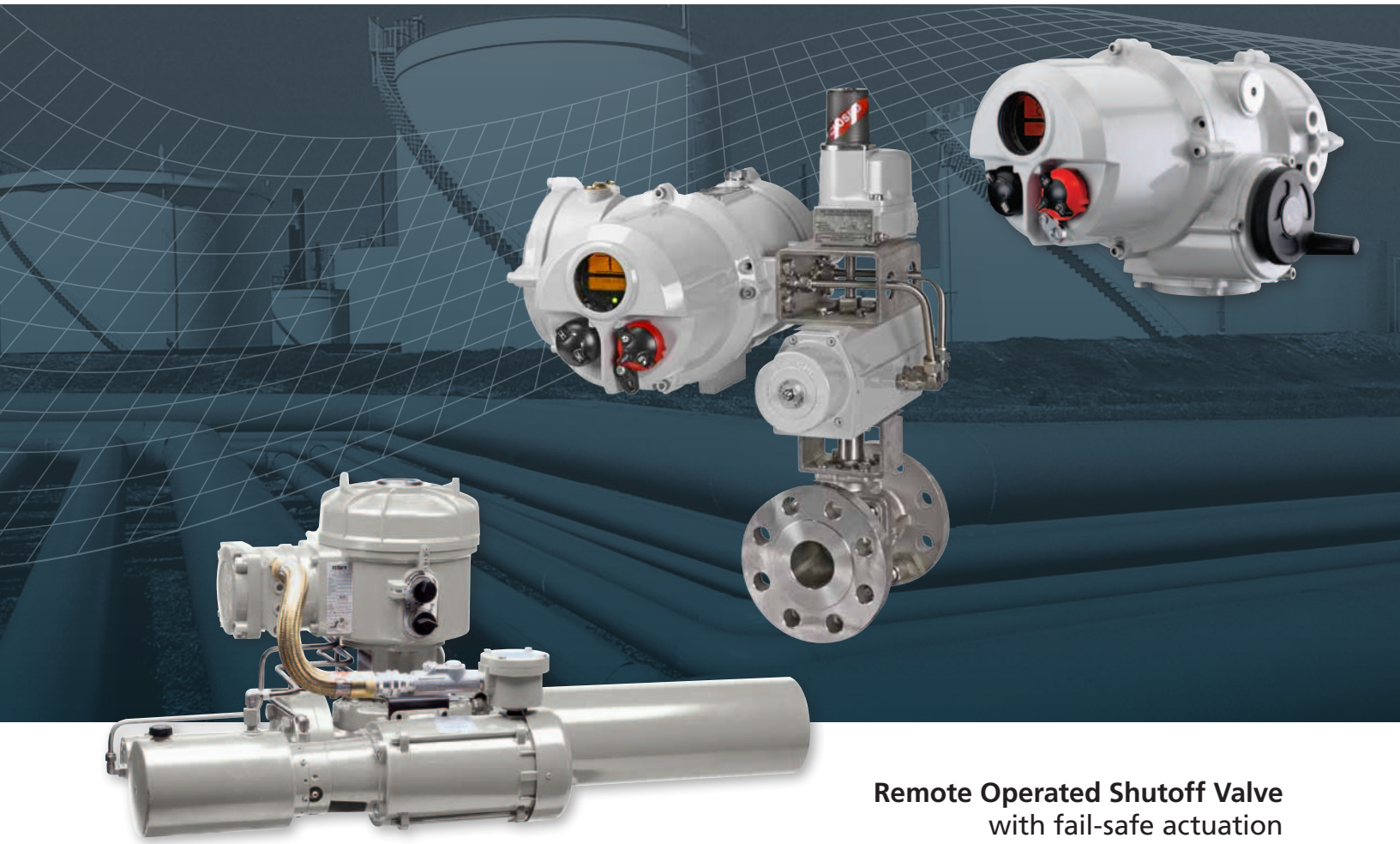
rotork®

ROSoV Actuation Solutions



Remote Operated Shutoff Valve
with fail-safe actuation

Redefining Flow Control

Contents

Rotork is the global market leader in valve automation and flow control. Our products and services are helping organisations around the world to improve efficiency, assure safety and protect the environment.

We strive always for technical excellence, innovation and the highest quality standards in everything we do. As a result, our people and products remain at the forefront of flow control technology.

Uncompromising reliability is a feature of our entire product range, from our flagship electric actuator range through to our pneumatic, hydraulic and electro-hydraulic actuators, as well as instruments, gear boxes and valve accessories.

Rotork is committed to providing first class support to each client throughout the whole life of their plant, from initial site surveys to installation, maintenance, audits and repair. From our network of national and international offices, our engineers work around the clock to maintain our position of trust.

Rotork. Redefining flow control.

Rotork ROSoV Solutions

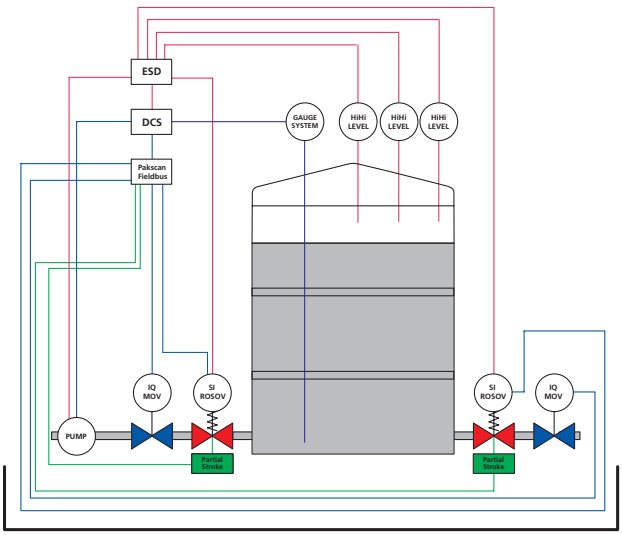
Remotely Operated Shutoff Valves (ROSoV) are valves designed and installed for the purpose of quickly isolating plant items which are used for the storage of hazardous substances. These valves could also be called Emergency Isolation Valves (EIV) or Emergency Shutdown Valves (ESDV). The valves play a major role within the safety system. The standards mentioned below recommend that ROSoV installations are periodically tested to ensure availability of the complete valve, actuator assembly. If a failure is reported as a result of the test, this detected failure can be immediately addressed and a potential undetected failure has now been avoided.

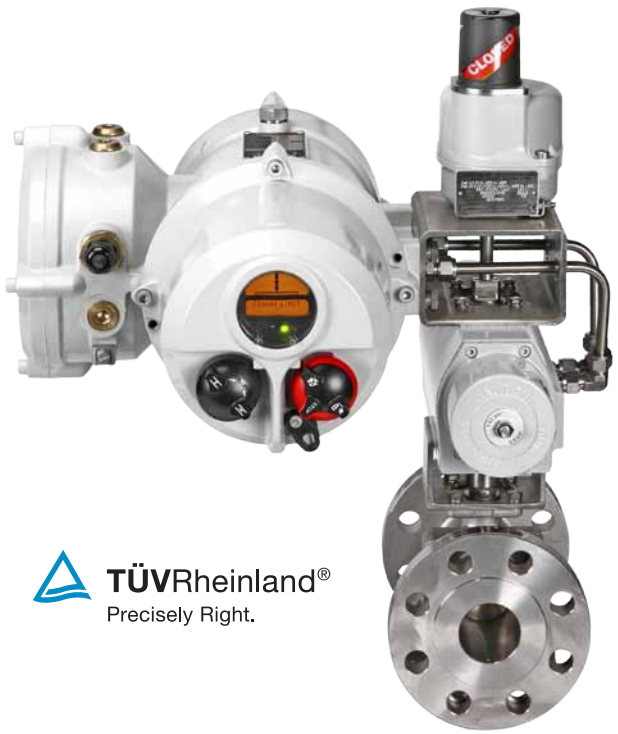
Due to various events in recent years operators and developers have invested heavily in improving their Safety Instrumented Systems (SIS). The SIS can sometimes be separate to the normal control system and usually performs specific control functions. Should an incident occur the SIS will play a significant role in stabilizing the plant, reducing the threat to human life and the environment.

Historically, individual companies would design their own protective systems based on certain industrial standards and company codes of practice. The industry is now moving forward and standards such as IEC 61511, applicable to operators or owners and IEC 61508, applicable to manufacturers are now widely used.

Rotork offer a range of electrically operated spring-return actuators (TÜV verified to SIL 2-3) specifically designed for applications where these standards are being implemented.

The below diagram illustrates where ROSoV (Rotork Skilmatic SI range) actuators are being used within the SIS and Rotork IQ actuators are operated via the DCS. This would typically be a SIL 2-3 system.





TÜVRheinland®
Precisely Right.

Skilmatic
range

The Rotork Skilmatic electrically operated, fail-safe actuator range combines the simplicity of electrical operation, precision of hydraulic control and the reliability of spring powered fail-safe action.

Torque outputs are from 65 Nm up to 600,000 Nm.

TÜV Verified to SIL 2 & 3, the Skilmatic actuators are an ideal solution for operating critical valves (ESDV's, ROSoV's) within a safety instrumented system.

Consisting of a self contained electro-hydraulic control module and scotch yoke drive, the actuators are available as spring-return (clockwise, anti-clockwise) or lock in last position. Single-phase, three-phase, or 24 VDC options are available. Watertight to IP67, SI and EH units are certified for hazardous areas with ATEX, FM, CSA, GOST, INMETRO and IEC Ex approvals.

The following features are relevant to SI and EH actuators for use in critical shutdown applications.

ESD

SI/EH-Q actuators are specifically designed for Emergency Shutdown (ESD) applications and can accept various input signals as standard. Closing speeds are adjustable and can be tailored to suit the application requirement. When the ESD signal is tripped the actuator will move to the pre-determined safe position and will be ready to operate on the next command when the ESD signal is reinstated.

A local ESD manual reset can be enabled to restrict the actuator from operating from a remote command until the ESD has been reset. Rotork Skilmatic units are fully compatible with fieldbus communication systems such as Rotork's Pakscan, Foundation Fieldbus™, Modbus®, Profibus® and Devicenet™. If the hardwired ESD signal option is being used in conjunction with remote monitoring and control this will allow the SIL rating of the safety system to be maintained.

Partial Stroke Testing (PST)

Rotork Skilmatic actuators have a partial stroking facility built in as standard. This allows the actuated valve to be functionally tested without the need to fully close the valve.

Data Logger

The data logger will record configuration settings, the last 1,024 events will be stored with 32 bits of status.

Bluetooth® Setting Tool

The intrinsically Safe *Bluetooth*® Setting Tool allows for transferring of data from a PC to the actuators. Configurations and settings can be changed via the setting tool avoiding the need to remove covers. Trends, faults and other events can be analysed.

Independent Alarm and Status Relays

Rotork Skilmatic actuators are fitted with volt free output relays which can be configured to customer specific alarm and status requirements or general group alarms. A monitor relay is also provided to monitor the power supply and any hardware errors.

Product Range

IQ *Pro*
multi-turn actuator

Rotork IQ *Pro* – Reliable, Intelligent Control

IQ *Pro* provides the customer with unparalleled support in achieving reliable valve actuation by combining existing proven Rotork IQ features with text displays, performance monitoring and datalogging - including valve torque signature profiles. In combination with the non-intrusive, intrinsically safe Rotork Setting Tool *Pro*, actuator set-up and datalogger files can be transported from the field to the office for storage and analysis.

The IQ range of actuators incorporate real time, instantaneous torque & position monitoring as standard. Torque & position can be used to monitor valve performance during operation. The effect of process changes (differential pressure etc.) can be evaluated. Tight spots in valve travel can be pinpointed as well as gauging torque developed through stroke for torque value setting. Using the Setting Tool, the display can be set to indicate torque and position.

IQT *Pro*
quarter-turn actuator

Rotork IQT *Pro* – Reliable, Intelligent Control

The IQT *Pro* delivers a complete range of actuators suitable for most quarter applications that require control and indication flexibility, offering end users ever higher standards of performance build quality and overall value.

By use of motor control technology proven in the AQ range over 20 years and now integrated with the IQ electronics, the output speed of the IQT can be adjusted without affecting the torque output.

IQT uses a 24 volt DC motor. For single and 3-phase supplied actuators the motor supply is internally provided via a transformer - rectifier (24 volt DC supplies - rectifier only). IQT will always run in the correct direction irrespective of supply type and connection. On loss of one or more of the utilised phases (or DC supply pole) the IQT actuator will stop.

Insight2 Intelligent Software

Rotork Insight2 facilitates the review, configuration and analysis of set-up 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.

Bluetooth® Setting Tool *Pro*

The *Bluetooth*® Setting Tool *Pro* allows downloading and uploading of data logger and configuration files. The tool is intrinsically safe and can be used in hazardous areas. File transfer and data exchange is made over *Bluetooth* between the Setting Tool and PC and between the Setting Tool and the actuator.

Rotork IQ3, Skilmatic Range EH *Pro* and SI *Pro* actuators all support *Bluetooth* communication. Insight2 requires a PC with a *Bluetooth* interface running Microsoft™ Windows XP or newer.

Data Logging

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 on a PC using Insight2. Log data is time and date stamped and can be viewed on an event by event basis.

Missions

Insight2 enables the user to pre-configure actuator missions on a PC, transfer them to a *Bluetooth*® Setting Tool *Pro* and transmit them out in the field to the actuator. The missions can be dedicated to specific actuators by type or serial number.

Standard missions include:

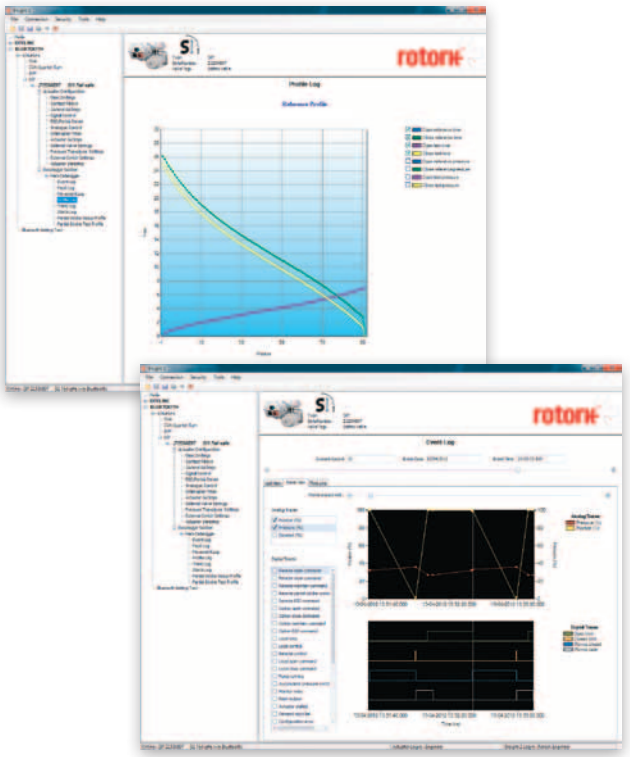
Extraction of Actuator Configuration & Datalogger.
Modification of actuator and option configuration.

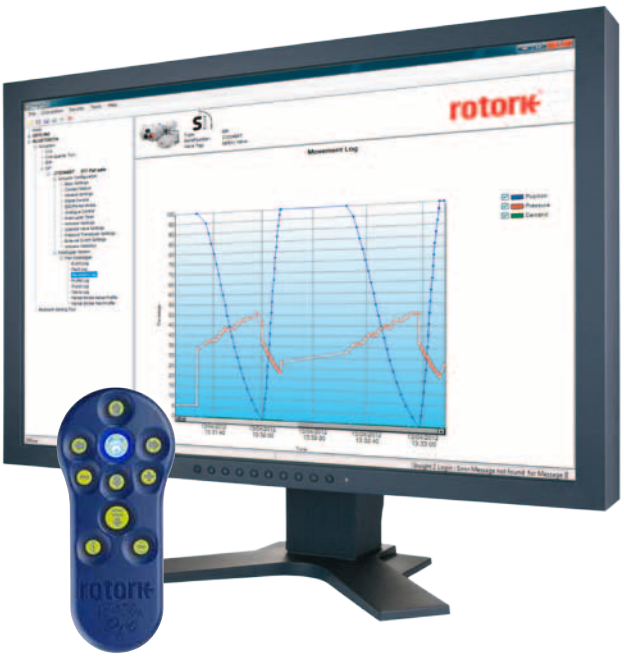
Security Protocols

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

Features:

- View and Modify actuator specification and configuration on PC.
- Valve and Actuator starts against position log.
- 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 PC and transfer them to actuators in the field via the *Bluetooth*® Setting Tool *Pro*.





Partial Stroke Testing (PST)

Partial Stroke Testing is a technique used in safety systems that allows the owner or operator to test a percentage of the possible failure modes of a shutdown valve. This test can be performed without the need to physically close the valve. The procedure, allows the user to identify any faults which could potentially prevent the actuated valve from performing it's safety function.

There are varying methods used which are dependent upon which type of actuator has been installed. Rotork Skilmatic actuators offer the perfect solution for critical loop applications where PST and emergency shutdown is required.

The Rotork SI/EH electrically operated spring-return actuators have a partial stroking feature built in as standard. When the command is given to initiate the test the actuator will move the valve to a preset position and time taken will be measured and compared to the original time recorded at the commissioning stage. The internal pressure is also measured and recorded. A pass or fail will be given when the test has been completed.

SI & EH Partial Stroke Testing (PST)

The Rotork Skilmatic advanced PST system operates by de-energising each solenoid valve in turn to allow the valve to move to the required position and then return the valve to the open state. The degree of movement required is configured by the user during the commissioning process and is adjustable from 0 to 99%.

Safety Performance

At higher SIL levels (SIL2 & SIL3) it is common that the calculated maximum allowable time between compulsory shutdowns is too short to allow the plant to operate to an acceptable level of production. In these cases partial stroke testing can be an invaluable tool to allow the operator to test the valve on-line and take a credit for proving the performance of the valve. Dependent upon the quality and frequency of the test the calculated time for the shutdowns can be extended. This not only improves the safety performance of the plant but also improves production performance.

Diagnostics

When the SI/EH intelligent PST technique is used, along with improving safety and performance, the operator can also gain information relating to the performance of the valve-actuator assembly. The PST system monitors the hydraulic pressure and time to position which provides the user with a higher level of diagnostic coverage on all critical components within the actuator including the solenoid valves. This helps to give the operator the highest possible level of safety performance and assists with maintaining the required SIL level.

ESD (Emergency Shut Down)

In the event of the ESD signal being de-energised or "tripped" the actuator and valve will move straight to the pre-determined safe position. The ESD system overrides all other commands.

Bus Control Systems

Rotork Pakscan - the total control solution

Pakscan

Whether you need remote control of a few motorised valves, or full automation of a complex plant, Pakscan can help you to achieve significant savings in both time and costs.

Pakscan allows the remote control of actuators and valves over a simple single twisted pair data highway, removing the need for heavy multicore cables. It also includes automatic inbuilt redundancy of the field network to ensure control will be maintained even in the event of equipment or cable failure.

Available as a single or hot standby master station variant, Pakscan has the ability to control up to 240 actuators, and other field devices, using secure field communications. The field data highway cable may be up to 20 km in length so even quite distant valves can easily be incorporated into the network, without the need for repeaters.

Simple to install and simple to use, the highly successful Pakscan system has proved its value on many varied sites with over 70,000 Pakscan actuators installed worldwide.

See publication PUB058-001 for further details.

Fieldbus Compatibility

In addition to offering full compatibility with Pakscan, IQ, SI and EH actuators can be specified to interface seamlessly to many other fieldbus digital control systems. Open fieldbus protocols such as Profibus®, Foundation Fieldbus™, DeviceNet™ and Modbus® are all available within the IQ, SI and EH actuator control options.

This is achieved simply and cost effectively through fitting an appropriate Rotork manufactured circuit board module inside the actuator's electrical housing – normally at the time of production. Module commissioning and setup is carried out using a combination of the Rotork Setting Tool and the network commissioning tools used for the chosen protocol.

An internally mounted Pakscan field unit is used for remote control and status indication over a fault tolerant two-wire serial link. The system has loop distances of up to 20 km without repeaters and host communications using Modbus protocol. System variables are programmable over the infra-red data link.

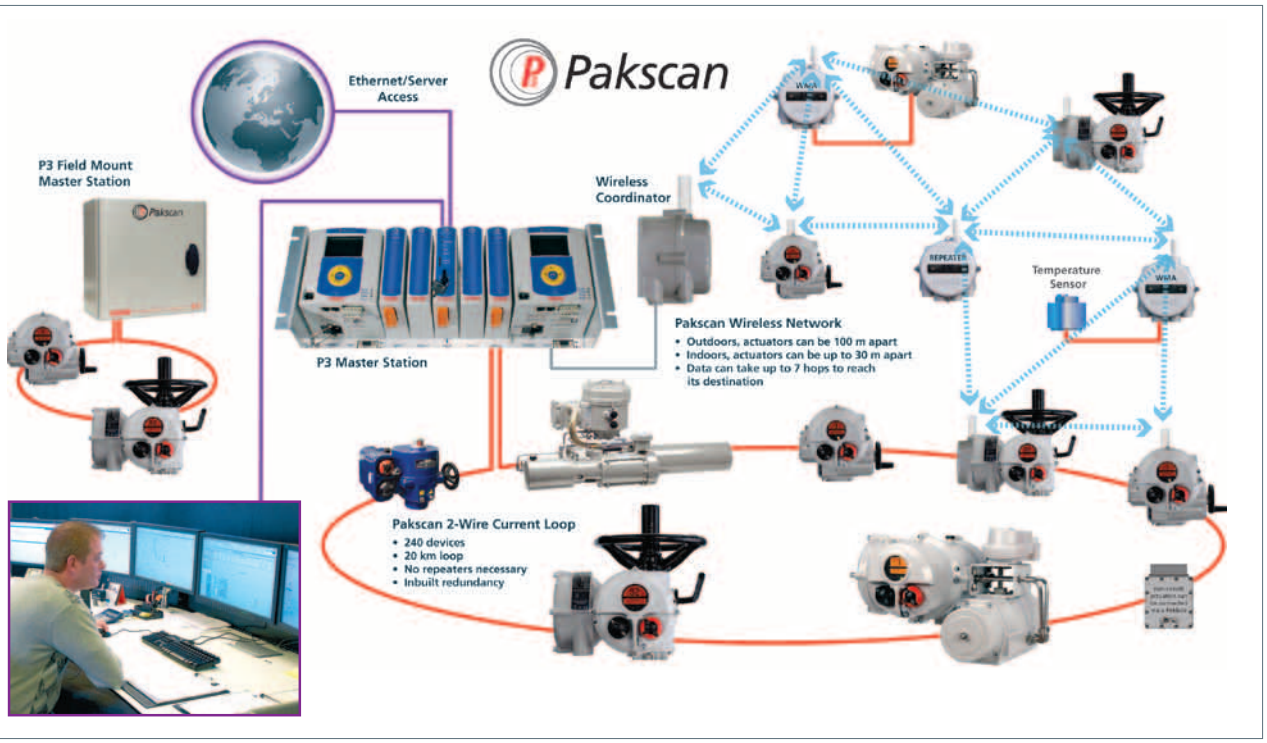
Rotork IQ, SI and EH Range actuators are fully compatible with the following fieldbus communication systems:

FOUNDATION™

DeviceNet™

Modbus®

PROFIBUS PROCESS FIELD BUS



SIL Solutions

Safety Integrity Levels are part of a larger scheme called Functional Safety that deals with techniques, technologies, standards and procedures that help operators protect against hazards.

Functional Safety adopts a life cycle approach to industries that deal with hazardous processes. The requirement to meet a given SIL level is becoming increasingly common in many industrial process environments. Assessing the performance of the final elements can be a complex process, however manufacturers can assist by having products independently certified as "Suitable for Use" at particular SIL levels by independent organisations such as TÜV. Ultimately the end user must still conduct all the necessary calculations to ensure that the Final Elements as a whole adhere to the requirements for the SIL level required.

SI and EH/Q Electrically operated, spring-return actuators are ideal for use in safety systems or any critical loop where SIL 1,2 or 3 Levels are requirement. The actuators have Partial Stroking capability built-in as standard to help maintain the required SIL level.

Rotork can offer the following certified products:

- Pneumatic actuators
- Hydraulic actuators
- Electro-Hydraulic actuators
- Electric actuators
- Smart Valve Monitoring (SVM) system

Certified Personnel

- TÜV certified Functional Safety professionals
- International network of IEC 61508 specialists

SIL System Design Specialists

- Final Element design services for green field sites
- Retrofit solutions for plant upgrades
- Final Element SIL verification calculations

Notes:
1. **All failures rates are 10^{-9} failures/hour.**
2. **Safe Failure Fractions for fluid power actuators take credit for partial stroke testing.**

SI (Electro-Hydraulic Spring-Return Actuators)

	SI-1		SI-2-1	
	NO PST	PST	NO PST	PST
SIL Rating	2	3	2	3
Hardware Fault Tolerance (HFT)	0		0	
Safe Failures (λ_S)	1120 FIT		1130 FIT	
Dangerous Failures (λ_D)	148 FIT		141 FIT	
Dangerous Detected Failures (λ_{DD})	141 FIT		134 FIT	
PFD_{AVG}	649,000	83,100	619,000	80,300
Safe Failure Fraction (SFF)	88.3%	99.4%	88.9%	99.4%
Hardware Type	A		A	
Partial Stroke (Months)	0	1	0	1

EH (Electro-Hydraulic Spring-Return Actuators)

SIL Rating	3
Hardware Fault Tolerance (HFT)	0
Safe Failures (λ_S)	4,270
Dangerous Failures (λ_D)	379
Dangerous Detected Failures (λ_{DD})	341
Safe Failure Fraction (SFF)	99.2%
Hardware Type	A

Fire Protection Solutions

Fire and explosion is a major cause of concern to refinery, gas processing, petro-chemical and offshore installations. Danger and damage from fire can be minimised by the efficient and effective protection of the systems, which control the plant.

For this reason Rotork can recommend a range of fire proofing options for it's actuators, ranging from fixed passive protection through to full fire retardant enclosures.

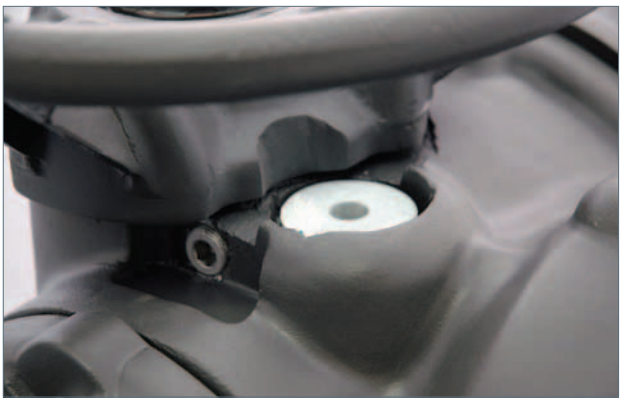
- Semi-Rigid Enclosure System
- Flexible Enclosure System
- Rigid Enclosure System
- Rotork System-E Intumescent Coating System

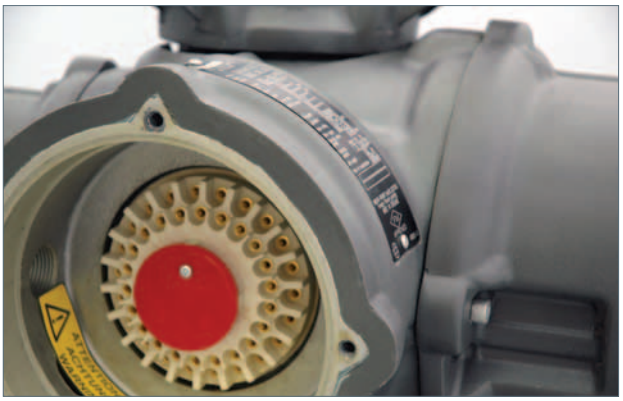
Fire protection systems allow a Rotork actuator to continue to operate for a significant period of time in fire temperatures of over 1,000 °C (1,832 °F). Whilst Rotork's compact, fixed passive, 'System E' or 'K Mass' is used on the IQ and IQT range of actuators, other rigid and semi-rigid systems are available that offer similar levels of protection for other Rotork actuators.

It is often difficult to draw the line when it comes to protecting equipment against fire.

Whilst this brochure shows examples of fire proofing for Rotork actuators it is essential that valve top works, power and control cables and their entries are also protected.

Rotork Site Services have many years experience with the installation and maintenance of a large variety of fire proofing systems.





Case Study

Rotork provides electric solutions for automated **flow control at the Botlek Tank Terminal**

The Botlek Tank Terminal (BTT) at Rotterdam relies on Rotork's latest electric valve actuation technologies for automated flow control and vital safety related duties associated with the import, export and storage of a varied range of liquid bulk products.

Construction of the €70 million first phase of the terminal began in April 2010 and was completed within budget and on time by the Polish company Polimex-Mostostal S.A. BTT has 34 storage tanks, providing a combined storage capacity of 200,000 cubic metres, of which 130,000 cubic metres is earmarked for clean fuels and the rest is for edible oils and biodiesel. The state-of-the-art terminal has deepwater berths including a 420 metre jetty that can simultaneously accommodate two seagoing vessels and two barges, operating 24 hours-a-day.

Over 250 Rotork IQ *Pro* multi-turn and quarter-turn intelligent electric actuators have been installed to operate the valves that control the routine movement of liquids throughout the site. A further 55 Rotork Skilmatic SI self-contained electro-hydraulic actuators have been installed in strategic areas on valves that provide failsafe Emergency Shutdown (ESD) protection from potential accidents and spillages. All the Rotork actuators are monitored and controlled on fully redundant Rotork Pakscan digital bus loops, linked by three Pakscan P3 master stations to the site's central SCADA system.

The Skilmatic SI actuators are equipped with integral circuitry designed to receive a separately hardwired discrete ESD alarm signal that will override any other input and move the actuator to the pre-determined safe position, even in the event of electrical power failure. These actuators are situated on the inlet and outlet ports of the storage tanks and on the marine and truck loading bays. They are key components in the Safety Instrumented System (SIS) that operates with dedicated level and flow sensors and ESD logic solvers to provide the site's Safety Instrumented Function (SIF).

BTT General Manager Charles Smissaert pointed out that the Rotork Skilmatic electro-hydraulic solution for ESD protection at the site had been selected as a more robust and reliable alternative to air operated actuators, which also require more maintenance.

All Rotork actuators at BTT feature ATEX explosionproof certification and IP68 double-sealed watertight enclosures designed for harsh and exposed environments. They also share Rotork's IQ *Pro* non-intrusive setting, commissioning and data communication technologies, enabling actuator configuration and data logger files to be transferred from the field to the office for diagnostics, analysis and storage. In combination with Rotork IQ-Insight software, this data can help to maximise plant utilisation by identifying potential valve wear problems and facilitating predictive maintenance.

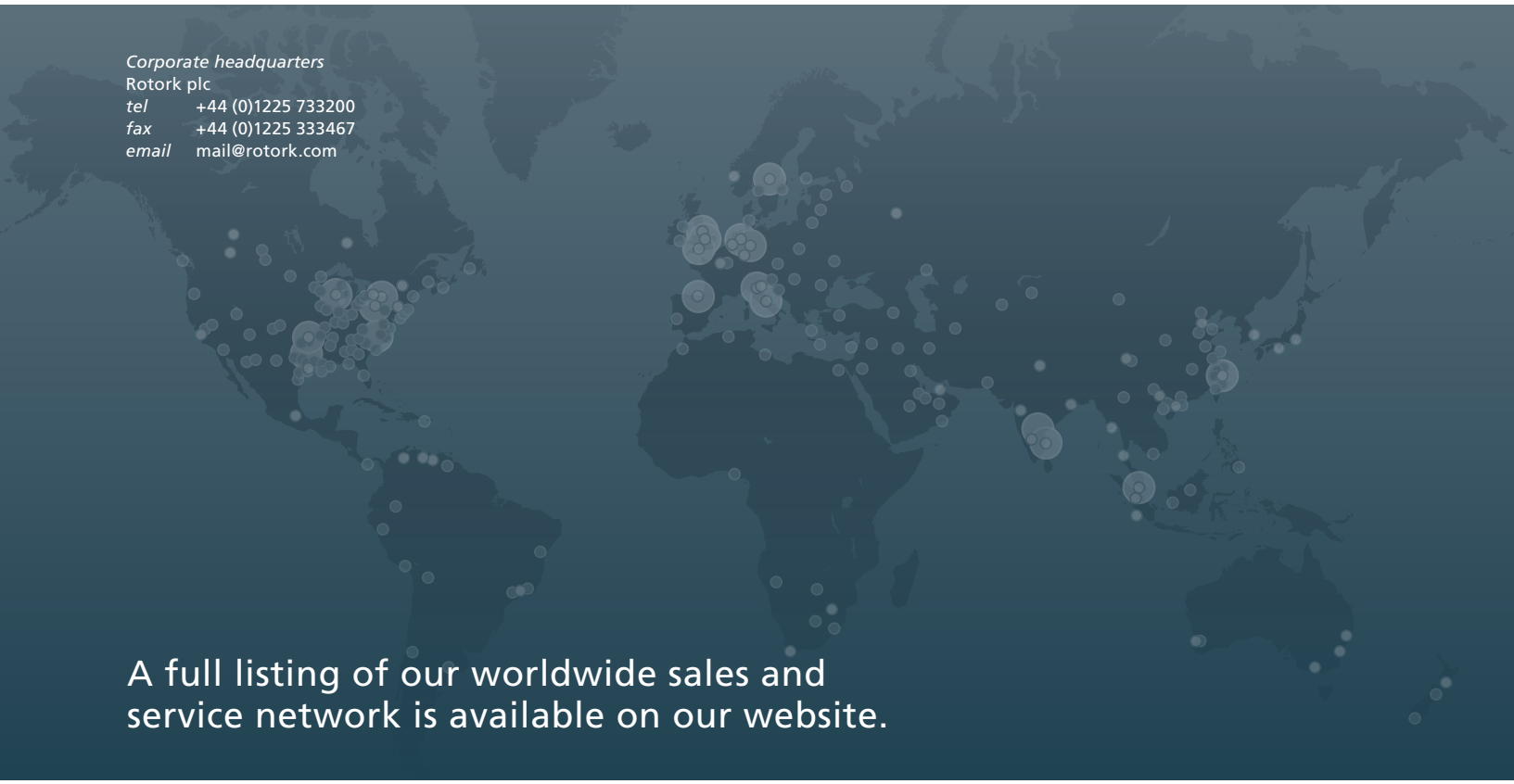
The punctual completion of the tank farm was assisted by the nearby presence of Rotork BV's fully equipped workshop, which provided the facilities to motorise all the valves, encompassing gate and butterfly designs in sizes up to 16 inches, before shipping them to site as complete, factory tested packages. Rotork also assisted with installation and commissioning and will continue to provide local support for all the installed actuators.

rotork®

Electric Actuators and Control Systems
Fluid Power Actuators and Control Systems
Gearboxes and Gear Operators
Precision Control Instruments
Projects, Services and Retrofit

rotork®

Corporate headquarters
Rotork plc
tel +44 (0)1225 733200
fax +44 (0)1225 333467
email mail@rotork.com



A full listing of our worldwide sales and service network is available on our website.

www.rotork.com

PUB000-054-00
Issue 07/12