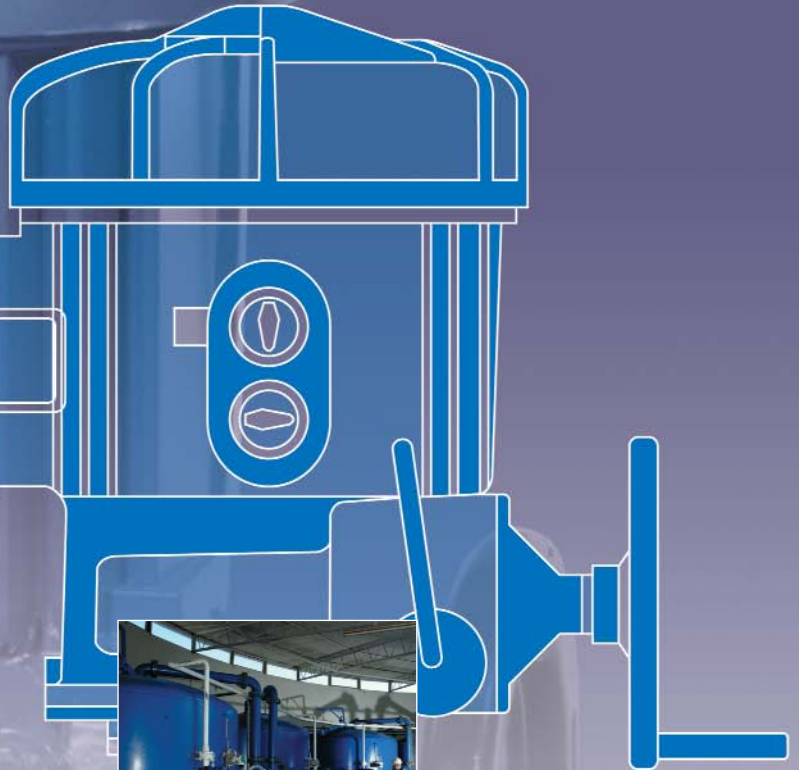


rotork®

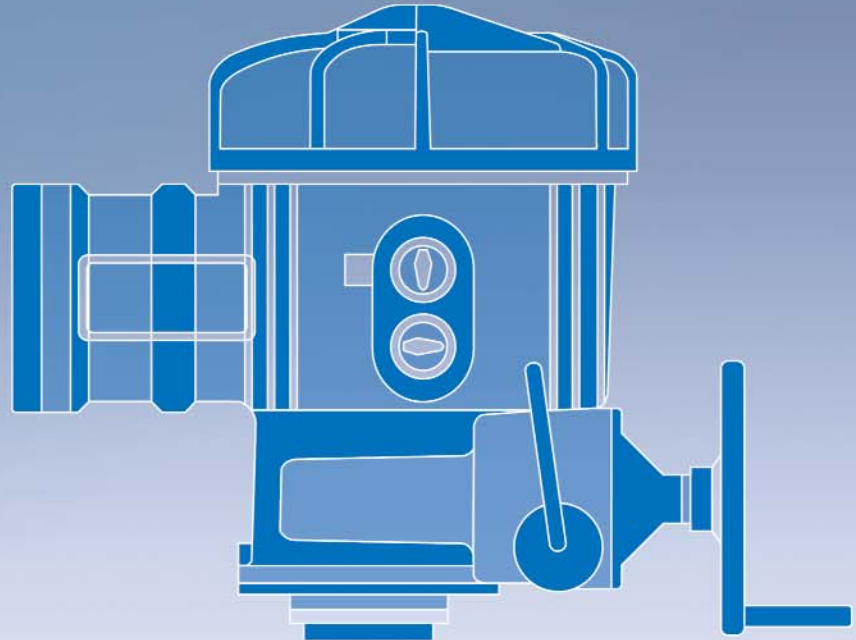
Established leaders
in Actuation Technology



AQ Range

flameproof watertight
3-phase, 1-phase, DC
failsafe quarter turn valve actuators

defining your exact requirements



whatever you need wherever you are

In the 45 years since it was founded Rotork has become the name for excellence in the field of valve, sluice gate and damper actuation products for every industry - worldwide.

Rotork has the experience, know-how and product range to deliver virtually any actuation solution - from compact, manually operated gearboxes, to large, highly specified actuators for use in extreme temperature and hazardous environments.

the knowledge to help

Rotork has been at the forefront of actuation technology since the company was formed in 1957 and enjoys an unrivalled reputation for its commitment to the development of leading-edge techniques and processes. Rotork products are designed and manufactured to the highest possible standards of engineering - a principle which drives all areas of our business. So whether you require electric, fluid power, specialist gear or valve adaption products services Rotork has the experience to help you.



everything you need to succeed

Our involvement can go further than just providing the actuator. We can also supply the gearbox, valve adaption kits and control systems to complement it.

Well equipped, Rotork-trained engineers, technicians and representatives work out of 76 offices worldwide and offer both on-site and factory service. Specialist teams offer predictive maintenance and retrofit valve motorisation backed by a quick responsive service. Our aim is to provide our customers with service excellence.

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AQ - Electric, Direct Drive, quarter turn actuators

The Rotork 'AQ' actuator provides industry with a reliable quarter turn operator for isolating duty with the ability to integrate fully into sophisticated control systems.

In keeping with Rotork's design philosophy of proven reliability, the 'AQ' takes advantage of the same electronic control techniques that have been developed for and used in the 'IQ', 'A' and 'Q' ranges of actuators.

For fully modulating duties an alternative version of the 'AQ' actuator, designated the AQM, is available.



AQ features are:

- Rugged construction giving protection to IP68 (NEMA 4 and 6).
- Rotork unique double seal to prevent water and dirt ingress even during site wiring.
- Versions available for DC, single or 3-phase power supplies.
- Secure self-locking drives suitable for butterfly valves and dampers without the use of additional brakes.
- External setting of valve travel limits.
- Simple setting of auxiliary control limit switches.
- Torque output up to 1080Nm (800 lbsft).
- Two auxiliary limit switches.
- Available with a watertight enclosure to IP68 (NEMA 4 and 6) or with a flameproof (explosion proof) and watertight enclosure to IP68 (NEMA 4 and 6).
- Suitable for mounting at any operating angle.

The actuator consists of a motor controlled by an integral solid state control assembly driving through two stages of worm and wheel gearing to a quarter turn output assembly giving clockwise to close output, with an easily removable steel drive bush for machining by the customer to suit the valve stem. There is also a gear drive to a limit switch assembly. A handwheel with a power preference clutch arrangement is provided for manual operation.

The solid state control assembly consists of two elements, the transformer rectifier providing DC power via thyristors to the motor and the CMOS gate array which controls and monitors the actuator functions and interfaces with remote controls.

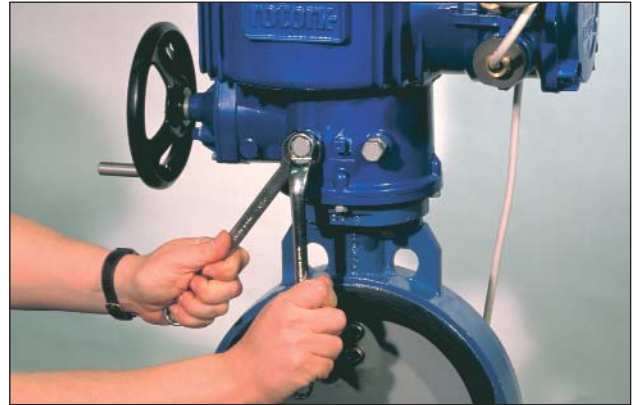
Opto isolators are incorporated to interface with remote control inputs. They protect the logic circuits from high voltage transients which may appear at the actuator terminals. The current drawn by the actuator circuit from each externally fed control signal is approximately 5mA at 24 volts and will be in proportion at other voltages.

The motor is a 24 volt DC high efficiency compact unit with a proven reliability record in automotive and industrial applications. Actuator output speed can be adjusted with a 4 to 1 range.

Overload protection is by means of a thermostat which disconnects the control circuit if the maximum permitted winding temperature is reached. This protection is independent of ambient temperature variation and motor current. This provides optimum usage of motor thermal capacity.

Mechanical Stops

Externally adjustable mechanical output stops are provided with a setting range of 80° to 100° of movement. The setting of these provides travel limitation for both electrical and manual operation.



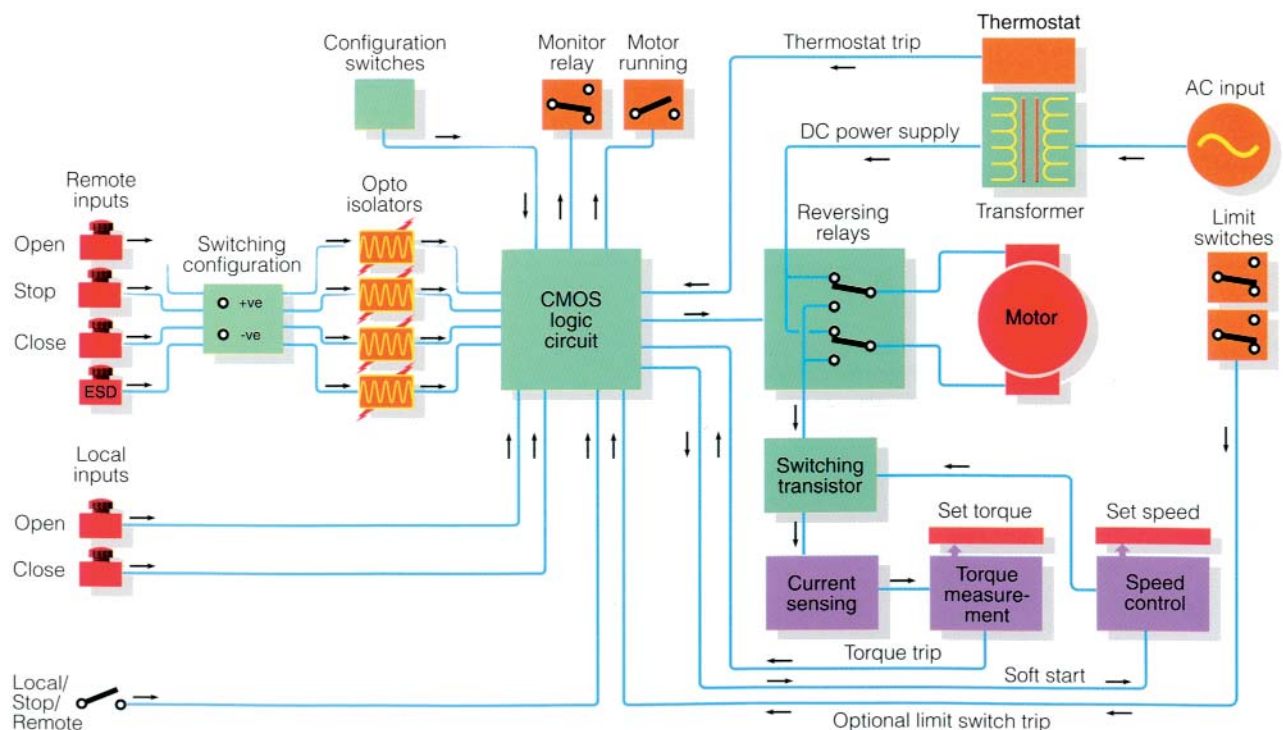
End of Travel Control

The 'AQ' actuator is designed to 'torque off' at each end of travel against its adjustable mechanical stops. This feature enables adjustment of travel limits without removing electrical covers. Where a particular application requires conventional gear driven end of travel limit switches, these are available as an optional extra.

Output Torque Adjustment

Close torque adjustment is by means of a potentiometer fitted inside the electrical enclosure with a setting range of 30% to 100% of rated output torque.

Opening torque is factory set to rated torque.



Electrical Supplies

The actuator can be supplied to suit most standard single and three phase AC voltages and 24V DC.

Duty Rating

The rating for the standard 'AQ' is S2 with a Cyclic Duration Factor of 20% according to IEC 34.2 with up to 60 starts per hour.

Auxiliary Limit Switches

A pair of single pole changeover auxiliary limit switches are provided for status feedback. Contract ratings for inductive circuits are as follows;

Voltage	AC current	DC current
240	15	0.25
110	15	0.25
50	15	2.50
24	15	3.00

The switches are capable of adjustment to any point in valve travel.

Monitor Relay

The monitor relay provides an alarm signal to indicate the operational status of the actuator. Contract rating 5A 250V AC, 30V DC (resistive load).

Motor Running Indication

A normally open contact is provided to permit remote indication motor running. Contact rating 5A 250V AC, 30V DC (resistive load).

Terminal Compartment

A separately sealed compartment contains segregated power and control terminal as follows:

Power: No. 10-24 UNC, Control: No. 6-32 UNC. All internal control connections to the printed circuit boards are via plugs and sockets. Terminal box cover carries a terminal identification code card. The terminal compartment also contains a start-up kit with instructions, wiring diagram, terminal screws and washers, spare cover screws and seals. Where metallic cable glands are to be used with the actuators that may be subject to salt water spray, it is recommended that the cable gland material should be one that is compatible with aluminium to avoid electrolytic action.

Two threaded conduit entries are supplied with the following alternative sizes available as standard:

2 x M32 metric to BS3643
2 x 1 1/8" ASA NPT
2 x PG21

Position Indication

Continuous mechanical valve position indication is provided and illuminated green for closed, white for intermediate and red for open.

Manual Operation

A lockable hand/auto lever is provided to engage handwheel operation. Energisation of the motor automatically re-engages power operation.

Paint Finish

Castings are dipped after machining in Waltecrom 7400. The castings are then stove enamelled at 200°C with Cromadex 'Interpon D' polyester power coating (or equivalent) 75 microns thick, blue RAL5005. This paint finish has passed a BS2011 Part 2.1 Kb severity one test.

Environmental**Enclosure**

The rugged construction of the 'AQ' actuator enables it to operate in arduous environments and conditions.

The standard actuator is available with a watertight enclosure to IP68 (NEMA 4 and 6)

The optional enclosures are:

Flameproof - BASEEFA certified EExd IIB T4 or EExde IIB T4 according to Cenelec Norm EN50014, EN50018 or EN50019 - BS5501.

Factory Mutual certified (explosionproof) Class 1 Groups C and D Division 1 Hazardous Areas to NEC Article 500, or CSA groups C and D.

Conduit entries are normally fitted with plastic transit plugs. Metal plugs should be specified if it is expected that cabling will not be completed for some time on outdoor installations.

Temperature

The standard actuators are suitable for ambient temperatures of -30°C to +70°C (-22°F to +158°F). Factory Mutual certified explosionproof actuators are subject to a maximum ambient temperature of 60°C (140°F), CSA explosionproof -30°C to +40°C (-22°F to 104°F). For ambient temperature outside these ranges please apply to Rotork.

Seismic

The 'AQ' actuator is designed to withstand the following:

Plant induced vibration, 0.5g over a frequency range of 10-200Hz.

Seismic frequency range of 0.2 - 33Hz, 1.0g if it is to operate during and after the event or 5.0g if it is only required to maintain structural integrity and does not have to operate during or after the event.

Actuator Mounting Base

The base of the actuator is fitted with a mounting flange complying with ISO5211 or alternatively USA Standard MSS SP -101.

The interface provided for mounting of the actuator onto the valve should conform to good engineering practices ensuring adequately toleranced limits for parallelism, perpendicularity and concentricity.

Valve Protection

The Rotork 'AQ' actuator has 3 valve protection systems:

Direction corrector circuit

This ensures that the motor turns in the correct direction, irrespective of the polarity of the supply connected to the power terminals.

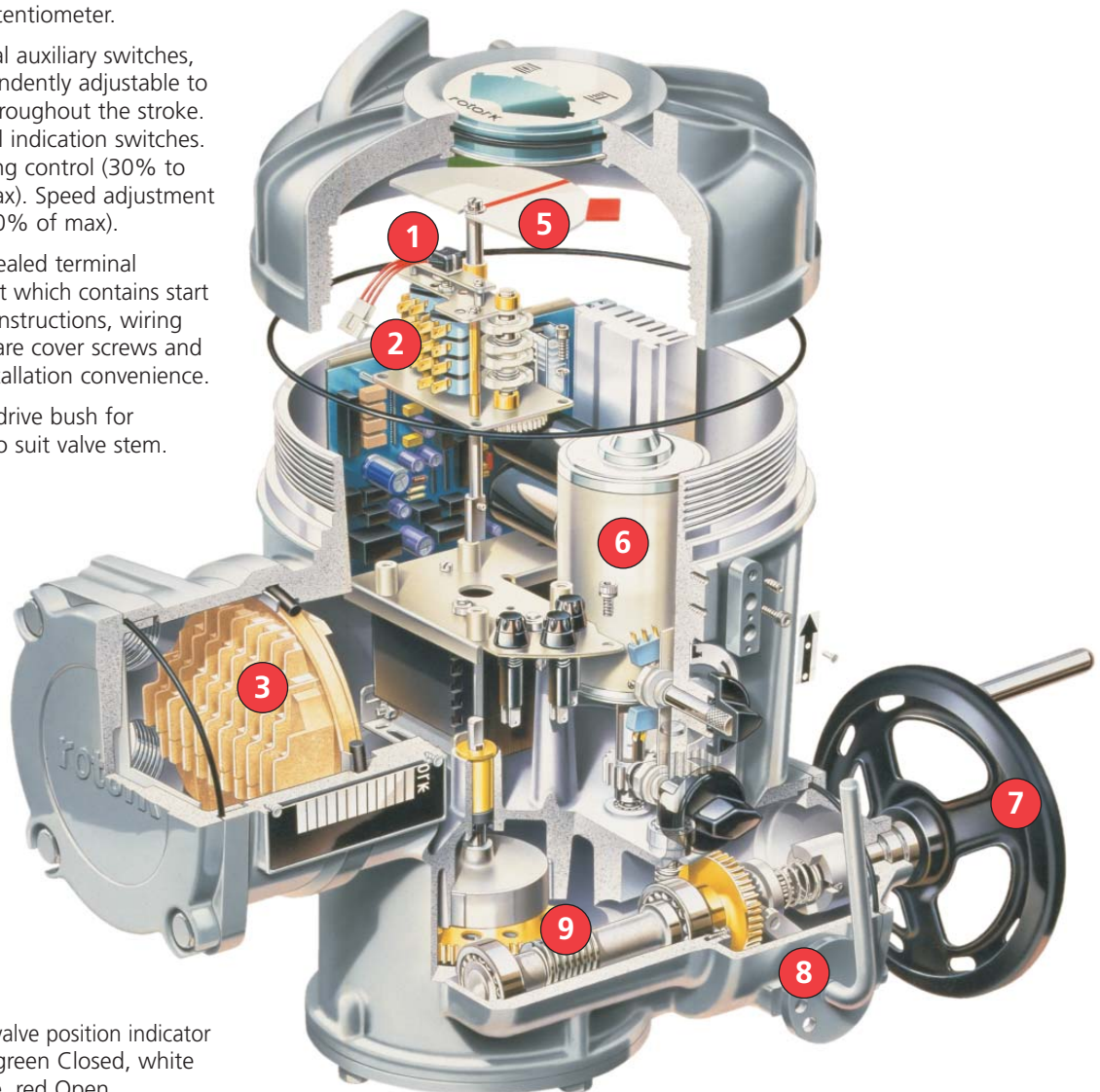
Instantaneous reversal protection

An automatic time delay circuit limits current surges when an actuator is signalled to reverse its direction instantaneously.

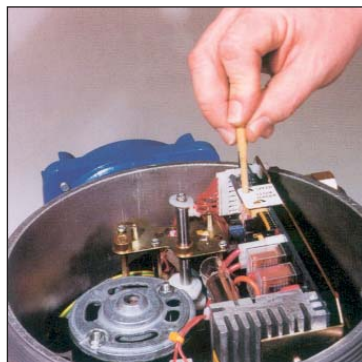
Anti-hammer protection

Adjustable electronic torque limitation switches off the actuator when a preset load is reached either due to an obstruction or at end of travel. Torque switch hammer, which is often a problem in the presence of a continuous control signal, is prevented from occurring by the logic control circuits.

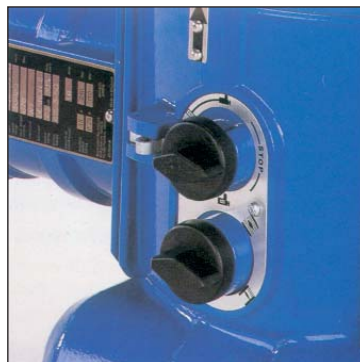
- 1 - Optional potentiometer.
- 2 - Four optional auxiliary switches, each independently adjustable to any point throughout the stroke. End of travel indication switches. Torque setting control (30% to 100% of max). Speed adjustment (25% to 100% of max).
- 3 - Separately sealed terminal compartment which contains start up kit with instructions, wiring diagram, spare cover screws and seals for installation convenience.
- 4 - Detachable drive bush for machining to suit valve stem.



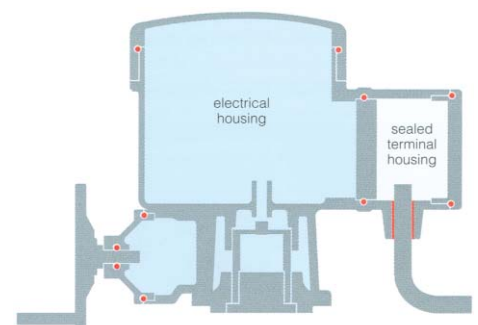
- 5 - Continuous valve position indicator illuminated green Closed, white Intermediate, red Open.
- 6 - Motor.
- 7 - Handwheel for emergency manual operation.
- 8 - Padlockable hand/auto lever.
- 9 - Rolled steel wormgears on aluminium bronze wormwheels oil bath



Torque and Speed Settings



Standard Local Controls



Sealed Terminal Housing

Push-button Station

Push-button station consists of a rotary control button (open/close) and a lockable 3 position selector (local/stop/remote). The buttons are integrally mounted on the side of the main casting.

Independent Auxiliary Switches

4 independently adjustable limit switches may be fitted. Each switch is independently adjustable to any valve position. The contact rating is identical to the standard auxiliary limit switches.

End of Travel Limit Switches (Control)

1 open and 1 close limit switch may be fitted and used to control the limits of valve travel if desired. These switches are directly connected to the control circuit PCB and are not available for external connections.

Two Speed Operation

This feature may be added to the main circuit board to slow the final portion of closure to one quarter of the maximum operating speed. This facilitates rapid closing of valves whilst reducing the possibility of hydraulic shock within the pipework system. The independent auxiliary switch assembly must also be fitted.

Ant-Clockwise to Close

Actuators can be supplied suitable for anti-clockwise to close applications.

Potentiometric Position Transmitter

A potentiometer, gear driven from the actuator output, provides the simplest and most economic method of transmitting an analog signal for remote valve position indication. It may be connected directly to a voltmeter-type position indicating instrument.

Current Position Transmitter

An electronic transducer mounted in the main electrical compartment provides a 4-20mA analog position indication signal. This is fed from the internal 24 volt DC supply. This enables the actuator to automatically position a valve in proportion to an analog current, voltage or potentiometric signal. The signal ranges are:

0-5, 0-10, 0-20, 0-50 or 4-20mA.
0-5, 0-10, or 0-20V.

The potentiometric signal may be derived from an external potentiometer having an overall resistance of 500 Ohms up to 10k Ohms.

To facilitate fast response without the tendency to overshoot signal position, a sophisticated control algorithm is utilised. The actuator's speed automatically decreases as the signalled position is approached. For small errors the actuator moves slowly, for large errors the actuator output speed is increased. When folomatic is fitted to 'AQ' actuators, they can be controlled from analogue signals demanding up to 1200 starts per hour.

Modulating Duty Actuators

Modulating duty 'AQ' actuators, designated AQM, are available for applications requiring up to 1200 starts per hour with a Cyclic Duration Factor of 40% at 80% rated torque. AQM actuators have a fixed output speed which is the minimum speed (maximum operating time) indicated in Table 1 for the equivalent sized standard 'AQ' actuator.

Fire Protection

For applications where operation of the actuator is required during the initial stages of a plant fire, the actuator can be provided with an intumescent coating. Tests have shown the actuator will be protected for up to 30 minutes from the start of the fire with a flame temperature of 1065°C (1950°F). See publication S310E.

Failsafe Operation

Two versions of the 'AQ' are available to provide failsafe operation on failure of the AC power supply.

Type 1 Actuator arranged for use on a 24V DC supply provided by the customer. This version is available to suit any standard AC primary power supply, any listed enclosure and electrical option.

Type 2 Actuator with the addition of a separate, bolt on, weatherproof IP55 enclosure housing a rechargeable battery, charging unit and control and protection circuits. The actuator gives fully automatic operation. Under normal conditions, the battery is kept fully charged. An external, colour coded lamp indicates the battery charge level. For maximum number of operations, see table below.

Actuator response on AC power failure may be pre-selected for one of the following:

Fail open
Fail close
Stay-put awaiting a local or externally fed remote signal to open or close.

Note: Battery supply is automatically disconnected 30 minutes after AC power failure.

For further details see publication E520E.



Maximum Number of Operations

for 'AQ' battery pack failsafe actuators (at rated output torque)

Actuator size	Temperature °C			
	+20°, +40°, +60°	0°	-20°	-30°
AQ105	54	36	21	12
AQ115	36	24	14	8
AQ130	27	18	10	6
AQ310	18	12	7	4
AQ360	9	6	4	2
AQ830	10	6	4	2
AQ860	5	3	2	1

Note

As 'AQ' actuators are limited to a maximum 20% duty cycle at rated torque, the number of operations may be less than that shown in the table during the 30 minute operating period of the battery pack. The number of operations may be calculated for a given actuator speed by:

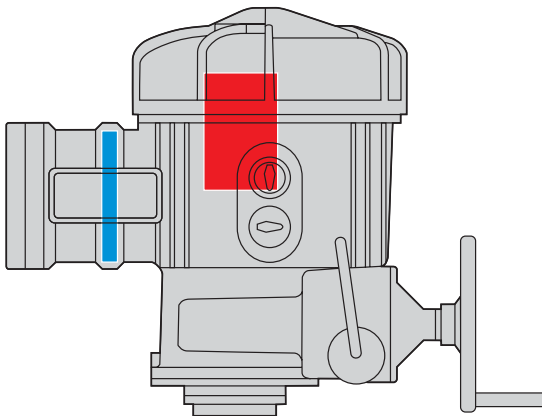
$$\text{number of operations} = \frac{1800}{\text{Operating time (sec)} \times 5}$$

If this figure is less than the one shown in the table, this should be taken as the maximum operations allowable.

Pakscan Two Wire Connectivity

Pakscan Interface

The actuator can be fitted with an internally mounted Pakscan field unit for remote control and status indication over a two wire serial link.



The Pakscan facility enables an actuator to be integrated into an overall supervisory remote control scheme including solenoids, pumps, mixers and other field devices.

Pakscan brings improved plant control with vast cost savings. A micro-processor based system, Pakscan is capable of controlling and monitoring up to 240 field devices per loop via a two-wire serial link. Using master stations, linked to field units, integral to the 'AQ' or other Rotork actuators, Pakscan can also gather important digital and analog plant data.

Each field unit has its own address and only acts upon appropriate commands sent from the master station, to control or monitor that specific device.

Whether you need remote control of just a few motorised valves, or full automation of a plant with thousands of instruments and control elements, Pakscan helps you achieve significant savings in both time and cost.



Considerable material and labour costs are made through the use of a single 2-core cable loop instead of a multi-core cable to each field device. In addition, the Pakscan package provides a comprehensive, standardised and pre-engineered system for control, status and alarm feedback signals of MOV's, pumps, mixers etc. This, together with the ability to communicate directly with a PLC or DCS system via an RS485 link, minimises customer's design work. *For more information, see brochure S110E.*

Rotork is also able to supply InVision, a SCADA (Supervisory Control and Data Acquisition) software system for full user-friendly control of complex installations.

Working with Pakscan and running on a standard PC, Invision provides a powerful control package at a fraction of the cost of other comparable systems. It combines a high flexible series of graphic displays with the PC's ability to carry out sequential control and overlocking.

InVision is ideally suited to installations such as oil storage depots and water treatment plants, where there is a very high number of digital signals and where analog signals must also be processed. *For more information, see brochure S210E.*



Table 1 — Mechanical Data

Model	Performance independently electronically adjustable					Mounting base designation to ISO 5211		Standard imperial mounting reference	Maximum spindle acceptance (see note 3)		
	Operating time, secs (see note 1)	Torque range, Nm lbs ft (see note 2)		Standard	Option	bore & key			square mm		
		Min	Max			mm	ins				
AQ105	5 to 20	40	30	135	100	F10	F7	FA10	42*	1 ⁵ / ₈	30
AQ115	15 to 60	40	30	135	100	F10	F7	FA10	42*	1 ⁵ / ₈	30
AQ130	30 to 120	40	30	135	100	F10	F7	FA10	42*	1 ⁵ / ₈	30
AQ310	10 to 40	80	60	270	200	F10	F7	FA10	42*	1 ⁵ / ₈	30
AQ315	15 to 60	135	100	406	300	F10	-	FA10	42	1 ⁵ / ₈	30
AQ360	60 to 240	135	100	406	300	F10	-	FA10	42	1 ⁵ / ₈	30
AQ830	30 to 120	203	150	676	500	F14	F12	FA14	50	2	42
AQ860	60 to 240	324	240	1080	800	F14	F12	FA14	50	2	42

* with F7 base, max acceptance is 28 mm round hole or 20mm A/F square hole

Modulating actuators

'AQ' actuators are available for modulating duties for torque ranges as above, and are designated AQM. Note minimum speed (ie maximum operating time) only is available.

Notes

- 1 For all AC electrical supplies, the setting of any operating time has no effect on the torque setting and vice-versa. For torque/speed relationships of 24V DC machines, see Table 3.
- 2 Close torque setting control is provided. Opening torque is factory set to maximum.
- 3 Drive sleeves are normally supplied blank for machining by valve supplier.

Table 2 — Electrical Data The following data refers to maximum closing torque

Model	Supply voltage	110v AC 115v AC	220v AC 230v AC 240v AC	380v AC	415v AC	460v AC	500v AC	575v AC	660v AC	24v DC
AQ115, 130, 360	Current Amps	2.9	1.2	0.8	0.73	0.65	0.64	0.43	0.41	7
	Power kW*	0.26	0.23	0.24	0.25	0.25	0.25	0.2	0.22	0.17
	Power Factor	0.81	0.8	0.79	0.82	0.83	0.78	0.8	0.81	-
AQ105, 310, 315, 830, 860	Current Amps	6.7	3.3	2	1.8	1.65	1.6	1.35	1.2	15
	Power kW*	0.63	0.68	0.63	0.63	0.61	0.62	0.635	0.68	0.36
	Power Factor	0.85	0.86	0.83	0.84	0.8	0.77	0.82	0.85	-

* To obtain equivalent horsepower values, multiply kW by 1.34. AC powered AQ actuators utilise a power transformer. For quiescent current please contact Rotork.

Table 3 — Performance Data for 24 volts DC

Model	Actuator operating times seconds						Actuator torque settings, Nm lbs ft									
	5	7	8	10	12	20	AQ105	AQ310	AQ315	AQ830	AQ860					
AQ105	10	13	17	20	23	40	AQ115									
AQ105	15	20	25	30	35	60	AQ130									
AQ105	30	40	50	60	70	120										
AQ105	60	80	100	120	140	240										
							13	10	27	20	40	30	67	50	108	80
							27	20	54	40	80	60	135	100	216	160
							40	30	80	60	121	90	202	150	324	240
							54	40	108	80	162	120	270	200	432	320
							67	50	135	100	202	150	337	250	540	400
							80	60	162	120	243	180	405	300	648	480
							94	70	189	140	283	210	472	350	756	560
							108	80	216	160	324	240	540	400	864	640
							121	90	243	180	364	270	607	450	972	720
							135	100	270	200	405	300	675	500	1080	800

The range of set times that can be achieved for a particular torque setting are defined by the table. Where a combination of torque and time settings falls in the green shaded area, the actuator will produce the set torque at a reduced speed.

The actuator is capable of producing any set torque up to the maximum actuator rated torque irrespective of the operating time selected.

	Standard AQ	Failsafe AQ
Main Drive Unit		
Electric actuator with double sealed watertight enclosure IEC IP68 (submersion in water to a depth of 3m for 48 hours). Other national enclosure standards also complied with, ie CSA, NEMA, BS5410 specifications, complete with segregated terminal area to IEC IP68. Declutchable lockable emergency handwheel. Class F insulated motor, rated for S2-20% duty to IEC 34.2 with thermostat protection. Torque switch travel limitation at each end of travel against externally adjustable mechanical stops. One pair of auxiliary limit switches.	E520E	E520E
Continuous local indicator. Illumination of local indicator (red - Open, white - Travelling, green - Closed)	E520E	E520E
Integral reversing controls	E520E	E520E
Local rotary Open/Close selector switch and lockable Local/Stop/Remote selector switch.	E510E	E510E
Electronic speed control 4:1 turndown ratio.	E520E	E520E
Control circuits proof against incorrect incoming 3 phase connection.	E520E	E520E
Control circuits protected against incorrect incoming single phase connection.	E520E	E520E
Control circuits protected against incorrect incoming 24v DC polarity.	E520E	E520E
Instantaneous reversal protection.	E520E	E520E
Three phase power supplies.	E520E	E520E
Single phase power supplies.	E520E	E520E
24v DC power supplies.	E520E	N/A
Flameproof enclosures, ie CENELEC, Factory Mutual.	E510E	E510E
Two speed operation.	E520E	E520E
End of travel limit switches.	E520E	E520E
Additional Valve Status Indication Facilities		
Potentiometer for remote continuous indication.	E520E	E520E

	Standard AQ	Failsafe AQ
Four independently adjustable auxiliary limit switches.	E520E	E520E
Current Position Transmitter (CPT) 4 - 20 mA output.	E520E	E520E
Integral smoothed DC power supply for CPT transmitter and external load.	E520E	E520E
'Valve running' indication (motor energised).	E520E	E520E
'Valve available' indication.	E520E	E520E
Additional Valve Status Indication Facilities		
Open/Stop/Close or Open/Close with mid travel reversal, control maintained or 'push to run' using volt free push-buttons.	E520E	E520E
Open/Stop/Close or Open/Close with mid travel reversal, control maintained or 'push to run' using panel fed remote controls with control supply 20v to 120v AC or DC.	E520E	E520E
Positive switching.	E520E	E520E
Negative switching.	E520E	E520E
Remote control from an analogue signal.	E520E	E520E
Two wire Open/Close from make/break switch.	E520E	E520E
Emergency shutdown circuit.	E520E	E520E
Pakscan two wire control system.	S110E	S110E
Additional Valve Status Indication Facilities		
Interlock circuits to prevent/permit either or both closing and opening movements.	E520E	E520E
Alarm signal on incomplete travel, sequence failure or unauthorised hand operation.	E520E	E520E
Alarm signal of integral control switch set to Stop, or Local control, motor overheated or power supply disconnected, from an integrally mounted monitor relay.	E520E	E520E
Separate alarm signals of Local/Stop/Remote selector not in Remote, motor overheated, plus any two of the following: control switch set to Stop, motor running, loss of internal power supply.	E520E	E520E

E520E 'AQ' Publication number for more detailed information

Standard

Optional

AQ Range

flameproof watertight, 3-phase, 1-phase, DC
failsafe quarter turn valve actuators

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