

# rotork®

## AQ Instruction Manual



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(AQ100 AQ300 AQ800)



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## Rotork actuator is supplied

- Fully rig and performance tested.
- Torque output set to maximum unless otherwise specified.
- Cable entries sealed for transit protection.
- Inclusive of commissioning kit.
- Inclusive of wiring diagram.

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

## Health and Safety

This manual is produced to enable the user to install, operate, adjust and inspect Rotork AQ range valve actuators.

The electrical installation, maintenance and use of these actuators should conform to the requirements of the Electricity (Factories Act) Special Regulations 1908 and 1944 and the guidance given in the 15th Edition of the IEE wiring Regulations. The user should therefore make himself familiar with these regulations and other Statutory regulations and other Statutory Provisions relating to the safe use of this equipment. Also the user should be aware of his duties under the Health & Safety at Work etc. Act 1974.

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

If the actuator has nameplates indicating that the actuator is suitable for installation in Hazardous Gas Areas then the following regulations apply.

The electrical installation, maintenance and use of these actuators should be carried out in accordance with BSEN60079-14:1997

No inspection or repair should be undertaken unless it confirms to the requirements given in these standards, and under no circumstances should any modification or alteration be carried out on the actuator as this could very well invalidate the conditions under which the certificate was granted.

These actuators are suitable for use in Zone 1 and Zone 2 explosive atmosphere only, and they should not be installed in atmospheres where Group IIC gases are present, or where gases are present, with an ignition temperature less than 135 degree Celsius, unless suitability for lower ignition temperatures has been indicated on the actuator nameplate. Any test instruments applied to the actuator should be of equivalent certification.

Access to live electrical conductors of the actuator is forbidden in the hazardous area unless this is done under a special permit to work

otherwise all power should be isolated and the actuator removed to a non hazardous area for repair or attention.

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

Should further information and guidance relating to the safe installation, maintenance and use of the Rotork 'AQ' Range actuator be required, this will be provided on request.


<b>rotork</b>	
Rotork Controls Limited Bath England	
actuator type	
serial number	
<b>EExd II B T4</b> 	
(Tamb = -30°C to +70°C)	
BASEEFA number EX 86B 1380	
wiring diag no	
speed range	secs
max torque setting	Nm
enclosure	
lubricant	
motor rating	kW
power supply	
current at rated torque	Amp
auxiliary switch rating	A
	Vac
	Vdc
British patent No 2101355    Canada patent No 1184627	
USA patent No 4445075    Other patents pending	
Z 28209-201	Made in England

Fig.1

## 1. Identifying actuator parts

### 1. Drive bush

Steel drive bush supplied blank. Valve manufacturer to machine to suit valve spindle. Retained in position by a single fixing screw.

### 2. Hand/auto lever

### 3. Handwheel

Handwheel is for manual operation and is engaged by pulling hand auto lever towards handwheel.

### 4. Mechanical stops

Two stop bolts are provided as mechanical stops and should be adjusted to suit valve open and closed positions  $90^\circ \pm 5^\circ$ .

### 5. Top cover

Screwed aluminium component locating with main gear case body and sealed with 'O' ring. Locking grub screw is located in locking plate.

### 6. Cable entries

Two cable entries are provided for power and control cables.

### 7. Terminal cover

### 8. Nameplate

(see Fig.1)

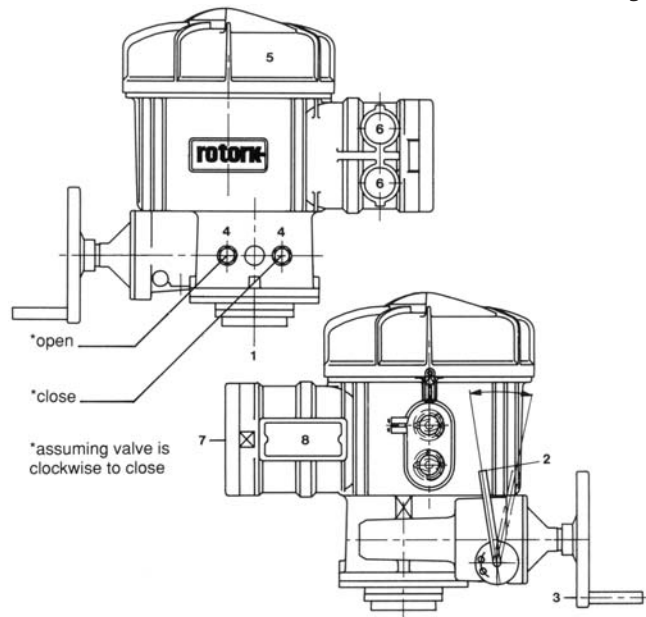


Fig.2

## 2. Mounting actuator instructions

### 2.1 Drive Bush

To remove drive bush from actuator base first remove retaining screw. If actuator is fitted with alternative mounting base, this must be removed first, before drive bush can be removed. Determine keyway position in drive bush to suit. Reassemble drive bush to actuator base and secure with retaining screw.

### 2.2 Mounting Actuator to Valve

Secure actuator to valve with four fixing bolts. Check cast groove in actuator base is not obstructed. It's purpose is to protect the AQ actuator in the event of a product leak from the valve spindle/gland packing. Check base fixing bolts are tight.

## 3. Site Cabling

### Cable Entries

To remove terminal cover first remove 4 fixing bolts.

Remove transit blanking plugs and make cable entries to the appropriate standard. Blank off unused entry with steel blanking plug.

### Connections

Connect power supply and terminate control cables to appropriate standard. Refer to actuator wiring diagram enclosed with instruction manual. Re-fit terminal cover after checking condition of 'O' ring seal and greasing spigot. Secure cover with 4 fixing bolts.

## 4. Operational settings

### WARNING!

Electrical operation with top cover removed must not be carried out in explosion hazardous areas without official permit.

#### 4.1 Travel Limitation

The AQ range is designed to stop at end of travel by torque limitation against stop bolts. Stop bolts should therefore be set to the precise stopping point required.

#### To set

Open and closed bolts are set for approximately 90° valve travel and should be adjusted as necessary to suit the valve.

Engage hand/auto clutch level by pulling lever towards actuator handwheel. Manual mode of operation is now selected.

#### Open Stop

Hand wind valve to fully open position. Adjust lock nut/stop bolt to suit valve open position.

#### Closed Stop

Hand wind valve to closed position. Adjust lock nut/stop bolt to suit valve closed position. Open and closed stopbolts are now set.

#### 4.2 Torque setting

(Fig. 3)

Remove top cover by undoing grub screw in locking plate and unscrew cover.

Open direction.

Not adjustable - factory set to actuator rated torque.

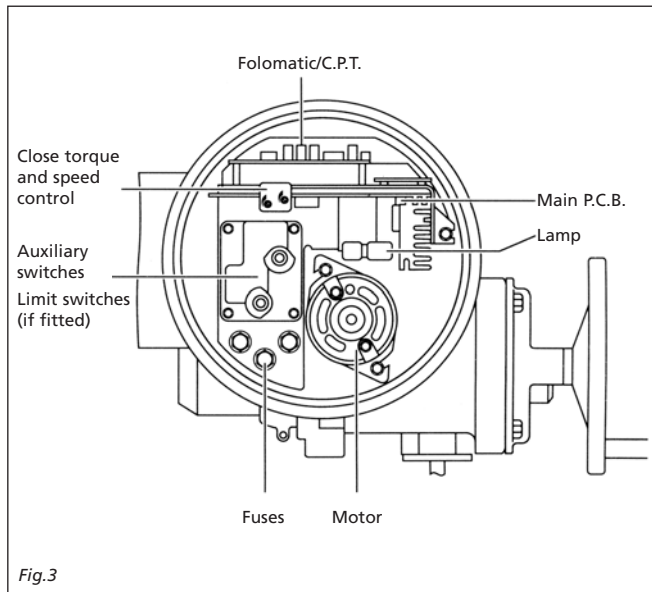
Close direction.

Adjustable from 30% rated torque to rated torque.

Closed torque is adjusted by turning 'close torque' pot on main PCB.

Anticlockwise to reduce torque.

Clockwise to increase torque.



**Note:** Red LED on main PCB will illuminate when actuator torques off in either direction.

#### 4.3 Setting speed control

(Fig.3)

Actuator operating speed range is recorded on the nameplate. The operating speed is varied within this range by adjusting speed control potentiometer located on main PCB.

Turn pot clockwise to increase speed.

Turn pot anticlockwise to decrease speed.

#### 4.4 Setting Auxiliary Switches

(Fig.4)

The actuator incorporates two independently operated open and closed auxiliary switches to provide end of travel indication.

Auxiliary Switch Cam adjustment is by finger tip rotation in each direction, cams are compression spring loaded and held in position by taper centres.

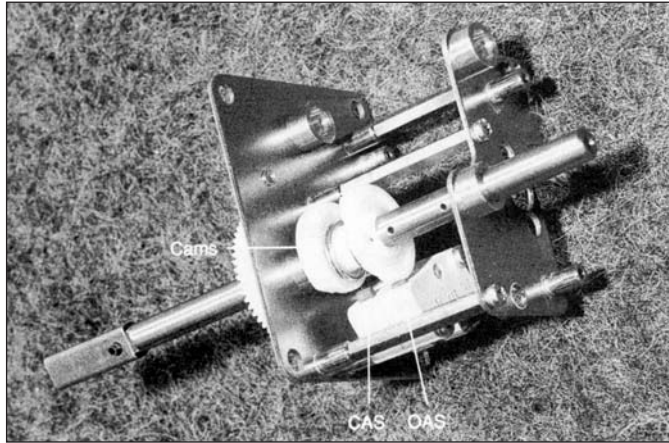


Fig.4

#### Clockwise to close actuators Closed Auxiliary Switch (CAS)

Move valve to fully closed position. Locate bottom cam on the shaft, lift and turn cam clockwise until switch just operates, release cam. Switch is now set.

#### Open Auxiliary Switch (OAS)

Move valve to fully open position. Locate second cam up from bottom of shaft. Push cam down and rotate anticlockwise until switch just operates, release cam. Switch is now set.

#### Anti-clockwise to Close actuators Closed Auxiliary Switch (CAS)

Move valve to the fully closed position. Locate bottom cam on the shaft, lift and turn cam anti-clockwise until switch just operates, release cam. Switch is now set.

#### Open Auxiliary Switch (OAS)

Move valve to fully open position. Locate second cam up from bottom of shaft. Push cam down and rotate clockwise until switch just operates, release cam. Switch is now set.

#### 4.5 Continuous Position Indicator

Ensure valve is in the fully open position. Re-position continuous indicator with red (open) lens over bulb and tighten securing screw.

#### Replacement of Top Cover

Check condition of 'O' ring and replace if necessary. Grease thread and spigot. Screw on top cover and hand tighten. Secure in position with locking grubscrew in locking plate.

#### 4.6 Remote Options

The 8 switch selector on main PCB enables different remote control functions to be chosen, also on 'local' control the option of maintained control or 'push to run'.

PCB switch		ON	OFF
1	ESD	ESD	No ESD
2	TBY	Stat by-pass	No stat by-pass
3	P1	Both "On"	Both "Off"
4	P2	Close Priority	Open Priority
		One Switch On and One Switch OFF = Stayput	
5	ESD	ESD Close	ESD Open
6	C/A	Clockwise Close	Anti-clock Close
7	PTR	Maintain in local	Push to run in local
8	Fail	Failsafe if fitted	No Failsafe

## 5. Final check

Check stop bolts and lock nuts are tight.

Check terminal cover fixing bolts are tight.

Check top cover is screwed on hand tight and locking grubscrew is tight.

Check indication reads:

Red	Open
Green	Close

## 6. Trouble Shooting

#### Valve leaking

- i) Likely cause: Travel limitation stop bolts incorrectly set.  
Action: Reset stop bolts (refer to valve manufacturer).
- ii) Likely cause: Insufficient torque selected.  
Action: Increase torque control setting.
- iii) Likely cause: Obstruction of valve  
Action: Inspect and remove

**Actuator runs without driving valve**  
Hand/auto lever padlocked in manual.

**Actuator fails to start**  
Check fuses.  
Replace fuse.

## 7. Optional extras

(Refer to actuator wiring diagram)

### 7.1 Integral Local Control Station

(Refer to Fig. 5)

This module consists of a rotary direction (open/close) selector knob for local operation and a three position lockable rotary local/remote/stop selector knob.

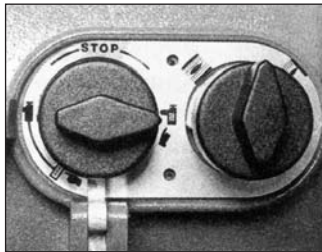


Fig.5

#### For Local Control

Disengage locking lever. Turn selector knob to 'local' position indicated on label.

To energise the actuator closed, turn direction control knob clockwise towards 'closed' position.

To stop actuator turn local/remote selector to 'stop' position. Knob will spring back to 'local' position.

To energise the actuator open, turn direction control knob anti-clockwise towards 'open' position.

#### For Remote Control

Disengage locking lever turn selector knob to 'remote' position indicated on label.

### 7.2 Travel Limit Switches

(Fig.6)

#### Setting Procedure

Set stop bolts to required open and closed position noting travel limit switch operation will stop the actuator short of these positions.

**Clockwise to close actuators: Closed travel Limit Switch (CLS)**

**and**

**Anti-clockwise to close actuators: Open travel Limit Switch (OLS)**

Engage manual operation (see 4.1). Turn handwheel clockwise until stop is reached. Locate second cam down. Lift and turn cam clockwise until switch just operates. Release cam, switch is now set.

**Clockwise to close actuators: Open travel Limit Switch (OLS)**

**and**

**Anti-clockwise to close actuators: Close travel Limit Switch (CLS)**

Engage manual operation (see 4.1). Turn handwheel anti-clockwise until stop is reached. Locate top cam. Depress cam and turn anti-clockwise until switch just operates. Release cam, switch is now set.

**Note:** Open and close auxiliary switches must now be set to trip before set travel limit positions to enable positive indication refer to 4.4.

#### Checking travel limit switch operation

Electrically run actuator to closed position. Red LED should not be illuminated. If LED is illuminated closed limit switch is incorrectly set, (actuator torquing off against stop bolts).

Electrically run actuator to open position. Red LED should not be illuminated. If LED is illuminated open travel limit switch is incorrectly set (actuator torquing off against stop bolts).

If limit operation is required at one end of travel only, set limit switch for that direction. At the opposite end of travel ensure limit switch cam does not operate switch (LED will then be illuminated indicating actuator has torqued off in that direction).



### 7.3 Extra Auxiliary Switches (Fig. 6)

Four auxiliary switches are incorporated into the switch mechanism. Each switch can be independently adjusted to trip at any point throughout actuator cycle/valve stroke. Refer to wiring diagram and valve makers/clients instruction for required auxiliary switch tripping position.

#### Setting Procedure

Move valve to required switch tripping position. Locate bottom cam (IAS 4). Lift and turn cam until switch just operates release cam. Switch is now set.

Repeat operation until all required switches are set:

3rd cam - IAS3 - depress and turn cam.

2nd cam - IAS2 - lift and turn cam.

1st (top) cam - IAS1 - depress and turn cam.

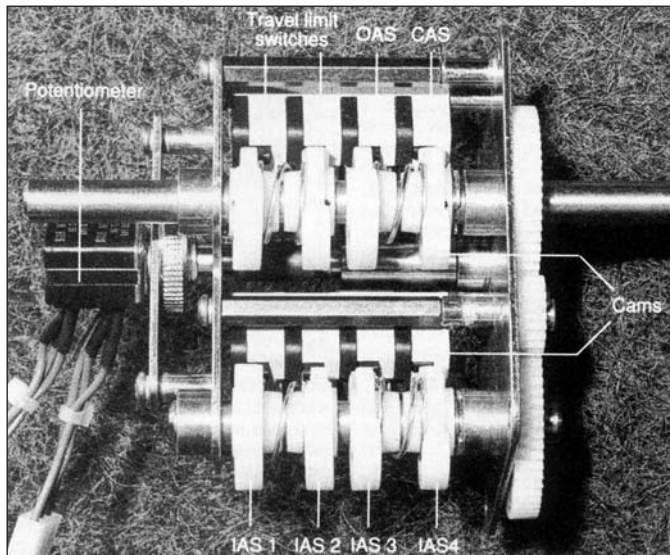


Fig.6

### 7.4 Two Speed Control

The actuator incorporates a two speed function to enable slow running at the closed end of travel. This feature is designed to prevent hydraulic shock in pipeline control.

#### Setting Procedure

Move actuator to position where slow running is required to start. Locate bottom cam of the extra auxiliary switch cams. Turn cam clockwise for clock to close actuators - anti-clockwise for anti-clock to close actuators until switch just operates. Switch is now set.

#### To Test:

Move actuator to fully open position.

Run actuator closed - actuator will run at speed set on speed control (See 4.3).

At the point where bottom switch trips, actuator will automatically run at minimum speed until closed position is reached.

**Note:** From closed position, actuator will run open at selected speed set previously (See 4.3).

### 7.5 Potentiometer

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

#### Setting

Move actuator to fully closed position. Unlock pot by turning knurled nut clockwise. Rotate pot casing so that a approximately 50 ohms resistance is measured between terminal 23 and 32 of terminal bung (23-14 Anticlock to close actuator)

Lock pot by turning knurled nut anti-clockwise. Pot is now set.

### 7.6 Current Position Transmitter (CPT) 4-20mA Output (fig. 7)

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

#### Electrical connections

1. The CPT can be either internally or externally powered. Use the wiring diagram supplied with the actuator to check this.
2. Check whether valve is clock or anti-clock to close.

#### Setting of CPT

1. Signal Direction. Using Fig 7 locate the duel links J7.

a For clock to close valve and low signal at closed  
*and*

For an anti-clock to close valve and low signal at at open.

Links J7 must be positioned parallel to the edge of the board.

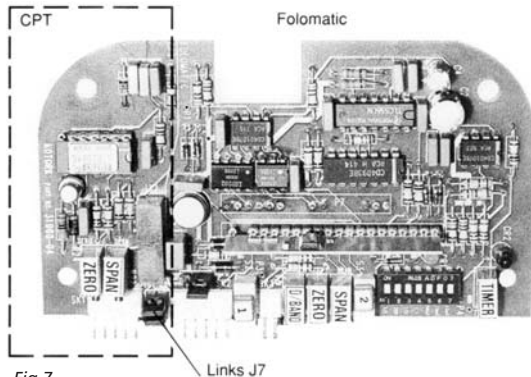


Fig.7

For a clock to close valve and low signal at open  
*and*

For anti-clock to close valve and low signal at closed.

Links J7 must be positioned at right angles to the edge of the board.

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

Locate socket 2 ( SKT 2) on folomatic CPT printed circuit board and remove socket. Socket pins are marked 1-6 using a multimeter reading ohms, test between appropriate pins (see table opposite). Turn potentiometer body as described in section 7.5 until approximately 50 ohms is measured. Lock potentiometer. Reconnect socket into CPT circuit board.

Indication system	Socket pin number	Ohms
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

- Adjust the CPT zero trimmer to give required minimum signal.
- Move valve to the high signal end of travel.
- Adjust the CPT span trimmer to give required maximum signal.
- Move valve back to the low signal end of travel and re-check the minimum reading and adjust if necessary.

## 7.7 Folomatic Proportional Control (Fig. 7)

### Zero/span/timer/dead band

The Folomatic Proportional Control Module sets the valve position relating to an input signal with adjustments for Zero and Span setting. Refer to the Wiring Diagram supplied in the actuator and also the customers instructions for exact setting.

When the actuator Local/Off/Remote selector is set to 'Local' the actuator functions like any other with Open/ Stop/Close local control. The actuator should therefore be set to work initially under local control in accordance with this Instruction Manual.

**Note:** The AQ folomatic incorporates a two speed function to enable the actuator to run at minimum speed as it approaches the desired value.

This function will minimise overshooting thus enabling a narrower deadband to be set.

It should be noted that when the actuator is operated by local control with a desired value signal present, it will slow to minimum speed around the desired value position and then speed up to set speed once desired value position is passed. This is quite normal, indicating to the operator the approximate desired valve position.

### Setting the Folomatic

**1.** Determine whether the valve is clock or anticlock to close and also whether it is to open or close on a low demand signal.

Using Fig. 7 locate switches 1 and 2, on folomatic/CPT PCB. select as follows:

**a For Clockwise Closing Valves**  
Input signal low to close, SW1 selected towards edge of board, SW2 selected away from board.

Input signal low to open, SW1 selected away from edge of board, SW2 selected towards edge of board.

**b For Anti-clockwise Closing Valves**  
Input signal low to close, SW1 and, SW2 away from edge of board.

Input signal low to open, SW1 and, SW2 towards edge of board.

**2** Determine what control input signal is going to be used. Refer to Fig 7 and locate the folomatic P.C.B. diI switches. Using appendix table 1 set the required current or voltage range.

**Note:** Unless range required was specified at time of ordering, folomatic will be set assuming a 4 - 20 MA range.

**3** When using a 4-20mA control loop signal it is possible to select whether the actuator will "stay put" or fail to the selected end of travel on loss of signal.

Switch No 1 on folomatic DIL switches to be selected 'on'. (See table Appendix 1).

Switches 3 (P1) and 4(P2) on Main Board DIL Switches. Both selected 'on' gives fail to the close end of travel. Both selected 'off' gives fail to open end of travel. One switch 'off' and one 'on' will give 'stay put'.

4. Check that incoming control cables are connected to the following terminals.

a Current or voltage signal to 9 (-VE) and 12 (+VE), or alternatively.

b Customer's potentiometer derived signal to 9,12 (Wiper) and 18.

5. With actuator set to local control run the valve to the nominated low signal end of travel.

Locate socket 2 (SKT 2) on folomatic/ CPT printed circuit board and remove socket. Socket pins are marked 1-6.

Using a multimeter reading ohms, test between appropriate pins (see table below). Turn potentiometer body as described in section 7.5 until approximately 50 ohms is measured. Lock potentiometer. Reconnect socket into CPT circuit board.

Indication system	Socket pin number	Ohms
Clockwise to close. Low output at close. or Anti-clockwise to close. Low output at open.	3 to 1	= 50
Clockwise to close. Low output at open. or Anti-clockwise to close. Low output at close.	3 to 2	= 50

**Note:** If potentiometer was set for the CPT it is not necessary to adjust potentiometer again for the folomatic.

6. Set input signal to required minimum value.

7. Locate the 'zero' trimmer and adjust until the green indicator (if valve is at closed position) or red indicator (if valve is at open position) on the PCB just lights either flashing or steady, clockwise movement of zero trimmer will illuminate appropriate indicator.

8. Operate the valve to the opposite end of travel (High Signal) using local control.

9. Set input signal to it's required maximum level.

10. Locate the 'Span' trimmer and adjust until the red indicator (if valve is at the open position) or green indicator (if valve is at the close position) on the PCB just lights either flashing or steady, anti-clockwise movement of span trimmer will illuminate the appropriate indicator.

11. Set local/remote selector to 'Remote'. The actuator is available for Folomatic remote control to give full valve stroke with maximum input signal.

**Deadband and motion inhibit timer adjustment**

The deadband and motion inhibit timer controls are ten turn potentiometers incorporating a slipping clutch to prevent overwinding.

Both controls will be factory set to minimum (fully anti-clockwise) enabling zero and span controls to be set.

**Deadband adjustment**

If the actuator overshoots or responds unnecessarily to small changes in signal, increase the deadband by turning the deadband control clockwise. If greater sensitivity is required reduce deadband by turning anticlockwise. Check that hunting does not occur eg. when the actuator is moving in the increasing signal direction, it should stop when the balance between the input signal and the actuator feedback potentiometer is achieved. If hunting does occur, increase the deadband as necessary.

**Motion inhibit timer adjustment**

The motion inhibit timer is designed to prevent the actuator responding unnecessarily to a rapidly fluctuating input signal when the average remains constant. The timer should be set for the maximum inhibit time permissible for the control application. This will ensure maximum service life from the actuator by eliminating unnecessary operation.

The red and green indicators on the PCB indicate a change of signal state:

Red = in the open direction  
Green = in the close direction

If either indicator is flashing it indicates a change of signal state that is being held off from operating the actuator for a predetermined length of time. This motion inhibit time is adjustable between 2 second and 40 seconds. To increase time turn motion inhibit control clockwise.

Refit top cover ensuring that the 'O' ring seal is in good condition, correctly fitted and retaining grub screw is tight.

**Final checks**

See Section 4.

**7.8 Commissioning Instructions for AQ Range Battery Pack Failsafe Actuators**

Install and commission actuator as normal and per Instruction Book.

After site installation and commissioning has been completed:

- 1 Switch off AC supply.
- 2 Remove cover.
- 3 Set switches 1, 2, 5 and 8 on main PCB to desired mode.

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

Actuators are set for fail closed as standard.

On loss of power	SW1	SW2	SW5	SW8
Failsafe Close	ON	ON	ON	ON
Failsafe Open	ON	ON	OFF	ON
Stay Put with Local or Remote Control	ON	ON	ON	OFF

**4** Remove cover of battery pack. Plug floating connector into PCB socket. Replace cover ensuring vent is pointing down. Remove plastic plug from vent pipe.

**5** Switch on AC supply. Actuator will now function as normal on AC and fail as selected on loss of AC supply.

**WARNING:** A powerful battery is now providing DC potential to terminals 24 and 22. Care should be taken not to short out these terminals.

Rotork AQ Range actuators are dispatched with gearboxes filled with oil to DEXRON II specification plus the addition of 20% paraffin, suitable for ambient temperatures ranging from -22°F (-30°C) to 160°F (70°C).

If oil is replaced, DEXRON II should be used, however the addition of 20% paraffin is not required unless ambient temperatures below -4°F (-20°C) are likely to be encountered.

**Oil Capacities**

AQ100/300  
1.5 pints/855cc.

AQ800  
2.5 pints/1425cc

## Appendix 1

### Folomatic PCB DIL switch settings voltage or current ranges

Gama	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
0-5mA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0-10mA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
0-20mA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
4-20mA	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
0-50mA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
0-5V	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0-10V	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0-20V	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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 P.C.B.

Switches

3 and 4 "ON" = Fail to the close position

3 and 4 "OFF" = Fail to the open position

One switch "ON" and one switch "OFF" will give "Stay Put"



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