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Keeping the World Flowing
for Future Generations

Q Range

Electric direct-drive part-turn valve actuators

Instructions for Safe Use and Maintenance

⚠ 🕮 **This manual contains important safety information. Please ensure it is thoroughly read and understood before installing, operating or maintaining the equipment.**

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Rotork actuator is supplied

- Fully rig and performance tested
- Torque output set to maximum
- Cable entries sealed for transit protection with transit plugs
- Inclusive of commissioning kit
- Inclusive of wiring diagram and instruction manual

The actuator type is identified by a stainless steel label fitted to the main body.

Health and Safety

This manual is produced to enable a competent user to install, operate, adjust and inspect Rotork Q Range valve actuators.

The electrical installation, maintenance and use of Q Range actuators should conform to the requirements of the Electricity at Work Regulations 1989 and the guidance given in the IET Wiring Regulations. For the USA: NFPA70, National Electrical code® is applicable. Other national legislation may be applicable depending on location.

The mechanical installation should be carried out as outlined in this manual and also in accordance with the relevant National Standard Codes of Practice.

⚠ CAUTION: Misuse of this product may be hazardous to health. Strictly follow correct installation and operating practices detailed in this manual. Rotork decline any responsibility for damage to people and/or equipment resulting from misuse of this product.

Only persons competent by virtue of their training and experience should be allowed to install,maintain and repair Q Range actuators. Any work carried out should be in accordance with the instructions given in this manual. The user and those persons working on this equipment should be familiar with their responsibilities under the Health and Safety at Work Act 1974 and relevant Statutory Provisions relating to their work.

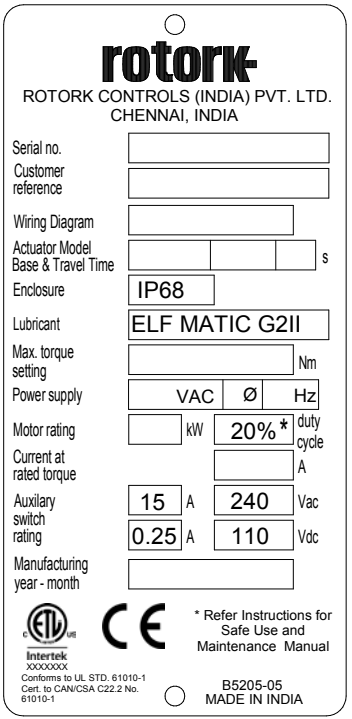
⚠ **Thermostat Bypass:** Electrical Equipment Safety certification is invalidated if the actuator is configured to bypass the motor thermostat. Additional electrical hazards may occur when using this configuration. The user should ensure that any necessary additional safety measures are implemented.

Thermostat contact rating at unity power factor:

1-phase: 230 VAC, 6.3 A

3-phase: 230 VAC, 2 A

⚠ CAUTION: Under no circumstances should any additional lever device such as a wheel-key or wrench be applied to the handwheel in order to develop more force when closing or opening the valve. This may cause damage to the valve and/ or actuator or may cause the valve to become stuck in the seated/ backseated position.



1. Identifying Actuator Parts

1. **Drive Bush**
   Steel Drive Bush supplied blank. Requires machining to suit valve spindle.
2. **Hand Auto Lever**
   Returns to auto position when motor is engaged unless it is locked in the hand position. Note: more effort will be required to operate this lever when the actuator has torque seated at the end of travel.
3. **Hand Wheel**
   Manual operation is engaged by pulling the hand auto lever up towards the handwheel.
4. **Mechanical Stops**
   Two stop bolts are provided with a setting range of 80° to 100° total output movement.
5. **Top Cover**
   6 fixing bolts to ensure sealing is achieved along the full mating profile.
6. **Conduit Entries**
   Two cable entries are provided for power and control cables.
7. **Terminal Cover**
   Secured with 4 fixing bolts and sealed with O-ring.
8. **Pak Adaptor**
   Required for 3-phase Q Pak actuators only.
9. **Motor**
   ⚠ **CAUTION: Motor surface temperature can reach 132 °C (270 °F) during normal operation.**

Fig. 1.0.1 Top cover in secured position.

1.1 Weights

	1-phase	3-phase
Q100	11 kg (24.3 lbs)	12 kg (26.5 lbs)
Q100 Pak	12 kg (26.5 lbs)	14 kg (30.9 lbs)
Q300	21 kg (46.3 lbs)	21 kg (46.3 lbs)
Q300 Pak	22 kg (48.5 lbs)	24 kg (52.9 lbs)
Q450	N/A	21 kg (46.3 lbs)
Q450 Pak	N/A	24 kg (52.9 lbs)
Q650	N/A	25 kg (55.1 lbs)
Q650 Pak	N/A	28 kg (61.7 lbs)

2. Mounting and Commissioning the Actuator

2.1 Drive bush

Removal of the drive bush from the actuator base requires removal of the retaining circlip (Q100) or removal of the retaining screw (Q300/Q450/Q650).

Determine the correct keyway position on the drive bush with the valve in the fully open position.

Machine drive bush to suit valve spindle. Re-assemble drive bush to actuator base and secure with circlip or retaining screw.

2.2 Mounting to the valve

Refer to the actuator weights table in section 1 to determine lighting weight. Ensure that the valve is secured firmly before fitting actuator to it as the combination once bolted together may be top heavy and therefore unstable.

It may be necessary to use lifting equipment to correctly support the actuator during mounting. Refer to Fig. 2.2.1 for guidance on the correct slinging method when mounting onto a vertical valve shaft. Trained and experienced personnel should be used to ensure safe lifting practices are followed at all times.

A suitable mounting flange conforming to ISO 5211 must be fitted to the valve.

Ensure that the position of both the valve and actuator are the same, i.e. both open or both closed.

Lower the actuator onto the valve aligning the drive nut keyway or machined square on the valve shaft. Secure the actuator to the valve flange using 4 studs or bolts of the appropriate size and material, conforming to ISO Class 8.8, yield stress 628 N/mm^2.

Fig. 2.2.1

⚠ WARNING: Do not lift the actuator and valve combination from the actuator. Always lift the actuator and valve assembly via the valve. Each assembly must be assessed on an individual basis for safe lifting.

2.3 Setting mechanical stops

Instructions for clockwise to close operation.

Q Range actuators are designed to stop on torque at each end of travel against the integral mechanical stops. Each stop bolt includes 10° of adjustment resulting in 80° to 100° of valve movement.

Setting of the stop bolts can be in any order. When viewing the actuator in normal orientation, the left stop bolt is the Open travel stop and the right stop bolt is the Close travel stop.

Procedure

Loosen both mechanical stops by two turns. Engage the hand/auto lever by pulling up towards actuator handwheel. The actuator will remain in hand until electrical operation occurs.

Hand wind the actuator until the exact valve end position is reached. Screw in the appropriate mechanical stop as far as it will go and tighten the lock nut to fix the stop bolt in place. Repeat this process for the opposite end of travel.

2.4 Wiring up

⚠ WARNING: Ensure all power supplies are isolated before removing actuator covers.

Check the supply voltages matches the power supply listed on the actuator nameplate.

A switch or circuit breaker must be included in the wiring installation of the actuator. The switch or circuit breaker shall be mounted as close to the actuator as possible and be marked to indicate it is the disconnecting device for the actuator.

The actuator must be protected with an overcurrent protection device rated in accordance with PUB007-006 Electric Motor Performance Data for Q Range Actuators.

Remove the terminal cover to expose the actuator terminal block and accompanying commissioning bag. Included will be terminal screws and washers, replacement cover seal, wiring diagram and instruction manual.

Cable Entries

Remove transit plugs and replace with cable glands suitable for the entry, cable size and environment. All thread adaptors, cable glands or conduit must be fully sealed to maintain the IP68 protection. Seal unused cable entries with a steel or brass threaded plug. All conduit fittings must comply with the required hazardous area certification if applicable.

⚠ CAUTION: Ensure that all cables to be terminated are electrically isolated.

Connections

Electrical connections should be made according to the actuator wiring diagram with the supplied terminal screws, spring and plain washers. The wiring diagram and instruction manual should be stored in a safe place for future reference.

Cables used for terminal connection must be capable of withstanding 95 °C for external customer connection.

Refit the terminal cover and check the O-ring seal is not damaged or degraded. Secure the cover with the four fixing screws provided.

Earth/Ground Connections

⚠ WARNING: Risk of electric shock. Do not operate the actuator with the Protective Earth (PE) conductor disconnected.

The actuator is supplied with two earthing points. A 6 mm diameter hole is tapped adjacent to the conduit entries on the main casting, for attachment of an external Protective Earth connection. An internal 6 mm Earth connection is also provided however it must not be used as the sole Protective Earth connection.

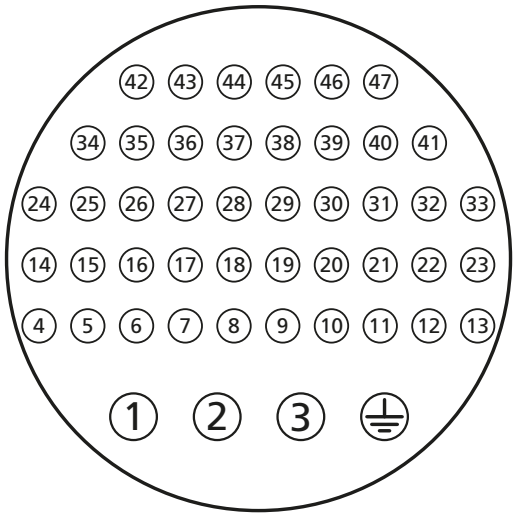


Fig. 2.4.1 Terminal block layout for electrical connections

2.5 Operating the actuator

Switch on the power supply to the actuator.

Selecting Local or Remote
The red mode selector enables either LOCAL or REMOTE control, lockable in each position using a padlock.

When the selector is locked in the LOCAL or REMOTE position, the STOP facility is still available. The selector can also be locked in the STOP position to prevent all electrical operation.

Local Control
Select LOCAL with the mode selector. The OPEN/CLOSE selector can now be used to operate the actuator. STOP is available by rotating the mode selector to the STOP position.

Remote Control
Select REMOTE with the mode selector. The actuator will respond to remote control signals, refer to actuator wiring diagram. The OPEN/CLOSE selector will not function in REMOTE. STOP is available by rotating the mode selector to the STOP position.

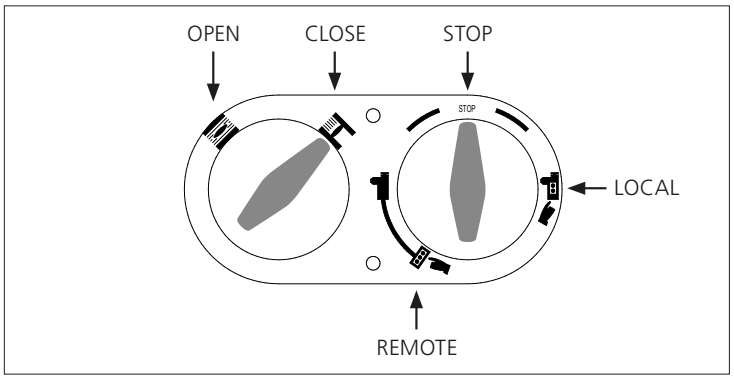


Fig. 2.5.1

2.6 Switch settings

⚠ WARNING: The actuator should be completely isolated prior to adjusting any of the switch settings.

Please note, Q range actuators are designed to stop on torque against the pre-set stop bolts at each end of travel (Refer to section 2.3) therefore there are no end of travel position limit switches to set.

Auxiliary switches

Fig. 2.6.1

The electrical specification of the actuator may include two or four auxiliary switches that can be adjusted for remote position indication (Fig. 2.6.1).

Rotork advise that the lower pair of switches (CAS and OAS) are used for remote end of travel indication. The top pair of switches can be used for intermediate position indication (IAS1 and IAS2) and can be configured to switch at any point in travel.

Rotork recommend connecting a continuity meter across the switch terminals in order to easily identify the exact point of engagement.

Remove the actuator top cover to access the switches. During switch adjustment, the cover can be fixed to the actuator body using the 2 mounting holes on the side of the gearcase (Fig. 1.0.1).

Auxiliary position switches are cam engagement. Adjustment is possible by compressing the cam against the retaining spring and rotating to the desired engagement position.

Instructions for clockwise to close actuators.

Closed auxiliary switch (CAS)

Move valve to the fully closed position. Lift and rotate the bottom cam clockwise until the switch engages. Release cam to set the switch position.

Open auxiliary switch (OAS)

Move valve to fully open position. Depress and rotate the second cam anti-clockwise until the switch engages. Release cam to set the switch.

Instructions for anti-clockwise to close actuators.

Closed auxiliary switch (CAS)

Move valve to the fully closed position. Lift and rotate the bottom cam anti-clockwise until the switch engages. Release cam to set the switch.

Open auxiliary switch (OAS)

Move valve to fully open position. Depress and rotate the second cam clockwise until the switch engages. Release cam to set the switch.

Fig. 2.6.2

Torque output adjustment

Torque cams are factory set to trip at the maximum rated torque in both directions. Torque can be progressively decreased if required.

Instructions for clockwise to close actuators.

Close - Green cam

Loosen locking screw and rotate the cam anti-clockwise to decrease torque trip point. Tighten locking screw to set the cam.

Open - Red cam

Loosen locking screw and rotate the cam clockwise to decrease torque. Tighten locking screw to set the cam.

Instructions for anti-clockwise to close actuators.

Close - Red cam

Loosen locking screw and rotate the cam anti-clockwise to decrease torque. Tighten locking screw to set the cam.

Open-Green cam

Loosen locking screw and rotate the cam clockwise to decrease torque. Tighten locking screw to set the cam.

2.7 Selection of remote control functions

The 7 switch selector on the main PCB determines the control behaviour of the actuator.

PCB Switch	On	Off
1 ESD	ESD	No ESD
2 TBP	Stat bypass	No stat bypass
3 PTR	Maintain in Local	No maintain in local
4 C/A	Clockwise close	Anti-clockwise close
5 ESD	ESD close	ESD open
6 P2 7 P1	Both switches 'On' gives 'Close' priority	Both switches 'Off' gives 'Open' priority
	One switch 'On' and one 'Off' gives 'Stayput' mode	

3. Replacement of Top Cover and Local Indication

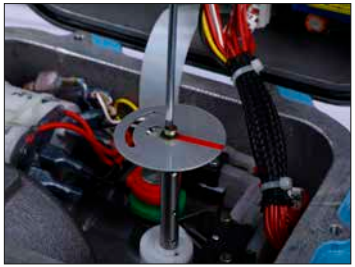


Fig. 3.7.1 Q actuator indicator disc

Local Position Indication

Move the actuator to an end of travel position. Loosen the locking screw and rotate the local indicator disc to match the cover appropriate position. Tighten screw and refit the top cover ensuring the mating face is clean and lightly greased.

3.1 Checking electrical operation

⚠ WARNING: If possible electrical operation should only be carried out with the top cover fitted.

Q Standard Specification

Switch on power supply.

Operate actuator open and closed using external controls.

Q Pak Specification

Switch on power supply.

Rotate LOCAL/STOP/REMOTE selector knob clockwise to LOCAL position.

Rotate the OPEN/CLOSE selector in each direction to check operation. During movement, check that STOP inhibits operation and stops the actuator.

4. Final Inspection

Verify the stop bolt lock nuts are tight.

Check terminal cover fixing bolts are secure.

Ensure conduit entry connections are suitably sealed and secure.

Observe correct indication during operation.

Check cast groove in actuator base is not obstructed. Its purpose is to discharge pressure in the event of a product leak from the valve spindle/ gland packing.

Check actuator to valve flange fixings are sufficiently tightened.

5. Optional Extras

5.1 Potentiometer transmitter

Actuator should be electrically isolated from mains power and control supplies before the top cover is removed.

Fig. 5.1.1

The Potentiometer is used for position feedback and may be directly connected to a voltmeter type indicating instrument.

Move the valve to the fully closed position, loosen the two screws securing the potentiometer bracket to the gearcase and rotate the assembly so that a nominal 50 Ω resistance is measured between terminals 23 and 32 (or 14 and 23 for anti- clockwise closing valves). Re-tighten fixing screws to secure the potentiometer in position.

5.2 Current Position Transmitter (CPT) 4-20 mA output

The CPT gives continuous indication with adjustment for span and zero settings.

CPT is available as internally or externally powered configuration. Use the Wiring Diagram supplied with the actuator to confirm which is installed.

Check whether valve is clockwise or anti-clockwise to close.

⚠ WARNING: Setting the CPT requires mains power to be supplied whilst the top cover is removed. Appropriate care should be taken due to the risks associated with live voltages.

Externally powered CPT only requires power to be applied to the loop (15 - 40 VDC).

Valve movement should be achieved in both instances using the actuator handwheel.

⚠ WARNING: The CPT printed circuit board is situated inside the actuator top cover. All electrical connections in this area are well insulated, however, only a fully insulated trimming tool should be used for adjustment. Care should be taken not to interfere with mains voltage connections in the electrical compartment.

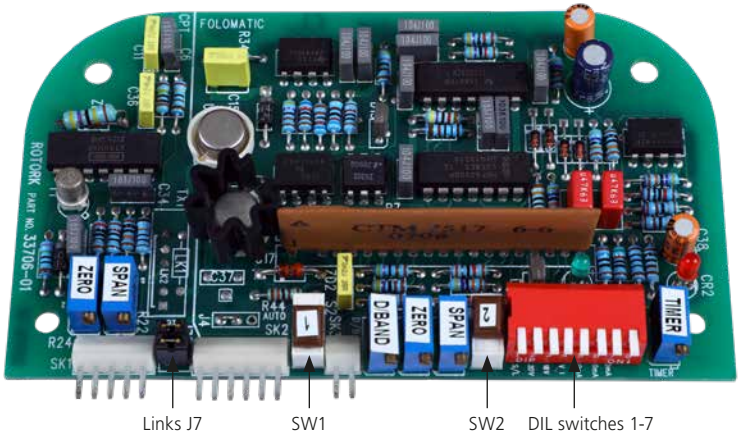


Fig. 5.2.1 Folomatic DIL switch settings for input signal (see appendix 1.)

Setting the CPT

1. Define signal direction

a. Using Fig. 5.2.1 locate the dual links J7. For clockwise to close valves with low signal at the closed end of travel (or anti-clockwise to close valves with low signal at open end of travel), Links J7 must be positioned parallel to the edge of the PCB.

b. For clockwise to close valves with low signal at the open end of travel (or anti-clockwise to close valves with low signal at the close end of travel), Links J7 must be positioned perpendicular to the edge of the PCB.

c. Move valve to the low signal end of travel.

2. Calibrating potentiometer position

Remove the connector fitted to socket 2 (SKT 2) on the Folomatic/ CPT PCB. Use a multi-meter measuring resistance to test between the appropriate pins as detailed below. Follow instructions included in section 5.1 to adjust the potentiometer until approximately 50 Ω is measured. Refit the connector to SK2.

Indication system	Socket Pin number	ohms (Ω)
Clockwise to close Low output at close or Anti-clockwise to close Low output at open	4 to 5 =	50
Clockwise to close Low output at open or Anti-clockwise to close Low output at close	4 to 6 =	50

3. Adjust the CPT ZERO trimming potentiometer to calibrate the output signal as desired.

4. Move the actuator to the opposite end of travel (high signal position).

5. Adjust the CPT SPAN trimming potentiometer to calibrate the output signal as desired.

6. Move the actuator to the low signal position to confirm the signal remains correct. Adjust by repeating step 3 if required.

5.3 Folomatic proportional control

Zero / Span / Timer / Deadband

The Folomatic proportional control option sets the valve position relating to an analogue input signal with adjustments for Zero and Span. Signal should be calibrated to meet the requirements of the site control system.

Folomatic control will only function when the actuator is set to REMOTE mode on the local selector.

⚠ WARNING: Setting the Folomatic control input requires mains power and customer instrumentation signal to be applied. Appropriate care should be taken due to the risks associated with live voltages.

⚠ WARNING: The Folomatic printed circuit board is situated inside the actuator top cover. All electrical connections in this area are well insulated however, only a fully insulated trimming tool should be used for adjustment. Care should be taken not to interfere with mains voltage connections in the electrical compartment.

Setting the folomatic

1. Define signal direction

Using Fig. 5.2.1 for guidance, adjust SW1 and SW2 as detailed below.

a. For clockwise to close valves with low signal to close (or anti-clockwise to close valves with low signal to open), SW1 should be set towards the edge of the board and SW2 set towards the centre of the board.

b. For clockwise to close valves with low signal to open (or anti-clockwise to close valves with low signal to close), SW1 should be set towards the centre of the board and SW2 set toward the edge of the board.

2. Identify the required control input signal range and set the DIL switches appropriately (refer to Appendix 1).

Note: Folomatic range will be configured to 4-20 mA by default unless another range is specified with the order.

3. Loss of signal action for 4-20 mA control loops can be configured by setting SW1 Folomatic DIL switch (refer to Appendix 1) and configuring P1 and P2 switches on the main PCB (refer to section 2.7).

4. Confirm that incoming control wiring is connected as per the actuator wiring diagram.

5. Move the actuator to the low signal end of travel using local control or the handwheel.

6. Input a low signal from the control system.

7. Adjust the Folomatic ZERO trimmer until the applicable indicator is flashing or illuminated (green for close, red for open). Clockwise adjustment of the trimmer will illuminate the indicator.

8. Move the actuator to the high signal end of travel using local control or the handwheel.

9. Input a high signal from the control system.

10. Adjust the Folomatic SPAN trimmer until the applicable indicator is flashing or illuminated (red for close, green for open). Anti-clockwise adjustment of the trimmer will illuminate the indicator.

11. Set the actuator to REMOTE control mode and verify movement is possible when inputting a valid control signal.

12. Deadband adjustment

It is common for analogue control signals to fluctuate around the desired set point causing a hunting movement from the actuator. In order to filter this out, the deadband can be adjusted to prevent actuator movement until the set point moves beyond the deadband. To increase deadband (reduce sensitivity), rotate the D/BAND adjuster clockwise. To decrease deadband (increase sensitivity), rotate the D/BAND adjuster anti-clockwise. Deadband should always be adjusted to maximise accuracy whilst filtering spurious signals.

Motion inhibit timer adjustment

The Red and Green indicators on the PCB indicate a change of signal state:

Red = opening direction signal
Green = closing direction signal

If either indicator is flashing it indicates a change of signal state is recognised but actuator movement is being inhibited by the motion inhibit timer. The motion inhibit time is adjustable between 2 seconds and 40 seconds and should be set to suit site requirements. It is advisable to reduce the delay time (anticlockwise adjustment of the trimmer) to the minimum during the setting up procedure.

Refit the actuator top cover and check the O ring seal is not damaged or degraded. Lightly grease the mating surface and secure with the 6 fixing screws.

6. Lubrication and Maintenance

Rotork Q range actuators are dispatched with lubricating oil to DEXRON 2 specification plus the addition of 20% paraffin, suitable for ambient temperatures ranging from -30 to +70 °C (-22 to +160 °F).

Foodgrade lubrication is available when requested. Hydralube GB medium oil and Hydralube WIC medium compound grease.

Replacement oil should meet the DEXRON 2 specification and the 20% paraffin mix is only required if ambient temperatures are below -20 °C (-4 °F).

Oil Capacities

	Litres	Pints
Q100	0.25	0.5
Q300	0.85	1.8
Q450	0.85	1.8
Q650	0.85	1.8

Mechanical maintenance

Rotork advise tightening the mounting fixings after 6 months of actuator service to ensure a secure actuator to valve flange connection is maintained.

Provided correct installation and sealing practices are performed, Q range actuators should not require any routine maintenance.

For infrequently stroked valves, a routine operating schedule should be introduced to partially stroke the valve. This ensures the valve assembly does not seize.

1. Check actuator to valve fixing bolts for tightness
2. Ensure valve stem and drive nut is clean and properly lubricated
3. Check the actuator for damage, loose or missing fixings
4. Ensure there is not an excessive build up of dust or contaminate on the actuator

7. Transport and Storage

During transportation, care should be taken to ensure that your actuator is protected from impact. In the unfortunate event of your actuator receiving an impact, the actuator should be inspected by a Rotork trained technician.

If your actuator cannot be installed immediately, store it in a clean, dry and ventilated location. The actuator should be kept off the floor and covered to protect from dust and dirt.

8. Environmental

Standard Q range actuators are suitable for indoor or outdoor applications including wet locations.

Enclosure	IP68 – 3 m for 48 hrs
Max. Operating Altitude	2000 m as per IEC 61010-1
Operating Temperature	-30 to +70 °C (-22 to +158 °F)
Relative Humidity	100%
Overvoltage Category	II
Pollution Degree	2
Vibration	0.5 g over a frequency range of 10 to 200 Hz
Shock	NSS Grade II

9. Decommissioning and Environmental Considerations

End user advice on disposal at end of life of the product.

In all cases check local authority regulation before disposal.

The actuator can be removed by reversing the operations detailed in the mounting and cabling sections.

All warnings as detailed in the mounting and cable connection sections must be followed. Disposal of the actuator or any of its components should be done in accordance with the table below.

⚠ WARNING: It is essential that the actuator is not subject to any valve / system loads at the time of removal as this could cause operator injury due to the actuator moving unexpectedly.

Subject	Definition	Remarks / examples	Hazardous	Recyclable	EU Waste Code	Disposal
Electrical & Electronic Equipment	Printed circuit boards	All products	Yes	Yes	20 01 35	Use specialist recyclers
	Wire	All products	Yes	Yes	17 04 10	
Glass	Window	Indicator window	No	Yes	16 01 20	Use specialist recyclers
Metals	Aluminium	Gearcases and covers	No	Yes	17 04 02	Use licensed recyclers
	Copper/Brass	Wire, motor windings	No	Yes	17 04 01	
	Iron/Steel	Gears	No	Yes	17 04 05	
	Mixed Metals	Motor	No	Yes	17 04 07	
Plastics	Glass filled nylon	Covers	No	No	17 02 04	Disposal as general commercial waste
	Unfilled	Gears	No	Yes	17 02 03	Use specialist recyclers
Oil /Grease	Mineral & Kerosene Mixed	Gearbox lubrication	Yes	Yes	13 07 03	Will require special treatment before disposal, use specialist recyclers or waste disposal companies
	Mineral	Gearbox lubrication	Yes	Yes	13 02 04	
	Food Grade	Gearbox lubrication	Yes	Yes	13 02 08	
Rubber	Seals & O-rings	Cover and shaft sealing	Yes	No	16 01 99	May require special treatment before disposal, use specialist waste disposal companies

10. Approved Fuses

1-phase Actuators	
FS1	Protection Electromech PSF 6.3A 250 V, 6.3 A Fast Acting
FS3	Protection Electromech PSF 160 mA 250 V, 160 mA Fast Acting

3-phase Actuators	
FS1	Littelfuse 0313.100MXP Shurter FST 34.5207 250 V, 100 mA Slow Blow
FS2	Littelfuse 0217.001HXP 250 V, 1 A Fast Acting
FS3	Littelfuse 0217.250HXP 250 V, 250 mA Fast Acting

Appendix 1

Folomatic PCB DIL switch settings voltage or current ranges

Range	SW1	SW2	SW3	SW4	SW5	SW6	SW7
0-5 mA	○	○	○	●	○	○	○
0-10 mA	○	○	○	●	○	○	●
0-20 mA	○	○	○	●	○	●	●
4-20 mA	◑	○	○	●	○	●	●
0-50 mA	○	○	○	●	●	●	●
0-5 mA	○	○	○	○	○	○	○
0-10 mA	○	○	●	○	○	○	○
0-20 mA	○	●	○	○	○	○	○

○ Off
● On
◑ Off/On

SW1 Off - actuator runs to low signal end of travel on loss of signal.

SW1 On - actuator responds on loss of signal according to priority setting on main board switches P1 and P2.

Refer to section 2.7.

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