rotork®

IQ Range IQ3



Multi-turn and Part-turn
Intelligent Electric Valve Actuators

Keeping the World Flowing

rotork®

Keeping the World Flowing



Reliable operation
when it matters

Assured reliability for critical applications and environments.

Whether used 24/7 or infrequently, Rotork products will operate reliably and efficiently when called upon.

Quality-driven
global manufacturing

Products designed with 60 years of industry and application knowledge.

Research and development across all our facilities ensures cutting edge products are available for every application.

Customer-focused service
worldwide support

Solving customer challenges and developing new solutions.

From initial enquiry through to product installation, long-term after-sales care and Client Support Programmes (CSP).

Low cost
of ownership

Long-term reliability prolongs service life.

Rotork helps to reduce long term cost of ownership and provides greater efficiency to process and plant.

IQ3 Range

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Comprehensive product range
serving multiple industries

Improved efficiency, assured safety and environmental protection.

Rotork products and services are used throughout industry inclusive of Power, Oil & Gas, Water & Wastewater, HVAC, Marine, Mining, Pulp & Paper, Food & Beverage, Pharmaceutical and Chemical industries around the world.

Market leader
technical innovator

The recognised market leader for 60 years.

Our customers have relied upon Rotork for innovative solutions to safely manage the flow of liquids, gases and powders.

Global presence
local service

Global company with local support.

Manufacturing sites, service centres, sales offices and *Centres of Excellence* throughout the world provide unrivalled customer services and fast delivery.

Corporate social
responsibility

A responsible business leads to being the best business.

We are socially, ethically, environmentally responsible and committed to embedding CSR across all our processes and ways of working.

The most **robust actuator design** in the industry providing **exceptional reliability**

- **Continuous position tracking** at all times, even without power
- **On power loss, graphical interface, remote indication and data logger** are maintained and accessible
- **Oil bath lubrication** provides extended life and the ability to mount in any orientation
- **Water ingress protection**, not reliant on terminal cover or cable gland sealing – double-sealed to IP66/68 20 m for 10 days
- **Increased protection** by using independent torque and position sensing
- **Remote operation, configuration and commissioning** up to 100 m from actuator, with Remote Hand Station
- **Safe, motor-independent, handwheel operation** available at all times
- **Detailed trend analysis and diagnostic data** available for asset management
- **Field upgradeable and configurable control & indication options**, using *Bluetooth*® setting tool
- **Real time valve and actuator performance information** viewable on screen
- **Rapid and secure commissioning & configuration** even without power, via non-intrusive and intrinsically safe *Bluetooth*® setting tool
- **Certified for safety applications** (SIL2/3)
- **Easy installation and maintenance** using detachable thrust bases
- **Explosionproof** to international standards
- Backed by **Rotork Global Support**

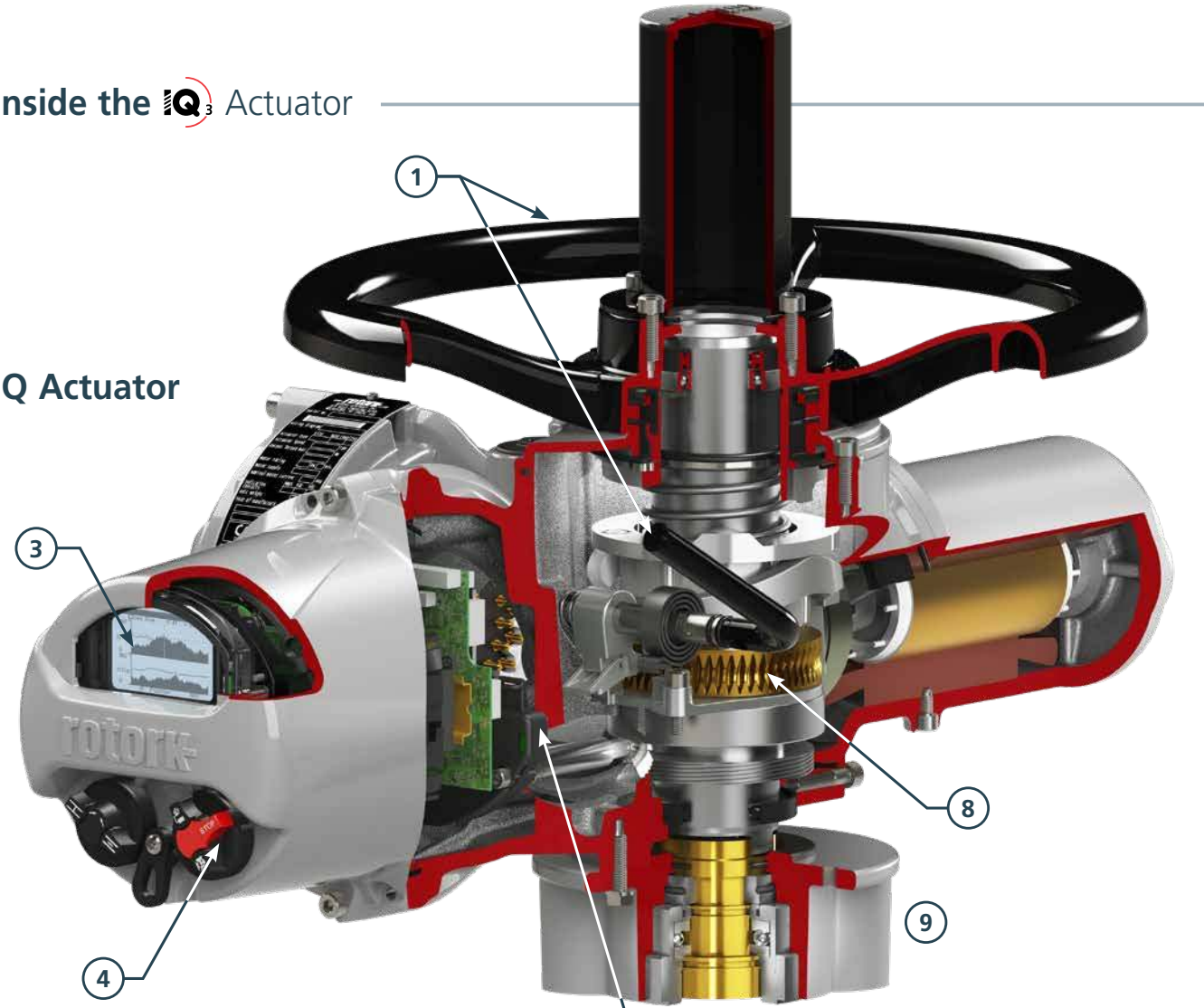


IQ3

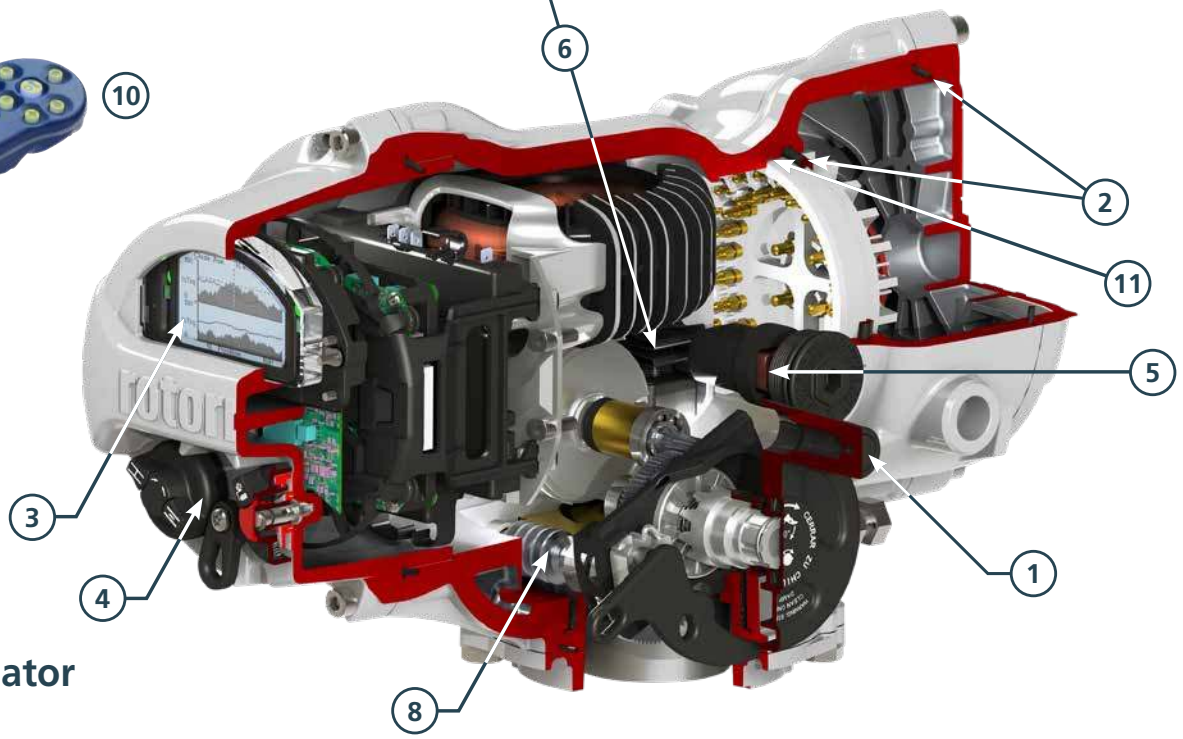


Inside the IQ3 Actuator

IQ Actuator



IQT Actuator



1. Hand Operation

Direct-drive and geared handwheels sized for effective manual operation of the valve. Handwheel drive is independent of the motor drive and is selected with a lockable lever for safe operation even when the motor is running. See section 9.1.

2. Environmental Sealing IP66/68; 20 m for 10 days

The double-sealed terminal compartment results in the actuator enclosure being completely sealed, protecting the actuator from environmental ingress. See section 5.

3. Display

The advanced display has a wide viewing angle making it legible from a distance. The dual mode display allows a high temperature range of operation for position (-50 to +70°C) in addition to detailed graphical information. See section 7.2.

4. Local Controls

Open/Close and Local/Stop/Remote selectors are magnetically coupled to the solid state switches inside the cover. This along with double-sealing, further enhances the non-intrusive protection of the actuator. See section 7.2.

5. Battery

A battery is provided to support the display, remote indication and configuration when no mains power is available. See section 9.12.

6. Position Control

Patented absolute position encoder is provided to enable robust, high accuracy measurement of up to 8,000 actuator output rotations under all conditions, including loss of mains power. See section 9.7.

7. Torque Sensor

State-of-the-art piezo torque sensor for IQ provides reliable torque measurement over a wide temperature range. See section 9.6.

8. Drive Train

Simple, proven, robust and lubricated for life in a self-contained oil bath, with the ability to perform in any orientation. See section 9.2.

9. Separable Bases

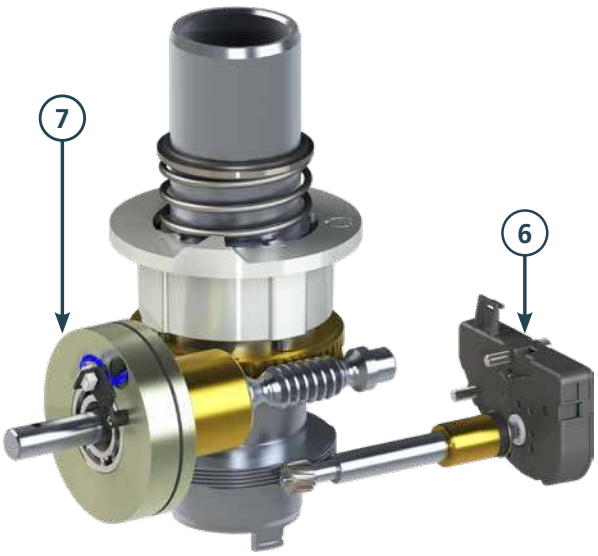
For all actuator frame sizes, the thrust and non-thrust base types are separate to the main gearcase facilitating easy installation. See section 2.

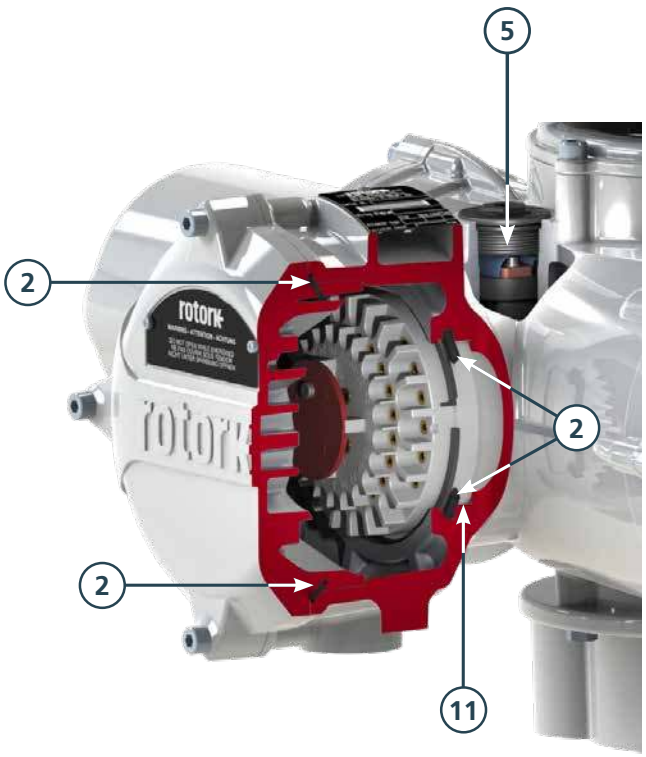
10. Rotork *Bluetooth*® Setting Tool Pro

Intrinsically-safe setting tool used for commissioning and data logger download. See section 7.2.

11. Certified for use in Hazardous Areas

The Rotork explosionproof Exde enclosure has a flamepath between the main enclosure and the terminal enclosure. This means an explosion on either side of the terminal compartment will not be transmitted to the other side or the outside environment. See section 5.





Actuator Selection for Linear Valve Types

Actuator selection for linear valve types: Wedge, Conduit/slab, Parallel slide, Globe, Choke, Knife, Sluice/weir, Diaphragm.

Torque/thrust range - actuator availability

Direct



ISO5210 MSS SP-102		IQ (3-Phase) Min	IQ (3-Phase) Max	IQS (1-Phase) Min	IQS (1-Phase) Max	IQD (DC) Min	IQD (DC) Max	IQM (3-Phase) Min	IQM (3-Phase) Max
Torque	Nm	14	3,000	26	450	14	305	14	544
	lbf.ft	10	2,200	19	332	10	225	10	400
Thrust	kN	44	445	44	150	44	100	44	150
	lbf	10,000	100,000	10,000	33,750	10,000	22,480	10,000	33,750
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

With IB Gearbox



ISO5210 MSS SP-102		IQ (3-Phase) Min	IQ (3-Phase) Max	IQS (1-Phase) Min	IQS (1-Phase) Max	IQD (DC) Min	IQD (DC) Max	IQM (3-Phase) Min	IQM (3-Phase) Max
Torque	Nm	29	7,604	41	3,060	23	2,074	23	3,686
	lbf.ft	21	5,610	31	2,258	17	1,530	17	2,720
Thrust	kN	53	1,320	53	1,320	53	1,320	53	1,320
	lbf	1,200	296,750	1,200	296,750	1,200	296,750	1,200	296,750
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

With IS Gearbox



ISO5210 MSS SP-102		IQ (3-Phase) Min	IQ (3-Phase) Max	IQS (1-Phase) Min	IQS (1-Phase) Max	IQD (DC) Min	IQD (DC) Max	IQM (3-Phase) Min	IQM (3-Phase) Max
Torque	Nm	38	40,718	38	9,756	38	6,612	38	11,750
	lbf.ft	28	30,030	28	7,200	28	4,878	28	8,672
Thrust	kN	53	2,900	53	2,900	53	2,900	53	2,900
	lbf	1,200	651,946	1,200	651,946	1,200	651,946	1,200	651,946
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

Direct - Control Valve



ISO5210 MSS SP-102		IQTF (A coupling*) Min	IQTF (A coupling*) Max	IQTF (L coupling*) Min	IQTF (L coupling*) Max	IQL (3-Phase*) Min	IQL (3-Phase*) Max	IQML (3-Phase) Min	IQML (3-Phase) Max
Torque	Nm	50	250	N/A		N/A		N/A	
	lbf.ft	37	185						
Thrust	kN	44	100	3	76	6	100	5	57
	lbf	10,000	22,480	710	17,086	1,349	22,480	1,124	12,814
Class/Starts-Hour		C / 1,800		C / 1,800		A & B / 60		C / 1,200	

Actuator Selection for Part-turn Valve Types

Actuator selection for part-turn valve types: Butterfly, Ball, Plug, Damper.

Torque range - actuator availability

Direct



ISO5211 MSS SP-101		IQT (3-Phase, 1-Phase) Min	IQT (3-Phase, 1-Phase) Max	IQT (DC) Min	IQT (DC) Max	IQTM (3-Phase, 1-Phase) Min	IQTM (3-Phase, 1-Phase) Max	IQTM (DC) Min	IQTM (DC) Max
Torque	Nm	50	3,000	50	2,000	50	3,000	50	2,000
	lbf.ft	37	2,214	37	1,476	37	2,214	37	1,476
Class/Starts-Hour		A & B / 60		A & B / 60		C / 1800		C / 1800	

With IW/MOW Gearbox



ISO5211 MSS SP-101		IQ (3-Phase) Min	IQ (3-Phase) Max	IQS (1-Phase) Min	IQS (1-Phase) Max	IQD (DC) Min	IQD (DC) Max	IQM (3-Phase) Min	IQM (3-Phase) Max
Torque	Nm	204	826,888	144	208,000	162	131,950	162	76,964
	lbf.ft	150	609,880	108	153,400	120	97,500	120	56,800
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

Direct - Control Valve



ISO5211 MSS SP-101		IQTF (B coupling) Min	IQTF (B coupling) Max
Torque	Nm	20	3,000
	lbf.ft	15	2,214
Class/Starts-Hour		C / 1,800	

IQT Battery Backup Option

IQT, IQTM and IQTF are available with a battery backup option, allowing the valve to move automatically to a configurable end of travel safe position should main AC power be lost. Alternatively, they may be configured to remain operable for local/remote control for a nominal 30 minutes after mains power is lost.

Notes:

- Actual selection may be determined by power supply requirement - refer to page 34, valve stem dimensions and operating time.
- Class/Starts refers to EN15714-2 duty types: A & B: isolating/regulating, C: modulating, D: continuous modulating.

* IQSL 1-phase and IQDL DC variants available - apply to Rotork for details. IQTF-A is limited to 22 output turns. IQTF-L, IQL and IQML are limited to 150 mm (6") stroke.

Simple, Secure Commissioning and Configuration

Ensuring correct configuration and keeping it secure is the bedrock of reliable operation.

All IQ range actuators are set up non-intrusively using a Rotork setting tool. Torque levels, position limits, control and indication functions can all be accessed using the intrinsically safe, wireless handheld setting tool. Compatible with the existing infra-red IQ Setting Tool, the 3rd generation IQ range can now operate using its partner the Rotork *Bluetooth*® Setting Tool Pro. *Bluetooth*® wireless connectivity allows easier use without direct line-of-sight and over greater distances, however security has to match. This is achieved by the initial 'pairing' of tool and actuator being carried out by a single infra-red transaction after which a *Bluetooth*® wireless connection automatically takes over. As before, configuration changes are password protected and the actuator is immune to connection by non-Rotork devices or programs.

New 3rd generation IQ range actuators benefit from further advances in human interface design. In addition to a configurable, information-rich display, they offer a highly intuitive menu system for commissioning, updates and diagnostics.

With the latest version of the Rotork Insight 2 software, you can further streamline actuator setup, by pre-defining complete sets of instructions and settings. Each collection of settings can be saved as a 'mission' and quickly applied to individual actuators via the handheld Rotork *Bluetooth*® Setting Tool Pro.

IQ range actuators can be interrogated and set up even when mains power is not available; the actuator can be configured and interrogated by using power from its display back-up battery.

- Rapid and secure commissioning and configuration even without power via advanced, multilingual HMI display
- Non-intrusive setting in any environmental conditions - no cover removal required, using Rotork *Bluetooth*® Intrinsically Safe setting tool
- Easy installation and valve maintenance using detachable thrust bases
- Duplicate operation, configuration and commissioning up to 100 m from actuator with Remote Hand Station (RHS)
- Auto set-up function on part-turn variants

Technological Advances

Position

Reliable valve position sensing is critical. Using the latest technology and after years of testing, the patented Rotork IQ absolute encoder is contactless, has only four active parts, can measure up to 8,000 output turns and has redundancy and self checking. The Rotork IQT redundant absolute encoder is contactless, has only one moving part and self-checking ability. Unlike existing absolute encoder designs, these technological breakthroughs increase position sensing reliability while providing zero-power position measurement.

Display

The advanced display allows large segment character position displays down to -50 °C while the matrix display provides detailed setting, status and diagnostic multilingual screens. Overall the display is 30% bigger, is backlit to provide excellent contrast even in the brightest ambient light conditions and is protected by a toughened glass window. An optional protective clip-in cover is available where high UV levels or abrasive environments are present.

Torque

The 3rd generation of IQ utilises the torque sensor developed and used successfully by Rotork for over 15 years. Torque generated in moving the valve produces a proportional thrust reaction on the motor worm-shaft. This thrust creates pressure in the piezo torque transducer which converts it to a voltage signal directly proportional to the output torque being produced by the actuator. This signal is used by the control circuit for torque limiting, real-time torque indication and for recording valve operating force profiles by the data logger. Now enhanced to provide increased integrity and performance, torque sensing is simple, accurate with high resolution and extremely reliable over the life of the actuator. Unlike other systems employed, the IQ system of torque measurement has the advantage of being independent of voltage and temperature variations.

Control

Control elements such as main control and network interface cards, like those used with fieldbus systems, are connected using an internal bus system based on CAN, reducing wiring and connections and increasing reliability.

Unrivalled Industry-leading Reliability

Valve operation must be reliable. Rotork IQ range actuators are designed to meet the toughest applications and engineered for a lifetime of uninterrupted service. Built on the Rotork drive train, proven for over 50 years, 3rd generation IQ range actuators retain industry leading reliability:

- Advanced absolute position measurement allowing continuous position tracking even without power
- On power loss, graphical Interface, remote indication and data logger are maintained and accessible
- Extended life and mounting in any orientation with oil bath lubrication
- Water and dust ingress protection, not reliant on the terminal cover or cable gland sealing - double-sealed to IP66/68 at 20 m for 10 days
- Increased protection by using independent torque and position sensing
- Safe, motor-independent handwheel operation available at all times
- Explosionproof and certified for safety applications (SIL2/3)
- Drive bush bearings sealed for life - no maintenance required
- Backed by Rotork global support



Asset Management

With an advanced display, position, torque, status and configuration data is clear and immediately accessible. In addition the valve, actuator and process data is available in real-time on screen or in the control room. Valve stroke torque/thrust graphs, duty trend logs, vibration levels and valve & actuator manufacturing data can be extracted by the user and stored as the basis for planned maintenance and operational activities, process performance characteristics and comparison.

Entire operations can now be carried out in moments and data logger data downloaded using the supplied Rotork *Bluetooth*® Setting Tool Pro. The data can be downloaded to a PC and analysed using the Rotork Insight 2 software.

- Real-time valve and actuator performance information viewable on-screen
- Safe and secure data download via non-intrusive and intrinsically safe setting tool
- Field upgradeable and configurable control and indication options using setting tool
- Compatible with *Pakscan* digital control and monitoring system plus all leading fieldbus networks
- Detailed trend analysis, diagnostics and data logger available, on-screen or downloadable via *Bluetooth*®

Optimised for Preventative Maintenance

All IQ actuators incorporate a sophisticated data logger, which can provide comprehensive data capture and analysis for planned maintenance and troubleshooting issues with valves and processes. They capture:

- Valve torque profiles
- Operational starts profiles
- Operational, vibration and temperature trend logs
- Event log

In addition, asset management data regarding the actuator and the valve is stored within the actuator and available for download. Specific asset management information includes:

- Running time
- Average torque
- Starts
- Life statistics

IQ actuators include configurable service / maintenance alarms. The alarm parameters can be set in the assets section of the setup menus and include:

- Open torque levels
- Close torque levels
- Starts/hr
- Total starts
- Total turns
- Service intervals

Indication Power

With the absolute encoder, a battery is not required for position sensing and tracking. As all configuration and data logger data is stored in non-volatile EEPROM memory, all settings are safe when no power is available. However, to maintain the display and ensure remote indication is kept updated, allow datalogging and power off commissioning, an indication battery is included as standard. Reduced power consumption means the battery has an exceptionally long life and low-cost replacements are available from suppliers globally. In addition, the auxiliary power module option is available, allowing the user to connect a 24 Volt supply to the actuator should communication with network systems be required when main actuator power is switched off.

Safe Manual Operation

In case of an emergency, power outage or failure of the control network, IQ actuators can be operated by hand. A manual clutch and handwheel allow an operator to disengage the motor and operate the valve independently, without risk of damage or injury.

Where the location requires it, the clutch can be padlocked into position to prevent accidental or unauthorised manual operation.

Manual movements of the valve are recorded and logged by the actuator. Position sensing in Rotork IQ actuators is highly reliable (power on or off) thanks to the unique robust and simple design of the absolute encoder.

Network System Connectivity

With the addition of an appropriate option card, the IQ actuator can be incorporated into a number of different fieldbus control systems. The IQ actuator can be utilised within the Rotork *Pakscan*™ control system, either wired or wirelessly, and the major open Fieldbus protocols including Profibus®, DeviceNet®, Foundation Fieldbus®, Modbus® and HART®.

Future-proofing

3rd generation IQ actuators have been designed with future advances in mind. In addition to highly configurable setup options they now feature flexible design technology.

Using the Rotork Insight 2 software and Rotork *Bluetooth*® Setting Tool Pro, it is also possible to apply updates to each actuator. This procedure is subject to four layers of security, with the option of disabling the *Bluetooth* communication for maximum security.

Remote Field Operation

The IQ Remote Hand Station uses the same display and controls interface from the IQ 3rd generation actuator, allowing users to remotely operate, interrogate and configure the IQ actuator from up to 100 m distance. Due to the familiar, feature rich interface, set up couldn't be simpler using the Rotork *Bluetooth*® Setting Tool Pro supplied with the IQ.

Duplicating the full functionality of the IQ, data logs can be viewed and downloaded locally at the Remote Hand Station (RHS) instead of gaining access to the actuator. Power for the RHS is supplied by the actuator, removing the need for supplementary power supplies.

- Installation using standard data cable, up to 100 metres away from the actuator
- Pole or wall mountable
- Replica of IQ 3rd generation user interface, including setup and configuration
- Powered via the attached actuator (24 VDC output)
- Explosionproof option available
- Enclosure IP66 / IP68
- Double-sealed
- Simple setup
- Actuator data logs available for viewing and downloading locally



Explosionproof Conformity

3rd generation IQ actuators conform to the following international explosionproof standards:

- ATEX II 2GD c
- IECEx
- FM3615
- CSA EP to C22.2 No 30–M

Rotork *Bluetooth*® Setting Tool Pro certification conforms to:

- ATEX II 1G
- FM3610
- Canada CSA - C22.2 No.157-92

For full details of certification conformity for non-hazardous and hazardous areas see Section 6.

Syncrophase - Incorrect Wiring Protection

Rotork's Syncrophase automatic phase rotation correction prevents valve damage caused by incorrect wiring by ensuring that the IQ 3-phase motor is always presented with the correct phase rotation. Syncrophase senses the incoming phase rotation then energises the appropriate contactor to cause movement in the correct direction.

Single Phasing Protection*

The IQ power module monitors all 3 phases of the power supply. Should one or more phases be lost the control system inhibits operation, preventing motor 'single phasing' and burn-out. The actuator display will indicate 'phase lost', remote indication is also available from the configurable indication contacts.

** IQ 3-phase only.*

Valve Jammed Protection

The actuator faces its severest operating duty during unseating of the valve, when operating forces are at their highest or where an infrequently operated valve can get stuck. IQ has the intelligence to systematically cope with these demands, ensuring reliable valve operation together with valve and actuator protection.

If valve "sticking" is considered possible, as with a wedge gate type, the torque switches can be by-passed during the a configurable portion of travel away from the valve seated position. This allows "extra" torque up to 1.5 times rated to be applied in unseating the valve. In the majority of cases, applying additional force causes the sticky valve to move and allows operation to continue. After the torque switch bypass set position has been reached, the torque switch returns to the set value for the rest of travel. If this additional torque is still insufficient to cause movement, IQ recognises the valve is jammed and stops operation within seconds preventing further valve damage or motor burn-out.



Design Features

IQ Thermostatic Protection

In the event of overheating, two thermostats embedded in the motor windings directly sense the temperature and trip the actuator control circuit.

Auto Self Test and Diagnosis (ASTD)

Vital operational circuits automatically self test to ensure correct operation. In the unlikely event that a fault is diagnosed the information is automatically presented on the display. At the same time, actuator operation can be inhibited to enable on-site investigation.

Instant Reversal Protection

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

Vibration Measurement

Vibration can severely affect plant equipment's performance and life and its effects are cumulative. Levels of vibration can vary significantly depending on process conditions such as start up and shut down, valve cavitation and at different flow rates making it difficult to capture with mobile measuring devices.

The IQ actuator includes a vibration sensor that measures and captures vibration levels in the range 10 Hz to 1 kHz (RMS average) and peak acceleration (maximum g) in 3 axis (x, y and z). Vibration trend logs can be viewed on the display or downloaded and viewed using Insight 2.

Lifetime Support

With communication featuring Bluetooth wireless technology, the onboard data logger and the new dual stacked display, the IQ range offers unrivalled support to provide complete product back up with local analysis and configuration. This is further supported up by the introduction of the new Insight 2 programme, which allows the user full access to configuration and data analysis. With Rotork's unrivalled worldwide service, network expert advice is always close to hand.

Remote Diagnosis - *Bluetooth*

The Rotork *Bluetooth*® Setting Tool Pro allows downloading of data logger and configuration files The tool also allows uploading of configuration and calibration data. The tool is intrinsically safe and can be used in hazardous areas. File transfer and data exchange is made using Bluetooth wireless technology between the actuator, the Rotork *Bluetooth*® Setting Tool Pro and a PC.

Graphical Data Logger

Greater amounts of data and analytical screens are now available in the data logger and viewable locally. The data logger screens are displayed on a 168 x 132 pixel dot-matrix display and can display anything from a torque vs position graph to statistical operational data.

Rotork Help – Online

Rotork has a comprehensive worldwide service network to provide you with local support wherever you are.

Rotork trained technicians working from our network of offices and centres of excellence are available to offer immediate assistance.

To contact Rotork, visit www.rotork.com



PC tools - Insight 2

Rotork Insight 2 facilitates the review, configuration and analysis of setup configuration and data logger information for Rotork *Bluetooth* enabled actuators. The visually interactive application is intuitive with clear menus making it a simple and fast process.

All Rotork *Bluetooth* enabled actuators include an onboard data logger. The data logger captures and stores valve, actuator, control signal operation and status data which can be viewed locally on the display or on a PC using Insight 2.

Log data is time and date stamped and can be viewed on an event by event basis. Insight 2 enables the user to pre-configure actuator missions on a PC, transfer them to a Rotork *Bluetooth*® Setting Tool Pro and transmit them to the actuator on-site. The missions can be dedicated to specific actuators by type or serial number and are password protected for extra security.

Standard missions include: extraction of actuator configuration and data logger, modification of actuator and option configuration.

Password protection is available on the Insight 2 software and actuators to prevent unauthorised or accidental modification of actuator configuration parameters.

Key Features

- View and modify actuator specification and configuration on PC
- Valve and actuator starts against position log
- Valve reference profile trend logs
- Valve torque profile, open/closed instantaneous and average torque against valve position
- View and modify option card configuration
- Operation and actuator control status log
- Pre-configure missions on a PC and transfer them to actuators in the field via the Rotork *Bluetooth*® Setting Tool Pro. Insight 2 requires a PC with a *Bluetooth* interface running Microsoft™ Windows XP or newer.

Local Diagnostics and Setup

The large dual stacked, high resolution display, with positional characters that are 25 mm high, is unrivalled in visibility for all lighting and orientation conditions. Consisting of a static, high-contrast positional display and a fully configurable dot-matrix LCD behind, the IQ range offers the easiest, user-friendly configuration and data analysis ever seen in the actuation world.

Configurable Home Screens

With a mixture of the static and dot-matrix displays, there are now four configurable home-screens available to the user. The four screens reflect the parameters most commonly required to analyse operation at-a-glance:

- Positional information with status
- Positional information with torque (digital)
- Positional information with torque (analogue)
- Positional information with input demand (digital and analogue)

Using the Rotork *Bluetooth*® Setting Tool Pro, each of these screens can be easily accessed with a press of a button. Alternatively you can select one of the four screens to be continually displayed in the setup menu.

User Friendly Setup Menus

A single press of a button on the Rotork *Bluetooth*® Setting Tool Pro takes you into the user-friendly setup menu. This menu has been designed and structured to reduce reliance on having a written manual to hand. With large, clear characters available in many languages, setup and configuration has never been so easy.

Plug and Socket

IQ range actuators can be supplied with a fully engineered plug and socket interface to provide fast connection and disconnection in the field. Plug and socket facilitates field wiring in advance to improve commissioning speed and efficiency.

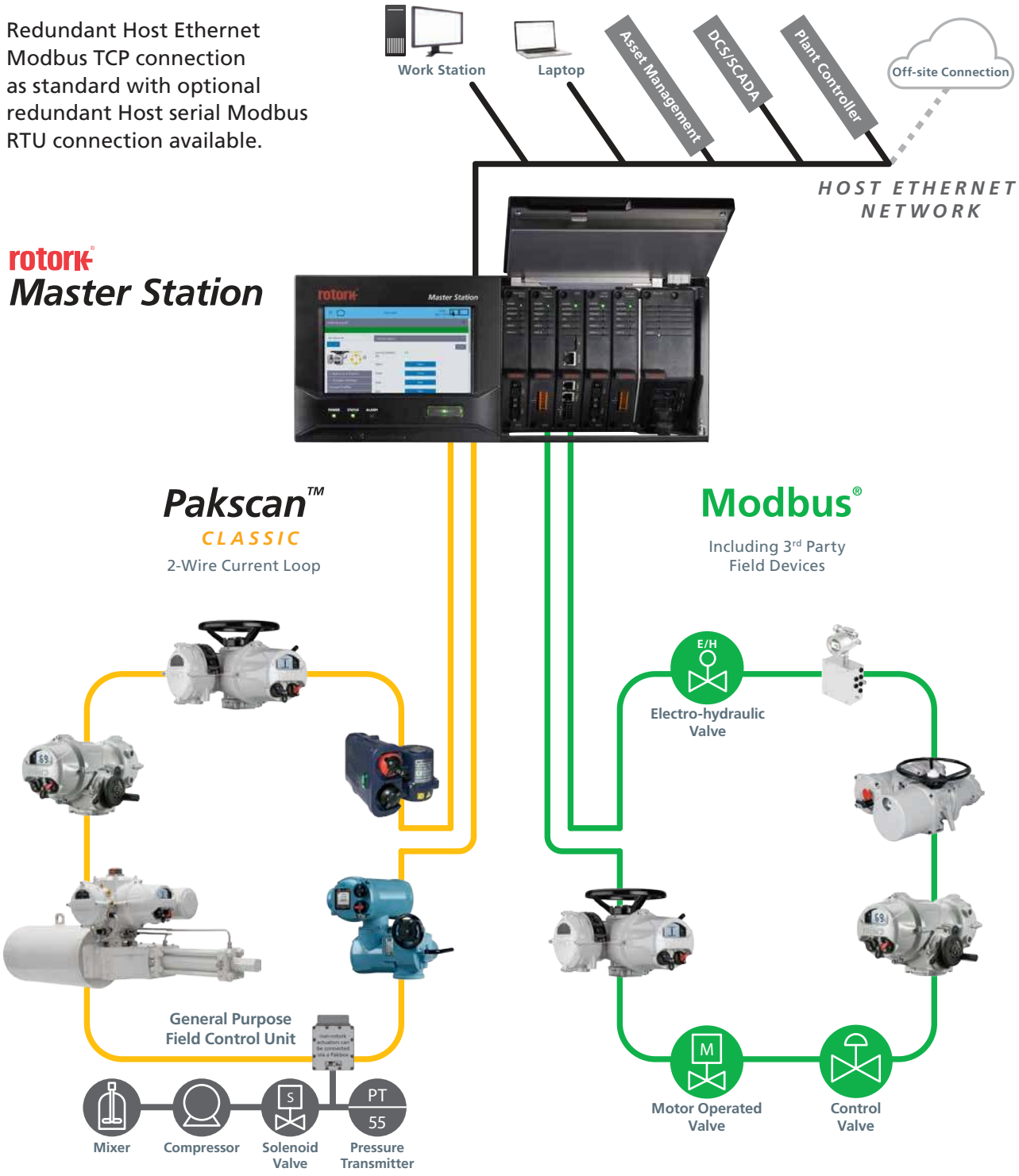
The IQ plug and socket option maintains the IP68 rating (20 m for 10 days) and is certified for use in hazardous areas.

Refer to PUB002-127 for further details.



Rotork *Master Station* Network Capabilities

Redundant Host Ethernet Modbus TCP connection as standard with optional redundant Host serial Modbus RTU connection available.



Pakscan Classic field network Add In Module (AIM)

The *Pakscan* Classic redundant loop network has been the network of choice for actuator control for over 30 years. Using robust current loop technology, up to 20 km loop lengths and 240 field devices are possible.

Modbus field network Add In Module (AIM)

Modbus field network with standard highway or redundant loop topology options. Other manufacturers devices integrated into the network by use of a Rotork field device description file.

Fieldbus Compatibility

IQ actuators are compatible with most industry standard fieldbus systems as well as Rotork's own *Pakscan* system.

- Compatibility via network cards that are fitted in the main electronics enclosure
- Full integration with your existing plant control systems

Pakscan™

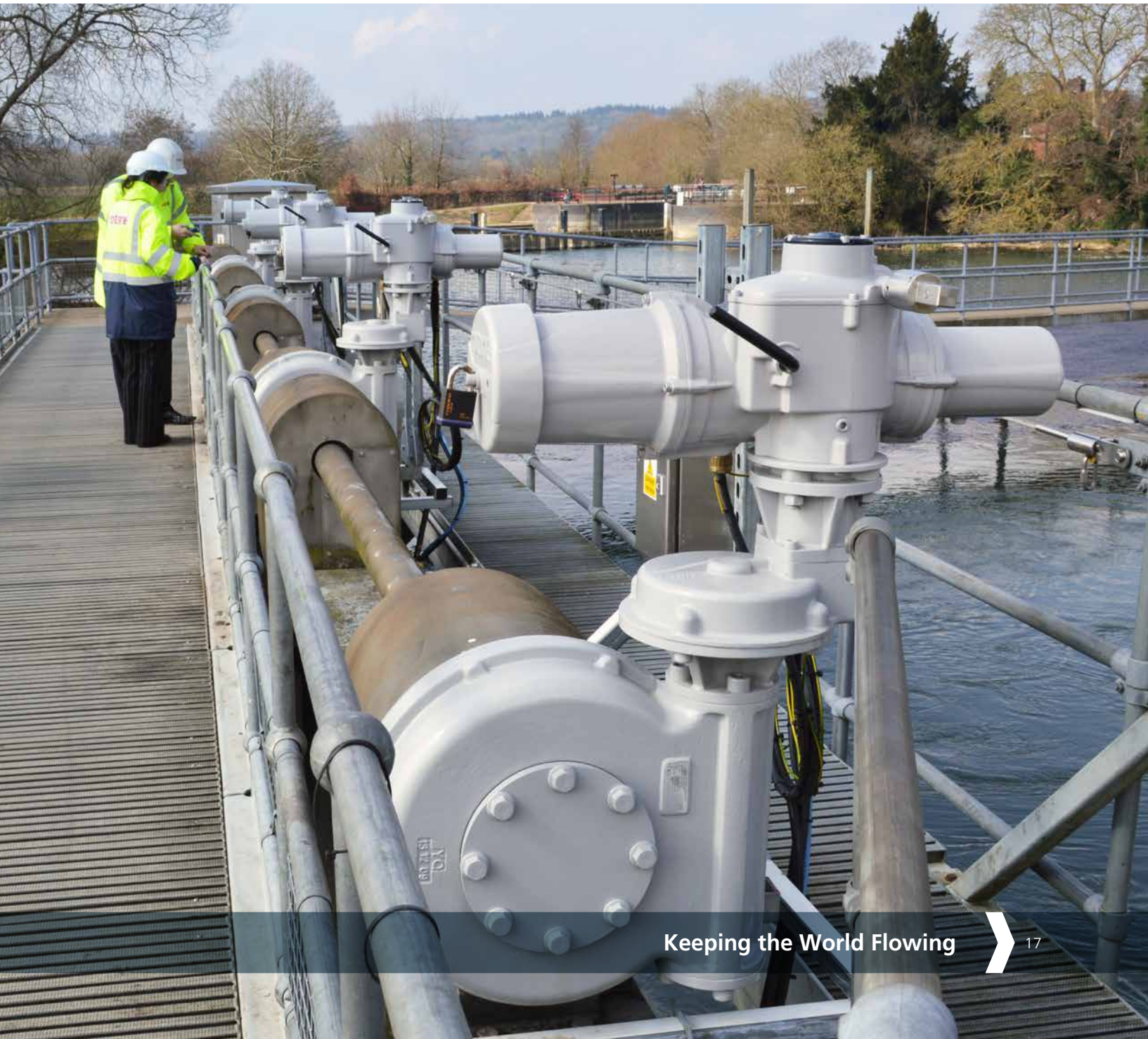
Modbus®

FOUNDATION

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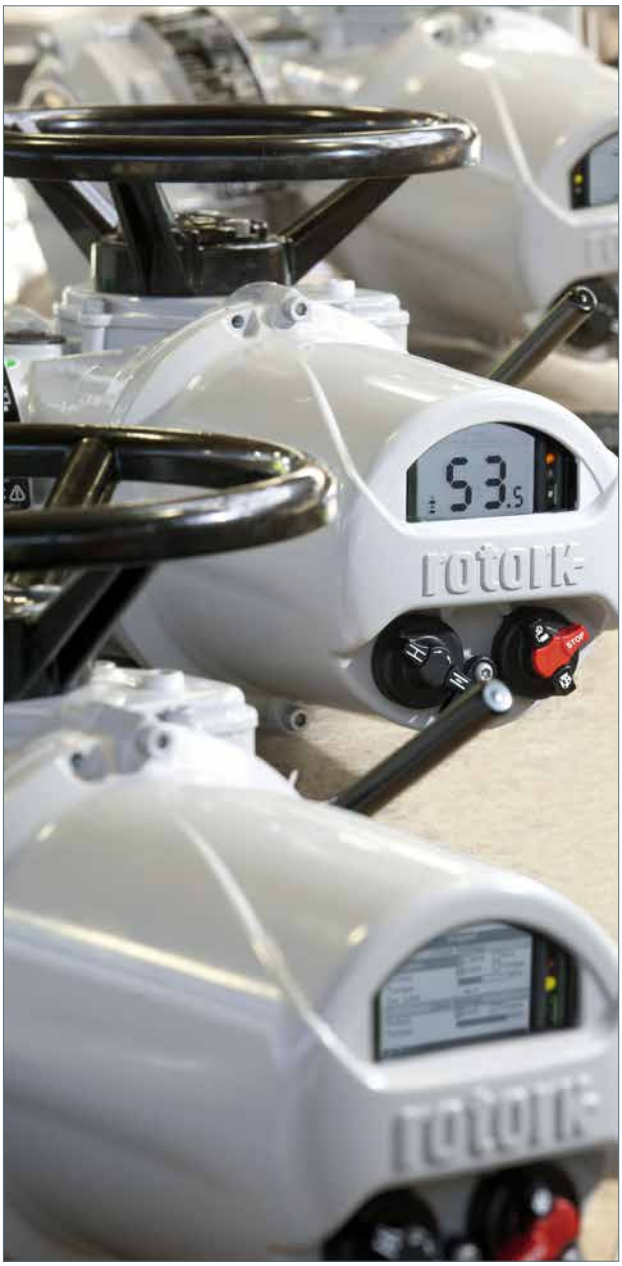
IQ range actuators perform unfailingly in environments ranging from desert to tundra, offshore to underground, where flooding, humidity, extremes of heat and cold, ultraviolet and corrosive atmospheres are the norm.

IQ actuators have a record of reliability and safety that is second to none.

Actuator Specification

The following pages contain details on performance and specification for the Rotork IQ range of actuators.

Please use the following contents table to help access the information you require.



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1 Performance Summaries

	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[3]	Nm / lbf.ft						
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	89[1]	80[1]	69[1]	60[1]	49[1]	39[1]
	80	80	66[1]	59[1]	51[1]	44[1]	36[1]	29[1]
IQ19	135	135	135	135	135			
	100	100	100	100	100			
IQ20	203	203	203	203	176	142	102[2]	
	150	150	150	150	130	105	75[2]	
IQ25	400	400	298	244	244	230	149[2]	140[1]
	295	295	220	180	180	170	110[2]	103[1]
IQ35	610	610	542	474	474	366	257[2]	257[1]
	450	450	400	350	350	270	190[2]	190[1]
IQ40	1,020	1,020	845	680	680	542	406[2]	
	750	750	625	500	500	400	300[2]	
IQ70	1,490	1,490	1,290	1,020	1,020	745	645[2]	542[2]
	1,100	1,100	950	750	750	550	475[2]	400[2]
IQ90	2,030	2,030	1,700	1,355	1,355	1,020	865[2]	730[2]
	1,500	1,500	1,250	1,000	1,000	750	640[2]	540[2]
IQ91							1,355[2]	1,355[2]
							1,000[2]	1,000[2]
IQ95		3,000						
		2,200						

Notes:

1 Please see Section 7.1 for power supply availability.

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

3 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.

IQS and IQD Performance Summary

IQS - Performance Data

	Actuator output speeds						
rpm at 50 Hz	**18**	**24**	**36**	**48**	**72**	**96**	**144**
rpm at 60 Hz	**21**	**29**	**43**	**57**	**86**	**115**	**173**
Actuator size	Torque[2]	Nm	lbf.ft				
IQS12	65	60	45	40	30	25	
	48	44	33	30	22	18	
IQS20	165	130	130	125	100	80	60[1]
	122	96	96	92	74	59	44[1]
IQS35[3]	450	400	350	320	230	190	135[1]
	332	295	258	236	170	140	100[1]

IQD - Performance Data

	Actuator output speeds			
rpm	**18**	**24**	**36**	**48**
Actuator size	Torque[2]	Nm	lbf.ft	
IQD10	34	34	31	27
	25	25	23	20
IQD12	68	68	61	54
	50	50	45	40
IQD18		108		
		80		
IQD20	163	163	136	108
	120	120	100	80
IQD25	305	305	257	203
	225	225	190	150

DC supply voltage

	24 V	48 V	110 V
IQD10	✔	✔	✔
IQD12	✗	✔	✔
IQD18	✗	✔	✔
IQD20	✗	✗	✔
IQD25	✗	✗	✔

Notes:

1 Actuator output speed 144/173 rpm is not recommended for direct mounted gate valve applications.

2 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.

3 IQS35 not available at 115 Volts.

If maximum torque is required for more than 20% of valve travel, refer to Rotork.

Performance Summary

Mechanical Data

Actuator size IQ, IQS, IQD, IQM		10 12 18	19 20 25	35	40 70 (90)[1]	(40)[1] (70)[1] 90	91	95
Flange size	ISO5210	F10	F14	F16	F25	F30	F25	F30
	MSS SP-102	FA10	FA14	FA16	FA25	FA30	FA25	FA30
Approximate weight[2]	kg	31	54	75	145	160	150	160
	lbs	68	119	165	320	353	331	353

Group "A" Couplings – Torque and Thrust

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

Aluminium bronze drive couplings supplied pilot bored for machining - Maximum stem acceptance diameter:

A (Z3)[3] **Rising**	mm	32	51	67	73	83	N/A	83
	in	1¼	2	2⅝	2⅞	3¼	N/A	3¼
A (Z3)[3] **Non-rising**	mm	26	38	51	57	73	N/A	73
	in	1	1½	2	2¼	2⅞	N/A	2⅞
Pilot bore[4]	mm	15	20	25	33	38	N/A	38

Group "B" couplings – Non-thrust
Steel drive couplings - Maximum stem acceptance diameter:

B1 Fixed bore	mm	42	60	80	100	120	100	N/A
B3 Fixed bore	mm	20	30	40	50	50	50	N/A
B4 (max)	mm	20	32	44	60	60	60	N/A
	in	¾	1¼	1¾	2¼	2¼	2¼	N/A

Handwheels: IQ, IQS, IQD, IQM, IQML, IQL

Actuator size	10, 12, 18	19, 20	25	35	40	70, 90, 91	95
Standard ratio	1:1	1:1	13.3:1[5]	22.25:1	15:1	30:1	45:1
Option ratio	5:1	13.3:1	1:1[6]	N/A	30:1	45:1	30:1[6]

Notes:

1 IQ40 and IQ70 have an F25/FA25 base fitted as standard. F30/FA30 can be fitted as an option. IQ90 B3 and B4 couplings are only available with F25/FA25. IQ90 A coupling is only available with F30/FA30.
2 Approximate net weights of standard build actuators. Actual weight will be dependent on specification and options fitted.
3 Rotork standard "Z3" option is extended below baseline allowing additional reach. Refer to Section 2.
4 Solid coupling option available on request.
5 IQM25 and IQML25 standard ratio is 1:1.
6 Rimpull does not meet the requirements of EN12570. May be used for lower torque applications or where higher handwheel forces are acceptable.

IQT, IQTM and IQTF Performance Summary

Performance and Mechanical Data

The below performance information is for actuators with B type couplings. For alternative flange, coupling and weight information on IQTF actuators - refer to PUB002-006.

Actuator	IQTF50	IQTF100	IQT125 IQTF125 IQTM125	IQT250 IQTF250 IQTM250	IQT500 IQTF500 IQTM500	IQT1000 IQTF1000 IQTM1000	IQT2000 IQTF2000 IQTM2000	IQT3000 IQTF3000 IQTM3000
Torque								
Max Nm	50	100	125	250	500	1,000	2,000	3,000
Min Nm	20	40	50	100	200	400	800	1,200
Max lbf.ft	37	74	92	185	369	738	1,476	2,214
Min lbf.ft	15	30	37	74	148	295	590	886
Modulating Torque (IQTM and IQTF only)								
Nm	25	50	62.5	125	250	500	1,000	1,000
lbf.ft	18.5	37	46	92.5	184.5	369	738	738
Operating Time (IQT and IQTM only)								
90° Min	–	–	5	8	15	30	60	60
90° Max	–	–	20	32	60	120	240	120
Operating Speed Range (IQTF only)								
rpm	2.5 - 10	1.5 - 6	0.75 - 3	0.5 - 1.88	0.25 - 1.0	0.125 - 0.5	0.125 - 0.25	0.125 - 0.25
max turns, min rpm	22	22	12	7.5	3.75	1.88	1.88	1.88
max turns, max rpm	22	22	22	22	15	8	4	4
Flange								
ISO 5211	F05* F07* F10	F05* F07* F10	F05* F07* F10	F07* F10	F10	F12 F14	F14	F16
MSS SP-101	FA05* FA07* FA10	FA05* FA07* FA10	FA05* FA07* FA10	FA07* FA10	FA10	FA12 FA14	FA14	FA16
Weight								
kg	22	22	22	22	22	37	37	39
lbs	49	49	49	49	49	82	82	86
Couplings** Spindle acceptance								
Bore & key max mm	22 28 42	22 28 42	22 28 42	28 42	42	60	60	60
Bore & key max in	0.87 1.1 1.65	0.87 1.1 1.65	0.87 1.1 1.65	1.1 1.65	1.65	2.36	2.36	2.36
Square AF max mm	14 19 32	14 19 32	14 19 32	19 32	32	41	41	46
Square AF max in	0.56 0.75 1.25	0.56 0.75 1.25	0.56 0.75 1.25	0.75 1.25	1.25	1.62	1.62	1.81
Handwheel								
Turns for 90°	26	26	88	88	88	83	83	83

IQT / IQTM / IQTF 24 VDC (17-37 Volts) Performance
Torque outputs for 24 VDC are the same as above, however speed varies with load.

* Optional flanges F05, FA05, F07 and FA07 use a base adapter plate. Required base type must be specified.

** Couplings are supplied blank for machining by valve maker.

IQTF Linear Output Performance Summary

IQTF Choke and Control - L Output: Thrust Only

Drive designed for rising, plain stem valve types. Thrust only.

Size nomenclature example: IQTF50 F10**L**

L – F10 / F14. Threaded male coupling valve stem interface. Drives include anti-rotation keys, protection bellows and grease point. Factory greased using Total Multis MS2 high temperature grease.



	Stem Lead	Base	Coupling	Rated Thrust		Max Stroke	mm /sec	
Size	mm			lbf	kN	mm	Max	Min
IQTF50 L	3	F10	M18 x 1.5	5,271	23.45	60	0.5	0.13
IQTF50 L	5	F10	M18 x 1.5	4,695	20.88	100	0.83	0.21
IQTF50 L	7	F10	M18 x 1.5	4,232	18.82	140	1.17	0.29
IQTF100 L	3	F10	M18 x 1.5	10,543	46.90	60	0.3	0.08
IQTF100 L	5	F10	M18 x 1.5	9,389	41.77	100	0.50	0.13
IQTF100 L	7	F10	M18 x 1.5	8,463	37.65	140	0.70	0.18
IQTF125 L	5	F14	M30 x 2	8,518	37.89	100	0.25	0.06
IQTF125 L	7	F14	M30 x 2	7,891	35.10	140	0.35	0.09
IQTF125 L	10	F14	M30 x 2	7,107	31.61	153	0.50	0.13
IQTF125 L	15	F14	M30 x 2	6,077	27.03	153	0.75	0.19
IQTF250 L	5	F14	M30 x 2	17,036	75.78	100	0.16	0.04
IQTF250 L	7	F14	M30 x 2	15,783	70.21	140	0.22	0.05
IQTF250 L	10	F14	M30 x 2	14,214	63.23	153	0.31	0.08
IQTF250 L	15	F14	M30 x 2	12,154	54.06	153	0.47	0.12

Thrust is adjustable in the range 40% to 100% rated thrust in 1% increments.

IQTF choke and control – A output: torque and thrust

Drive designed for rising, threaded stem valve types. Torque and thrust.

Size nomenclature example: IQTF50 F10**A**

A – F10 / F14. Detachable aluminium bronze drive bush supplied blank for machining. Minimum 3 times thrust overload rating.



	Rated Thrust		Rising Max Diameter	
Coupling Acceptance	kN	lbf.ft	mm	in
F10	44	10,000	32	1.25
F14	100	22,480	38	1.5

	Turns	Stroke	RPM		Rated Torque		Base
Size	Max	Max (mm / in)	Max	Min	Nm	lbf.ft	
IQTF50 A	20	153/6	10	2.5	50	36.9	F10
IQTF100 A	20	153/6	6	1.5	100	73.8	F10
IQTF125 A	20	153/6	3	0.75	125	92.3	F14
IQTF250 A	20	153/6	1.88	0.47	250	184.5	F14

Torque is adjustable within the range 40% to 100% rated torque in 1% increments.

IQM and IQML Performance Summary

IQM Performance Data

		Actuator output speeds									
	rpm at 50 Hz	18		24		36		48		72	
	rpm at 60 Hz	21		29		43		57		86	
Actuator size		Torque	Nm	lbf.ft							
IQM10	Modulating	17	12.5	17	12.5	15.6	11.5	13.6	10	-	-
	Seat	34	25	34	25	30	23	27	20	-	-
IQM12	Modulating	34	25	34	25	30	22	27	20	-	-
	Seat	61	45	54	40	54	40	48	35	-	-
IQM20	Modulating	81	60	81	60	68	50	54	40	47	35
	Seat	122	90	109	80	81	60	68	50	54	40
IQM25	Modulating	152	112.5	152	112.5	129	95	102	75	102	75
	Seat	204	150	204	150	163	120	136	100	136	100
IQM35	Modulating	271	200	271	200	253	187	203	150	203	150
	Seat	544	400	544	400	408	300	313	230	218	160

IQML Performance Data

			Actuator output speeds									
		rpm at 50 Hz	18		24		36		48		72	
		rpm at 60 Hz	21		29		43		57		86	
Actuator size	Leadscrew dia/lead mm		Linear Speed at	50 Hz	60 Hz		Thrust	kN	lbf			
IQML10	25 / 3	mm/sec	0.9	1.1	1.2	1.5	1.8	2.2	2.4	2.9	-	-
		Modulating	7.9	1,785	7.9	1,785	7.3	1,643	6.4	1,429	-	-
		Seat	15.9	3,570	15.9	3,570	14.6	3,285	12.7	2,858	-	-
IQML12	25 / 3	mm/sec	0.9	1.1	1.2	1.5	1.8	2.2	2.4	2.9	-	-
		Modulating	15.9	3,571	15.9	3,571	14.0	3,143	12.7	2,857	-	-
		Seat	28.6	6,428	25.4	5,714	25.4	5,714	22.3	5,005	-	-
IQML20	38 / 7	mm/sec	2.1	2.5	2.8	3.4	4.2	5.0	5.6	6.7	8.4	10.0
		Modulating	22.8	5,128	22.8	5,128	19.0	4,274	15.2	3,419	13.3	2,991
		Seat	34.2	7,692	30.4	6,838	22.8	5,128	19.0	4,274	15.2	3,419
IQML20	38 / 15	mm/sec	4.5	5.4	6.0	7.3	9.0	10.8	12.0	14.3	18.0	21.5
		Modulating	17.6	3,947	17.6	3,947	14.6	3,289	11.7	2,632	10.2	2,303
		Seat	26.2	5,921	23.4	5,263	17.6	3,947	14.6	3,289	11.7	2,632
IQML25	38 / 7	mm/sec	2.1	2.5	2.8	3.4	4.2	5.0	5.6	6.7	8.4	10.0
		Modulating	42.8	9,615	42.8	9,615	36.1	8,120	28.5	6,410	28.5	6,410
		Seat	57.0	12,821	57.0	12,821	45.6	10,256	38.0	8,547	38.0	8,547
IQML25	38 / 15	mm/sec	4.5	5.4	6.0	7.3	9.0	10.8	12.0	14.3	18.0	21.5
		Modulating	32.9	7,401	32.9	7,401	27.8	6,250	21.9	4,934	21.9	4,934
		Seat	43.9	9,868	43.9	9,868	35.1	7,895	29.3	6,579	29.3	6,579

IQML size 10 and 12 have base size F10 and stroke length 115 mm / 4½ inches.
IQML size 20 and 25 have base size F14 and stroke length 110 mm / 4⅓ inches.

2 Actuator Drive Couplings

2.1 IQ and IQT Drive Couplings

The IQ range features a removable base and coupling for all sizes. Flanges and couplings comply with ISO 5210 or MSS SP-102. Other base interfaces are available – apply to Rotork for details.

Drive Couplings

The removable drive bushes are supplied blank or pilot bored for machining to suit valve stem.

Thrust Bearings

Type 'A' and 'Z3' couplings include a fully sealed and lubricated-for-life thrust bearing. The thrust bases are designed to retain all the developed valve thrust reaction forces without any thrust load being transmitted to the actuator gearcase.

2.2 Thrust (Temperature) Compensation - Coupling T

For applications when valve stem expansion (caused by temperature change), within the valve body, can generate excess thrust and cause the valve to become damaged, Rotork offer a thrust compensator. This limits thrust and prevents damage, while maintaining a sufficient level to prevent leaking.



F10 Type A thrust base assembly.



Thrust compensator.



F14 and F16 Type A thrust base assembly.



F25 and F30 Type A thrust base assembly.

Actuator Drive Couplings

IQ Actuator Drive Couplings

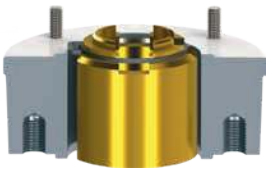
All size IQ actuators

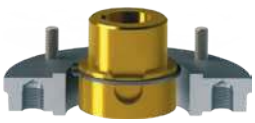


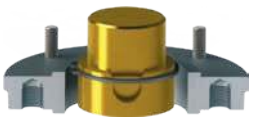


	Type A	**Type Z3** Increased reach
Thrust		

Non-Thrust	Large fixed bore with ISO standard bore and keyway **Type B1**	Fixed bore with ISO standard bore and keyway **Type B3**	Blank drive bush for machining by customer **Type B4**

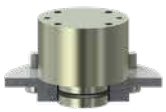


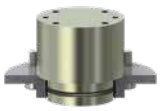




IQT Actuator Drive Couplings

All size IQT actuators







F05/FA05 for size IQT125	**F07/FA07** for sizes IQT125/250	**F10/FA10** for sizes IQT125/250/500







F12/FA12 for size IQT1000	**F14/FA14** for size IQT2000	**F16/FA16** for size IQT3000

3 Introduction

IQ range actuators are self-contained, purpose designed and built for the local and remote electrical operation of valves. Comprising an electric motor, reduction gearing, reversing starter with local controls and indication, turns and torque limitation with electronic logic controls and monitoring facilities housed in a double-sealed watertight enclosure. Hazardous area certified enclosures meeting international and national requirements are also available.

All torque, turns settings and configuration of the indication contacts are made using the non-intrusive, handheld Rotork *Bluetooth*® Setting Tool Pro.

The specifications in this section cover IQ range standard and optional features. Enclosure requirements and selected build options must be specified at time of enquiry.

4 Design Specification

The IQ range of actuators comply with standards EN 15714-2 Industrial Valves – Actuators – Part 2: Electric actuators for industrial valves – Basic requirements, ISA-SP96.02 Electric Actuators and ISO 12490 / API 60X

Petroleum and natural gas industries – Mechanical integrity and sizing of actuators and mounting kits for pipeline valves.

4.1 Duty Rating

Duty Classification	Actuator Type	Rating
On-Off & Inching[1]	IQ / IQS / IQD	Nominal 60 starts per hour at a rate not exceeding 600 starts per hour. 15 minutes rated based on a nominal torque of 33% of rated (S2/S3, Class A & B)
Modulating	IQM / IQML	Nominal 1,200 starts per hour, 50% duty cycle based on a modulating torque of 50% of rated torque (S4 Class C)
On-Off & Inching	IQT	Nominal 60[2] starts per hour at a rate not exceeding 600 starts per hour based on 75%[3] of rated torque
Modulating	IQTM / IQTF	Nominal 1,800 starts per hour, 50%[4] of rated torque (S4 Class C)

Note:
1 Up to AC4 rating for IQ actuators
2 Suitable for duty cycles up to 1,200 starts per hour depending on load and control method applied. Contact Rotork for details
3 IQT3000 = 50% rated torque
4 IQT3000 = 33% rated torque

4.2 Design Life

Design life is a function of actuator torque and speed. Values quoted are the minimum requirements; for most sizes/speeds life will be extended above the values quoted. Prior to life testing, actuators are stalled against a solid object 25 times to prove durability. Contact Rotork for more information.

Duty Classification	Actuator Type	Size	Minimum Design Life Rating
On-Off & Inching	IQ / IQS / IQD	10 - 35	Torque and thrust test: 10,000 cycles (500,000 output turns) seating at rated torque, 33% rated torque through stroke
		40 - 95	Torque and thrust test: 5,000 cycles (250,000 output turns) seating at rated torque, 33% rated torque through stroke
Modulating	IQM / IQML	12 - 35	1,800,000 starts at load of 50% rated torque (1 start constitutes at least 1% movement)
On-Off & Inching	IQT	125-2000	Torque test: 25,000 cycles seating at rated torque, 75% rated torque through stroke
On-Off & Inching	IQT	3000	Torque test: 10,000 cycles seating at rated torque, 50% rated torque through stroke
Modulating	IQTM	125-2000	1,800,000 starts at load of 50% rated torque (1 start constitutes at least 1% movement)
Modulating	IQTM	3000	1,800,000 starts at load of 33% rated torque (1 start constitutes at least 1% movement)
Modulating	IQTF	50-2000	1,800,000 starts at load 50% rated torque (1 start constitutes 1% movement based on a nominal 2.5 turns)
Modulating	IQTF	3000	1,800,000 starts at load 33% rated torque (1 start constitutes 1% movement based on a nominal 2.5 turns)

4.3 Vibration, Shock and Noise

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

Type	Level
Plant induced vibration	1g RMS total for all vibration within the frequency range of 10 to 1,000 Hz
Shock	5g peak acceleration
Seismic	2g acceleration over a frequency range of 1 to 50 Hz if it is to operate during and after the event
Emitted noise	Independent tests have shown that at 1m generated noise does not exceed 70 db (A)

Levels quoted are those present at the actuator mounting interface. It should be noted that the effects of vibration are cumulative and therefore an actuator subjected to significant levels may have a reduced lifespan. 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.

The IQ includes a vibration sensor that measures and captures vibration levels in the range 10 Hz to 1 kHz (RMS average) and peak acceleration (maximum g) in 3 axis (x, y and z). Vibration trend logs averaged over one hour can be viewed on the display or downloaded and viewed using Insight 2.

4.4 Valve / Actuator Interface

The IQ range of actuators are available with mounting base and output drive couplings conforming to the following international standards:

Valve to actuator interface:

Valve type	Actuator Range	Area	Standard	Code
Multi-turn	IQ	International	ISO 5210	"F" metric
Multi-turn	IQ	USA	MSS SP-102	"FA" imperial
Part-turn	IQ + ¼ turn gearbox	International	ISO 5211	"F" metric
Part-turn	IQ + ¼ turn gearbox	USA	MSS SP-101	"FA" imperial
Part-turn	IQT	International	ISO 5211	"F" metric
Part-turn	IQT	USA	MSS SP-101	"FA" imperial

Actuator Orientation:

Actuators can be mounted in any orientation. The user/installer is responsible for considering the effects of orientation and subsequent loading on the supporting pipework and valve structure including any interface adaption kits.

4.5 Operating Temperature

Actuators are suitable for operation within the ambient temperature ranges shown below. Refer to Section 5 for Hazardous Area Certification operating temperature restrictions. For temperatures outside this range please contact Rotork. Prior to installation actuators should be stored in a dry location with a temperature range not exceeding -60 to 80 °C (-76 to 176 °F).

Actuator Type	Standard Temperature[1]	Low Temperature Option[1]
IQ, IQM, IQML	-30 to +70 °C (-22 to +158 °F)	Refer to Section 5
IQS, IQD	-20 to +70 °C (-4 to +158 °F)	Not available
IQT / IQTM / IQTF	-30 to +70 °C (-22 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

Note:
1 Hazardous Area certification determines permissible operating temperature range. Refer to Section 5.

5 Non-Hazardous & Hazardous Certified Enclosures

All IQ actuator hazardous and non-hazardous area enclosures are watertight to IP68/NEMA Type 4 & 6. The Rotork double-sealed terminal compartment features a seal at the terminal cover and a separate seal at the terminal bung. This results in the actuator internals being completely sealed from the environment for life, even with the terminal cover removed. Through the use of non-intrusive commissioning and adjustment using the Rotork *Bluetooth*® Setting Tool Pro, covers never need removing and therefore the hermetic, factory-sealed enclosure protects internal components for life. In addition, the Rotork *Bluetooth*® Setting Tool Pro is certified Intrinsically Safe permitting power-on commissioning in hazardous areas.

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 contact Rotork.

IQ actuators are available built in accordance with the following standards:

5.1 Non-Hazardous Area Enclosures

WT: Standard Watertight

Standard	Rating	Standard Temperature	Option 1	Option 2	Option 3
IEC 60529 (1989-11)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	n/a
BS EN 60529 (1992)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	n/a
NEMA (US)	Type 4, 4X & 6	-22 to +158 °F	-40 to +158 °F	-58 to +104 °F	n/a
CSA (Canadian)	Type 4, 4X & 6	-22 to +158 °F	-40 to +158 °F	-58 to +104 °F	n/a
EAC (Russia)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	-61 to +40 °C

5.2 Hazardous Area Enclosures

European Hazardous Area Directive – ATEX (2014/34/EU)

Directive Code	Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
ATEX II 2GD c	**Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])**	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)
ATEX II 2GD c	**Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])**	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

International Hazardous Area – IECEx

Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)
Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

USA Hazardous Area – Factory Mutual Certified Explosionproof to FM3615

Class	Division	Groups	Standard Temperature	Temperature Option 1	Temperature Option 2
I II	1 1	C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)
I II	1 1	B, C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)

Canadian Hazardous Area – Canadian Standards Association (CSA EP) to C22.2 No 30-M

Class	Division	Groups	Standard Temperature	Temperature Option 1	Temperature Option 2
I II	1 1	C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)
I II	1 1	B, C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)

EAC (Russia) – Ex

Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-61 to +40 °C (-78 to +104 °F)
Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-61 to +40 °C (-78 to +104 °F)

Note:

1 Applies to IQT range only

Rotork *Bluetooth*® Setting Tool Pro Certification

Directive / Standard	Rating	Standard Temperature
ATEX II 1G	**Ex ia IIC T4**	-30 to +50 °C (-22 to +122 °F)
FM3610	**Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	-30 to +50 °C (-22 to +122 °F)
Canada CSA – C22.2 No.157-92	**Exia - Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	-30 to +50 °C (-22 to +122 °F)

Marine Approval

Actuator Type	Approval	Certificate
IQ	**Lloyd's Register Mutual Recognition Type Approval**	16/ 00066
IQT, IQTM, IQTF	**Lloyd's Register Mutual Recognition Type Approval**	18/ 00005

6 Regulatory Standards

Compliance with the following European Economic Community Directives permits IQ range actuators to be CE marked under the provision of the Machinery Directive.

Directive	Applicable to	Reference
Electromagnetic compatibility (EMC)	**Immunity to / emissions of electromagnetic energy**	2004/108/EC
Low voltage (LV)	**Electrical safety**	2006/95/EC
Machinery[1]	**Product safety**	Actuators follow the provision of the Machinery Directive 2006/42/EC. 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 2006/42/EC.
Waste Electrical Equipment (WEE)	**Exempt under the scope of the directive**	
Federal Communications Commission	***Bluetooth* modules - actuator and Rotork *Bluetooth*® Setting Tool Pro.**	Contains FCC certified transmitter module. Refer to PUB002-039 for FCC ID.

Note:

1 Actuators are not classified as machines within the scope of the machinery directive. Contact Rotork for a copy of our Declaration of Conformity and Incorporation.

7 Power, Control & Indication

7.1 Power Supplies

IQ actuators are suitable for operation with the following 1-phase, 3-phase and DC power supplies:

Standard supply voltage ranges – actuator availability

IQ Actuator – 3-phase

Actuator Size	10	12	18	19	20	25	35	40	70	90	91	95
rpm	Voltage Availability											
18	A	A	A	A	A	A	A	C	C	C	–	–
24	A	A	A	A	A	A	A	C	C	C	–	C
36	A	A	B	A	A	A	A	C	C	C	–	–
48	A	A	B	A	A	A	A	C	C	C	–	–
72	A	A	B	A	A	A	A	C	C	C	–	–
96	A	A	B	–	A	A	A	C	C	C	–	–
144	–	–	B	–	A	A	A	C	C	C	C	–
192	–	–	B	–	–	B	B	–	C	C	C	–

Group A **50/60 Hz:** 190, 200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 480, 500, 550, 575, 590, 600, 660, 690 V
Group B **50 Hz:** 380, 400, 415, 440 V. **60 Hz:** 460, 480 V
Group C **50 Hz:** 200, 380, 400, 415, 440, 500, 660, 690 V. **60 Hz:** 240, 480, 600 V
Additional voltages are available for specific speeds and/or duty, refer to PUB002-099 or contact Rotork for more information.

IQM, IQML Actuators – 3-phase

Actuator Size	10	12	20	25	35
rpm	Voltage Availability				
18	A	A	A	A	B
24	A	A	A	A	B
36	A	A	A	A	B
48	A	A	A	A	B
72	–	–	A	A	B

Group A **50/60 Hz:** 190, 200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 480 V
Group B **50 Hz:** 380, 400, 415 V. **60 Hz:** 440, 460, 480 V
Additional voltages are available for specific speeds and/or duty, refer to PUB002-120 or contact Rotork for more information.

IQS Actuator – 1-phase

Actuator Size	12	20	35
rpm	Voltage Availability		
18	A	A	B
24	A	A	B
36	A	A	B
48	A	A	B
72	A	A	B
96	A	A	B
144	-	A	B

Group A **50/60 Hz:** 110, 115, 120, 220, 230, 240 V
Group B **50/60 Hz:** 220, 230, 240 V
Refer to PUB002-119 or contact Rotork for more information.

IQD Actuator – DC

Actuator Size	10	12	18	20	25
rpm	Voltage Availability				
18	A	B	-	C	C
24	A	B	B	C	C
36	A	B	-	C	C
48	A	B	-	C	C

Group A 24, 48, 110 V
Group B 48, 110 V
Group C 110 V
Refer to PUB002-121 or contact Rotork for more information.

Tolerances

Voltage Tolerance	+/-10%	Applies to rated torque performance only; duty cycle and speed is not guaranteed
Frequency Tolerance	+/-5%	Applies to rated torque performance only; duty cycle and speed is not guaranteed
Non-standard tolerances	For tolerances larger than those quoted, contact Rotork	
Uninterruptable power supplied	For AC systems the UPS output should conform to recognised supply standards such as BS EN 50160 in respect of waveform, harmonics etc.	

IQT, IQTM, IQTF Actuators

Actuator Size	50	100	125	250	500	1000	2000	3000
Voltage	Voltage Availability							
DC – 24 V	✓	✓	✓	✓	✓	✓	✓	✗
1-Phase 50/60 Hz: 100, 110, 115, 120, 208, 220, 230, 240 V	✓	✓	✓	✓	✓	✓	✓	✓
3-Phase 50/60 Hz: 200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 480, 500, 550, 575, 590, 600, 660, 690 V	✓	✓	✓	✓	✓	✓	✓	✓

7.2 HMI, Local Control, Indication & Set-up

The high resolution LCD display has a wide viewing angle making it easily legible from a distance. The LCD display operates from -50 °C up to +70 °C.

Non-intrusive selectors are provided on the actuator electrical control cover which also includes a window showing actuator position, status and alarm display.

The control cover may be rotated through 360° (90° increments) to suit actuator orientation/operator access. Set-up is over a *Bluetooth* interface using the supplied Rotork *Bluetooth*® Setting Tool Pro.

Standard local controls

Operation	Type	Function	Comments
Position	Red, rotary selector	Selects "Local", "Stop" or "Remote" control	Can be padlocked in each position (stop remains available) for site operational protection
Local control	Black, rotary selector	Initiates local "Open" and "Close" operation	Spring-return to centre neutral position. Local control may be user configured for inching action
Bluetooth	Rotork *Bluetooth*® Setting Tool Pro	Initiates local "Open" and "Close" operation	May be user configured for *Bluetooth* operation over a nominal distance of 10 m (30 ft)

Standard local indication

Operation	Type	Function	Comments
Position indication	LCD - Large character (25 mm/1")	Close icon – 0-99% (0.1% increments) – Open Icon	Back-lit (power on) – operating temperature range -50 to +70 °C (-58 to +158 °F). Battery supported power off
Position indication	Coloured indication lights	Green (close), Red (open) Yellow (mid-travel)	Power on – lamp indication, colours can be reversed. Blinker and alarms can be configured to indicate
Status and Alarm (multi-language)	LCD – position display status and alarm text	Real time status and alarm text integrated into position display	Power on – battery supported (when awake)
Status and Alarm (multi-language)	LCD – text display	Real time status and alarm text via status	Power on – battery supported (when awake)
Status and Alarm (multi-language)	General alarm Battery alarm	Display icons	At a glance indication, detail provided by status/alarm text

7.2 HMI, Local Control, Indication & Set-up cont.

IQ range actuators are set up using the non-intrusive Rotork *Bluetooth*® Setting Tool Pro. Torque levels, position limits, control and indication functions can all be accessed using the intrinsically safe, wireless handheld setting tool.

Bluetooth wireless connectivity allows easier use without direct line-of-sight and over greater distances, however security has to match. This is achieved by the initial 'pairing' of tool and actuator being carried out by a single infra-red transaction after which a *Bluetooth* wireless connection automatically takes over. As before, configuration changes are password protected and the actuator is immune to connection by non-Rotork devices or programmes.

IQ range actuators benefit from advances in human interface design. In addition to a configurable, information-rich display, they offer a highly intuitive menu system for commissioning, updates and diagnostics.

Rotork Insight 2 software facilitates actuator setup by pre-defining complete sets of instructions and settings. Each collection of settings can be saved as a 'mission' and quickly applied to individual actuators via the handheld Rotork *Bluetooth*® Setting Tool Pro.

IQ actuators can be interrogated and set up even when mains power is not available; the actuator can be configured and interrogated by using power from its display back-up battery.

Actuator Set-Up, Configuration & Datalogging

Setting Tool & LCD displays	Simple non-intrusive, interactive set-up procedure using supplied Rotork *Bluetooth*® Setting Tool Pro with read-back from LCD's. Settings include limits & torque, indication contacts and control options. Settings may be password protected.
PC/PDA	Using freeware Insight 2, actuators may be configured / analysed over *Bluetooth* interface.
Datalogging	Standard onboard data logger provides valve torque and starts profiles, operational statistics, events log. Actuator configuration and manufacturing data also available. Files can be downloaded direct to PC or to Rotork *Bluetooth*® Setting Tool Pro (IS certified) for transport to office PC. Freeware Insight 2 for PC is available to download at www.rotork.com

Options

Vandal resistant	**Option 1:** Red / black control selectors not fitted	**Option 2:** Lockable cover protects standard selectors and window

Reference documents

Refer to PUB002-039 for details of status and alarm text messages, alarm icons, help screens and actuator set up procedure.
Refer to PUB095-001 for Rotork *Bluetooth*® Setting Tool Pro manual.

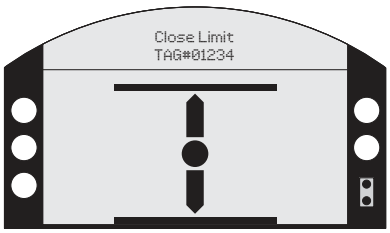
7.2.1 Local Diagnostics and Setup

The large dual stacked, hi-resolution display, with positional characters that are 25 mm high, is unrivalled in visibility for all lighting and orientation conditions. Consisting of a static, high-contrast positional display and a fully configurable dot-matrix LCD behind, the IQ range offers the easiest, user-friendly configuration and data analysis ever seen in the actuation world.

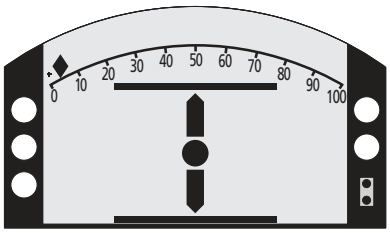
7.2.2 Configurable Home Screens

With a mixture of the static and dot-matrix displays, there are now four configurable home-screens available to the user. The four screens reflect the parameters most commonly required to analyse operation at-a-glance:

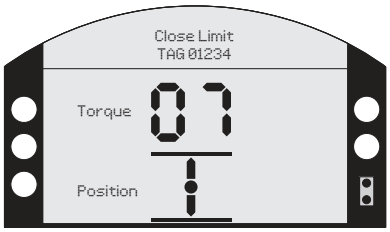
- Positional information with status



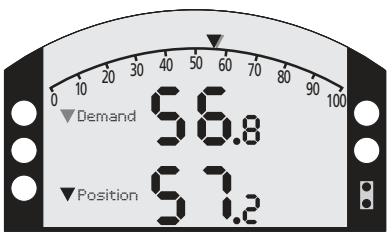
- Positional information with torque (analogue)



- Positional information with torque (digital)



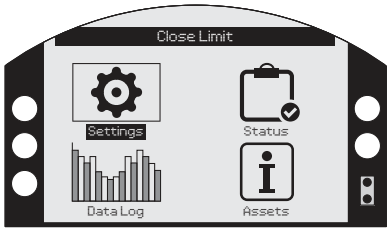
- Positional information with input demand (digital and analogue)

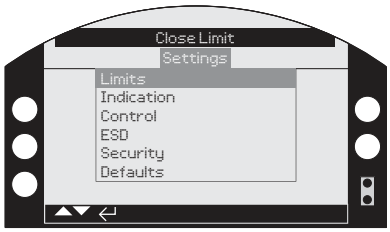


Using the Rotork *Bluetooth*® Setting Tool Pro, each of these screens can be easily accessed with a press of a button. Alternatively you can select one of the four screens to be continually displayed in the setup menu.

7.2.3 User Friendly Setup Menus

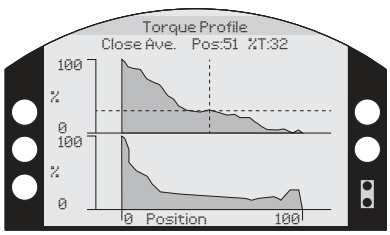
A single press of a button on the Rotork *Bluetooth*® Setting Tool Pro takes you into the user-friendly setup menu. This menu has been designed and structured to reduce reliance on having a written manual to hand. With large, clear characters available in many languages, setup and configuration has never been so easy.

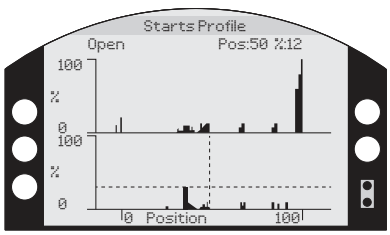




7.2.4 Graphical Data Logger

Greater amounts of data and analytical screens are now available in the data logger and viewable locally. The data logger screens are displayed on a 168 x 132 pixel dot-matrix display and can display anything from a torque vs position graph to statistical operational data.

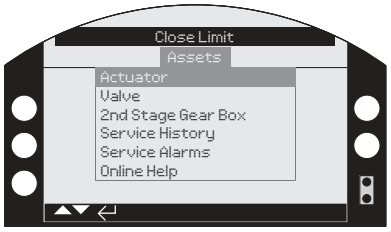




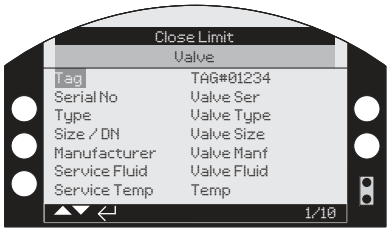
7.2.5 Asset Management

Not only can you store information relating to the actuator, but also the valve and gearbox. This includes data about build (class, size, ratio and tag numbers) along with service information (commission date, service date etc).

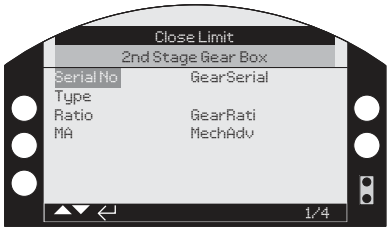
- Actuator data



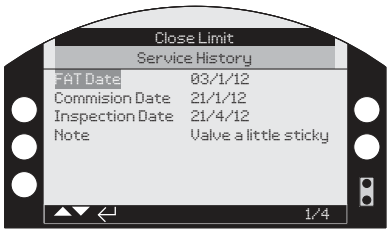
- Valve data



- Gearbox data



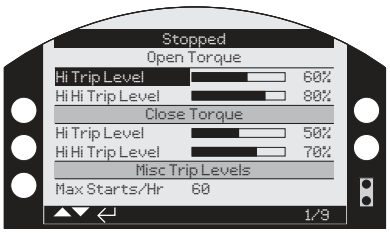
- Service history



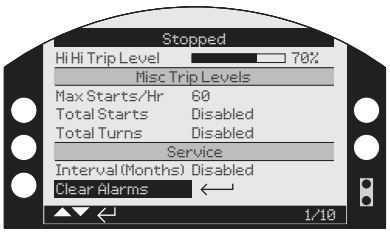
7.2.6 Configurable Service Alarms

To help optimise preventative maintenance, the 3rd generation IQ now includes configurable service / maintenance alarms. The alarm parameters include:

- Open torque levels
- Close torque levels



- Miscellaneous trip levels:
  - Starts/Hr
  - Total starts
  - Total turns
  - Service intervals



7.2.7 QR Code – 2d Barcode

A QR (Quick Response) code or 2d barcode can be generated on the dual stacked display, which can be scanned with a Smartphone. This enables the user a quick link to the Rotork website for further information and online help.



7.2.8 Rotork Help – Online

Rotork has a comprehensive worldwide service network to provide you with local support wherever you are. Rotork trained technicians working from our network of offices and centres of excellence are available to offer immediate assistance.

To contact Rotork, visit www.rotork.com

7.3 Remote Control & Indication

IQ range actuators enable remote control and indication of valves for centralised control. Actuator control and indication forms are available to meet the requirements of the various site control systems, from simple manual push-button control through to sophisticated Distributed Control Systems (DCS) using relay outputs or digital "bus" network systems.

Standard remote controls

Operation	Type	Range	Comments
Open/Close/ Maintain Common	Positive switched 3 x opto-isolated inputs designed for fleeting or maintained contacts	20 - 60 VDC, 40 - 120 VAC	Actuator derived 24 VDC (120 VAC available as an option) or externally supplied derived from the control system. Various forms available.
ESD Open interlock Close interlock Common	Positive switched 3 x opto-isolated inputs designed for maintained contacts.	20 - 60 VDC, 40 - 120 VAC	ESD can be user configured open, stayput or close, from an NO or NC contact. ESD has priority over all other applied local or remote control signals. Interlocks provide hardwired "permissive" protection (ie. main and bypass control) and are active for local and remote or may be configured for remote signals only.
Drive enable (option)	Positive switched 1x opto-isolated input. (maintain input)	20 - 60 VDC, 40 - 120 VAC	Maintain input configurable as drive enable: actuator will not operate unless signal is applied.

Options

120 VAC actuator derived supply	5 VA rated	Actuator derived supply for remote control.
125 VDC remote control	20 mA per input	Suitable for 125 VDC remote control supply - positive switching.
Negative switching	20 - 60 VDC	Suitable for negative switched systems applies to open, stop, close, ESD and interlocks.
Analogue control – Option Folomatic	0 to 5/10/20 mA or volt ranges	Proportional control over the whole or part of valve stroke. Configurable for open, close or stayput on loss of analogue signal.
Hydraulic shock 'water hammer'/ surge protection – Option Interrupter timer	Internal control system - Interrupter timer	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.

7.3 Remote Control & Indication cont.

Standard remote indication

Operation	Type	Range	Comments
Position, status and alarm indication	4 x configurable volt free latching contacts - S1 to S4. Single pole -single throw (SPST), configurable NO or NC	5 mA to 5 A[1], 120 VAC, 30 VDC	Independently configurable using the supplied Rotork *Bluetooth*® Setting Tool Pro to signal one of the following: **Valve position:** fully open, fully closed or intermediate positions (0-99% open) **Status:** Valve opening, closing, moving, local stop selected, local selected, remote selected, open or close interlock active, ESD active **Valve alarms:** Torque tripped in mid travel, going open, going closed, valve jammed, handwheel operation **Actuator alarms:** Lost phase (3-phase IQ only), customer 24 VDC (120 VAC) supply lost, battery low, internal failure detected, thermostat tripped, service alarms
Actuator availability / fault	Monitor relay configurable change over contact	5 mA to 5 A, 120 VAC, 30 VDC	In available mode the relay will de-energise when the actuator is unavailable for remote control due to any one or more of the following conditions: Power supply or control supply lost; local control selected; local stop selected; motor thermostat tripped; detected internal failure In fault mode, as above but ignores local/stop selection

Options

Operation	Type	Range	Comments
Position, status and alarm indication	Up to 8 configurable volt free latching contacts. Single pole – change over (SPCO)	5 mA to 5 A[1], 120 VAC, 30 VDC	Independently configurable using the supplied Rotork *Bluetooth*® Setting Tool Pro as per contacts S1 to S4 above
Analogue position feedback	Current position transmitter - CPT	4-20 mA output proportional to position	Auto range to set limits. Normally internally powered, available suitable for externally 'loop' powered - will default to 4 mA when actuator is powered down.
Analogue torque feedback	Current torque transmitter - CTT	4-20 mA output proportional to output torque	Range 0% to 120% of rated torque (4 to 20 mA)
Auxiliary power supply	Maintains power to the actuator control on loss of mains	Nominal 24 VDC, 1 A (switching inrush 8 A max)	Customer supply maintains backlit display, CPT analogue indication and bus network communications during actuator power outages. Customer supply is isolated from internal control power for protection

Reference documents:
Refer to PUB002-041 IQ Control and Monitoring.

Note:
1 Maximum total combined current through all four relays not to exceed 8 A.

7.4 Fieldbus System Control Options

IQ range actuators are available with the following network interface cards to enable remote control and indication using digital "bus" network systems communication to the Distributed Control Systems (DCS).

Standard remote controls

Network Type	Comments
Pakscan™	An internally mounted *Pakscan* field unit for remote control and status indication. *Pakscan Classic* network operates on a 2-wire current loop containing up to 240 field devices with a loop length of up to 20 km without repeaters and host communications using Modbus protocol. *Pakscan Wireless* operates over a secure wireless mesh network supporting up to 60 wireless actuators with 100 m between devices. Utilising the license free ISM frequency band (2.4 Ghz). Only compatible with existing *Pakscan* P3 wireless. For more information please refer to PUB059-048.
Modbus®	Modbus modules suitable for single or dual communication highways may be included in the IQ actuator, to provide Fieldbus communication of all the actuator control functions and feedback data. Data is carried on an RS485 data highway and the communications protocol used is Modbus RTU. System variables such as unit address and data baud rate are programmed over the *Bluetooth* data link. For more information please refer to PUB091-001.
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 PUB088-001.
Foundation Fieldbus®	An IEC 61158-2 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. For more information please refer to PUB089-001.
HART®	HART (Highway Addressable Remote Transducer) is a process control communication protocol. The signal consists of two parts, the analogue 4-20 mA current loop and a superimposed digital signal. Traditionally the 4-20 mA loop is used for control and the superimposed digital signal for feedback, diagnostics and configuration. Configuration and feedback using the HART digital signal can be achieved using the host connected to the actuator to select the parameters required. The majority of the user configurable settings can be made over the HART communication protocol. See PUB092-001 for further details.
DeviceNet®	DeviceNet® is a communications protocol which utilises the CAN bus network. The IQ DeviceNet® module Electronic Data Sheet (EDS) file is used to set up the actuator parameters and allow system performance to be optimised. Status, alarms and control functions are available over the DeviceNet® network. For more information please contact Rotork.

8 Protection and Operating Features

The IQ control system incorporates the following standard operating features and comprehensive valve, actuator and control protection to ensure reliable valve operation and protection under all circumstances.

Fault / Feature	Cause / Operation	Function
Obstructed valve	Valve meets an obstruction or process conditions that prevent movement. Obstruction must be sensed and operation prevented to prevent damage to valve and actuator.	**Independent Settable Open and Close Torque Switches** Torque switch will "torque trip" the actuator motor when the preset output torque level is reached. Torque switches can be set in the range 40% to 100% of rated torque. Torque trips are indicated on the actuator display and can be remotely signalled.
Jammed valve	Valve is stuck in its seat at the close or open position and operation fails to move the actuator and clear the limit position.	**Jammed Valve Protection** Torque switch will "torque trip" the actuator motor when the preset output torque level is reached or at 150% (nominal) if set to "bypass torque switch". Torque switches can be set in the range 40% to 100% of rated torque. Jammed valve protection prevents damage to valve and is indicated on the actuator display or remotely signalled.
Torque switch bypass	Provides increased torque above actuator rated for unseating sticky valves.	**Torque Switch By-pass** User selectable, torque switches are automatically bypassed during the first 5% of travel from both open and close limit positions. This permits torque above actuator rated torque and up to actuator stall torque (1.4 to 2.0 times rated torque) to be developed during unseating, ensuring "sticky" valves do not cause unwanted torque trips. Refer also to jammed valve protection, above.
Torque switch hammer	Actuator repeatedly tries to move an obstructed valve in response to a standing control signal. This can cause damage to both valve and actuator.	**Anti Hammer Protection** Once a torque trip occurs the control prevents repeated operation in the same direction as a response to a standing remote or local control signal. Actuator must be operated in the opposite direction and therefore moved away from the obstruction, which then has a chance to clear, before it can be signalled to run in the requested direction. Torque trips are indicated on the actuator display and can be remotely signalled.
Incorrect phase rotation (3-phase actuators only)	Due to 3-phase supply wiring incorrectly connected to actuator. Actuator moves in the opposite direction to that signalled. At end of travel the wrong limit/torque switch is activated preventing the motor being de-energised and causing it to stall with consequent valve damage and/or motor burn-out.	**Syncrophase™** Protection ensures actuator always runs in the correct direction corresponding to the applied control signal (open or close). The patented circuit senses connected phase rotation and ensures the actuator always runs in the correct direction by energising the appropriate motor control contactors/switches.
Lost phase / motor overheating (3-phase actuators only)	"Single phasing". One of the 3 phases applied to the actuator is lost due to fault causing the motor to single phase i.e. attempts to run with only 2 of the 3 phases applied. Motor may fail to start (stall) or run unbalanced causing overheating and possible burn-out.	**Syncrophase™** The patented circuit monitors all 3 supply phases. If a phase is lost the Syncrophase circuit prevents the motor from being energised. If during operation 1 phase is lost this cannot be detected due to back-feed through the motor windings, however once operation stops, re-energising of the motor will be prevented. Lost phase is indicated on the actuator display and can be remotely signalled.
Motor overheating	Actuator duty cycle is exceeded causing the motor to overheat. This often occurs during factory acceptance testing /commissioning or during process start up.	**Motor Thermostat Protection** Two thermostats are embedded in the motor end windings (hottest part of the motor) which directly sense motor temperature. Thermostats will open circuit when set temperature is reached causing the motor to be de-energised. Thermostats will auto-reset once the motor has cooled sufficiently allowing operation to continue. Motor thermostat trips are indicated on the actuator display and can be remotely signalled.

8 Protection and Operating Features cont.

Fault / Feature	Cause / Operation	Function
Instantaneous reversal	Control system instantaneously reverses the control signal which causes the actuator to reverse direction with associated inertial stress to valve drive and internal motor switching surges.	**Instantaneous Reversal Protection** A delay of 300 ms is automatically applied between reversals allowing the actuator to come to rest before responding to reverse control signal.
Actuator fault	Detected actuator fault.	**ASTD (Automatic Self Test & Diagnosis)** ASTD detects any internal control system failures preventing operation. Detected internal control system faults are indicated on the actuator display allowing rapid diagnosis and can be remotely signalled. In addition diagnostic screens can be accessed allowing problem to be pin-pointed.
Remote control circuit failure (actuator derived remote control supply only)	Loss of remote control.	**Remote Control Supply** The 24 VDC internal power supply made available for remote control switching is protected by an auto-reset fuse device. Should the power drawn from the supply exceed its rating (due to a remote control wiring fault, etc.), the fuse will disconnect the supply. Once the fault is cleared the supply will automatically be reinstated. Loss of internal supply is indicated on the actuator display and can be remotely signalled.
Spurious operation	Operation commanded due to unintended or spurious remote control signals leading to process problems or hazards.	**Conditional Control** User selectable. The interlock input can be configured for "conditional control", being active only for remote control. In this mode, for the actuator to respond to a remote control signal, two signals must be applied simultaneously, one to the control input and one to the interlock input. If an unintended or spurious signal is applied only to the control input it will be ignored. Intended signals can therefore be verified by applying a second "permissive" signal, effectively preventing spurious operation.
Emergency Shutdown (ESD)	Priority action where the valve is required to stayput or move to a safe end-of-travel position determined by the process - open or closed limit.	**Dedicated ESD Control Input** User configurable, the ESD action has priority over any existing or applied local or remote control signal. ESD can be configured to open, close or stayput depending on the process requirements. ESD must be derived from a latched type, normally open or normally close ESD contact (configurable) and may be configured to override local stop, interlocks or interrupter timer.

9 Components

Details of major actuator mechanical and electrical/electronic components are provided below:

9.1 Handwheel

A handwheel is provided to allow manual operation of the valve during electrical power interruption. Handwheel size and mechanical advantage are generally designed in accordance with standards EN 12570 and AWWA C540 (American Water Works Association) to give the most efficient compromise of force and turns for emergency operation.

Handwheel types: IQ, IQS, IQD, IQM, IQML, IQL

Actuator size	Standard Type / Ratio	Option
10, 12, 18	Direct / 1:1	Geared / 5:1
19, 20	Direct / 1:1	Geared / 13.3:1
25	Geared / 13.3:1[1]	Direct / 1:1[2]
35	Geared / 22.25:1	✗
40	Geared / 15:1	Geared / 30:1
70, 90, 91	Geared / 30:1	Geared / 45:1
95	Geared / 45:1	Geared / 30:1[2]

Note:
1 IQM25 and IQML25 standard ratio is 1:1.
2 Rimpull does not meet the requirements of EN12570 at actuator rated torque. May be used for lower torque applications or where higher handwheel forces are acceptable.

Handwheel types: IQT

Actuator	IQTF50	IQTF100	IQT125 IQTF125 IQTM125	IQT250 IQTF250 IQTM250	IQT500 IQTF500 IQTM500	IQT1000 IQTF1000 IQTM1000	IQT2000 IQTF2000 IQTM2000	IQT3000 IQTF3000 IQTM3000
Turns for 90°	26	26	88	88	88	83	83	83

During electric operation of the actuator, the handwheel is mechanically disengaged from the drive. To engage handwheel operation, the hand/auto selection lever is pushed down 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 kickback.

The hand/auto selection lever incorporates a facility for locking in the hand or auto positions using a 6 mm 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 pushing down and holding the hand/auto lever during electric operation.

9.2 Drive Train

The drive train and motor uses the proven basic design principals employed for over 50 years. Simple, reliable and robust, the components are oil bath lubricated (for life).

IQ actuators are factory filled for life with premium quality gear oil selected for the application. Standard oils are automotive grades easily available worldwide and have been used successfully for over 50 years. Oil lubrication out-performs grease over a wide temperature range and allows installation in any orientation. It has none of the problems associated with grease such as separation at elevated temperatures and "tunnelling" at lower temperatures where grease is thrown away from rotating components creating a void or tunnel in the grease around components that require lubrication.

Lubrication

Range	Standard Temperature Range -30 to +70 °C (-22 to +158 °F)	Option Low Temperature -50 to +40 °C (-58 to +104 °F)	Option Food Grade -20 to +70 °C (-4 to +158 °F)
IQ	SAE80EP	MOBIL SHC624	Hydra Lube GB Heavy

	Standard Temperature Range -50 to +70 °C (-58 to +158 °F)	Option Food Grade -20 to +70 °C (-4 to +158 °F)
IQT 50 - 500	600 ml made up from TEXACO ATX / Dexron2 (120 ml), CASTROL Aero HF585B (480 ml)	Hydra Lube GB Medium
IQT 1000 - 3000	1600 ml made up from TEXACO ATX / Dexron2 (320 ml), CASTROL Aero HF585B (1,280 ml)	Hydra Lube GB Medium

Food grade
Lubricant is a synthetic, non-aromatic hydrocarbon mixture with PTFE and other additives. It does not contain chlorinated solvents.
Food grade grease used in assembly and thrust bearings is Hydra Lube WIG Medium-NLGI-123.

9.3 Corrosion Protection

All IQ actuator finishes are tested in accordance with Rotork 1,000 hour cyclic salt spray test procedure which is the most realistic and arduous test cycle applicable. The test combines cyclic salt spray, drying and humidity at elevated temperatures on complete factory built actuators. This tests the finish and the various substrate materials, fixings and interfaces that make up an actuator. Substrate materials and finishes are selected to provide maximum corrosion resistance combined with good adhesion. Paint finishes fully conform to the requirements of ISO12944. Fireproofing options available:

- System ER
- K-Mass
- FR coating by Mov

Corrosivity category	IQ paint solution	Exterior environment	Interior environment
C1	Standard Polyester powder coat (P1)	N/A	Heated buildings with clean atmospheres e.g. offices, shops, schools and hotels.
C2		Atmospheres with low levels of pollution, e.g. rural areas.	Unheated buildings where condensation may occur, e.g. depots and sports halls.
C3		Urban and industrial atmospheres, moderate SO2 pollution, e.g. city centres and coastal areas with low salinity.	Production rooms with high humidity and some air pollution, e.g. food processing plants, laundries, breweries and dairies.
C4	Standard Polyester powder coat plus offshore coating on ferrous materials (P2)	Industrial and coastal areas with moderate salinity, e.g. coastal ship and boatyards.	Areas with permanently aggressive atmospheres, e.g. chemical plants and swimming pools.
C5-M (Marine)		Coastal and offshore areas with high salinity, e.g. offshore rigs and boats.	Areas with extremely aggressive atmospheres containing high humidity, salinity and pollutant concentration, e.g. cooling towers and boats.
C5-I (Industrial)	Full offshore coating on all materials (PX)	Industrial areas with high humidity and aggressive atmospheres, e.g. water treatment plants and power stations.	Areas with extremely aggressive atmospheres containing high humidity and high pollutants, e.g. chemical plants and boiler houses.

The above table details paint protection levels based on high durability (>15 years) as per ISO12944-2.

9.4 Motor

IQ actuators utilise purpose designed motors that are integral to the actuator. As such, these motors do not fall within the scope of IEC 60034 or MG1, however they do meet the applicable requirements, where appropriate, of motor design for actuator operation.

Actuator Type	Duty Classification	Comments
IQ	On-Off & Inching (Class A & B)	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQS	On-Off & Inching (Class A & B)	Class F insulated, 1-phase capacitor / run start squirrel cage motor incorporating thermostat protection. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQD	On-Off & Inching (Class A & B)	Class F insulated, permanent magnet DC brush motor incorporating thermostat protection.
IQM	Modulating (Class C)	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. User selectable thyristor controlled dynamic braking available. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQT[1]	On-Off & Inching	Permanent magnet 24 VDC motor (DC supply derived internally from 3-phase and 1-phase supplies) incorporating thermostat protection. Low inertia design.
IQTM[1] **/ IQTF**[1]	Modulating	Permanent magnet 24 VDC motor (DC supply derived internally from 3-phase and 1-phase supplies) incorporating thermostat protection. Low inertia design.

Note:

1 Speed control independent of load, temperature and supply voltage.
Speed is automatically reduced on fast operating units to reduce inertial impact when running into an end stop (5% from user set position limit).
Speed is automatically adjusted when positioning the actuator via analogue or network control to improve positional accuracy.

9.5 Power Module

The power module for IQ actuators produces internal power supplies for control systems and remote control derived from the actuator electrical supply. It also contains the motor control and switching components.

Actuator Type	Internal Power Supplies	Motor Switching
IQ	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option).	Reversing contactor assembly, mechanically and electrically interlocked. 24 VDC coil up to and including size IQ35 and 120 VAC for IQ40 and above.
IQD	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24 VDC supply for actuator fed remote control. Fuse protected. Incorporates sleep circuit for power reduction when used on solar powered derived DC supplies.	Reversing contactor assembly, mechanically and electrically interlocked.
IQS	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option). Fuse protected.	Solid state thyristor array for motor switching/ reversal and capacitor starting. Includes snubber protection and timing control.
IQM	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control. Fuse protected.	Solid state thyristor array for motor switching/ reversal and braking (user selectable). Includes snubber protection and timing control.
IQT / IQTF / IQTM	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option). Fuse protected.	Solid state motor switching incorporating motor speed control.
IQT / IQTF / IQTM 24 VDC actuator power supply only	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24 VDC supply for actuator fed remote control. Fuse protected.	Rectifier and fuse protection ensures correct polarity and protection of supply. Solid state motor switching incorporating motor speed control.

9.6 Torque Sensor

State of the art piezo thrust sensor measures motor shaft thrust produced as a reaction to output torque developed in the motor worm and wheel gear assembly. Thrust measured is directly proportional to output torque. The piezo sensor develops a voltage proportional to shaft thrust (output torque) which is amplified and then measured by the control module. Output torque is controlled by switching the motor off when the set torque limits have been reached. This system allows the torque to be displayed via the LCD display and captured by the data logger in the form of valve torque profiles, statistical torque information and the event log.

9.7 Position Sensor

Using the latest technology and after years of testing, the patented Rotork IQ absolute encoder is contactless, has only four active parts, can measure up to 8,000 output turns with a resolution of 7.5° and has redundancy and self checking. Unlike existing absolute encoder designs, this technological breakthrough increases position sensing reliability while providing zero-power position measurement.

9.7.1 Mechanical Position Indication

The availability of the graphical display, even on power loss, usually supercedes the need for mechanical position indication, however a mechanical position indication option is available upon request.

9.8 Control and User Interface (UI) Modules

The control and UI modules for IQ actuators are common and take the form of a PCB with on-board liquid crystal displays (LCD) and a control PCB. For IQM actuators the control module incorporates "fast remote" mode (24 VDC remote control only) allowing rapid actuator switching down to 100 ms pulses for precise positioning.

Logic controlled, the control module is programmed over the non-intrusive *Bluetooth* interface with set-up configuration for torque, limits indication and control features undertaken using the Rotork *Bluetooth*® Setting Tool Pro. It monitors local and remote control signals, torque and position to switch the actuator motor in the correct direction or off.

Standard IQ control features are shown below:

Feature	Type	Specification
Remote control	Input	User switched Open/Close/Stop/ESD and interlock signals. Opto-isolated inputs for protection.
Local control	Input	Open/Close/Stop and Local/Remote selection. Non-intrusive control switches are magnetically operated so there is no penetration of covers.
Position	Input	Digital signal derived by absolute position sensor. Resolution to 7.5° of output rotation. Limit range configurable between 2.5 and 8,000 output turns.
Torque	Input	The piezo thrust sensor directly measures output torque and converts value to a voltage signal. Torque can be set in the range 40% to 100% of rated torque with the additional facility to bypass torque switching.
Set-up	Input	Set-up over the *Bluetooth* interface allows all settings to be configured for valve and process requirements. Set-up is non-intrusive requiring no covers be removed using the supplied Rotork *Bluetooth*® Setting Tool Pro. All settings can be password protected.
Indication contacts	Output	Four Volt free contacts S1 to S4 can be configured for a variety of position, status and alarm indication for remote indication and monitoring.
LCD indication	Output	The onboard backlit LCD display presents position, torque and setup displays for configuration. The LCD display is divided into two parts providing a large position indication (Open/Close icons plus % readout in 0.1% increments for mid travel) and a multilingual text display providing status, alarm and set up information.
Data logger	Output	The control module includes a data logger which stores torque, position and operational data in non-volatile memory for download via *Bluetooth* to the supplied Rotork *Bluetooth*® Setting Tool Pro or notebook PC. Data is date/time stamped. Data logger can be analysed using freeware Insight 2 for PC.
Memory	System	All configured settings are stored in non-volatile EEPROM memory (does not require power).
Micro-controller	System	Provides all control function logic, setup programming and allied system requirements. Software is field upgradeable for future enhancements. The micro-controller is widely used in the automotive industry with a long track record and a very reliable history.

9.9 Conduit / Cable Entries

IQ gearcases are machined with conduit/cable entries as indicated below. Alternative adapters are available.

Number of entries required and adapter type must be specified with order.

Actuator type	Gearcase Entries	Adapter 1	Adapter 2
IQ, IQM, IQS, IQD	3 x M25 plus 1 x M40	3 x 1" plus 1 x 1.5" ASA NPT	3 x PG16 plus 1 x PG29
IQT, IQTM, IQTF	4 x M25	4 x ASA NPT 0.75"	4 x PG16

IQ range actuators are despatched with transit plugs fitted into the conduit entries. It is the responsibility of the installer to ensure the appropriate cable/conduit adapters, cable glands and/or 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.

9.10 Terminals

The terminal compartment for IQ range actuators takes the form of a separately sealed compartment containing segregated metric thread M5 power and M4 control terminals. Terminal screws and washers are supplied with the actuator. Terminals are designed to accept ring tag crimped field wiring conductors up to 16 mm^2 for power and 4 mm^2 for control/indication. The terminal compartment cover carries a terminal identification code card. Each actuator is despatched with the applicable Installation and Maintenance Manual, actuator wiring diagram and remote control connection schematic.

9.11 Wiring

IQ range actuators utilise jig built wiring harnesses of individually numbered, tropical grade PVC insulated, stranded conductors. All internal control connections to the printed circuit boards use unique or polarised plugs and sockets.

9.12 Battery

The battery provides power to support the LCD display and remote (relay) indication when the main actuator supply is unavailable. The battery also provides power to enable actuator settings to be made using the Rotork *Bluetooth*® Setting Tool Pro; commissioning can take place at premises without power or the right voltage, or after installation but before site cabling is completed.

The standard 9 V battery is available worldwide with a high/low temperature type available from Rotork.

As all settings are stored in non-volatile memory and position is sensed by the Rotork absolute encoder, security of configuration and position is always assured. The actuator can be operated perfectly well electrically and by handwheel operation without a battery fitted.

Based on experience gained over 20 years of typical applications, the expected battery life is up to five years.

Battery life is however subject to temperature and at elevated and reduced temperatures may be reduced. Actuator indicates battery status locally and in remote.

9.13 SIL Capability

Actuators for use within a Safety Instrumented System (SIS) are available with the relevant Safety Integrity Level (SIL) certification. Both IQ and IQT can be supplied with the optional SIL stayput mode enabled which uses the Motor Enable feature to prevent unwanted operation from spurious signals. In addition the IQ can be supplied with the "Move to Limit" SIL2/3 option to either open or close in an emergency. For full details please refer to the SIL brochure PUB002-104.

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Rotork actuators are recognised as the best in the world for reliability and safety in the most demanding applications. To maintain this hard-earned leadership position, Rotork is committed to helping clients to maximise the continuous, fault-free operation and working life of all their actuators.

With established operations and worldwide service centres we are able to offer same-day or next-day service to all our customers. Our Rotork factory trained engineers have skills in both multi-purpose and industry specific applications and carry with them spare parts and specialist test equipment. Our operations utilise a documented Quality Management system established in accordance with ISO9001.

Rotork aims to be your number one choice for taking care of fault diagnosis, service repairs, scheduled maintenance and system integration needs.

Visit **www.rotork.com** to identify your nearest Rotork service centre.

Rotork has expertise and specialist knowledge of every aspect of flow control.

Our service solutions increase plant efficiency and reduce maintenance costs.

Workshop services return equipment to as-new condition.



Client Support and Site Services

Global Service and Support

Rotork understand the value of prompt and punctual customer site services and aim to supply our customers with superior flow control solutions, by providing high quality, innovative products and superior service – ***on time, every time.***

Whether you have an actuator requiring on-site servicing, a custom design service requirement or a new actuator installation, we can deliver the fastest turnaround with the least plant disruption.

Accreditation and Assurance

Rotork is accredited with all major safety authorities around the world, providing our clients with reassurance and peace of mind.

Rotork's engineering teams are experts in the design and implementation of actuation solutions for all circumstances and environments. Our knowledge base draws upon previous installations and environmental situations from all around the world.

Our track record of undertaken engineering projects is second to none. Rotork is trusted by major utility and industrial companies throughout the world to design, install and maintain their actuation stock. We keep their plants operating at peak efficiency, helping them to be more profitable and at the same time meet ever tightening industry watchdog requirements.

We have the knowledge and expertise to design, build and install any standard or custom installation for you, anywhere throughout the world.

Asset Management

Rotork is a corporate member of the Institute of Asset Management, the professional body for whole life management of physical assets.

Giving You Peace of Mind, Guaranteed Quality and Improving Your Site Efficiency

Actuator Workshop Overhaul

- Supporting all Rotork and non-Rotork products
- Workshop facilities including torque testing and re-coating
- Large OEM stock in all workshops
- Fully trained and experienced service engineers
- Fleet of well stocked service vehicles
- Loan actuator facilities

Field Support

- Site repairs
- Commissioning
- Upgrades
- Fault finding
- Maintenance
- Call-out
- Fully equipped service vehicles

Rotork Client Support Programme (CSP)

- Enables users to select a level of service precisely tailored for their individual asset management requirements
- Designed to provide the maximum reliability and availability of actuators over the life of the product – thereby improving production throughput
- Designed to reduce the cost of maintenance year on year
- Designed to allow customers to manage the problem of 'Risk vs Budget' in maintenance operations
- Designed to be flexible – you choose the level of cover you want
- Reports generated on agreed frequency to demonstrate **cost savings** and **performance improvements**

Turnaround, Shutdown and Outage Support

- Preventative maintenance
- Full on-site overhaul and testing facilities
- OEM spares and support
- Support for Rotork and non-Rotork products
- Commissioning support to achieve shutdown time targets
- Project management and supervision of your plant overhaul and return to service dates

Valve Automation Centres

- On Site – Manual Valve Automation
- On Site – Actuator Replacement
- Off Site – New Valve Automation

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