



The Rotork IQ range



a new generation of intelligent, non-intrusive 3-phase electric valve actuators

Rotork Actuation

World leaders in valve control

In the 40 years since the company was founded, Rotork Actuation has become a byword for excellence in the field of valve, sluice gate and damper actuation products for the oil, gas, power, water and waste treatment industries - worldwide.

We owe our success to an uncompromising focus on quality at every stage - and at every level - of Rotork's operations.

From initial site survey, specification and design, through to materials, manufacturing and testing processes, installation, commissioning and after-sales service we accept nothing but the best.

At the heart of the company is an exceptional workforce - the highly trained, forward-thinking engineers, technicians and support staff who each have a crucial role to play in maintaining Rotork's unrivalled reputation for innovation, reliability and first class customer support.

Rotork. Established leaders in actuation technology.

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Rotork Controls Ltd, Bath, UK



Rotork Controls Inc, Rochester, USA

Rotork's IQ intelligent valve actuator- the best just got better



Rotork's tried and tested range of IQ intelligent electric valve actuators is now further enhanced - retaining legendary features such as Rotork's unique double sealing system and 'non-intrusive' infra-red commissioning capability while delivering significantly increased functionality and reliability using fewer electronic components.

Rotork's latest IQ is the result of ongoing commitment to research and development at the leading edge of new technology, offering end users ever higher standards of build quality, performance and overall value.

The Rotork IQ standard specification delivers such wide ranging control and indication flexibility that complex and expensive customisation is frequently unnecessary. This approach allows for streamlined production processes which in turn ensure consistently high standards of product quality.

The IQ continues to offer all the key benefits which have made it a world leader including:

Fit for Life

Whatever the environment, whatever the duty IQ has become a byword for reliability. Design simplicity, double sealing with a watertight enclosure coupled with infra-red set-up and comprehensive protection systems have come together to make IQ the world leader in reliable valve operation. Gain peace of mind and minimise maintenance costs with fit and forget IQ technology.

Simple commissioning

Simple, safe and rapid non-intrusive commissioning with infra-red control. Actuator settings such as torque levels, position limits, control and indication functions can be accessed and adjusted using the "point and shoot" IQ Setting Tool. The supplied, intrinsically safe (IS) tool is unique to Rotork and allows non-intrusive actuator set-up whatever the environment, power on or power off.

Simple troubleshooting

Active valve, control and actuator alarm icons are provided on the easy to read illuminated display.



Access comprehensive, real-time, diagnostic help screens with the IQ Setting Tool for a full picture of local and remote control status, actuator configuration and torque against position profiles. The on-board data logger records operational, alarm and valve torque profile data providing valuable information of plant operating performance and conditions.

IQ now offers a range of powerful features unparalleled in valve actuation including:

- Direct current and single phase actuators
- On-board data logger included as standard
- IrDA compatible for local and remote actuator analysis via cell phone or PC
- Clearer and more user friendly controls and indication
- Simplified torque and position control for increased reliability
- Rationalised electronics - "system on a chip" technology
- Increased corrosion protection
- Increased control and indication flexibility
- Additional protection systems



IQ - simply unmatched for reliability



Protection - the key

Vast experience in the application of electric actuators has enabled Rotork to lead the world in actuator ingress protection. Situated in environments ranging from desert to tundra, offshore to underground, where flooding, humidity, extremes of heat and cold, ultra violet and corrosive atmospheres are normal, actuators have to perform unfailingly. Rotork understand that the most important factor in the reliability of an actuator is protection from the environment - in simple terms, the enclosure.

Double sealed for double protection

The IQ enclosure is rated IP68 - 3 metres for 48hours, NEMA 4/4X/6. It is completely watertight and dust-tight and does not "breathe". The Rotork Double Seal system ensures protection of internal components since they are separated from the cable gland and terminal compartment by a watertight terminal block. Protection is maintained during site hook-up when terminal covers are removed and is independent of cable gland sealing.

Non-intrusive - sealed for life

IQ covers need not be removed for site commissioning. All settings and adjustments are made using the supplied infra-red Setting Tool. After assembly in the controlled environment of our manufacturing

facilities, air exchanges are eliminated - all internal components are completely protected for life. Non-intrusive control selectors mean there are no moving shafts penetrating the control enclosure.

Reliability through simplicity

The IQ combines simplicity of design while extending specification and performance.

Torque measurement

An actuators ability to reliably and accurately determine the force applied in operating a valve is fundamental in providing valve and actuator protection. IQ utilises a patented output torque measurement system developed from familiar process measurement techniques such as pressure transducers. Tried and tested in industry, this technology has been adapted for valve actuation. Under load, the motor wormshaft thrust reaction is converted into an electrical signal directly proportional to output torque using a piezo resistive sensor embedded within torque transducer. Accurate, repeatable torque measurement is gained independent of variations in frequency, voltage and temperature.

Position measurement

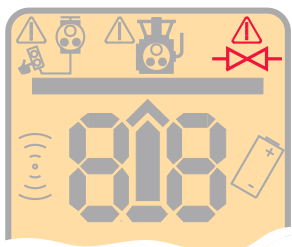
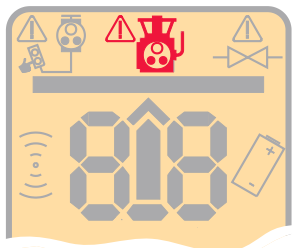
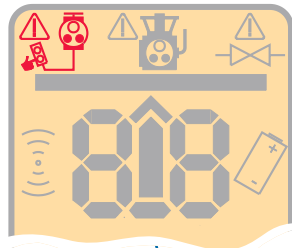
Reliable process control depends on accurate positioning of the valve at end of travel and for fluid control, mid travel. The patented IQ non-contacting position measuring system is the most simple yet devised for actuator control. With only one moving part, the resolver converts output centre column rotation into an electronic signal which is then compared to position limits stored within a safe, non volatile memory

Reduced components

Streamlining both mechanical and electrical systems has increased reliability. Improvements to the IQ base, handwheel mechanism and control chassis have all increased reliability of the actuator. The latest "system on a chip" technology has been applied to the IQ control module. Component numbers have been significantly reduced which in turn reduces interconnection, wiring and printed circuit board complexity. Enhanced features have been incorporated such as data logging, extra control and indication functionality and better protection systems leading to increased reliability and specification.

Safety integrity

From the outset the IQ was developed with a view to increasing the safety integrity status of valve actuation. Once again through design and innovation Rotork can provide the solutions, enabling process engineers to select actuators with defined safety integrity level evaluation. With international standards such as IEC 61508, ISA-S84.01 and DIN 19 250 becoming a requirement for assessing safety integrity of process systems, Rotork will be pleased to discuss your requirements.



Actuator display

The IQ incorporates a unique liquid crystal display developed specifically for actuator indication. Large segments allow easy, distance viewing of valve position, torque and diagnostic screens. A unique, diffused LED backlighting system provides high visibility in all light conditions. The LCD display is supplemented with position indication lights, green, yellow and red.

Indication back up

Rotork recognise the need for local and remote position indication at all times, even when the actuator is powered down. The IQ incorporates a battery to maintain and update position indication when the main power is switched off. The battery also supports power off data logging and commissioning.

Set-up

Infra-red set up, adjustment and review using the supplied, intrinsically safe IQ Setting Tool allows users access to the configuration of the actuator using the convenient actuator liquid crystal display.

On screen diagnostic icons

Four dedicated alarm icons are incorporated into the LCD display giving clear indication of valve, control system and actuator alarms.

Help screens

Nine help screens can be accessed with the IQ setting tool allowing real time, grouped analysis of control signal status, valve and actuator status and indication status.

Valve torque indication

Real time viewing of valve torque against valve position can be accessed with the Setting Tool via the IQ LCD. Analysis of valve operating conditions is therefore available as standard.

Conditional control

For applications where a high level of safety integrity is required the IQ can be configured for conditional control. In this mode, operation is conditional on two discrete signals being applied.

Looking at an example of a close valve command, by applying a signal to the remote close input and close interlock input simultaneously the actuator will operate and close the valve. If only one signal is applied, or a signal is lost, the actuator will failsafe by staying put or stopping. When conditional remote control is configured, the interlock inputs are not required for local operation.

Data logging

Every IQ includes an on board data logger. The data logger captures and stores valve, actuator and control signal operation and status data:

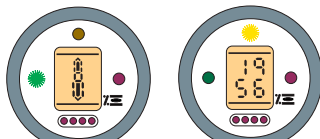
- Valve torque profile, open/closed instantaneous and average torque against valve position
- Number of operations
- Valve and actuator position status log
- Operation signal log
- Actuator control status log
- Statistics

Log data is time and date stamped and can be analysed by playing back in "real time" or on an event by event basis.

The data logger is accessed via the IrDA™ interface to compatible devices see below. Data logger data can be analysed with IQ-Insight PC based software, described in detail on page 8.

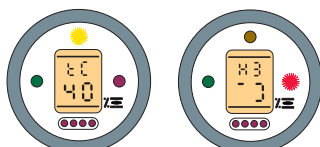
IrDA™ communication

Following on from the successful introduction of the IQ infra-red system, IQ now also supports IrDA™ compatible communication. IQ configuration and data logger files can be accessed from a local base or the Rotork Lifetime Care Facility allowing Rotork support to be on-hand wherever you are in the world. Data exchanges are via IrDA™ compatible mobile telephones, PC or when the actuator is located in a hazardous area, the Rotork intrinsically safe Communicator. IQ-Insight PC software provides the interface with the actuator and its on-board data logger.



Valve closed

Torque and position display



Close torque set to 40%

Diagnostics display

Full security, full protection

Syncrophase prevents valve damage through incorrect wiring

Rotork's unique 'Syncrophase' automatic phase rotation correction prevents valve damage through incorrect wiring by ensuring that the IQ three-phase motor is always presented with the correct phase rotation of the power supply.

Single phasing protection

Also developed to control motor overheating, IQ electronics constantly monitor all three phases of the power supply. Should one or more phases be lost the control circuit is prevented from energising the contactors. Local and remote alarm signals of incomplete supply are offered as standard features.

Motor protection when valve jams

Should a valve jam, the IQ motor is prevented from overheating by a logic circuit which trips the contactor when there is no movement within seven seconds of a start signal.

Thermostatic protection

Two thermostats embedded in the motor windings directly sense motor temperature, tripping the actuator control circuit in the event of motor windings overheating.



Instant reversal protection

An automatic time-delay circuit avoids the shock loads which may cause unnecessary wear to valve stems and gearboxes when an actuator is ordered to reverse direction 'instantaneously'. The circuit also limits current surges through the contactor.

Auto self test and diagnosis (ASTD)

Each time the actuator is powered up, its vital operational circuits automatically self test to ensure correct operation. In the unlikely event that a fault is diagnosed the information is automatically presented using the display icons. At the same time, actuator operation can be inhibited to enable site investigation.

Customised features



Even though Rotork's standard IQ actuator offers wide ranging control and indication flexibility, a variety of customised features can be specified to reflect individual customer requirements.

Gearboxes for multi-turn and part-turn valves

Large or slow moving gate and globe valves can be motorised through thrust taking bevel or spur gear operators on which the electric actuator is mounted. IQ actuators can also be fitted with part-turn worm and wheel gearboxes to provide increased torque at reduced speeds for the operation of part-turn valves. A sizing program for both part-turn and multi-turn applications is available on CD ROM.

Fireproofing and extreme cold

Fully operational at temperatures of up to +70°C, a standard IQ actuator can be made operable for up to thirty minutes in a fire (when temperatures may quickly climb to over 1000°C) through the use of boxes, blankets or intumescent coating, as specified by the customer. Modifications can also be implemented to allow cold temperature operation as low as -50°C.

For further details see publication S310E.

Floor mounting for easy remote coupling

Floor stands with upward or downward stubshafts are available for coupling, via customer shafts and universal joints, to remote valves.

Linear output drive assemblies

For applications requiring an actuator with a linear output, a leadscrew arrangement can be fitted to the base of the standard IQ actuator.

Damper actuators

Single blade and multi vane dampers can be motorised either by direct connection to the damper spindle or by lever arm.

Valve stem expansion

The stems of positive seating valves, such as solid or flexible wedge gates may be subject to significant expansion when used in high service temperature applications resulting in damaged or leaking valves. The effects of this expansion or contraction may be overcome by fitting the Rotork temperature compensator to the output of the IQ actuator.

For further details see publication E152E.



Intelligent communication - lifetime support



Lifetime support

Rotork understands our customers need for back up. The costs and penalties of plant downtime, delayed commissioning schedules and inappropriate maintenance are too high to allow for inefficient support. With IQ - IrDA™ (Infra-red Data Association) communication, Rotork can now offer unrivalled support wherever you are in the world. Over the IrDA™/cell phone link, Rotork's Customer Lifetime Care Facility can access the actuator to provide complete product back up with analysis and configuration.

Remote diagnosis - IrDA™

The IQ utilises IrDA™ communication for fast, safe, non-intrusive and standardised data exchange. Actuator set-up configuration can be analysed and if required changed. As every IQ includes an on board data logger, analysis of operational data such as valve torque profiles, actuator events and statistics can be interpreted and advice given. Data logger information can be relayed to the Rotork Customer Lifetime Care Facility or a user site base via an IrDA™ compatible cell phone. After analysis, any changes to the actuator set-up configuration can

be relayed back to the actuator. Valve and actuator operational analysis can be provided with a simple telephone call.

PC tools - IQ-Insight

IQ-Insight PC software is a graphical user interface allowing all IQ set-up configuration and data logger information to be reviewed analysed and reconfigured. The visually interactive application is browser based running under Microsoft Internet Explorer 4+. All the benefits of Internet browser systems such as linking, bookmarking, "back" and "forward" controls and history make analysing the data from an IQ simple and fast. Laptop PC's with IrDA™ interface (or serial port with IrDA™ interface) running IQ-Insight can be directly "connected" to an actuator located in the field to allow set-up, adjustment and analysis. Alternatively a PC running IQ-Insight located at a site base centre can, with a modem and cell phone, communicate directly with the actuator.

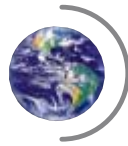


Above:
Actuator torque display
using IQ-Insight software



IQ communicator

The IQ IS Communicator allows access to the actuator configuration and Datalogger when actuators are located in hazardous areas. The Communicator allows data to be "transported" to a safe area where the data can be analysed using IQ-Insight or sent to the Rotork Customer Lifetime Care Facility. Alternatively, the data can be viewed and analysed directly on the Communicator.



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Global Warranty &
Customer Lifetime Care



Communication systems that work with you

In addition to offering full compatibility with Pakscan, Rotork's comprehensive remote supervisory control and monitoring system, IQ actuators can be specified to interface seamlessly with any other master control and communication protocols you may be using including Modbus, Profibus and Foundation fieldbus.

This is achieved simply and cost effectively through fitting an appropriate Rotork-manufactured PCB module inside the actuator's electrical housing - normally at time of production. Module commissioning and setup is by means of the IQ Setting Tool or IQ Communicator.

Pakscan - the total control solution

Whether you need remote control of just a small number of motorised valves or full automation of a plant with thousands of instruments and control elements, Pakscan can help you to achieve significant savings in terms of both time and money.

That's because Pakscan is capable of controlling and monitoring up to 240 field devices using a simple shielded, twisted pair cable loop instead of a multi conductor cable for each field device. The system can also gather important digital and analogue plant data when its master station(s) are linked to the double sealed field unit which is fully integral to each Rotork actuator.

Together with Pakscan's ability to communicate directly with a PLC or DCS system via an RS485 or RS232 link, its overall simplicity keeps customers' design work to a minimum.

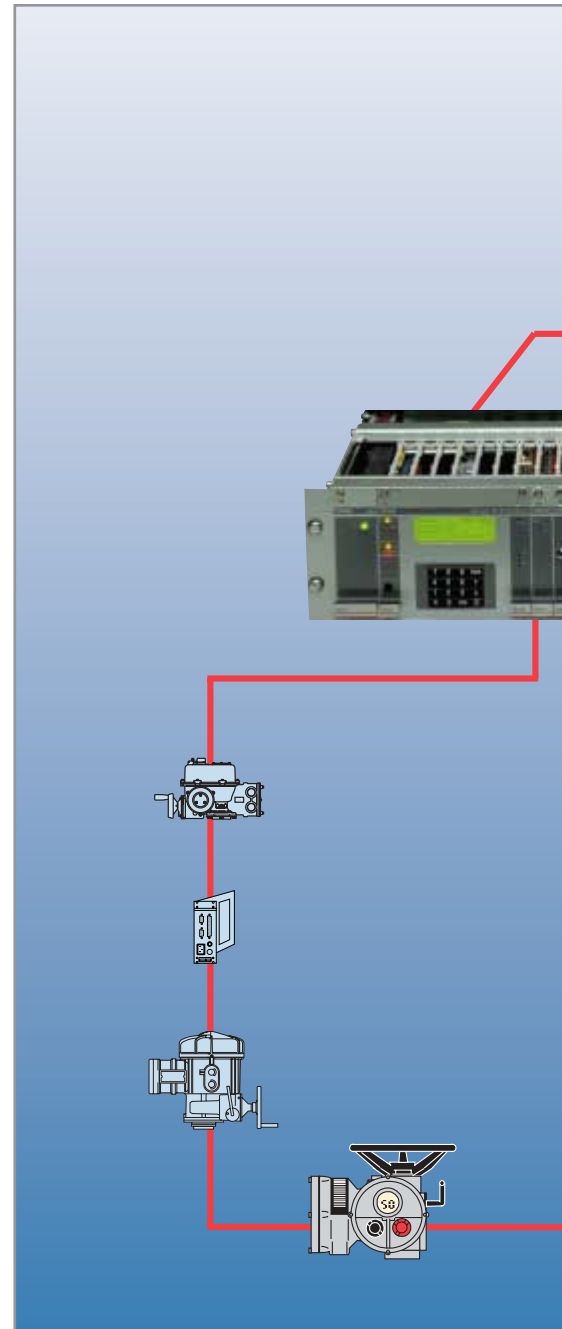
For further details see publication S000E.

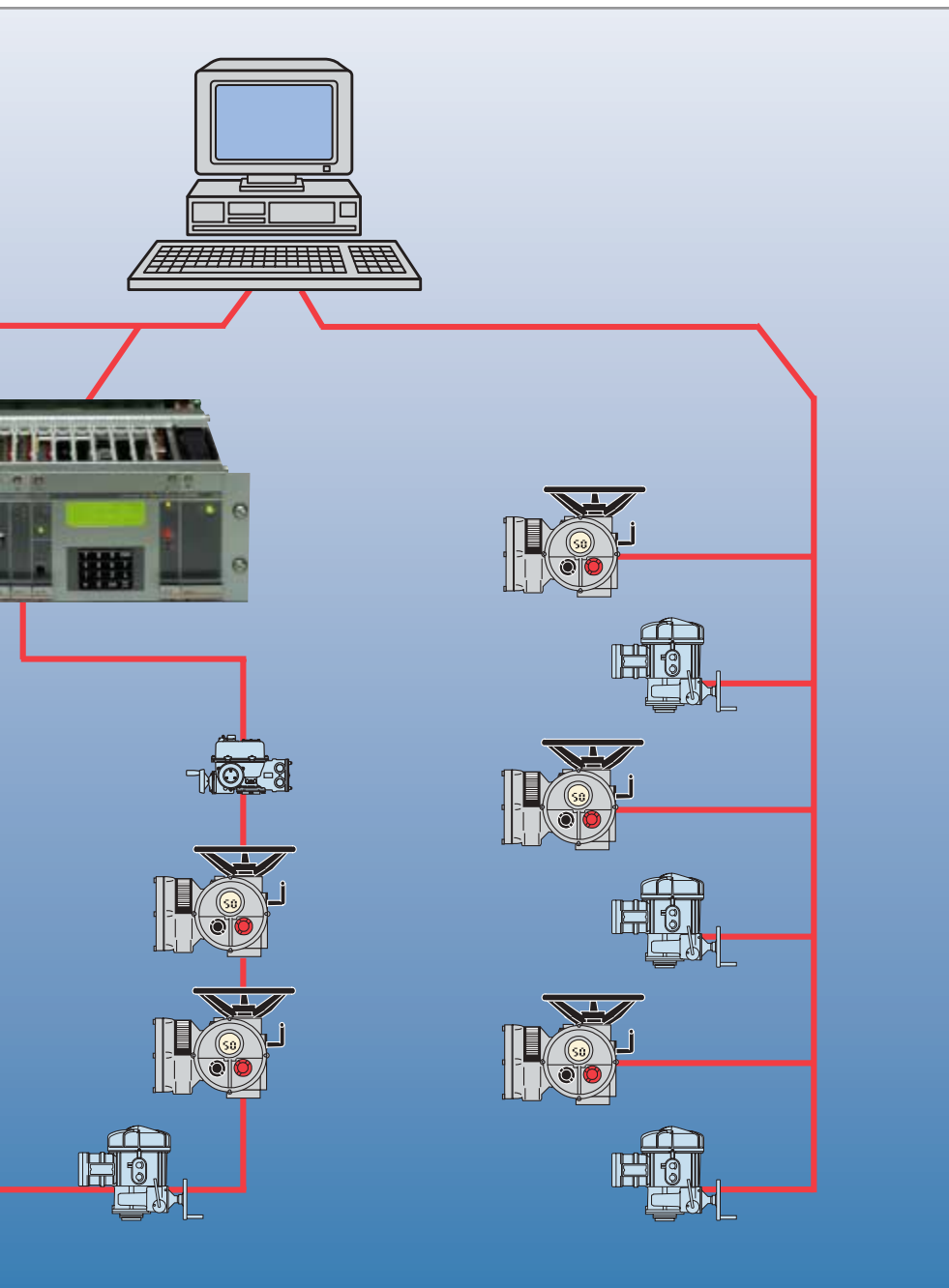
In-Vision - powerful, user-friendly

In-Vision is a SCADA (Supervisory Control And Data Acquisition) software application for full, user friendly control of complex installations such as oil storage depots and water treatment plants where there can be a high number of actuators and process signals to control and display.

Working with Pakscan and running on a standard PC, In-Vision offers a highly flexible series of graphic displays and controls that allow the plant managers to view and control all aspects of their process at a fraction of the cost of other comparable systems.

For further details see publication S210E





Pakscan IIE Master Station

Available in single or hot standby configurations the Pakscan IIE master station can control 240 field devices over a loop distance of up to 20km - without the need for signal repeaters. The Pakscan IIE is mounted in a 133mm high 19" rack and each master station comes complete with dual host communication ports (RS232 and RS485), a user interface LCD screen and operator keypad. The rack can house a single unit, two single units operating independently or a Hot Standby system. The Hot Standby version of the IIE features two identical modules and transfer between the main and standby is transparent and automatic in the event of a component failure.

For further details see publication S110E

Pakscan IIE Direct Operator Panel

The Pakscan IIE DOP provides push-button control for up to 240 valves on one system, gives clear and concise information on valve status and allows full plant operation. The system comprises a range of multi-channel modules able to control up to four actuators independently. Alternative modules permit the control of positioning actuators, and, when used in conjunction with general purpose field units, the control of pumps, mixers, compressors etc.

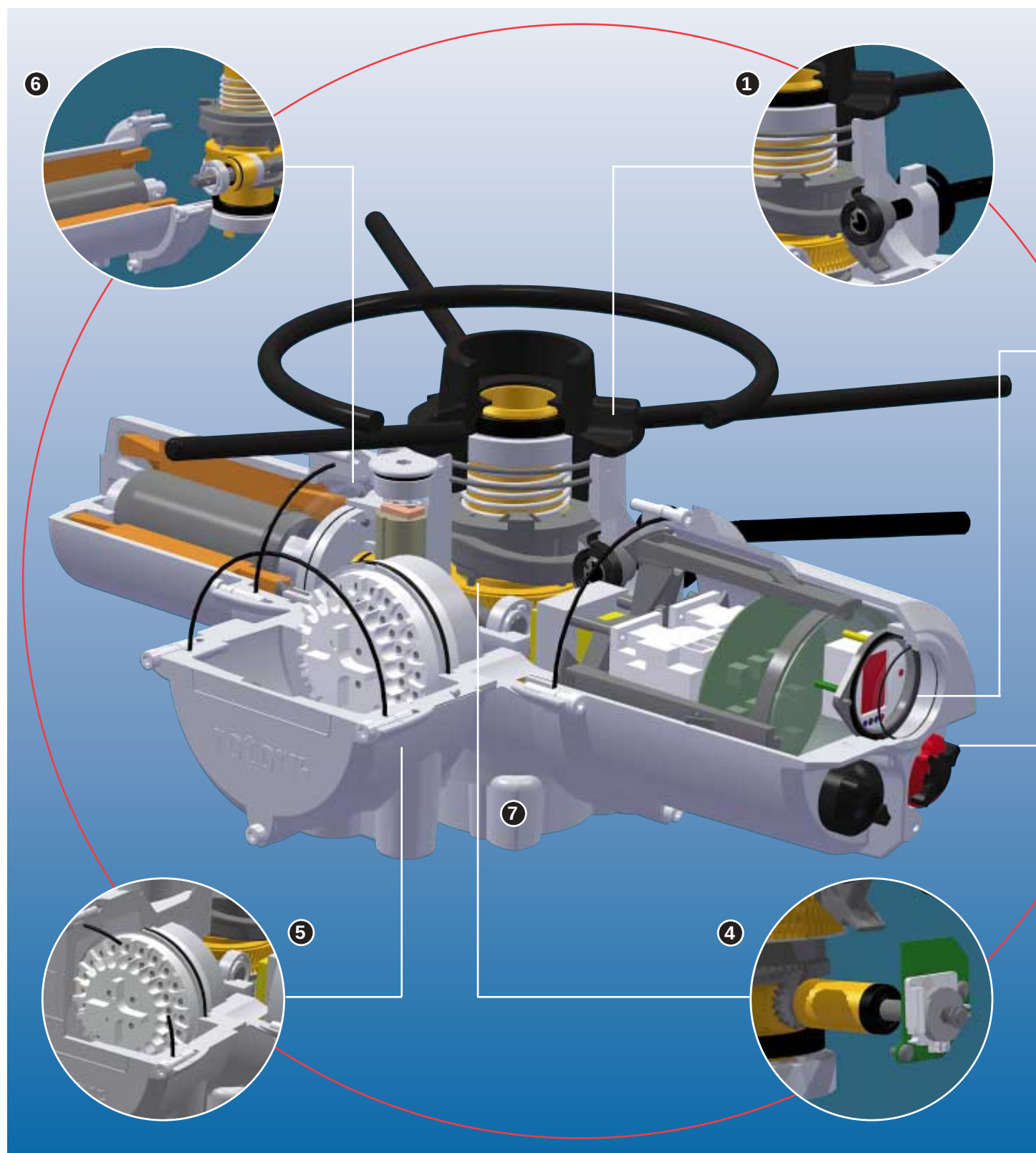
For further details see publication S111E.

Pakscan IIS Sequencer Master Station

The Pakscan IIS master station encompasses the proven features of the Pakscan 2 wire control system with the logic and programmability more commonly found in a PLC to provide a fully featured sequence and interlock control package. Easily programmed by 'fill in the box' menus the Pakscan IIS can quickly be made ready to run your plant. Located in the field close to the process, Pakscan IIS permits control and monitoring of up to 32 field units.

For further details see publication S112E.





2

3

1 Hand operation

Direct drive handwheel (or independently geared handwheel on larger sizes) to provide reliable emergency manual operation in the event of a power supply failure. With low speed padlockable* hand/auto clutch for safe operation even when the motor is running.

Note: power operation always has preference unless hand/auto lever is purposely locked into 'hand drive'. Lost motion 'hammerblow' effect is provided with both direct and independently geared handwheels.

2 Infra red settings

All actuator settings and diagnostics are made through the sealed indication window. It is not necessary to remove electrical covers exposing the integral controls on site.

3 Local controls

Local controls and padlockable* Local/Stop/Remote selector switch operate internal reed switches, avoiding penetrating shafts which would have to be sealed to prevent moisture ingress.

4 Position control

Hall effect magnetic pulse system accurately measures and controls the stroke of the actuator without using gears and switches.

5 Terminal compartment

Separately sealed terminal compartment ensures the integrity of the electrical equipment even when the terminal cover is removed during site wiring.

6 Motor and drive

Motor shaft and worm shaft separate to facilitate actuator speed change. Low inertia high torque motor. The motor produces peak torque rapidly after starting but with very little overrun when de-energized. The winding thermostat provides accurate temperature sensing independent of ambient temperature conditions to optimize the motor's thermal capacity. The motor drive includes a lost motion 'hammerblow' to assist in unseating tightly shut valves.

Single worm and wheel drive running in an oil bath for maximum life with ambient temperature tolerance.

7 Thrust base

Thrust base for type 'A' couplings lubricated for life and detachable, up to size IQ35, to allow actuator removal without disturbing the valve position. On sizes IQ40 and above the thrust base is an integral part of the gearcase assembly.

Easily removable drive bushing for machining to suit valve stem for convenient valve adaptation.

*Suitable for 6mm / 1/4 inch padlock

Gearboxes

Rotork produce ranges of gearboxes for use in motorising part-turn and multi-turn valve types where increased torque/thrust at reduced operating speeds or output turns are required.

With thousands of IQ + gearbox combinations available, part-turn valve types such as ball and plug and butterfly valves and multi-turn valves such as gate, sluice and penstocks can be easily motorised from standardised combinations. Please contact Rotork for a handy sizing selection program available on CD ROM.

90° output - IW Range

Worm and wheel part-turn gearboxes for 90° operating valves and dampers allowing IQ actuators to be used to their maximum potential. IQ - IW combination torque outputs up to 137,000Nm are available.

Key features:

- Totally enclosed, fully sealed and grease filled for life
- Removable output drive coupling for machining, repositionable baseplate facility
- Adjustable mechanical stops (at 0° and 90° +/- 5°)
- Comprehensive gear ratios combined with a selection of auxiliary input spur gear reducers
- Optional input flanges

Multi-turn output - IB and IS Range

Bevel (IB) and spur (IS) gear combinations for multi-turn applications where screwed or keyed stems are used to operate the valve. IQ - IB combinations are available up to 8,135Nm torque and 1,557kN thrust output. IQ - IS combinations are available up to 43,386 Nm torque and 3,342kN thrust output.

Key features:

- Totally enclosed, fully sealed and grease filled for life
- Removable output drive coupling for machining
- Comprehensive gear ratios combined with a selection of auxiliary input spur/bevel gear reducers



- Optional input flanges
- Optional twin pinion units for secondary drive (IB)
- Upward or downward drive option (IS)

Part-turn/multi-turn output - MTW Range.

Multi-turn worm and wheel gearboxes for use in conjunction with IB or IS gearbox ranges for large or slow moving multi turn valve types. The MTW range can also be used for part-turn valves (90°-360°) with the addition of an adjustable travelling nut stop.

Standard combination gearboxes are suitable for ambient temperatures in the range of -40°C to +95°C. For temperatures outside of this range please apply to Rotork.

Modulating and submersible gearbox forms are available. As standard, gearboxes are despatched painted the same colour as the actuator.



The following pages contain details on performance and specification for the Rotork IQ range of actuators. Please use the contents table below to help access the information you require.

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Actuator specification - contents

Performance summary

1 Performance data

		Actuator output speeds						
rpm at 50 Hz	18	24	36	48	72	96	144	192
rpm at 60 Hz	21	29	43	57	86	115	173	230
Actuator size	Torque**	Nm	Ft lbf					
IQ10	34	34	34	34	34	34		
	25	25	25	25	25	25		
IQ12	81	81	81	68	48	41		
	60	60	60	50	35	30		
IQ18	108	108						
	80	80						
IQ20	203	203	203	203	176	142	102*	
	150	150	150	150	130	105	75*	
IQ25	400	400	298	244	244	230	149*	
	295	295	220	180	180	170	110*	
IQ35	610	610	542	474	474	366	257*	
	450	450	400	350	350	270	190*	
IQ40	1020	1020	845	680	680	542	406*	
	750	750	625	500	500	400	300*	
IQ70	1490	1490	1290	1020	1020	745	645*	542*
	1100	1100	950	750	750	550	475*	400*
IQ90	2030	2030	1700	1355	1355	1020	865*	730*
	1500	1500	1250	1000	1000	750	640*	540*
IQ91							1355*	1355*
							1000*	1000*
IQ95		3000						
		2200						

* Due to the effects of inertia and drive nut wear, speeds not recommended for direct mounted gate valve applications.

** Torque rating is maximum torque setting in both directions.
 Stall torque will be 1.4 to 2.0 times this value depending on speed and voltage.
 If maximum torque is required for more than 20% of valve travel, refer to Rotork.

Performance summary



Mechanical data

Actuator size s		IQ10 IQ12 IQ18	IQ20 IQ25	IQ35	IQ40	IQ70	IQ90	IQ91	IQ95
Flange size	ISO 5210	F10	F14	F16	F25	F25	F30*	F25	F30
	MSS SP - 102	FA10	FA14	FA16	FA25	FA25	FA30*	FA25	FA30
Approximate weight**	kg	27	46	69	190	190	200	200	200
	lbs	60	101	152	418	418	440	440	440

Group 'A' couplings (thrust)

Thrust rating	kN	44	100	150	220	220	334	N/A	445
	lbf	10,000	22,480	33,750	50,000	50,000	75,000	N/A	100,000

Stem acceptance diameter

Type 'A' (maximum)

Rising	mm	32	38	54	64	70	70	N/A	N/A
	ins	1 ¹ / ₄	1 ¹ / ₂	2 ¹ / ₈	2 ¹ / ₂	2 ³ / ₄	2 ³ / ₄	N/A	N/A

Non-rising

mm	26	32	45	51	57	57	N/A	N/A
ins	1	1 ¹ / ₄	1 ³ / ₄	2	2 ¹ / ₄	2 ¹ / ₄	N/A	N/A

Type 'Z' (maximum)

Rising	mm		51	67	73	83	83	N/A	83
	ins		2	2 ⁵ / ₈	2 ⁷ / ₈	3 ¹ / ₄	3 ¹ / ₄	N/A	3 ¹ / ₄

Non-rising

mm		38	51	57	73	73	N/A	73
ins		1 ¹ / ₂	2	2 ¹ / ₄	2 ⁷ / ₈	2 ⁷ / ₈	N/A	2 ⁷ / ₈

Z3

mm		51	67	N/A	N/A	N/A	N/A	N/A
ins		2	2 ⁵ / ₈	N/A	N/A	N/A	N/A	N/A

Group 'B' couplings (non-thrust)

Bore diameter

Type 'B1' (fixed bore)	mm	42	60	80	100	100	120	100	N/A
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Type 'B3' (fixed bore)

mm	20†	30†	40†	50	50	50	50	N/A
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Type 'B4' (maximum)

mm	20†	30†	44†	50	60	60	60	N/A
ins	³ / ₄	1 ¹ / ₄	1 ³ / ₄	2	2 ¹ / ₄	2 ¹ / ₄	2 ¹ / ₄	N/A

Handwheel ratio	Standard	Direct	Direct	Direct	15:1	15:1	15:1	15:1	15:1
	Optional	12:1	13.5:1	22.5:1	30:1	30:1	45:1	30:1	45:1

* IQ90 with B3 and B4 couplings have flange size F25.

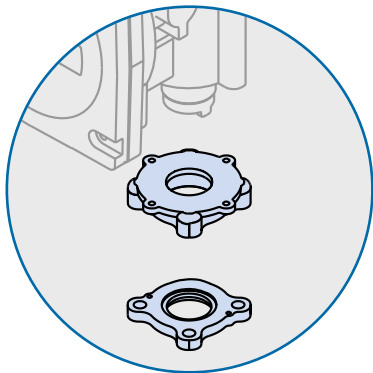
** Weight will be dependent on optional equipment fitted.

† For actuator sizes IQ10 to IQ35 when required to drive shafts or stems having any axial movement, a type 'A' coupling must be used.

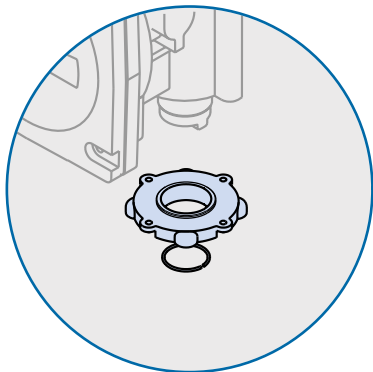
Actuator drive couplings

2 Actuator drive couplings

The IQ range features two actuator base designs - a removable base for the IQ10, 12, 18, 20, 25 and 35 sizes and an integral base for IQ40, 70, 90, 91 and 95. Both arrangements are available with flanges and couplings which comply with either ISO 5210 or MSS SP-102.



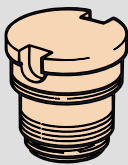
Removable thrust base



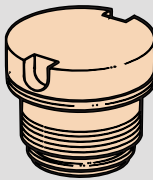
Removable non-thrust base

Actuators IQ10 IQ12 IQ18 IQ20 IQ25 IQ35

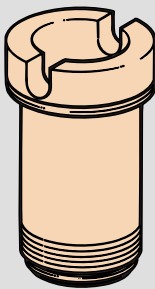
Thrust



Type A
for sizes IQ10 to 35



Type Z
for sizes IQ20 to 35
increased stem
acceptance

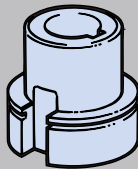


Type Z3
for sizes IQ10 to 35
increased stem
acceptance
and reach

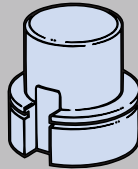
Non-Thrust



Type B1
for sizes IQ10 to 35
large fixed bore
with ISO standard
bore and keyway



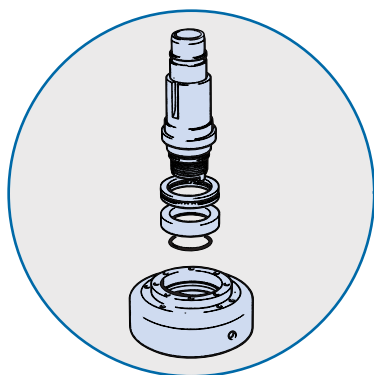
Type B3
for sizes IQ10 to 35
fixed bore with
ISO standard bore
and keyway



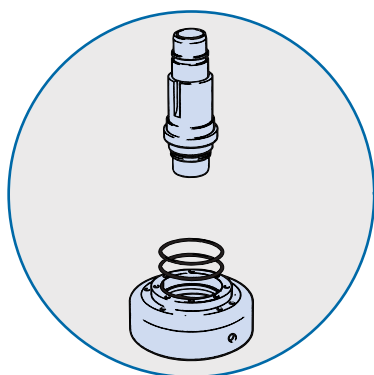
Type B4
for sizes IQ10 to 35
blank drive bush
for machining
by customer

Thrust bearings

Both type 'A' and 'Z' couplings feature an associated thrust bearing. In the case of the removable thrust base this is fully sealed and lubricated for life; in the integral base design this is lubricated by the actuator gearcase oil bath. Both integral and removable thrust bases are designed to retain all developed thrust reaction forces without any load appearing on the actuator gearcase.



Standard centre column
with thrust bearing

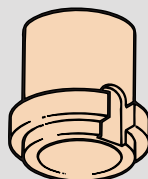


Non-thrust centre column

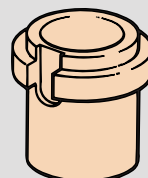
Actuators IQ40 IQ70 IQ90 IQ91 IQ95

T h r u s t

Position 1

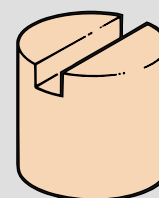


Position 2



Type A

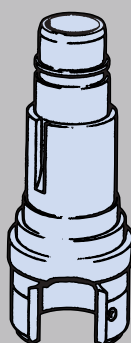
for sizes IQ40, 70
and 90



Type Z3

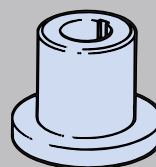
for sizes IQ40, 70, 90
and 95 increased
stem acceptance
and reach

N o n - T h r u s t



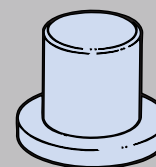
Type B1

for sizes IQ40, 70
and 90 large fixed
bore with ISO
standard bore
and keyway



Type B3

for sizes IQ40, 70,
90 and 91 fixed
bore with ISO
standard bore
and keyway



Type B4

for sizes IQ40, 70,
90 and 91
blank drive bush
for machining
by customer

Standard specification

3 Introduction

IQ actuators are self contained units for local and remote electrical operation of valves. Comprising an electric motor, reduction gearing, reversing starter with local controls, turns and torque limitation with electronic logic controls and monitoring facilities, all housed in a double-sealed watertight enclosure to IP68 3 metres-48 hours, NEMA 4, 4X and 6.

All torque and turns settings and configuration of the indication contacts are effected using the non-intrusive, hand held infra-red, IQ Setting Tool, which is included with each order.

The following specification covers standard features and available optional features. Options selected must be specified with enquiry.



4 Mechanical

4.1 Enclosure and ambient temperatures

All IQ actuator hazardous and non-hazardous area enclosures are built to a watertight standard. Through the use of non-intrusive commissioning and site adjustment using the supplied infra-red IQ Setting Tool, the hermetic, factory-sealed enclosure protects internal components for life as covers never need removing. The terminal compartment is sealed from other areas by the Rotork double seal, maintaining watertight integrity even during site connection.

Actuators are available with the following enclosure types for which the ambient working temperature ranges are stated. Where option temperatures are indicated, changes to some actuator components are required and therefore the temperature requirement must be specified. Hazardous area approvals for other country standards are available, please apply to Rotork.

The IQ is built in accordance with the following standards:

WT: Standard watertight, IEC 60529 (1989-11), IP68 3 metres/48 hours, NEMA 4, 4X and 6. Temperature -30°C to +70°C (-22°F to +158°F).
*Option -40°C to +70°C (-40°F to +158°F).

CENELEC EExd IIB: CENELEC Norm EN50014 and EN50018 for EExd IIBT4. Temperature -20°C to +70°C (-4°F to +158°F).
*Option -30°C to +70°C (-22°F to +158°F).
*Option -40°C to +70°C (-40°F to +158°F).

CENELEC EExd IIC: CENELEC Norm EN50014 and EN50018 for EExd IICT4. Temperature -20°C to +70°C (-4°F to +158°F).

CENELEC EExde IIB:

CENELEC Norm EN50014 and EN50019 for EExde IIBT4.

Temperature -20°C to +70°C (-4°F to +158°F).

*Option -30°C to +70°C (-22°F to +158°F).

*Option -40°C to +70°C (-40°F to +158°F).

CENELEC EExde IIC:

CENELEC Norm EN50014 and EN50019 for EExde IIC T4.

Temperature -20°C to +70°C (-4°F to +158°F).

FM: Factory Mutual - Explosionproof Class 1, Div 1, Groups C, D, E, F, G hazardous areas to NEC Article 500.

Temperature -30°C to +60°C (-22°F to +140°F).

*Option -40°C to +60°C (-40°F to +140°F).

* Alternative for Group B hazardous area. Temperatures as for Groups C & D.

CSA WT: Canadian Standard

Association - Watertight

Wiring and components complying with CSA Enclosure 4 and 4X.

Temperature -30°C to +70°C (-22°F to +158°F).

*Option -40°C to +70°C (-40°F to +158°F).

CSA EP: Canadian Standard

Association - Explosionproof

Class 1, Division 1, Groups C & D hazardous areas.

Temperature -30°C to +40°C (-22°F to +104°F).

*Option -40°C to +40°C (-40°F to +104°F).

4.2 Valve/actuator interface

The range of IQ actuators is available with mounting base and output drive couplings conforming to international standard ISO 5210 or USA standard MSS SP-102 (see Publications E140-1E through E147E for dimensions). Applications for which the various types of couplings have been designed are outlined as follows and the appropriate data concerning stem acceptance diameters are given in the table on page 17.

4.3 Handwheel

Handwheels are provided to allow manual operation of the valve during electrical power interruption.

IQ10 - IQ40 Direct acting top mounted handwheel. Option: side mounted geared handwheels.

IQ70 - IQ95 Side mounted geared handwheel. Option: alternative gear ratios.

During electric operation of the actuator the handwheel is mechanically disengaged from the drive. To engage handwheel operation, the hand/auto selection lever is depressed and released after which handwheel operation remains selected. When electrical operation takes place, the actuator will automatically return to motor drive without lever or handwheel kick-back. The hand /auto selection lever incorporates a facility for locking in the hand or auto positions using a 6mm diameter hasp padlock (not supplied by Rotork), preventing engagement of motor drive (locked in hand) or engagement of handwheel drive (locked in auto). Emergency disengagement of motor drive can be selected by depressing and holding the lever during electric operation.

4.4 Lubrication

IQ actuators are factory filled for life with premium quality gear oil, specified as SAE80/90 EP grade, available world-wide from lubricant suppliers. Oil lubrication out-performs grease over the IQ standard temperature range -30°C to +70°C, with none of the problems associated with grease such as separation and tunneling. Rotork have used this same grade of lubricating oil for 40 years.

Lubrication options

Food grade lubricant:

IQ actuators may be supplied with the gearcase filled with Hydra Lube GB Heavy food grade lubricant. This lubricant is a synthetic non-aromatic hydrocarbon mixture with PTFE and other additives. It does not contain chlorinated solvents. Grease used in assembly and thrust bearings is Hydra

Lube WIG Medium-NLGI-123.

Extreme temperature service:

Where actuator service requires operation outside of the standard -30°C to +70°C alternative lubricants are available, please apply to Rotork.

4.5 Finish

Actuators up to size IQ30 are finished in polyester powder coating, colour silver grey. Actuators size IQ40 and above are finished in air-dried urethane reinforced synthetic alkyd resin colour, silver grey. For full specification of paint finish see publication E151E.

Finish options

Colour: Other colours may be specified, please apply to Rotork

Offshore: 2 pack epoxy coatings are available for extreme environmental conditions, please apply to Rotork.



Standard specification

5 Electrical

5.1 Power supplies

IQ Actuators are suitable for operation with the following standard three phase, three wire nominal power supplies:

50Hz -

220, 240, 380, 400, 415, 440, 460, 500, 525, 550, 660 and 690 volts

60Hz -

208, 220, 230, 240, 380, 440, 460, 480, 575, and 600 volts

The required nominal operating voltage must be specified at time of order.

Actuator performance is guaranteed with a voltage tolerance $\pm 10\%$ and frequency tolerance $\pm 5\text{Hz}$. Actuators are capable of starting and running up to speed with a maximum 15% volt drop.

Uninterruptable power supplies

Standard actuators can be operated on UPS systems providing the above-specified tolerances are not exceeded and waveforms, harmonics, spikes etc. adhere to recognised supply standards such as EN50160. For more information refer to publication E130E.

Power supply options

IQ single phase:

Available for standard nominal 50Hz voltage: 110, 220, 240 $\pm 10\%$ and 60Hz voltage 110, 220, 230 $\pm 10\%$. Refer to publication E130E for motor performance data.

Non-standard voltages:

Actuators can be supplied to operate on power supply voltages other than those quoted above. Please apply to Rotork.

Non standard tolerances:

Where voltage and/or frequency variations may be experienced outside those quoted above, or where operation under large volt drop conditions may be required please apply to Rotork.

5.2 Control

Local control

Non-intrusive selectors are provided on the actuator electrical control cover, one for Local/Stop/Remote selection, pad-lockable in each position, and the other for Open/Close control. Controls may be rotated to suit actuator orientation.

Local control may be selected to operate using the supplied IQ Setting Tool. The Setting Tool incorporates dedicated open, stop and close buttons and will operate over a nominal distance of 0.75 metres from the display window.

Local control option

Vandal Resistant:

Selectors removed, indication window with removable cover, control of local, stop and remote selection and local open and closed control is via the supplied IQ setting tool.

Remote control

There are six control inputs for remote control:

Open, closed, stop/maintain.

Emergency shut down (ESD).

Open interlock and closed interlock.

Control can be connected for maintained or push to run, (inching) control. ESD signals must be derived from a stayput contact. For more information refer to publication E120E.

Control inputs are opto-isolated interfaces with a surge immunity of 2kV. Control is positive switching negative earth, internally fed from the actuator 24V DC customer supply or from external supplies within the ranges 20-60V AC or DC or 60-120V AC.

ESD can be configured off, active high or active low, to close or open the valve, with or without automatic motor thermostat bypass*. ESD will override any local or remote signals that may be active. If required ESD can be configured to override local stop, interlocks or the optional interrupter timer. The ESD input operates from a separate common allowing isolation between the ESD control system and operational control systems.

*Bypassing the motor thermostat will invalidate hazardous area certification.



Remote control can be configured so that the open signal and open interlock (or closed signal and closed interlock) can be combined to form a remote open (or closed) signal that can detect single faults. When configured, interlocks will not be active during local control.

For more information refer to publication E120E.

Remote control options

Negative switching:

For remote control systems where the negative pole of the remote control circuit supply is switched.

External control circuit supplies:

For control with supplies in the range 60 - 125V DC and 230V AC an alternative control circuit option is available.

Analogue Proportional Control:

The Rotork Folomatic proportional controller enables the actuator to automatically position a valve in proportion to an analogue current, voltage or potentiometric signal. Signal ranges: 0-5, 0-10, 0-20 or 4-20mA. 0-5, 0-10 or 0-20V.

Positioning can take place over the whole valve stroke or if required, a set portion of stroke. By incorporating a remote manual/remote auto control selector in the control scheme, proportional control can be overridden allowing standard remote control operation to take place when manual intervention is required (see above). The Folomatic can be configured to failsafe stayput, open or closed on loss of analogue signal.

Hydraulic shock/surge protection:

Where the operating time of the valve must be increased to prevent hydraulic shock or water hammer, or to prevent surges, the Rotork Interrupter Timer option can be included. Pulsed operation with independently adjustable on and off time periods in the range 1-99 seconds can be selected to operate over any portion of the closing or opening valve stroke, effectively



reducing valve speed. On/Off time period range may be extended when configuration is carried out with the IQ-Insight PC tool. The interrupter timer is active for both local and remote control.

5.3 Indication, monitoring and data logging

Local

A back-lit liquid crystal display gives digital indication from fully open to fully closed in 1% increments. Three LED's coloured red, green and yellow for indication of open, close and intermediate positions respectively are also provided. The display includes four icons for rapid diagnosis of valve alarm, actuator alarm, control system alarm and actuator battery status.

With the supplied IQ Setting Tool, actuator torque plus position can be displayed allowing the valve torque against position to be monitored in real time. Help screen diagnosis is available for monitoring valve, actuator and control system status. The local display can be rotated to suit actuator orientation. LED colours can be reversed. Please specify with order.

Remote

Four latching volt free contacts, S1, S2, S3 and S4 are provided each independently configurable using the supplied IQ Setting Tool to signal one of the following:

Valve Position:

fully open, fully closed or intermediate positions (0-99% open).

Status:

Valve opening, closing, moving (continuous or pulsing signal), local stop selected, local selected, remote selected, open or close interlock active, ESD active.

Valve Alarms:

Motor tripped on torque in mid travel, motor tripped on torque going open, going closed, pre-set torque exceeded, valve jammed, actuator being operated by handwheel.

Actuator alarms:

Lost phase, customer 24V DC (120V AC) supply lost, battery low, internal failure detected, thermostat tripped.

Each contact can be configured to either 'normally open' or 'normally closed' and rated at 5mA to 5A, 120V AC, 30V DC.

Standard specification

Monitor relay

An independent relay with a volt-free changeover contact for monitoring actuator electrical availability. Contact rating 5mA to 5A, 120V AC, 30V DC. The relay can be configured to de-energise under any one, or combination, of the following conditions:

Loss of one or more of the power supply phases.

Loss of control circuit supply.

Local control selected.

Local stop selected.

Motor thermostat tripped.

Data logger

The on board data logger allows infra-red, IrDA (Infra-Red Data Association) standard, download of historical actuator/valve performance data to PC or via an IrDA compatible mobile telephone to a local base or the Rotork Lifetime Care Facility. For hazardous areas the intrinsically safe Rotork Communicator tool is available. Rotork IQ-Insight PC software allows data logger information of operational events and statistics all time and date stamped plus valve torque/position profiles, both last operation and historical trends, all to be analyzed.

For more information please refer to publication E111E.

Indication options

Remote analogue position indication: The Current Position Transmitter (CPT) provides a contact-less internally fed 4-20mA analogue signal proportional to valve position, selectable for minimum signal corresponding to fully closed or fully open position with automatic zero and span setting. An externally powered version of the CPT is also available.

Remote analogue torque indication

The Current Torque Transmitter (CTT) provides an internally fed 4-20mA analogue signal proportional to actuator output torque 0-100% rated.

Extra indication contacts

The extra indication contacts module provides an additional four change-over contacts, S5, S6, S7 and S8. Each contact is latching, volt free and rated at 5mA to 5A, 120V AC, 30V DC. The extra indication contact functions are independently configurable in the same way as the standard contacts using the supplied IQ Setting Tool. The extra indication contact functions available are shown below:

- Valve position
Fully open, fully closed or intermediate positions (0-99% open)
- Status
Valve opening, closing, moving (continuous or pulsing signal), local stop selected, local selected, remote selected, open or close interlock active, ESD active
- Valve alarms
Motor tripped on torque in mid travel, motor tripped on torque going open, going closed, pre-set torque exceeded, valve jammed, actuator being operated by handwheel
- Actuator alarms
Lost phase, customer 24V DC (120V AC) supply lost, battery low, internal failure detected, thermostat tripped

5.4 Fieldbus system control

Pakscan

An internally mounted Pakscan field unit for remote control and status indication over a fault tolerant two-wire serial link. Loop distances of up to 20 km without repeaters and host communications using Modbus protocol. System variables programmable over the infra-red data link. For more information please refer to publication S000E.

Modbus

Single or dual Modbus modules may be included in the IQ actuator to provide fieldbus communications of all the actuator control functions and feedback data. The fieldbus uses an RS485 data highway and the communications protocol used is

Modbus RTU. System variables such as unit address and data baud rate are programmable over the infra-red data link. For more information please refer to publication E121E.

Profibus

A Profibus DP interface module is available to allow the actuator to be integrated into a Profibus network. Full compatibility with EN 50170 is provided and the Profibus network allows full actuator control and feedback of data to the host. For more information please refer to publication S113E.

Foundation Fieldbus

An IEC 1158-2 compliant Foundation interface module allows the actuator to be connected to a Foundation network. The device has link scheduler capability as well as digital and analogue function block capability. Foundation Fieldbus actuators can communicate directly between themselves without the need of a host supervisory system.

5.5 Protection

The IQ control system incorporates the following valve, actuator and control protection:

Obstructed valve (torque trip) protection.

Lost phase protection plus automatic Phase rotation correction by Synchrophase.

Jammed valve protection.

Motor thermostat protection.

Internal fault protection - ASTD (automatic self test & diagnosis).

Actuator control circuit supply protection.

Instantaneous reversal protection.

Control signal fault protection (configurable).

5.6 Actuator set-up

All actuator settings may be configured using the supplied IQ Setting Tool over the infra-red interface without the removal of any covers. Setup can take place with main power on or power off, during which power is provided by the actuator battery. Each IQ actuator includes a comprehensive installation and maintenance manual providing information on site commissioning and adjustment. An actuator wiring diagram is also included. As an option Rotork IQ-Insight software for PC allows configuration of actuator settings. For Bus control system options, tools are available allowing configuration testing over the serial interface as well as by Setting Tool or IQ-Insight software for PC.

6 Actuator components

6.1 Motor

Three phase, Class F, insulated squirrel cage motor of special high torque low inertia design. 15 minute rated with cyclic duration factor of 25% at 33% of actuator output rated torque giving a temperature rise not exceeding that permitted for Class B insulation at standard nominal voltage. Actuator rated up to 60 starts per hour at a rate not exceeding 600 starts per hour. Burnout protection by embedded thermostat, with facility for bypassing under emergency shutdown control. For details of motor performance and use of uninterruptable power supplies please refer to publication E130E.

Motor options

Modulating:

For applications requiring more than 60 starts/hour please refer to IQM publication E410E.

IQ Single Phase:

Capacitor start/run squirrel cage induction motor.

IQDC:

Permanent magnet, low inertia design.

6.2 Power module

The power module incorporates a mechanically and electronically interlocked reversing contactor starter*. The control supply transformer, fed from two phases of the incoming power supply, provides internal control circuit supplies and an isolated, nominal 24V DC customer supply rated at 5W for actuator fed remote control circuits. The Rotork Syncrophase circuit incorporates phase rotation correction and lost phase protection.

Option

Control circuit supply:

Nominal 110V AC supply, rated at 20VA.

*Single Phase and IQM modulating units utilise a solid state motor starter.

6.3 Control module

Incorporating a single integrated circuit, hard-wired logic control for the actuator together with infra-red (IrDA) interface for external non-intrusive settings and interrogation by IQ-Insight configuration and data logger viewer PC tool. On board data logger records operational data, valve torque/position profiles and statistical information, all time and date stamped.

6.4 Torque and position control

Position and torque are adjustable as follows:

Position setting range:

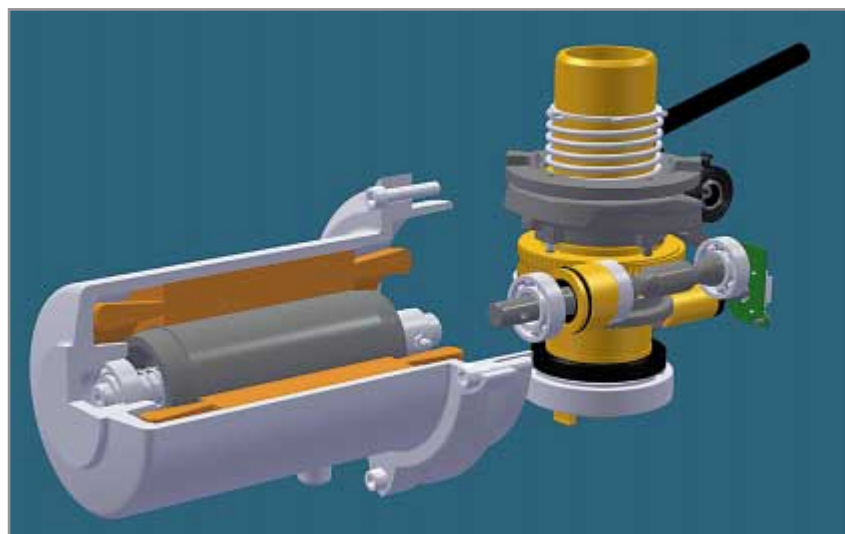
2.5 to 100,000 turns, with a maximum angular resolution to 7.5° of actuator output center column.

Torque setting:

40% to 100% rated torque.

Output torque is obtained via the direct measurement of wormshaft thrust reaction under load and is independent of voltage, frequency and temperature fluctuations. Torque off during unseating or during starting/reversing in mid travel against high inertia loads can be inhibited. The jammed valve protection circuit de-energizes the motor if no movement occurs after a few seconds from receipt of a signal to open or close.

When power to the actuator is isolated, all settings are retained in an EEPROM. In the event of manual operation of the valve during isolation or loss of the power supply a battery provides power to the internal position-monitoring transmitter to update the valve position data in the EEPROM. The battery also drives the LCD display, without backlighting, and the four latching contacts S1-S4



Standard specification

while the power to the actuator is not available. Based on a typical application the minimum battery life is 5 years. Infra-red setting is also available with main power off.

6.5 Conduit entries, terminals and wiring

Three threaded conduit entries are provided tapped: 1 x 1½" and 2 x 1" ASA NPT.

Unless otherwise specified, actuator will be dispatched with adapters: 1 x M40 and 2 x M25 metric to BS3643, "Ex" certified or as an alternative, 1 x PG29 and 2 x PG16.

It is the responsibility of the installer to ensure the appropriate cable/conduit adapters and blanking plugs are fitted, in order to maintain hazardous area certification and ingress protection levels. Certified adapters and blanking plugs are available as optional extras.

Conduit entry options

If specified with order, a fourth conduit entry can be provided tapped 1" ASA NPT with adapter to M25 or as an alternative PG16.

Separately sealed compartment containing segregated metric thread M5 power and M4 control terminals. Terminal screws and washers are supplied with the actuator. The terminal box cover carries a terminal identification code card. An Installation and Maintenance manual (E170E) and wiring diagram are enclosed with each actuator.

Jig built harnesses of individually numbered stranded conductors, tropical grade PVC insulated, connect internal components to the sealed terminal block. All internal control connections to the printed circuit boards are via plugs and sockets.

7 Design specification

7.1 Design life

For isolating duty, torque ratings of actuators are based on a minimum maintenance free life of 10,000 open/close/open cycles with rated seating torque at stroke end and an

average of 1/3 rated seating torque during stroke. For modulating duty during stroke please refer to IQM Range, publication E410E.

Life tests

Standard IQ life test is based on 10,000 open/close/open cycles (500,000 output turns) with maximum seating torque at stroke end and an average of 1/3 max. seating torque during stroke. Actuators are stalled against a solid object 25 times to prove durability.

7.2 Frequency of operation

IQ actuators are suitable for valve duty up to 60 starts per hour.

IQM Modulating service: up to 1200 starts per hour.

IQ Single Phase: up to 60 starts per hour.

IQDC: up to 60 starts per hour.

7.3 Operating temperature

Actuators are suitable for operation for ambient temperatures in the range -30°C to +70°C. Please note - Hazardous area certification defines the temperature operating range to maintain certification. Refer to 4.1.

For temperatures outside this range please apply to Rotork.

7.4 Vibration

Standard IQ Range actuators are suitable for applications where vibration severity does not exceed the following:

Plant induced: Where the cumulative level of all vibration within the frequency range of 10 to 1000Hz is less than 1g rms.

Shock: 5g peak acceleration.

Seismic: Frequency range 1 to 50Hz, 2g acceleration if it is to operate during and after the event. 5g if it is only required to maintain structural integrity.

Where excessive plant induced vibration is anticipated, mounting the actuator remote from the valve and

driving via extension shafting incorporating vibration absorbing couplings may provide a satisfactory solution.

7.5 Safety integrity

Electromagnetic compatibility directive (EMC)

Actuators conform to the requirements of the European Economic Community EMC Directive 89/336/EEC as amended by 92/31/EEC. Contact Rotork for a copy of our Declaration of Conformity.

Low voltage directive (LV)

Actuators conform to the requirements of the European Economic Community Low Voltage Directive 73/23/EEC amended by 93/68/EEC by the application of EN 60204-1 1993. Contact Rotork for a copy of our Declaration of Conformity.

Machinery directive

Actuators follow the provision of the Machinery Directive (89/392/EEC) as amended by 91/368/EEC and 93/44/EEC.

The IQ must not be put into service until the equipment into which it is being incorporated has been declared to be in conformity with the provisions of the European Community Machinery Directive (89/392/EEC) 91/368/EEC and 93/44/EEC. Contact Rotork for a copy of our Declaration of Incorporation.

7.6 Noise

Independent tests have shown that at 1m generated noise did not exceed 61db(A).





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