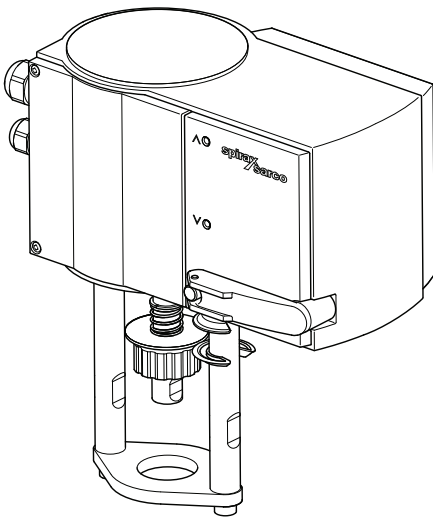

AEL3 Series
Electric Linear Actuators
Installation and Maintenance Instructions



1. Safety information
2. General product information
3. Installation
4. Commissioning
5. Maintenance

1. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.13) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

See separate Installation and Maintenance Instructions for the control valve.



If the actuator is handled improperly or not used as specified, the resultant may:


- cause danger of the life and limb of the third party,
- damage the actuator and other assets belonging to the owner,
- hinder the performance of the actuator.

1.1 Wiring notes

Every effort has been made during the design of the actuator to ensure the safety of the user, but the following precautions must be followed:

- i) Maintenance personnel must be suitably qualified in working with equipment containing hazardous live voltages.
- ii) Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this manual.
- iii) Isolate the actuator from the mains supply before opening the unit.
- iv) The actuator is designed as an installation category II product, and is reliant on the building installation for overcurrent protection and primary isolation.
- v) Wiring should be carried out in accordance with IEC 60364 or equivalent.
- vi) Fuses should not be fitted in the protective earth conductor. The integrity of the installation protective earth system must not be compromised by the disconnection or removal of other equipment.
- vii) A disconnecting device (switch or circuit breaker) must be included in the building installation. This must be in close proximity to the equipment and within easy reach of the operator.
 - There must be a 3 mm contact separation in all poles.
 - It must be marked as the disconnecting device for the actuator.
 - It must not interrupt the protective earth conductor.
 - It must not be incorporated into a mains supply cord.
 - The requirements for the disconnecting device are specified in EN 60947-1 and EN 60947-3 or equivalent.
- viii) The disconnecting device must not be located in such a way that the device is made difficult to operate.

1.2 Safety requirements and electromagnetic compatibility

This product is  marked. It complies with LV Directive 2014/35/EU, EN60730-1, EN60730-2-14.
This product complies with EMC Directive 2014/30/EU, EN61000-6-2, EN61000-6-4

The product may be exposed to interference above the limits of industrial immunity if:

- The product or its wiring is located near to a radio transmitter.
- Excessive electrical noise occurs on the mains supply.
- Cellular telephones and mobile radios may cause interference if used within approximately one metre of the product or its wiring. The actual separation necessary will vary according to the power of the transmitter.
- Power line protectors (ac) should be installed if mains supply noise is likely.
- Protectors can combine filtering, suppression, surge and spike arrestors. For a copy of the declaration of conformity contact Spirax Sarco.

1.3 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use / application.

- i) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous over pressure or over temperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- ii) Determine the correct installation situation.
- iii) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- iv) These actuators are not suitable for use as safety devices according to the pressure equipment directive 2014/68/EU or the machinery directive 2006/42/EU.

1.4 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.5 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.6 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery. Do not use the actuators in explosive atmosphere according the ATEX directive 2014/34/EU.

1.7 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.8 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.9 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.10 Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine Spirax Sarco replacement parts.

1.11 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.12 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.13 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.14 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 90°C (194°F).

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.15 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.16 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.17 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. General product information

2.1 Use

AEL3 series electric linear actuators are for use with Spira-trol two-port control valves and QL three-port valves. Actuators will normally be supplied fitted to the control valve. When supplied separately, ensure the actuator selected is capable of giving the force necessary to close the two-port or three-port control valve against the expected differential pressure. Do not use on valves with graphite stem seals. See the appropriate product specific Technical Information Sheet for full details of the control valve.

The AEL3 actuators are motor operated actuators for on-off, modulating or special control of valves for regulating control, cold, warm or hot water, steam or air and equivalent applications. Typical use is for HVAC applications.

AEL3 actuators are available with 3 supply variants, 24 Vac/dc as standard, 230 Vac or 100 Vac, available with additional modules, all being suitable for a VMD (Valve Motor Drive) input power signal or a 4-20 mA or 0-10 Vdc control signal.

The actuator has 3 speed options all selected via dip switches in the actuator.

Full details of the actuator types, and reference numbers, are given in Table 1 below:

Table 1 Series in the range AEL3

Product	A = Actuator
Type	E = Electric
Movement	L = Linear
Series	3
	E = Spring to extend
Failure mode	R = Spring to retract
	X = No spring
Thrust (kN)	2
Stroke (mm)	20
	2 s/mm = 0.5mm/s selectable in the actuator via dip switches
Selectable speed	4 s/mm = 0.25mm/s
	6 s/mm = 0.16mm/s
Supply voltage	24 Vac and 24 Vdc 230 Vac or 100 Vac by fitting power modules
Control signal	24 to 230 V VMD, 0 - 10 Vdc and 4 - 20 mA

2.2 Operation

Depending on the type of connection (see connection diagram), the actuator can be used as a continuous (0-10 V and/or 4-20 mA), 2-point (OPEN/CLOSE) or 3-point actuator (V.M.D.) (OPEN/STOP/CLOSE).

The running time of the actuator can be set with switches S1 and S2 according to the relevant requirements. Switches S3 and S4 are used to configure the characteristic (equal-percentage, linear or quadratic).

2.3 Manual operation

The external crank handle enables manual positional setting. When the crank handle is folded out, the motor is switched off. After the crank handle is folded back, the target position is approached again (without initialisation). When the crank handle is folded out, the actuator remains in this position. Handle needs to be rotated slowly to prevent damage to the actuator.

3. Installation

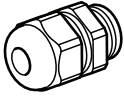
3.1 Location

The actuator should be mounted above the valve with sufficient space to remove the terminal cover and general ease of access. When selecting the location, make sure that the actuator is not exposed to an ambient temperature exceeding the range -10°C to $+55^{\circ}\text{C}$. Humidity $<95\%$. The actuator is rated at IP66.

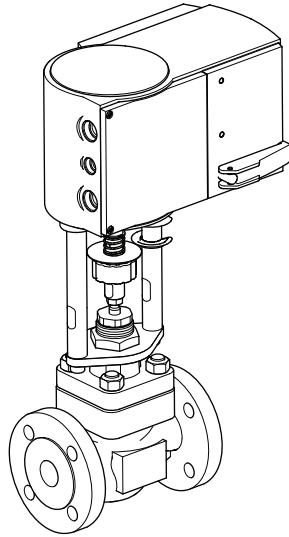


Warning

Prevent access by non technical personnel!



1: M16 x 1.5
1: M20 x 1.5



Software
A
EN 60730

IP66
EN 60529

Type
1AA
EN 60730



Fig. 1

Only actuators
without accessories

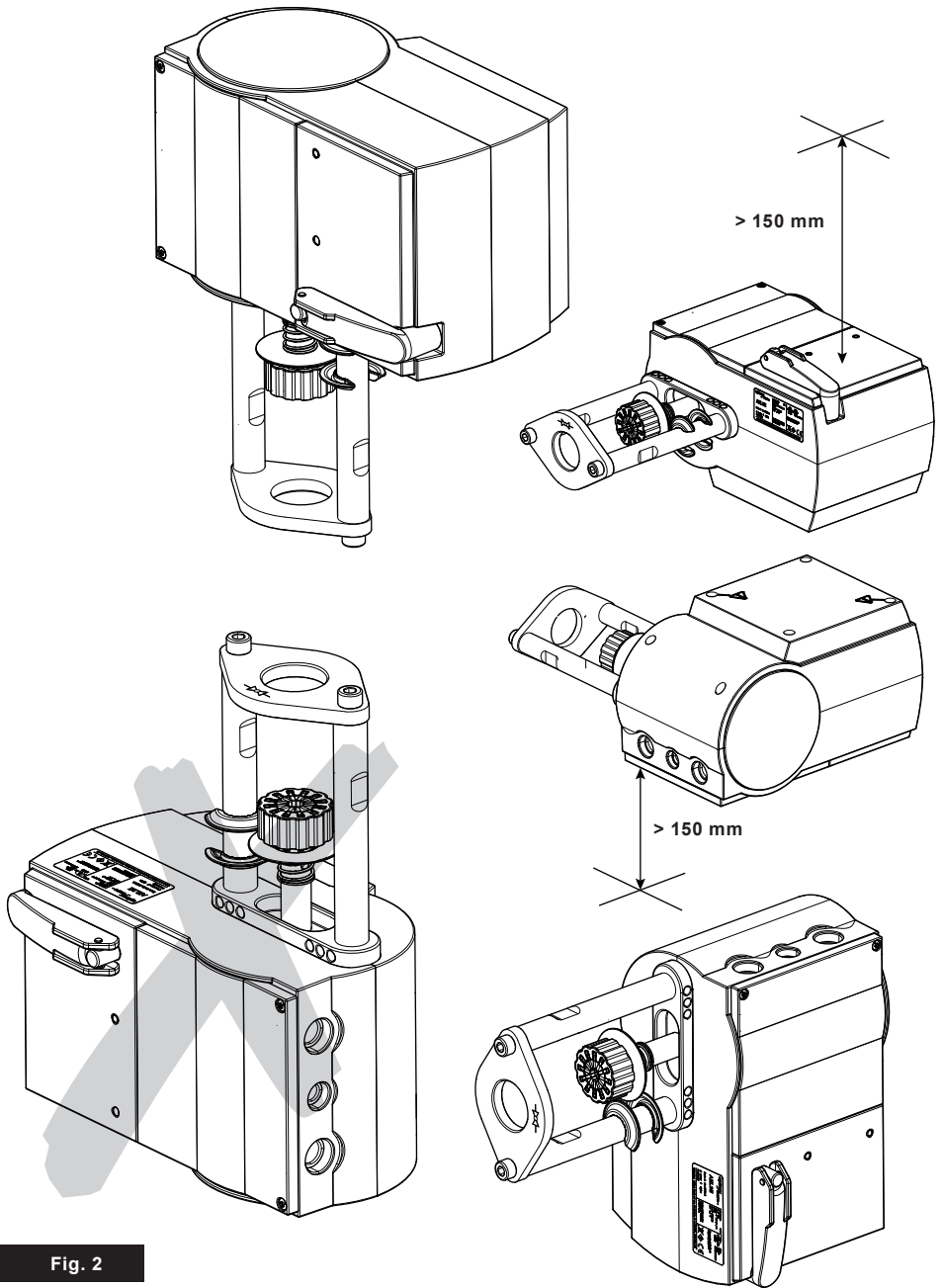


Fig. 2

3.2 Connecting the actuator to the valve

3.2.1 Mounting to 2-port Spira-trol valves

1. Remove the actuator retaining nut from the valve.
2. Screw the valve stem lock-nut 2 x valve stem diameters onto the valve stem
3. Screw the adaptor onto the stem and tighten the lock nut to secure it.

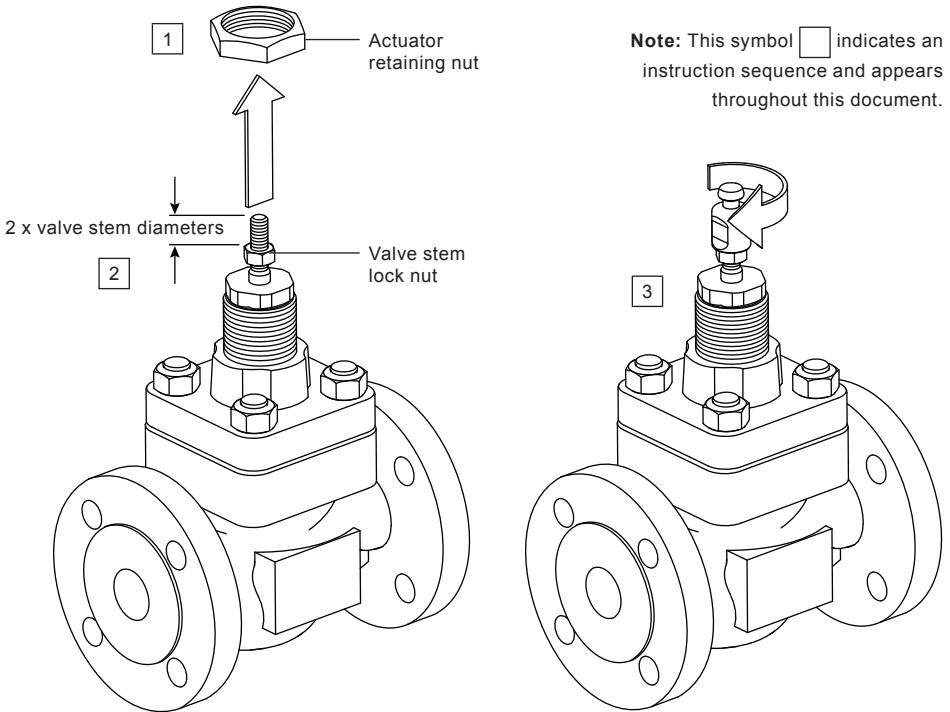


Fig. 3

4. Pull clamp ring up until it is heard to click.

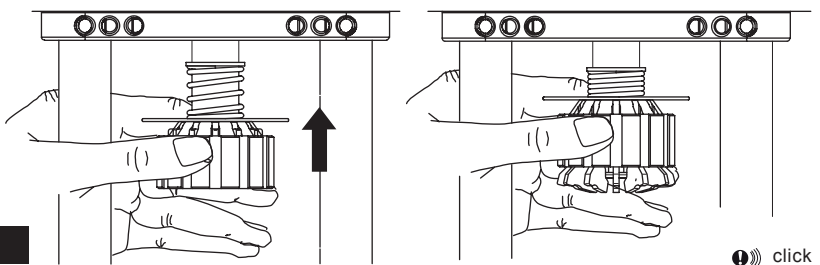


Fig. 4

5. Make sure that the spindle is fully retracted into the actuator and handle is up so that the spring is secured in place.

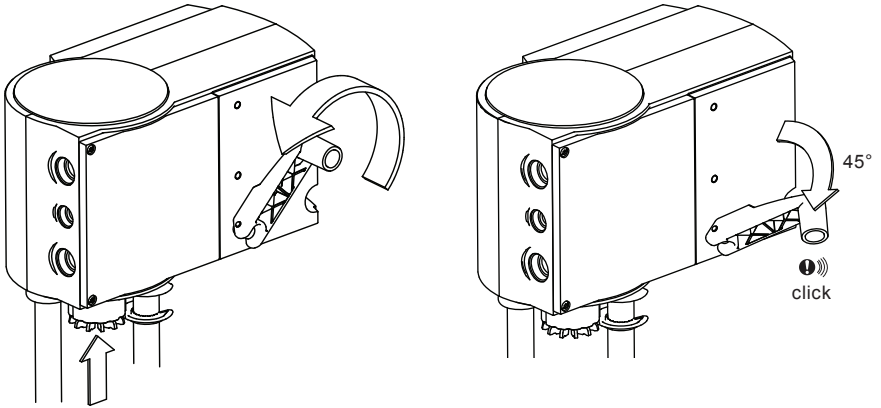


Fig. 5

6. Place the mounting flange and actuator over the valve bonnet thread.
7. Refit the actuator retaining nut and tighten (50 Nm for M34).

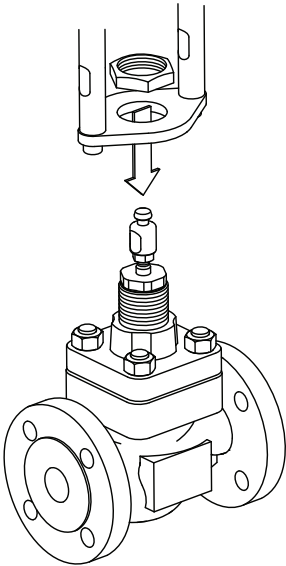


Fig. 6



Warning

- Risk of injury due to limbs being trapped
• Avoid contact with the danger areas.

8. For **AEL3R and AEL3X** - use the handle to lower the actuator spindle until the clamp tightens over the adaptor.
- For **AEL3E** - fold the handle back to the home position in the actuator head and the spindle will lower automatically.

**AEL3R
AEL3X**

AEL3E

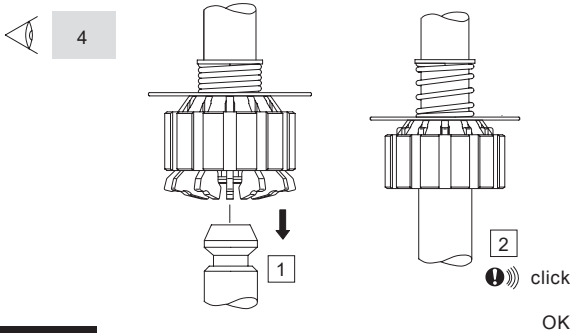
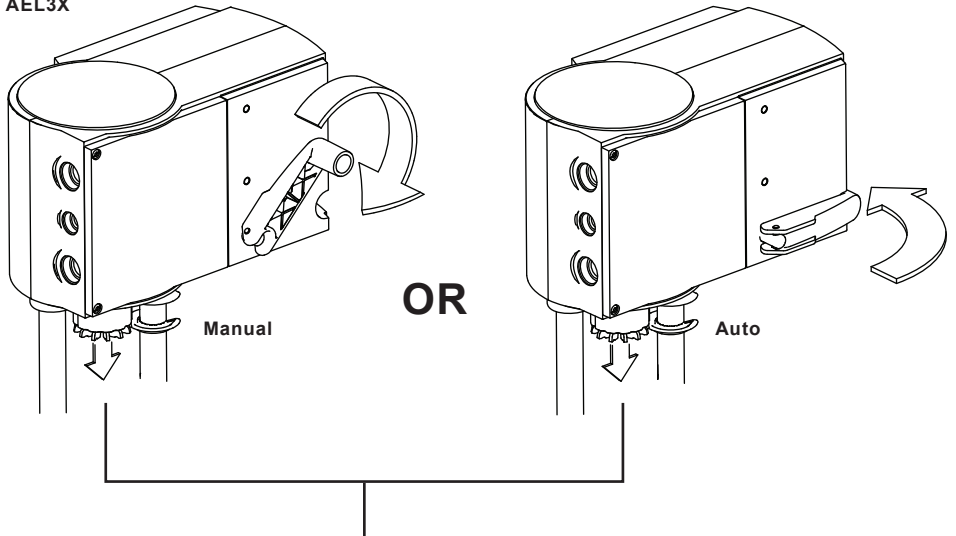


Fig. 7

9. Ensure handle is folded back against the actuator.

When mounting an actuator on a valve, never drive the actuator electrically, instead use the handle.

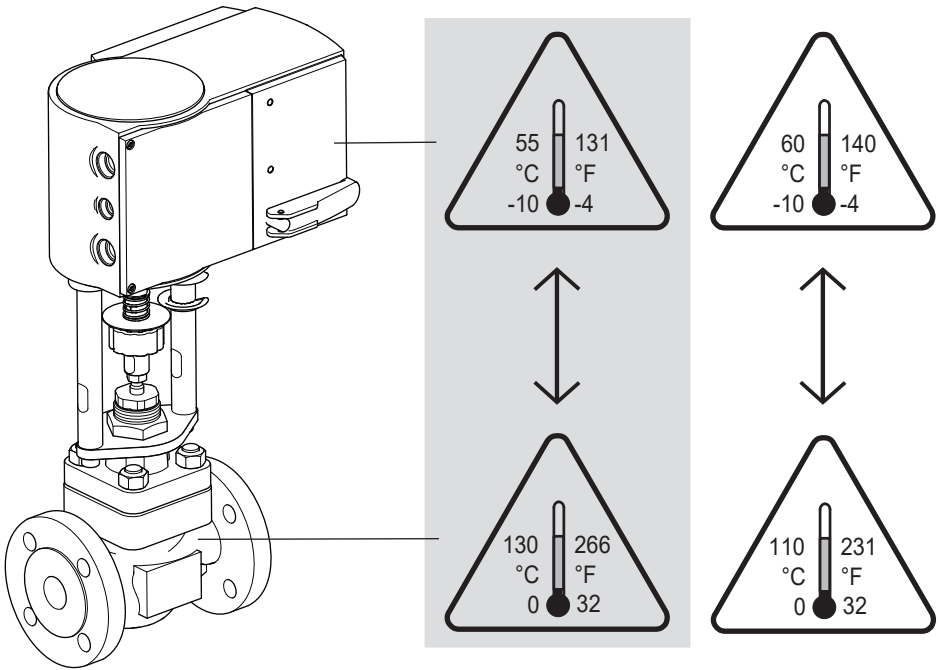


Fig. 8

3.2.2 Mounting to QL 3-way valves

1. Remove the actuator retaining nut from the valve.
2. Screw the valve stem lock-nut 2 x valve stem diameters onto the valve stem.
3. Make sure that the spindle is fully retracted into the actuator and handle is up so that the spring is secured in place.
4. Screw the coupling onto the stem and tighten the locking nut to secure it.
5. Place the centering adaptor onto the valve bonnet thread.
6. Place the mounting flange and actuator over the valve bonnet thread.
7. Refit the actuator retaining nut and tighten (50 Nm for M30).
8. Pull clamp ring up until it is heard to click.
9. Using the handle lower the actuator stem until the clamp tightens over the adaptor.
10. Ensure handle is folded back against the actuator.

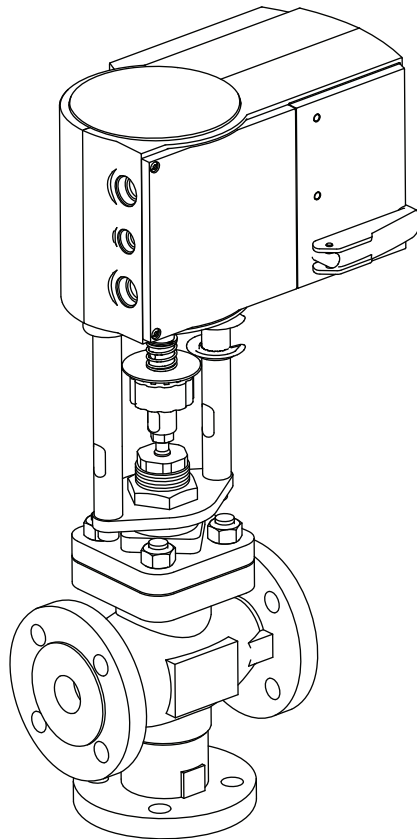


Fig. 9

3.3 Electrical connection



Warning

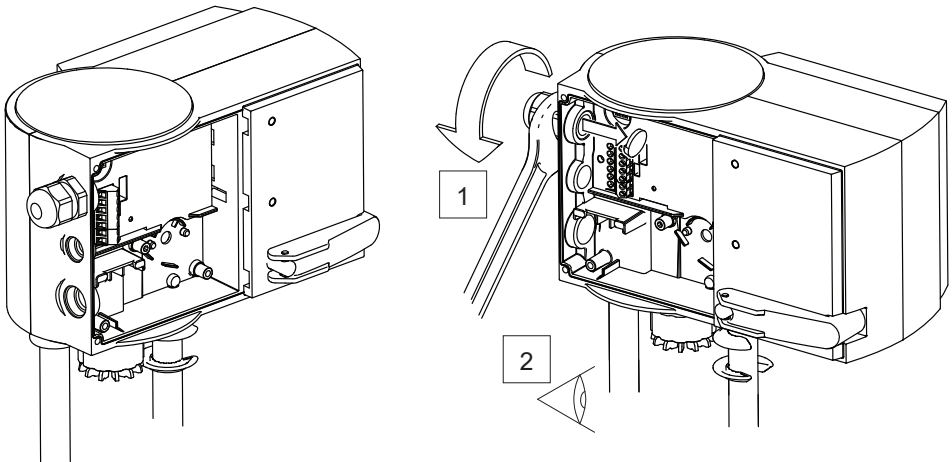
This is a class A equipment. It may cause radio interference in the home, in which case the operator may be requested to carry out appropriate measurement.

USA, Canada



Warning

This equipment is intended to be supplied by a „Power Source Class 2“. Allowed wire size: AWG 14-15. **All control signals and outputs are Class 2 AC/DC.**



Pollution degree III, over voltage category III, as per EN 60730

Fig. 10

Important

1. Read Section 1 'Safety information', before attempting to wire the supply to the actuator.
2. Slow blow fuses should be fitted in all phases, but not in the protective earth conductor.
3. The protective earth internal must be connected to the installation protective earth system. The integrity of the installation protective earth system must not be compromised by the disconnection or removal of other equipment.
4. For supply connections, use 1.5 mm² wire, double insulated as stated in IEC 60364 (or equivalent), if wires are exposed to touch.
5. Increase the wire section according to the length of the power line.
6. Dimension the safety transformer in the supply line correctly.
7. Inrush currents shall not conduct to a too big voltage drop.

3.3.1 Valve Motor Drive connection for 24V powered actuator

AEL3E/AEL3R

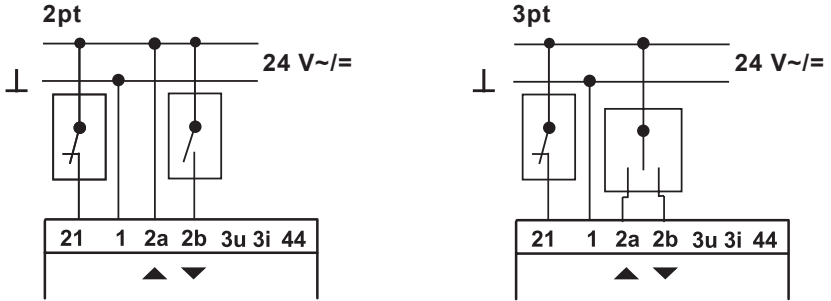


Fig. 11

AEL3X

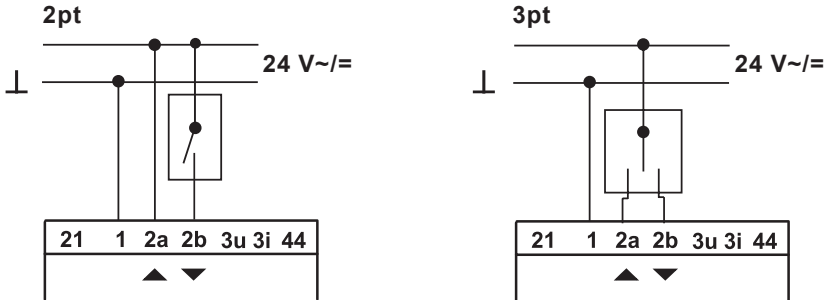


Fig. 12

3.3.2 Signal connection for 24 V powered actuator: 4-20 mA or 0-10 V

Connect the wiring as per the diagram.

Note: actuator action can be reversed via terminals 2a and 2b.

AEL3E/AEL3R

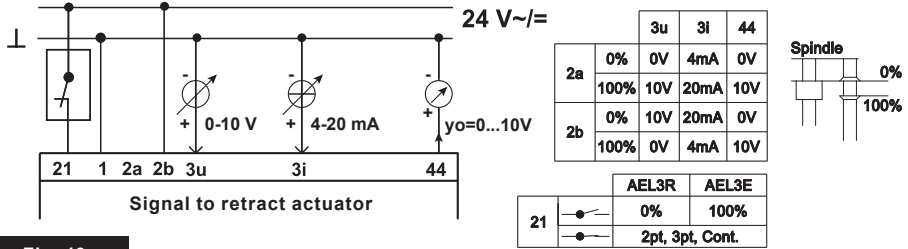


Fig. 13a

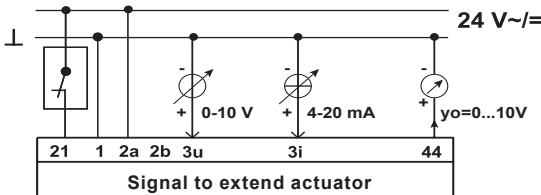


Fig. 13b

AEL3X

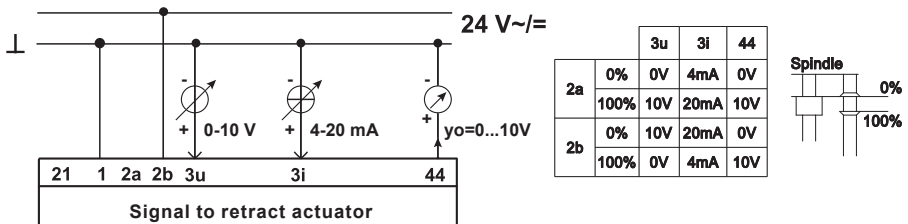


Fig. 13c

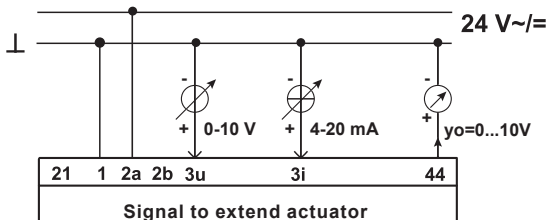


Fig. 13d

3.3.3 Switch coding

Applies for continuous mode only

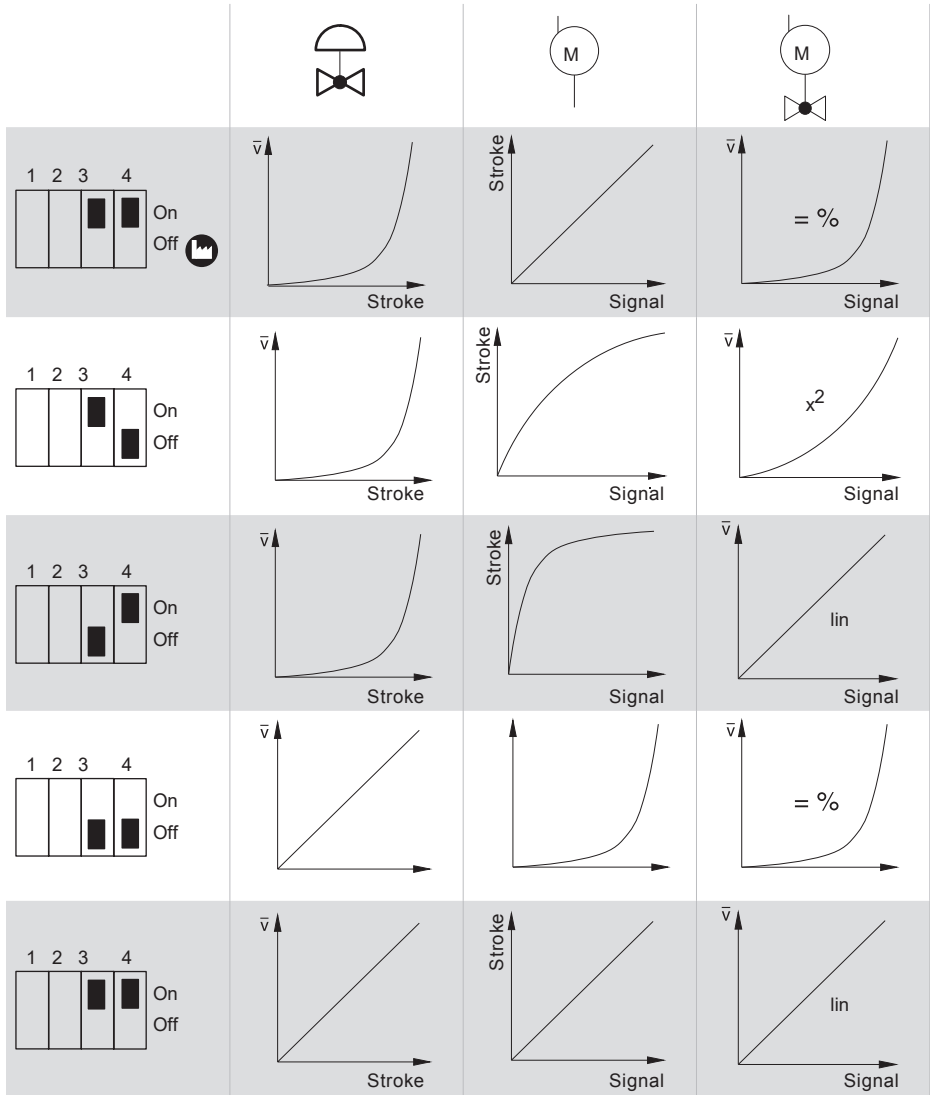


Fig. 14

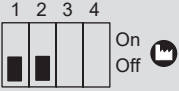


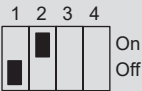
		Stroke	1 mm	20 mm
	Running time		2 s	40 s ± 1
			4 s	80 s ± 4
			6 s	120 s ± 4
				

Fig. 15

3.4 Initialisation

Automatic

When power is applied to the regulating unit for the first time, the automatic coupling with the valve and an initialisation take place. During this process, both LEDs on the drive flash in red.

1. The spindle extends until it reaches the mechanical stop on the regulating unit.
2. From this position, the spindle retracts until it reaches the mechanical stop on the regulating unit.
3. Initialisation is complete. The regulating unit moves to the position dictated by the control signal.

Manual

If required, initialisation can always be triggered manually.

- Fold out and fold back the crank handle twice within 4 seconds (see diagram). Initialisation begins.
- The initialisation can be aborted by folding out the crank handle again.

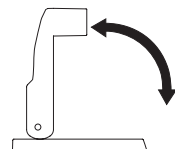


Fig. 16

3.5 LED functions

AEL3E and AEL3R	
LED	Description
Both LEDs flash red	Initialisation
Top LED lights up red	Top limit stop or "CLOSED" position reached
Bottom LED lights up red	Bottom limit stop or "OPEN" position reached
Top LED flashes green	Actuator is running, moving to "CLOSED" position
Top LED lights up green	Actuator is stopped, last direction of travel "CLOSED"
Bottom LED flashes green	Actuator is running, moving to "OPEN" position
Bottom LED lights up green	Actuator is stopped, last direction of travel "OPEN"
Both LEDs light up green	Waiting time after switching on or after spring return
No LED lights up	No power supply (terminal 21)
Both LEDs flash red and green	Actuator is in manual mode

AEL3X	
LED	Description
Both LEDs flash red	Initialisation
Top LED lights up red	Top limit stop or "CLOSED" position reached
Bottom LED lights up red	Bottom limit stop or "OPEN" position reached
Top LED flashes green	Actuator is running, moving to "CLOSED" position
Top LED lights up green	Actuator is stopped, last direction of travel "CLOSED"
Bottom LED flashes green	Actuator is running, moving to "OPEN" position
Bottom LED lights up green	Actuator is stopped, last direction of travel "OPEN"
No LED lights up	No power supply (terminal 2a or 2b)
Both LEDs flash red and green	Actuator is in manual mode

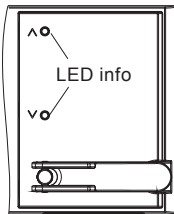


Fig. 17

Notice
 This product should not be put into service until the machinery or system into which the product is due to be fitted, or of which it is intended to be a component, fulfils the relevant regulations and standards. Responsibility lies with the plant engineer or the installer.

3.6 Actuator removal

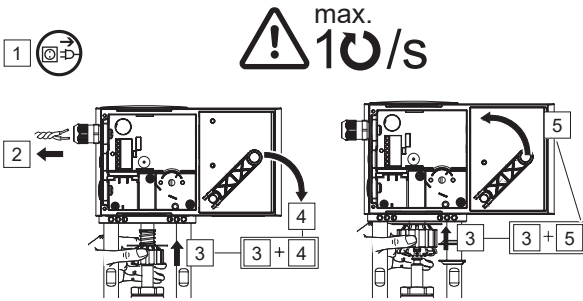


Fig. 18

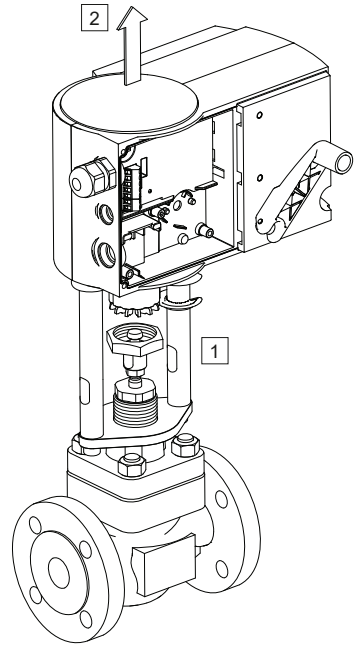


Fig. 19



Danger

Risk of hand injury caused by spring under tension.

- Do not dismantle the spring!

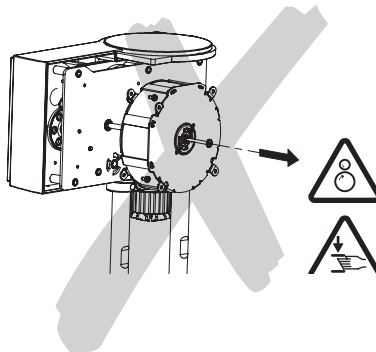


Fig. 20

3.7 100 V and 230 V power module installation

There are 2 additional options available for power supply: 100-110 V and 230 V. These are available by connecting an auxiliary power module to the standard actuator model. Fresh labels are provided that reflect the change made.

1. Open the actuator cover.
2. Slot in the appropriate power module in the space provided.
3. Replace/cover the original 24V wiring label on the inside of the actuator removable housing cover with fresh power module wiring label.
4. Use provided power module marking label and affix it to the existing label located on the underside of the actuator housing, so that it covers the existing portion of the label containing 24V and UL markings, as shown below.

Guidelines for the electrician

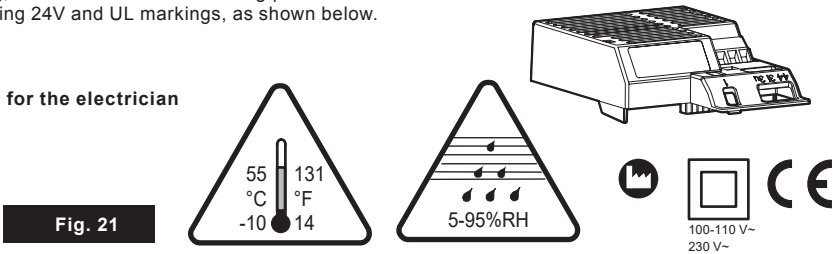
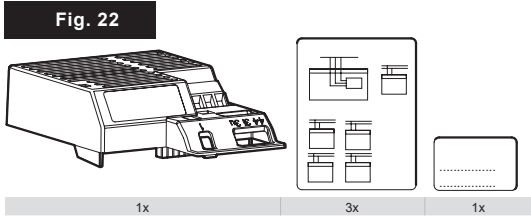


Fig. 21



1x 3x 1x

	T15
	3
	1

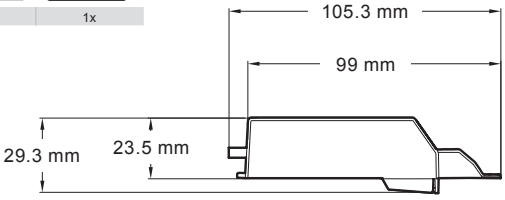


Fig. 23

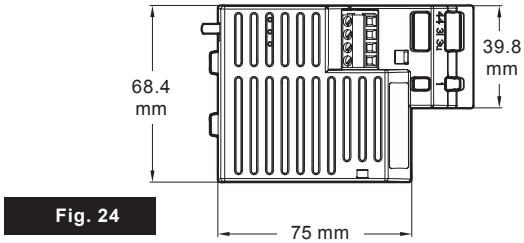


Fig. 24

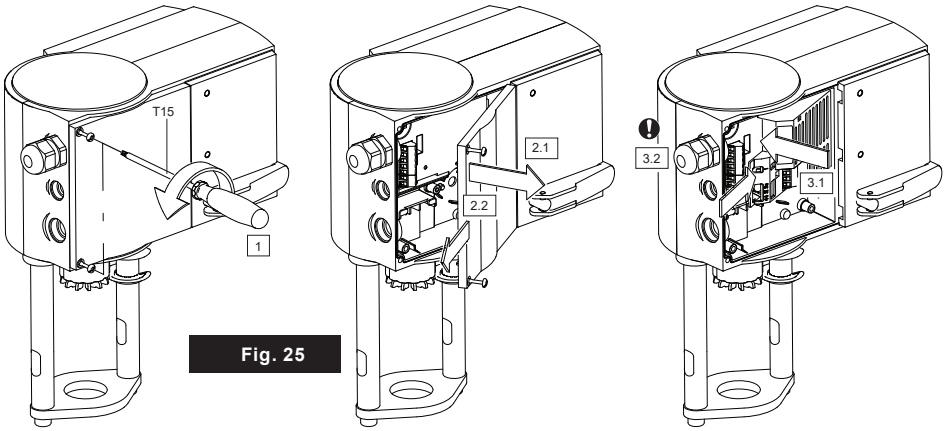


Fig. 25

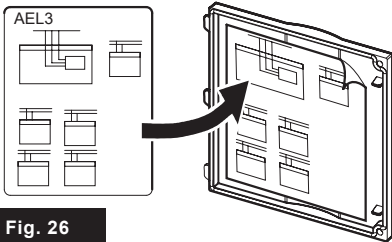
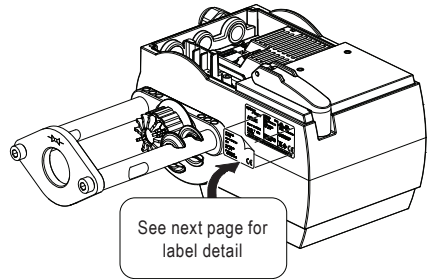


Fig. 26



See next page for label detail



Danger of electrocution

- Do not make a connection between terminal blocks X and Y.

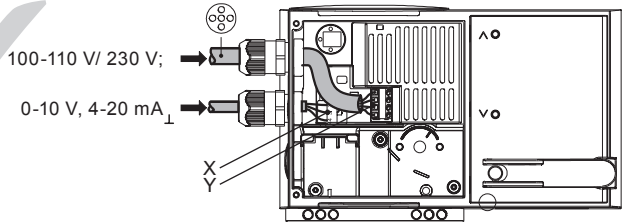
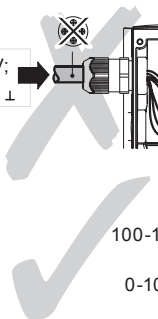
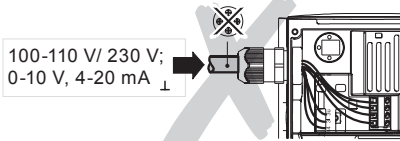


Fig. 27

 AEL3E Date Code: XXX-A Country of Origin: Germany	24 V _{ac} /dc 12W 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V	 28BA E78024 28FR AVF2348F232U	
	Equipment Intended for connection to a Class 2 power source.		
Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 9ER, GB			

 AEL3E Date Code: XXX-A Country of Origin: Germany	230 V~ 28 VA 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V		
	Pollution Deg. 3 Overvoltage Cat. III		
Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 9ER, GB			

230 V~ 28 VA 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V Pollution Deg. 3 Overvoltage Cat. III	
--	----------

Fig. 28a

 AEL3E Date Code: XXX-A Country of Origin: Germany	24 V _{ac} /dc 12W 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V	 28BA E78024 28FR AVF2348F232U	
	Equipment Intended for connection to a Class 2 power source.		
Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 9ER, GB			

 AEL3E Date Code: XXX-A Country of Origin: Germany	100-110V~ 28 VA 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V		
	Pollution Deg. 3 Overvoltage Cat. III		
Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 9ER, GB			

100-110V~ 28 VA 50/60Hz max. -10T55 (60)°C IP66 Control Signal: DC 0...10V Pollution Deg. 3 Overvoltage Cat. III	
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Fig. 28b

3.7.1 Valve Motor Drive connection for actuators fitted with power module

AEL3E/AEL3R

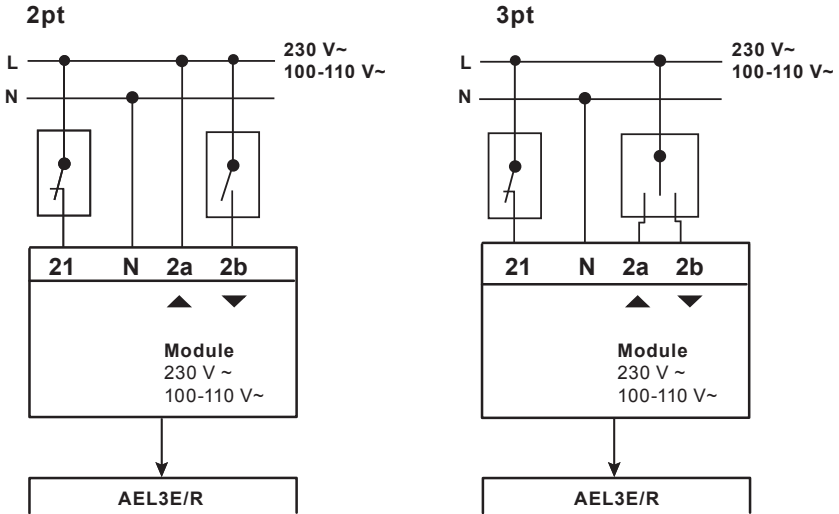


Fig. 29a

AEL3X

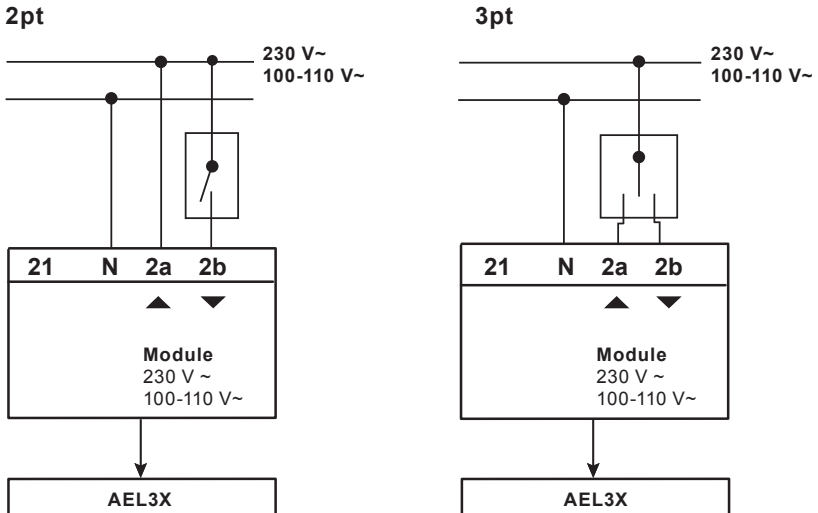


Fig. 29b

3.7.2 Signal connection for actuators fitted with a power module: 4-20 mA or 0-10 V

Note: Actuator action can be reversed via terminals 2a and 2b.

AEL3E/AEL3R

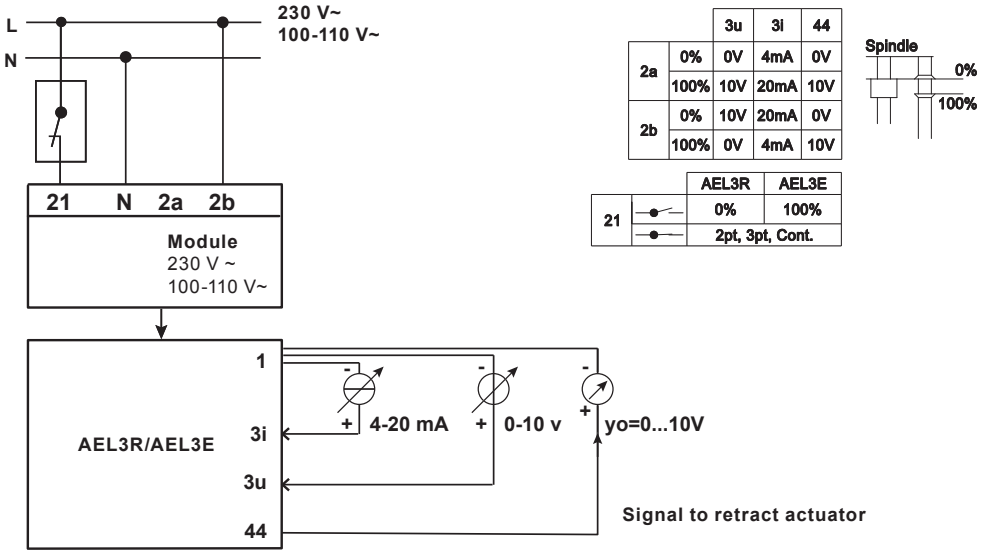


Fig. 30

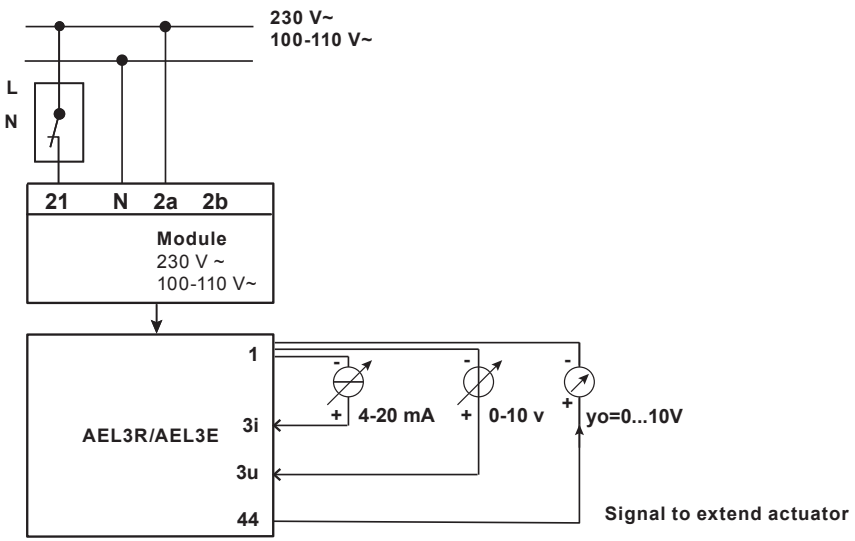


Fig. 31

AEL3X

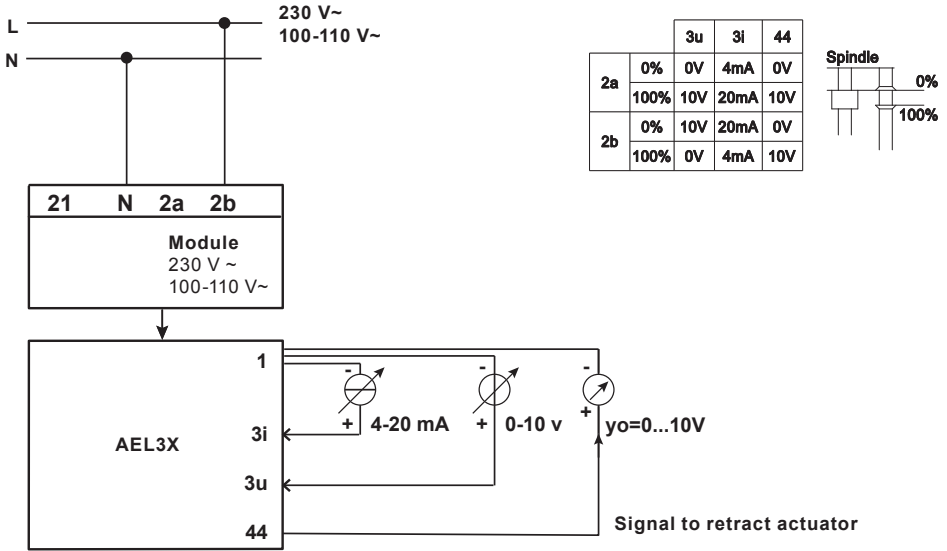


Fig. 32a

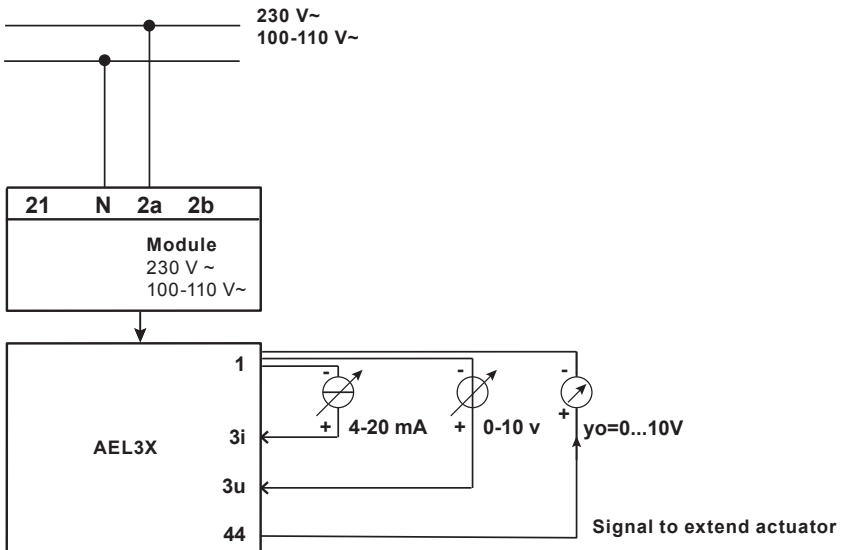


Fig. 32b

3.8 Removing the power module

1. Ensure actuator is disconnected from power supply.
2. Remove all wiring from the terminals.
3. Insert a flathead screwdriver in the slot as shown in the diagram.
4. Depress the screwdriver and push it gently to the right to unlock the latch. Be careful not to break it off.
5. While applying gentle pressure on the latch, pry the power module away from the actuator.

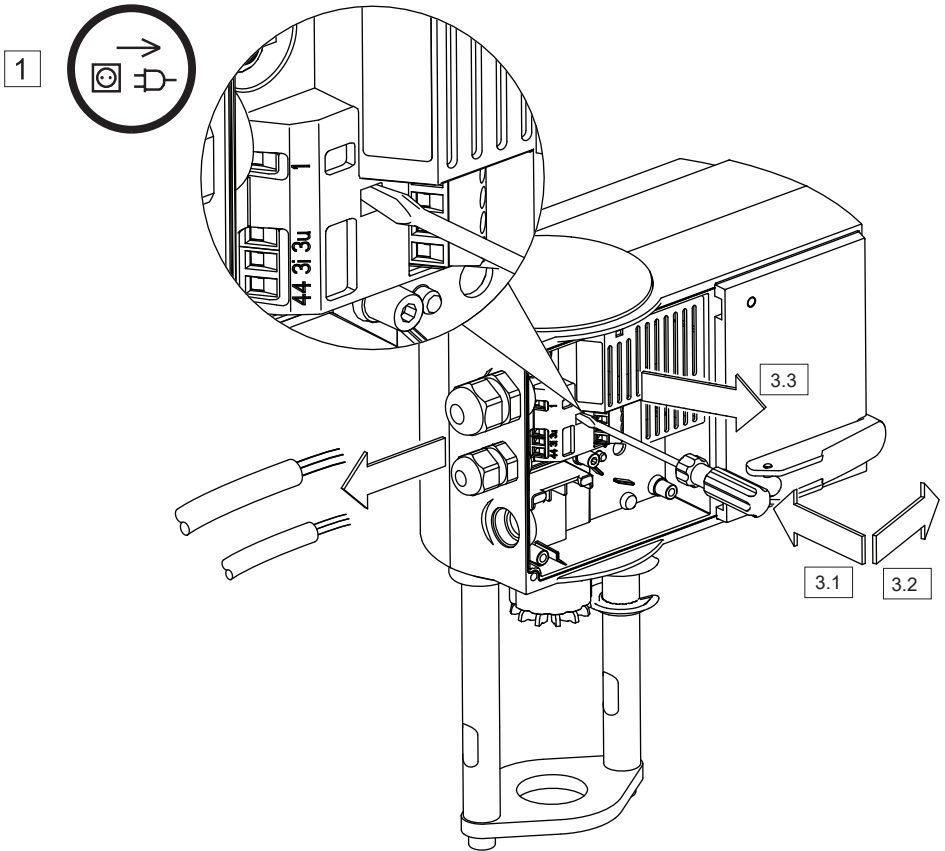


Fig. 33

3.9 Installing the auxiliary switches

For use in normal environments

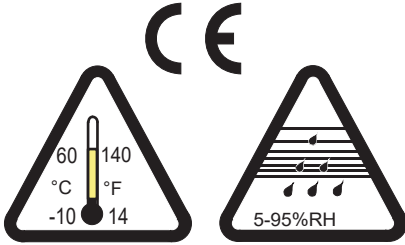


Fig. 34

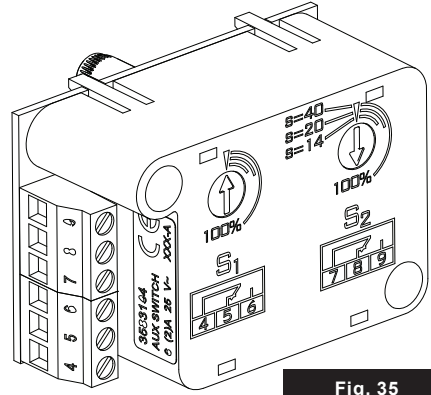


Fig. 35

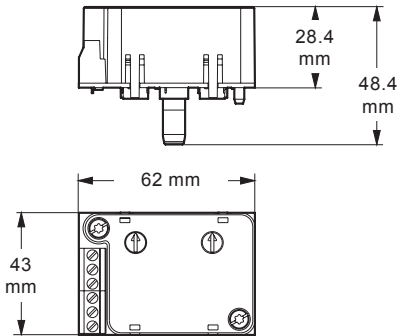


Fig. 36

	T15
	1
	3
	s24 (1x)

Fig. 37

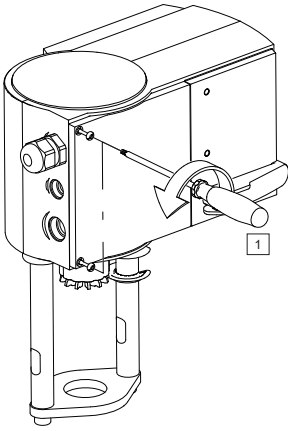


Fig. 38

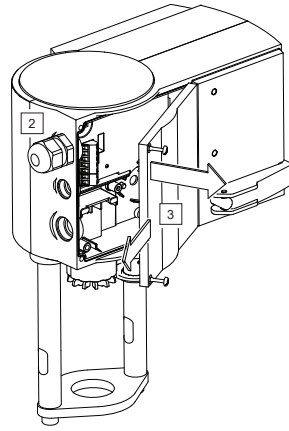


Fig. 39

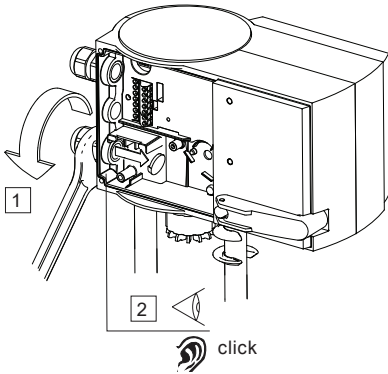


Fig. 40

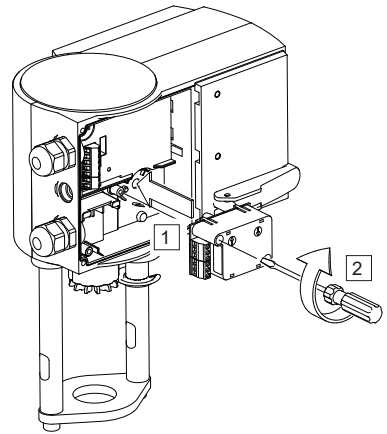


Fig. 41

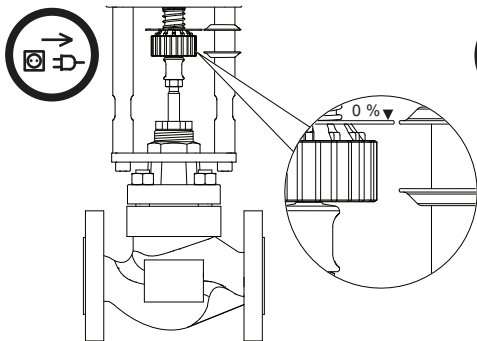


Fig. 42a

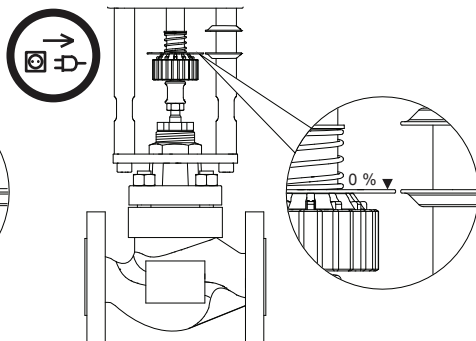


Fig. 42b

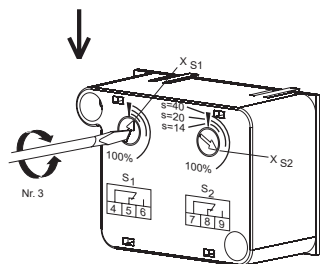


Fig. 43a

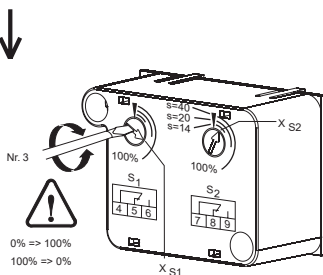
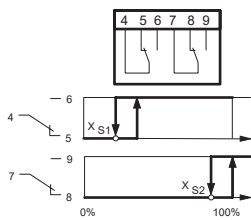


Fig. 43b

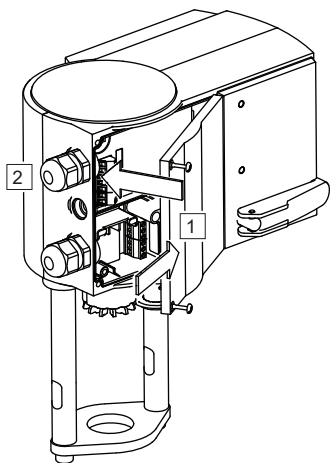


Fig. 44

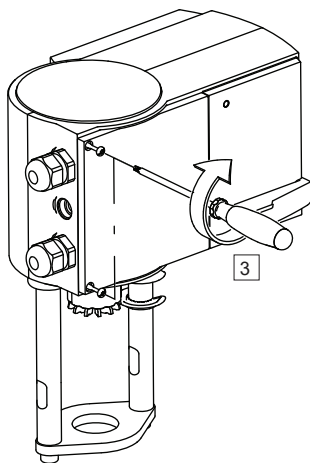
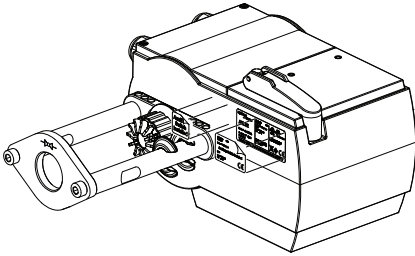


Fig. 45



spirax sarco AEL3E Date Code: XXX-A Country of Origin: Germany Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 8ER, GB	24 Vac/dc 50/60Hz max. -10T55 (80)°C IP66 Control Signal: DC 0...10V	232A E76224 23FR A1F2349F232U Temperature Indicating & Regulating Equipment	
	Equipment intended for connection to a Class 2 power source.		

spirax sarco AEL3E Date Code: XXX-A Country of Origin: Germany Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 8ER, GB	24 Vac/dc 50/60Hz max. -10T55 (80)°C	
	IP66 Control Signal: DC 0...10V	

24 Vac/dc 50/60Hz max. -10T55 (80)°C	
IP66 Control Signal: DC 0...10V	

Note: Overlay label also required for 24V variant as auxiliary switch is not UL approved.

Auxiliary
Switch
Installed

spirax sarco AEL3E Date Code: XXX-A Country of Origin: Germany Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 8ER, GB	24 Vac/dc 50/60Hz max. -10T55 (80)°C	
	IP66 Control Signal: DC 0...10V	

Auxiliary
Switch
Installed

spirax sarco AEL3E Date Code: XXX-A Country of Origin: Germany Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 8ER, GB	100-110 V- 25 VA 50/60Hz max. -10T55 (80)°C IP66 Control Signal: DC 0...10V Pollution Deg. 3 Overvoltage Cat. III	

Auxiliary
Switch
Installed

spirax sarco AEL3E Date Code: XXX-A Country of Origin: Germany Spirax-Sarco Limited, Charlton House, Cheltenham, Gloucestershire, GL53 8ER, GB	230 V- 25 VA 50/60Hz max. -10T55 (80)°C IP66 Control Signal: DC 0...10V Pollution Deg. 3 Overvoltage Cat. III	

Fig. 46

3.10 High temperature extension kit

The extension kit is to be used on applications above 130 °C to 180 °C. Please note the AEL3 actuator is not suitable for applications where graphite valve stem seal is used due to increased stem friction.

1. Unscrew the actuator mounting plate screws for pillars.
2. Screw the extension pillars into actuator pillars and tighten to 25 Nm.
3. Screw the actuator mounting plate screws into pillars and tighten to 25 Nm.
4. Mount the coupling extension into the actuator coupling until it snaps closed.

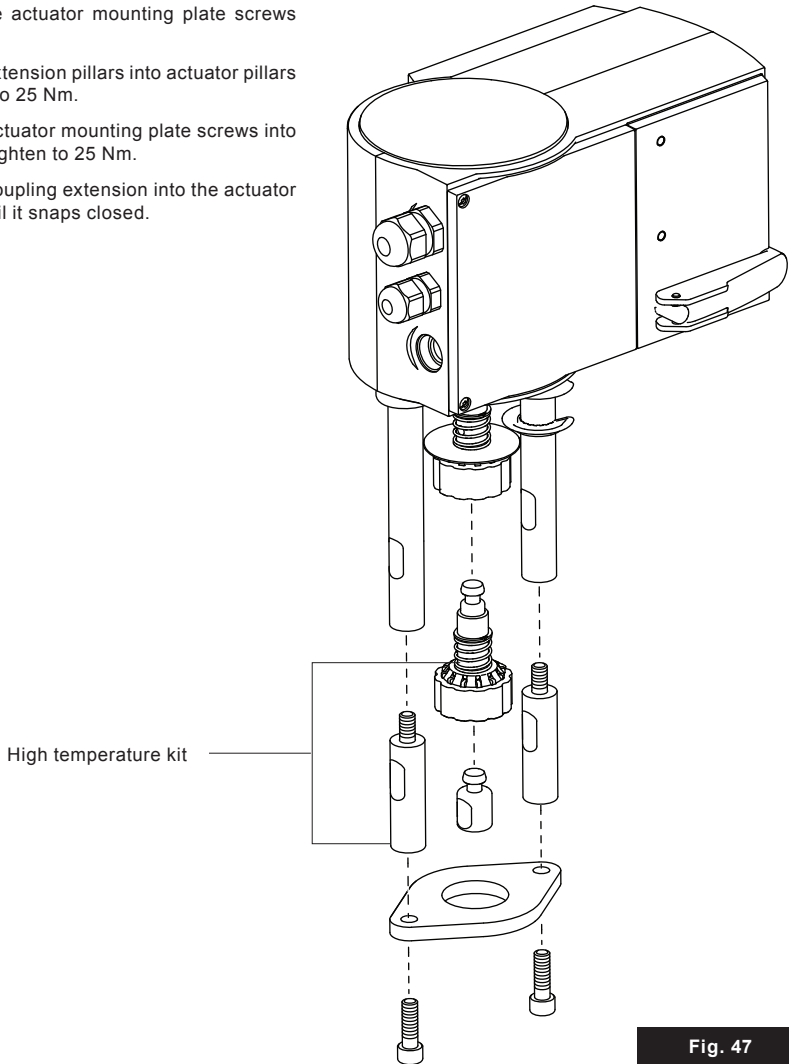


Fig. 47

4. Commissioning

Actuators supplied already fitted to control valves would be supplied already commissioned. However, should it be necessary to commission an actuator, the following procedure should be adopted.

4.1 Preliminary checks - All actuators

1. Check that the actuator voltage corresponds to that required.
2. Ensure the wiring corresponds to that outlined in Section 3.3 or 3.7.
3. Ensure the assembly of the valve and actuator has been carried out according to the instructions in Section 3.2.

5. Maintenance



Always make sure that the electrical supply is switched off when carrying out maintenance on the actuator or valve.

There are no maintainable parts within the actuator.