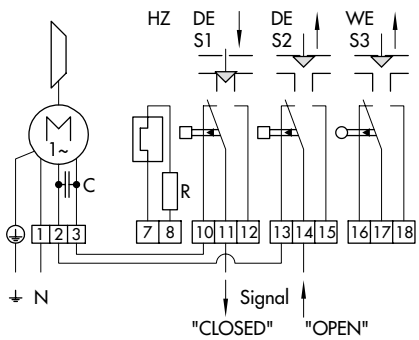
Refer to the documentation for the valve. If required, contact your manufacturer!

Connecting the actuator

– Connect the grounding conductor of the connecting line (green/yellow wire) to the grounding conductor clamp ⏚ .
– N of connecting line to clamp **1**.
– Control line extending actuator stem "CLOSED" to clamp **11**.
– Control line retracting actuator stem "OPEN" to clamp **14**.
– Insert jumpers; from clamp **10** to clamp **3** and from clamp **13** to clamp **2**.

Testing the actuator

– Use a three-step controller to control the actuator.
– Use an isolated screw driver to operate the switching rolls of the switch and check whether the switch actually does deactivate the motor:
With extending actuator stem ->
upper switch ***DE-S1***,
With retracting actuator stem ->
lower switch ***DE-S2***,
– If required, switch the motor supply jumpers on the clamps 2 and 3.



HZ Heating resistor
DE-S1 Torque limit switch S1, position "CLOSED"
DE-S2 Torque limit switch S2, position "OPEN"
WE-S3 Travel limit switch S3, position "OPEN"

Fig. 12 · Circuit diagram, connection example 1

Connection example 2 (globe valve)

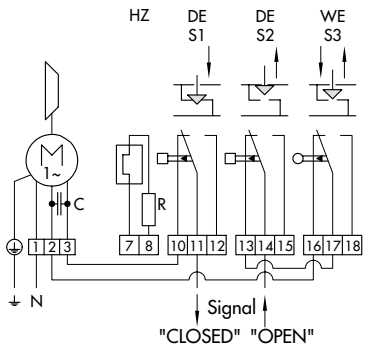
- Operation with single-phase alternating current (three-step control)
- Final switch-off, actuator stem extending from the actuator (direction "CLOSED"), load-dependent via switch ***DE-S1***
- Final switch-off, actuator stem retracting in the actuator (direction "OPEN"), load-dependent via switch ***DE-S2*** connected in series with switch ***WE-S3***

Connecting the actuator

– Connect the grounding conductor of the connecting line (green/yellow wire) to the grounding conductor clamp ⏚ .
– N of connecting line to clamp **1**.
– Control line extending actuator stem "CLOSED" to clamp **11**.
– Control line retracting actuator stem "OPEN" to clamp **14**.
– Insert jumpers; from clamp **10** to clamp **3**, from clamp**16** to clamp **2**, and from clamp **13** to clamp **17.**

Testing the actuator

– Use a three-step controller to control the actuator.
– Use an isolated screw driver to operate the switching rolls of the switch and check whether the switch actually does deactivate the motor:
With extending actuator stem ->
upper switch ***DE-S1,***
With retracting actuator stem ->
lower switch ***DE-S2*** and
switch ***WE-S3***.
– If required, switch the motor supply jumpers on the clamps 2 and 3.



HZ Heating resistor
DE-S1 Torque limit switch S1, position "CLOSED"
DE-S2 Torque limit switch S2, position "OPEN"
WE-S3 Travel limit switch S3, position "OPEN"

Fig. 13 · Circuit diagram, connection example 2

7 Adjustment and calibration

7.1 Travel

On delivery, the linear actuator is adjusted and calibrated to the travel indicated in the ordering text. If required, you can change or readjust the factory adjusted travel.

The slotted lever connected to the actuator stem is equipped with travel "markers". The scale inside indicates the adjustable travel values.

To adjust the travel, the actuator stem must be extended all the way to final position so that the two adjustment levers are in parallel (final control element "CLOSED"/travel indicator at the bottom mark).

Procedure

– Use a wrench to loosen flat nut from the slider.
– Move slider between the two slotted levers, thus setting the desired travel according to the marks.
– Secure slider with the flat nut again.
– Move position marks on the yoke to the new final positions.

NOTE!

The travel is infinitely variable, however, in accordance with the data indicated on the name plate, i.e. positions between the marks can also be set.

After changing the travel, the limit switch WE-S3 must also be readjusted (see "7.4 Limit switch WE-S3").

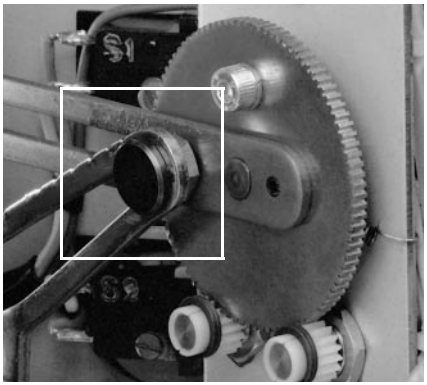


Fig. 14 · Travel adjustment

7.2 Adjusting the potentiometer

Depending on the version, the actuator can be equipped with one or two potentiometers (POT R1 and POT R2), see Fig.15.

When the actuator stem is in "OPEN"/ "CLOSED" position, the potentiometers *POT R1 and POT R2* must each be in final position.

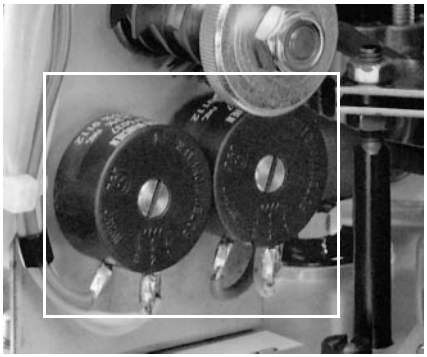


Fig. 15 · Potentiometer R1/R2

You can readjust the two potentiometers:

– Use handwheel to move the linear actuator to the final position "actuator stem extended" ("CLOSED") until DE-S1 switches. Adjusting lever and driving lever must be in parallel in their tilted position.
– Use an appropriate screwdriver to move the slider of the potentiometers to final position. For this, turn the potentiometer shaft counterclockwise until the stop can be just felt.
– Move actuator by the adjusted travel to the final position "actuator stem retracted" ("OPEN"). The potentiometers are then rotated into the other final position.
– Use a measuring instrument (ohmmeter) to monitor the potentiometer movement and check whether the entire potentiometer range is being covered.

NOTE!

If the potentiometers reach the end stop when reaching final position, the sliding clutch between potentiometer and pinion reacts and prevents damage. However, a distinct reproducibility of the measuring results is not given anymore.

In this case, a correspondingly higher travel must be adjusted via the slider and the adjusting lever (see section "7.1 Adjusting the travel").

For actuators with installed electric positioner, R1 is internally linked to the controller. Its resistance value is therefore not transmitted to the outside for indication.

7.3 Electr. position transmitter

Type SAM-20 to -52 Linear Actuators can be equipped with an *electronic position transmitter ESR* in place of the two R1/R2 potentiometers.

The transmitter's output signal indicates via output current in the range from 4 (0) to 20 mA the position of the final control element. Therefore, it is especially suited for remote transmission of the position.

Operating mode

The position transmitter can be operated in two modes.

Use the mode selector switch to select "Normal mode" or "Reverse mode" .

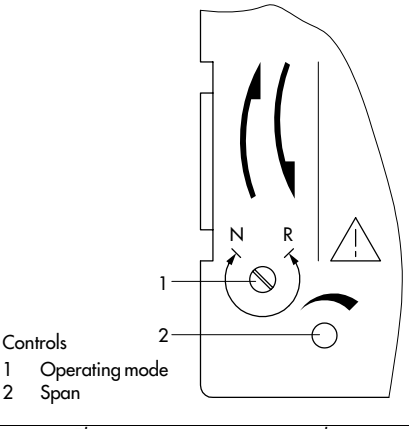


Fig. 16 · Electronic position transmitter, adjusters for operating mode and span

NOTE!

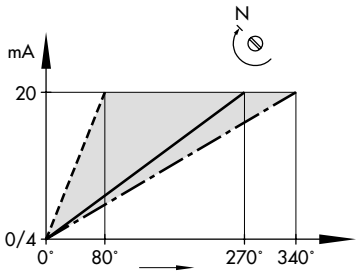
The adjuster for the operating mode must always be in the final position of "Normal/Reverse", otherwise lower and upper range value cannot be adjusted.

Normal mode

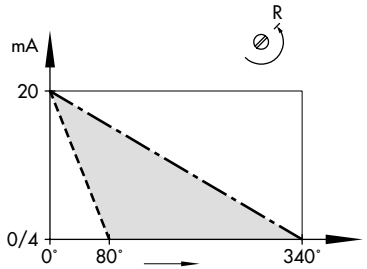
Rising characteristic when rotating the drive gear wheel clockwise.

Falling characteristic when rotating the drive gear wheel counterclockwise.

Normal mode



Reverse mode



Span adjustment upon delivery
Maximum span
Minimum span
Span infinitely adjustable in this range

Fig. 17 · Span, range of adjustment

Reverse mode

Rising characteristic when rotating the drive gear wheel counterclockwise.

Falling characteristic when rotating the drive gear wheel clockwise.

NOTE!

*With reverse final control elements, the position of the **extended** actuator stem corresponds to the final position **"OPEN"**.*

Adjusting the 0 or 4 mA output signal

Move actuator in the position in which the output current is to be 0 or 4 mA.

Turn black adjustment wheel against the white drive gear wheel to adjust the output current to

– 3.98 to 4.02 mA for two-wire connection

– 0.01 to 0.02 mA for three-wire connection

NOTE!

In three-wire connections, there is no polarity reversal at zero crossing. The device indicates 0 mA over a range of 8 degrees. Therefore, you should select a value as small as possible, however, other than zero (e. g. +0.01 mA).

Adjusting the 20 mA output signal

– Move the actuator to the position in which the output current is to be 20 mA.

– Set the output current to 20 ± 0.02 mA using the span adjuster (see Fig. 16).

– Check the output signal adjustment for 0/4 mA, repeat adjustment if required.

7.4 Limit switch WE-S 3

- Type SAM-20 to SAM-52 Linear Actuators -

"Readjust" the cam disc associated with *WE-S3* so that the actuator switches off after reaching the required travel.

– Actuator stem in "OPEN" position (final position).
– Loosen knurled nut slightly, so that the cam disc can be moved.

NOTE!

When the knurled nut is loose, the cam discs may come loose unintentionally, thus changing the respective switching position.

– Adjust cam disc for *WE-S3* in opening direction such that the switch deactivates the actuator (check with gauge).
– Retain the position of the cam disc; retighten knurled nut manually.
– Check the switching position in a test run.

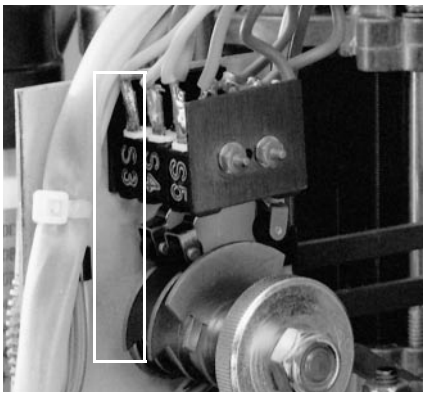


Fig. 18 · Switch WE-S 3 in the background with associated cam disc

7.5 Signal switches WE-S4 to WE-S6

- Type SAM-20 to SAM-52 Linear Actuators -

You can freely adjust the travel switches *WE-S4, WE-S5* and *WE-S6* to indicate certain control element positions.

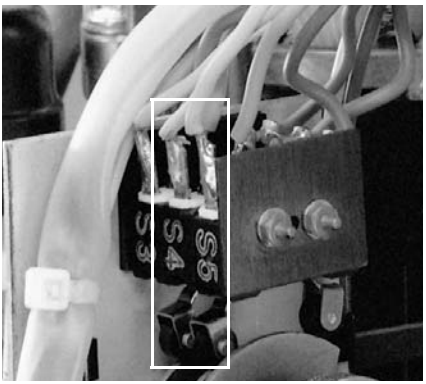


Fig. 19 · Switches WE-S4 and WE-S5; Switch S6 not installed

– Activate the required position for each switch.
– Loosen knurled nut.
– Adjust the associated cam disc of each switch accordingly (check switching point with gauge).
– Retain the position of the cam disc; retighten knurled nut manually.
– Check switching positions in a test run.

- Type SAM-01 to SAM-11 Linear Actuators -

The travel limit switches *WE-S3* and *WE-S6* are mounted on the lateral mounting plate. They are operated via the operating cams located at the top end of the actuator stem.

Depending on the movement of the actuator stem "OPEN"/"CLOSED", the associated limit switch deactivates the actuator travel.

You can adjust the switching position at random by moving the respective switch axially over the oblong hole, retighten.

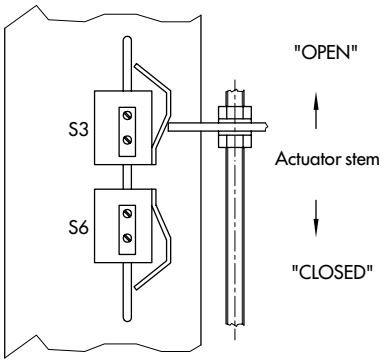


Fig. 20 · Operating cams WE-S3/WE-S6

WE-S3

– Move actuator stem to final position manually ("OPEN") - actuator stem retracted -.

First, the switch *WE-S3* must be above from the operating cam.

WE-S6

– Move actuator stem to final position manually ("CLOSED") - actuator stem retracted -.

First, the switch *WE-S6* must be below the operating cam.

For both cases ...

– Loosen the mounting screws of the respective switch from the back side so that the switch may be operated.
– Push the switch up/down until the operating cams switch off the actuator - depending on the travel - (check with a gauge).
– Retighten mounting screws.

Check switching position in a test run.

8 Additional electr. equipment

8.1 Heating

We recommend the installation of a heating resistor to prevent condensate from forming underneath the cover, for instance, in applications with strongly fluctuating ambient temperatures, high humidity and in outdoor applications.

The heating resistor "R" is controlled via a thermostatic switch "TW" (bimetallic-element switch). A continuous-operation voltage is required for operation (indicate when ordering).

The switch-off temperature is approximately +60 °C, the re-start temperature +40 °C.

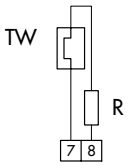


Fig. 21 · Heating resistor R and thermostatic switch TW, circuit diagram

For power supply, connect the heating resistor with thermostatic switch to clamps 7 and 8.

8.1.1 Retrofitting the heating resistor

You can install and connect a heating resistor at a later date.

– Remove cover

– Secure heating resistor to the position intended for this purpose (see Fig. 22) using the two self-cutting screws supplied with the resistor.

– Secure temperature monitor in the respective bore hole of the mounting bracket (nut width across flats 7).

– Connect the flexible lead end of the temperature monitor and the heating resistor to clamps 7 and 8.

– Route and mount lines in the actuator such that they are protected from moving or rotating parts and are not damaged when the cover is removed or replaced.

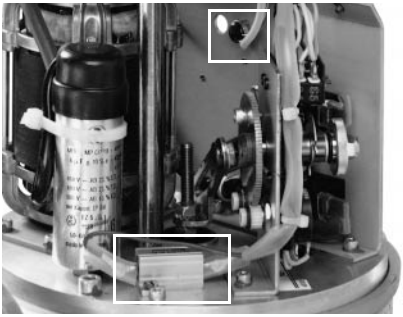


Fig. 22 · Heating resistor(bottom), thermostatic switch in the background (top)

9 Positioner

In a.c. brake motors for 230 V, 50 Hz, positioners can be installed as three-step controllers.

NOTE!

Under "normal" conditions, positioners are combined with a.c. brake motors.

Three-phase a.c. motors require external reversing-contactor switches that must be interlocked with the travel and torque switches.

With these motors, start-up must be carried out with special care, because in the event of an incorrect phase sequence and, hence, a wrong direction of rotation, the limit switches have no effect either. They would interrupt the "wrong" contactor.

Property damage may occur if the above precautions are not observed.

The positioner is located on the printed circuit board above the motor, final controlling element and terminal strip (see Fig. 23).

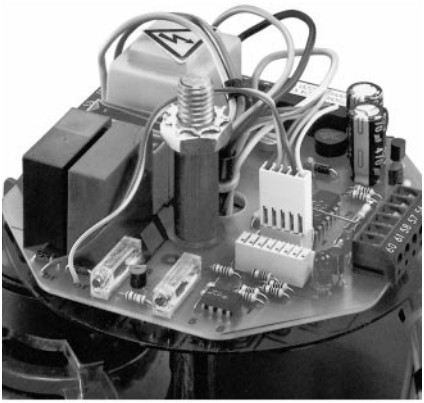


Fig. 23 · Location of the positioner

When the cover is removed, the components for connection, adjustment and readjustment can be easily accessed.

The positioner controls the actuator via a load-independent **d.c. current** or **voltage signal** as reference variable. The respective rated travel is assigned to the reference variable.

The controlled variable (actual value) and the reference variable (set point) in the range of 0 to 10 V or 0 to 20 mA are compared with each other.

If the actual value deviates from the set point, a manipulated variable is generated to control the actuator until set point and actual value match.

For signal feedback (actual value), POT R1 (1 kΩ–Poti) of the actuator is used.

NOTE!

The actuator is adjusted as factory default to the given control range and travel.

9.1 Electrical connection with positioner

See also section "10.1 Circuit diagram Type SAM ... with positioner".

DANGER!

Observe the safety regulations governing handling of electrical systems as described in section "5 Electrical connection"!

– Connect grounding conductor of the supply line to the grounding conductor clamp ⏚ .
– Directly grounded conductor "N" of the supply voltage to clamp **1**.
– Permanent phase "L" (operating voltage) to clamp **54** of the positioner's circuit board.

9.1.1 Connecting the control line

For the connection of the lines, refer to section "5.2 Establishing the connection ".

NOTE!

To keep the influence of the disturbing pulse as small as possible, the control signal (set point) must be routed to the actuator via separate line with tin-plated copper braiding as screening!

Control voltage **0 (2)** to **10 V**:
(–) Clamp **57** (+) Clamp **56**

Control current **0 (4)** to **20 mA**:
(–) Clamp **57** (+) Clamp **59**

10 V (20 mA) ≙ Actuator stem up ("OPEN")

2 V (4 mA) ≙ Actuator stem down ("CLOSED")

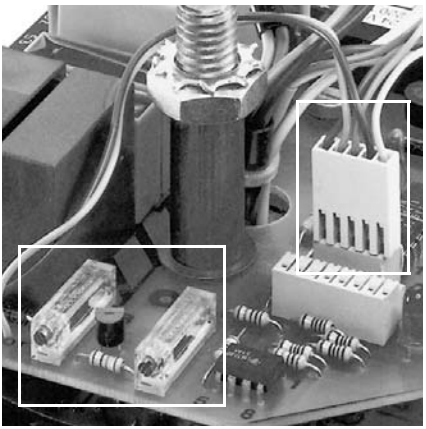


Fig. 24 · Potentiometer "A" and "B", Poti "B" on left, Poti "A" on right; reversing plug in background

9.1.2 Feedback signal

You can measure the actual value either as:

– Voltage **0 (2)** to **10 V**
(–) Clamp **58** (+) Clamp **61** or

– Current **0 (4)** to **20 mA**:
(–) Clamp **58** (+) Clamp **60**

The output signal always corresponds to the input signal at a tolerance of approx. 200 mV or 0.2 mA compared to the input.

The feedback signal is in the same direction, i.e. an increasing input signal (set point) also causes an increasing feedback signal.

The feedback signal must **not** be adjusted and is **not** electrically isolated from the input.

9.2 Corrections with potentiometers "A" and "B"

An LED simplifies the adjustment of the final points.

– Potentiometer "A" for upper set point mark: Turn clockwise, travel becomes shorter.

– Potentiometer "B" for lower set point mark: Turn clockwise, travel becomes longer.

The red LED signalizes: actuator in final position, no manipulated variable is generated, the set point has been reached.

9.3 Reversing

By turning the reversing plug (see Fig. 24), the direction of rotation is reversed by 180 degrees, i. e. the motor's direction of travel is reversed with regard to the set point.

– Disconnect actuator from the supply voltage.
– Remove reversing plug, turn by 180 degrees and plug back in.
– Reconnect actuator to supply voltage .
– If required, correct with Poti "A" or "B".

9.4 Sequential mode

You can also operate the positioner in sequential mode. The lowest range is 2 V or 4 mA.

The position of the sequence within the range of 0 to 10 V or 4 to 20 mA is arbitrary. Use the trimming potentiometers "A" and "B" to adjust the respective final value.

The upper range value must be adjusted first.

Use the potentiometer "A" to adjust the upper range sequential mark. Use the potentiometer "B" to adjust the lower range sequential mark.

10 Maintenance and service

WARNING!

Before you remove the cover and prior to any maintenance and adjustments, disconnect the supply voltage to the actuator.

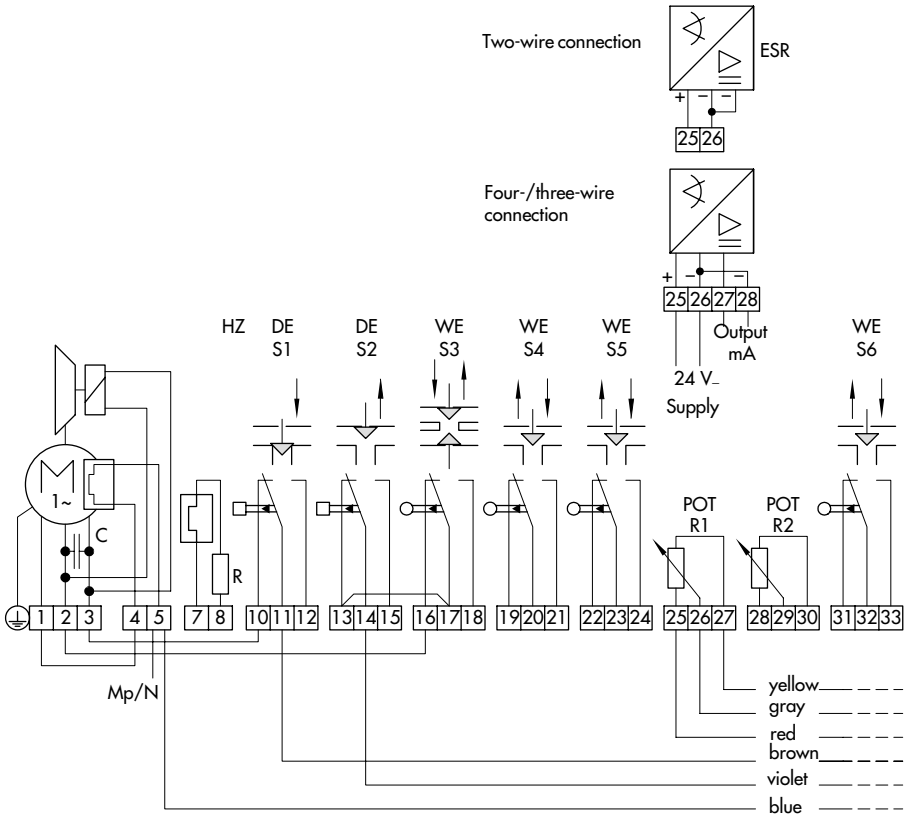
Ensure that the actuator cannot be switched on again accidentally!

The gearing and the actuator stem must be relubricated after approx. 200,000 double strokes. We recommend the following lubricants:

– Standard and tropics version:
  Klüber Microlube GL 261
– Oxygen version:
  BARRIERTA L55/3 OX.

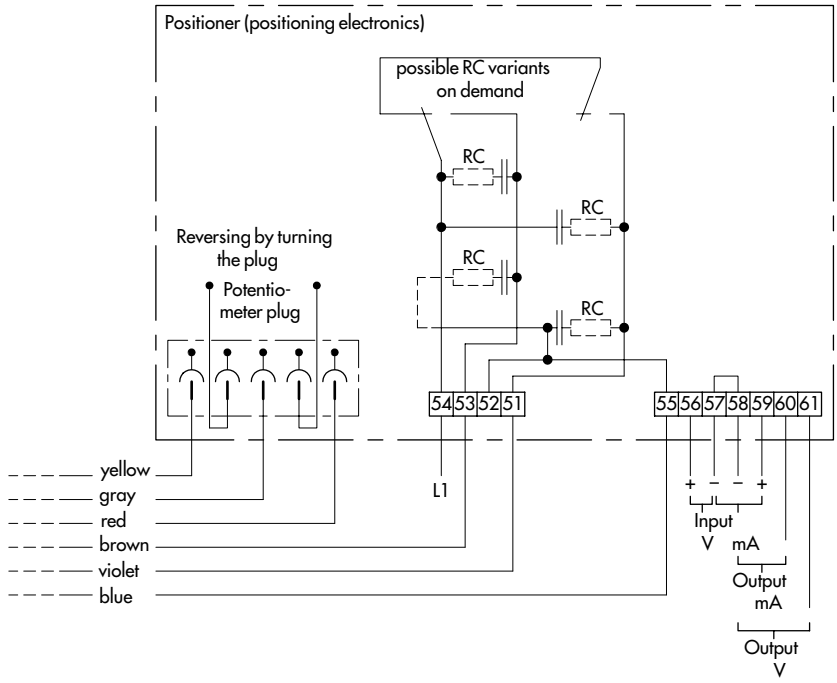
Do not attempt to repair the linear actuator on site. Defective actuators must be sent together with a fault report including the product number to SAMSON AG.

10.1 Circuit diagram Type SAM -... with positioner (maximum equipment)



- The circuit diagram shows the maximum equipment.
- Input 0 (4) to 20 mA or 0 (2) to 10 V is determined by the manufacturer as per order.
- Auxiliary power connection (230 V) to clamps 54 (L) and 55 (Mp/N).
- Electronic position transmitter ESR only for Type SAM-20 to Type SAM-52.

Fig. 25 · Circuit diagram, Type SAM-01 to SAM-52 Electric Linear Actuators with positioner



DE *Torque switches*
WE *Travel switches*
S3 for travel limitation
S4 to S6 for reporting intermediate positions
POT *Potentiometer*
HZ *Heating resistor with temperature monitor*
ESR *Electronic position transmitter (Type SAM-20 to 52 only)*

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