

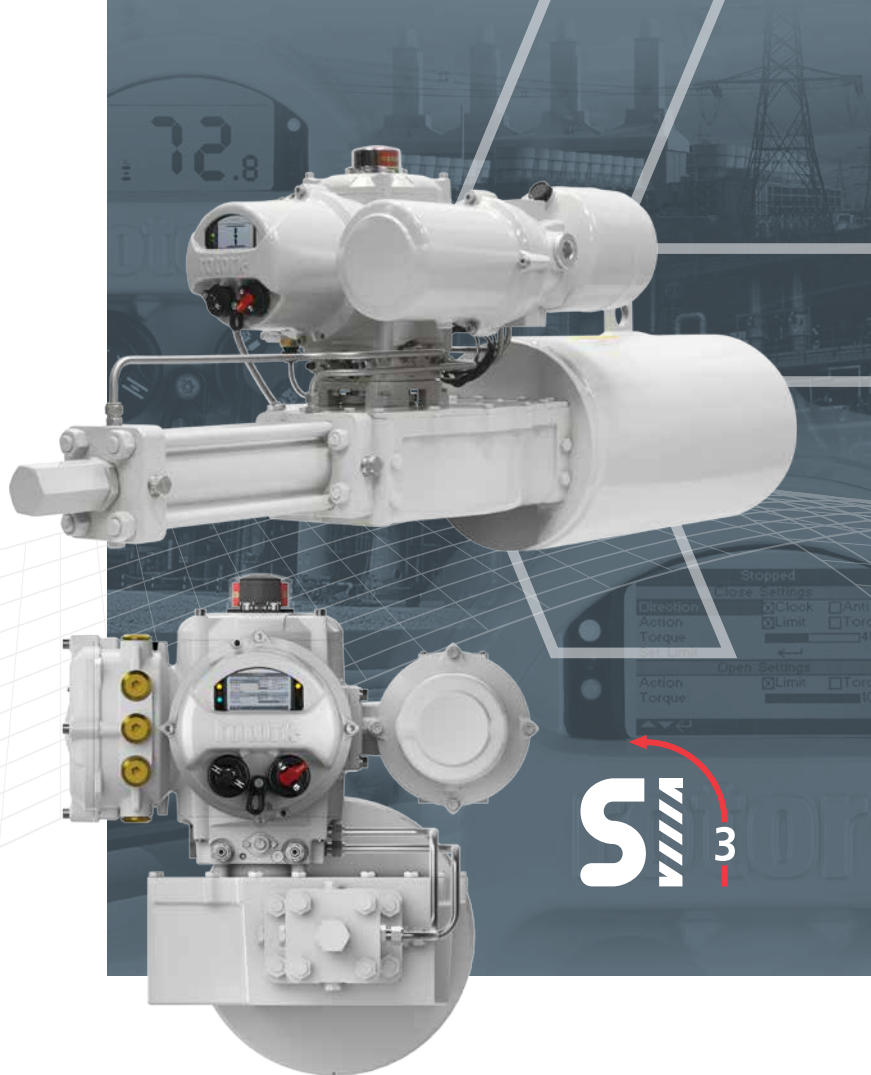
### Introducing the 3<sup>rd</sup> generation of Skilmatic SI self-contained electric fail-safe actuators.

The SI range of self-contained electro-hydraulic actuators combining the simplicity of electrical operation with the precision of hydraulic control and the reliability of mechanical spring-return.

Building on the success of the Skilmatic SI range of actuators, Rotork has enhanced the range by introducing the new SI-3<sup>rd</sup> generation which includes an extended range of spring-return actuators with a torque range of 2,000 Nm to 30,000 Nm.

This new range of electrically operated actuators offers a wide range of operating speeds, additional ESD options with single or dual inputs, enhanced partial stroke testing and communication capabilities to meet a wide range of applications.

SI<sub>3</sub>-4 customised range of actuators with torques up to 600,000 Nm will be introduced in 2015.



**SI<sub>3</sub>**

## Skilmatic SI<sub>3</sub>-3

### Electric Fail-Safe Actuators

#### Key Benefits of the 3<sup>rd</sup> Generation SI Actuators

- Fail-safe, Closed, Open or in last position
- Only requires electrical power
- Flameproof Ex d IIB/IIC T4 & Watertight to a minimum IP67
- Additional ESD options including dual inputs
- Functional Safety to SIL 1 and SIL 2 certified to IEC 61508 -2 2010
- Partial Stroke Tests (PST) can be performed either via the Rotork *Bluetooth*® Setting Tool locally or remotely from the DCS or through network cards
- PST measures the time to move to a set position while monitoring the pressure
- All final elements are tested as part of the PST
- PST results are recorded in the data logger, shown on the display with an option for remote pass/fail indication
- Advanced dual stacked display presents valve and process data for asset management and data analysis
- Large information-rich backlit display. Low power version available for solar applications
- Non-intrusive setting – no cover removal required using secure *Bluetooth*® wireless connection
- Configurable Data logger functionality including service alarms
- Increased functionality over network cards including Profibus®, Foundation Fieldbus®, Modbus® and HART®
- Operating temperatures -50 to +70 °C

## Redefining Flow Control



## Technological Advances

### Display

The dual stacked display shows large segment characters 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.

### Control

The actuator can be controlled remotely by either digital inputs, analogue signals or 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.

### Pressure Monitoring

A pressure sensor is installed to measure the internal hydraulic pressure being generated within the actuator. The pressure sensor will detect obstructions in mid-travel (between the two limits) and to torque seat a valve at one or both ends of travel (past the limits). When torque seating is required, an option is included for the system to maintain the internal hydraulic pressure by re-starting the motor / pump if the pressure drops below the required pressure.

Hysteresis adjustment for over- and under- pressure can be enabled to compensate for hydraulic expansion or contraction due to ambient temperature changes.

### Position

A non-contacting hall-effect sensor constantly monitors the position of the actuator. Position feedback can be provided as a 4 to 20 mA output signal as an option.

### Auxiliary Supply

When mains power is not available an auxiliary supply can be used to power the processor, internal clock, indication relays, sensors, display and optional network cards from an external 24 VDC supply. This will also operate the data logger to allow the movement to the fail-safe position on loss of mains supply to be monitored and recorded.

### Indication Power

All configurations and data logger files are stored in non-volatile EEPROM memory, all settings are held in memory when the power is removed. A super capacitor is included as standard, allowing the internal clock for the data logger to be maintained for up to 2 weeks without power.

# Skilmatic SI<sub>3</sub>-3

## Electric Fail-Safe Actuators

### Optimised for Preventative Maintenance

All SI 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:

- Pressure profiles
- Operational starts profiles
- Operational, vibration and temperature trend logs
- Event logs

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 pressure
- Starts
- Life statistics

As part of the ongoing commitment to improving asset management and providing reliable data for optimised preventative maintenance, the 3<sup>rd</sup> generation SI now includes configurable service / maintenance alarms.

The alarm parameters can be set in the assets section of the setup menus and include:

- Pressure at Open limit
- Pressure at Closed limit
- Starts/Hr
- Total starts
- Service intervals

With 3<sup>rd</sup> generation SI actuators this data can be viewed in real-time using the large dual stacked display. In addition, the data can be downloaded wirelessly with the Rotork *Bluetooth®* Setting Tool Pro or to a PC and analysed using the Rotork Insight2 software.

### Safe Manual Operation

In case of an emergency, power outage or failure of the control network, SI actuators can be fitted with a hand pump as an option for manual operation. To put the actuator into manual mode will require a lockable lever to be rotated. This lever will also allow the actuator to detect which mode it is in, which will prevent electrical operation when it is in manual mode.

### Network System Connectivity

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



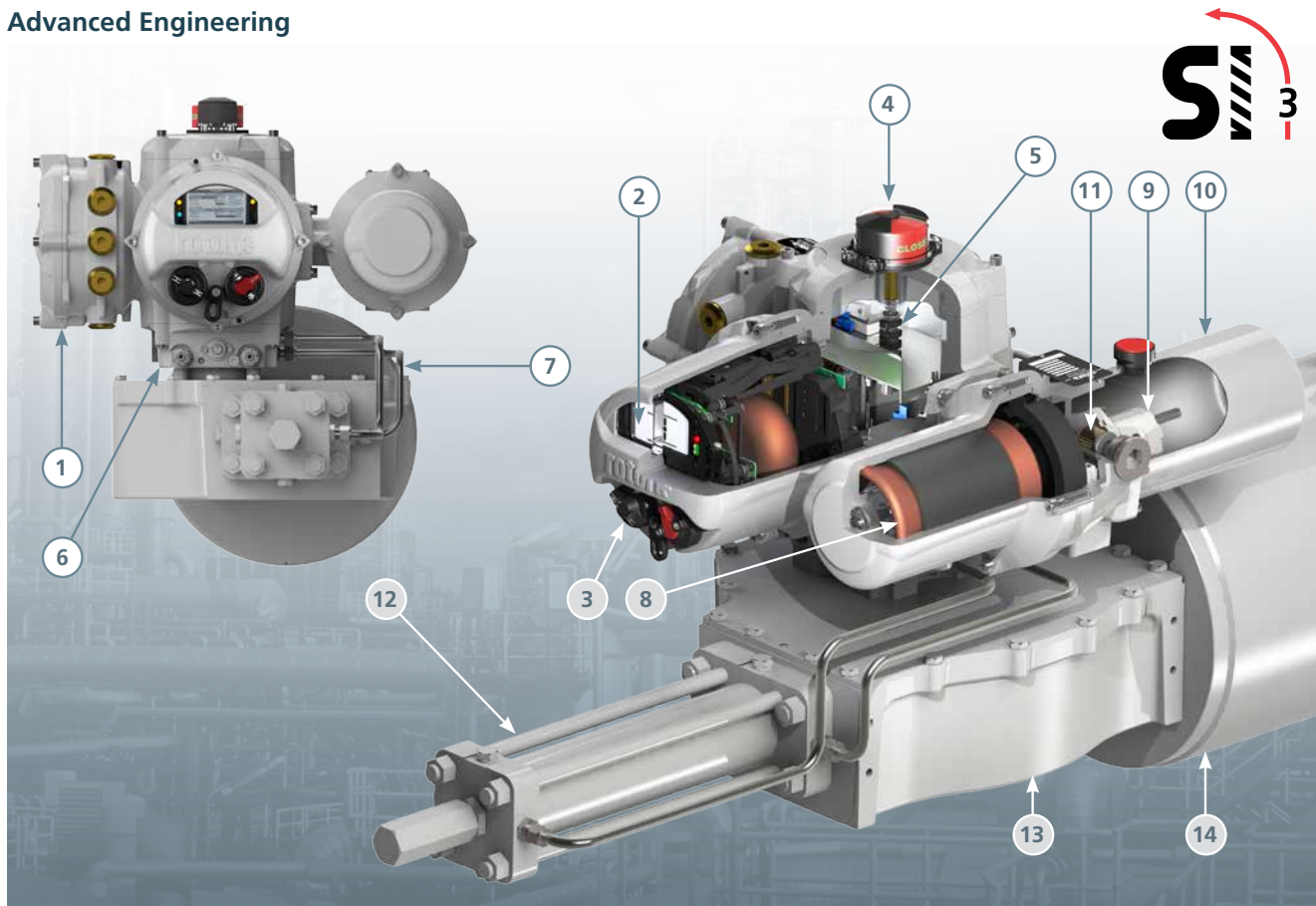
Modbus®

HART  
COMMUNICATION PROTOCOL



PROFI  
BUS

## Advanced Engineering



### 1 Environmental Sealing

The Rotork double-sealed terminal compartment provides a sealed actuator compartment to protect the actuator from the environment.

### 2 Display

The advanced dual stacked display is significantly larger, clearer and has a wide viewing angle making it easily legible from a distance.

### 3 Local Controls

Local Open/Close and lockable Local/Stop Remote selectors are coupled magnetically to the designated switches and therefore do not penetrate the control cover.

### 4 Position Indication Beacon

The actuator can be supplied with a beacon in various materials to suit the environment. Alternatively the actuator can be supplied with no indicator beacon.

### 5 Position Limit Switches

Up to four mechanical limit or proximity switches can be fitted for positional feedback.

### 6 Manifold Block

The manifold includes all the hydraulic components required to operate the actuator including solenoid valves, flow control valves, check valves and pressure relief valves.

### 7 Hydraulic Piping

All actuators are classed as being self-contained with stainless steel piping.

### 8 Electric Motor

The motor operates a gear pump which generates the hydraulic pressure required to overcome the spring, which is housed in a sealed enclosure.

### 9 Gear Pump

A selection of different size gear pumps can be fitted depending on the operating speed required.

### 10 Oil Reservoir

Different size oil reservoirs will be fitted depending on the actuator size.

### 11 Hydraulic Filter

The filter is replaceable.

### 12 Hydraulic Cylinder

### 13 Scotch Yoke Mechanism

### 14 Spring Can



# Skilmatic SI<sub>3</sub>-3



## Electric Fail-Safe Actuators

### Intelligent Communication

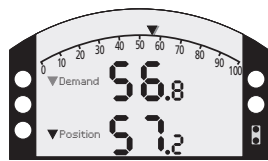
#### Local Diagnostics and Setup

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 SI 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:

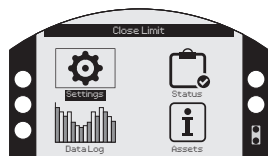
- Positional information with input demand (digital and analogue)



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.

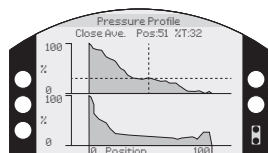
#### User Friendly Setup Menus

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.



#### Graphical Datalogger

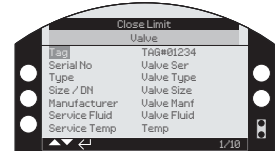
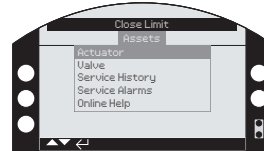
Greater amounts of data and analytical screens are now available in the data logger and viewable locally. The data logger screens are displayed on a 168 x 132 pixel dot-matrix display and can display anything from a torque versus position graph to statistical operational data.



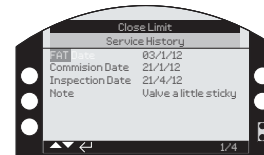
### Asset Management

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



- Service history



### Modulating Control

An optional analogue control card is available to accurately position a control valve from a 4-20 mA input signal with independent deadband and hysteresis adjustment to optimise the control to suit the process. The control card also provides a 4-20 mA output for remote valve position feedback.

### PC Tools - Insight2

Rotork Insight2 facilitates the review, configuration and analysis of setup configuration and datalogger information for Rotork *Bluetooth* enabled actuators. The visually interactive application is intuitive with clear menus making it a simple and fast process.

SI actuators have onboard dataloggers that capture and store valve, actuator, control signal operation and status data which can be viewed locally on the display or on a PC using Insight2. Log data is time and date stamped and can be viewed on an event by event basis. Insight2 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 security.

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

Password protection is available on the Insight2 software and actuators to prevent unauthorised or accidental modification of actuator configuration parameters.

## Emergency Shut Down (ESD) Input

The SI can be configured through hardware to operate in several different modes as detailed below:

### Fail-Safe on Loss of Mains Supply

This option offers a low power draw on the ESD input. In this mode the solenoid valve(s) that perform the safety function are to be powered by the mains power supply to the actuator with the following functionality:

- Fail-safe on loss of ESD signal
- Fail-safe on loss of mains power supply

### Fail in Position on Loss of Mains Supply

In this mode the solenoid valve(s) that perform the safety function are to be powered by the ESD signal to the actuator.

- Fail-safe on loss of ESD signal
- Fail in position on loss of mains power supply

### Additional ESD Input

There is also the option of being able to add a second ESD circuit with the following functionality:

- Two independent ESD signals operating the same solenoid valve(s). If either ESD signal is removed then the actuator will perform the safety function by using the same final elements.
- Two independent ESD signals operating independent solenoid valve(s). If either ESD signal is removed then the actuator will perform the safety function by using different final elements.

## Partial Stroke Testing (PST)

Partial Stroke Testing (PST) is a function used in safety critical applications where the safety valve is infrequently operated. PST allows the operator to test a percentage of possible failure modes of the actuated shutdown valve. The test can be performed without the need to physically close the valve and thereby maintain production. This procedure, allows the user to identify any faults which could potentially prevent the actuated valve from performing its safety function.

All final elements such as solenoid valves are tested during the Partial Stroke Testing.

The SI offers an electrically operated fail-safe actuator for use in safety applications where PST is required to test the availability of the valve. The SI spring-return actuators provide partial stroking as standard on all configurations. When the command is given to initiate the test, the actuator will move the valve to a preset position (adjustable).

The 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%.

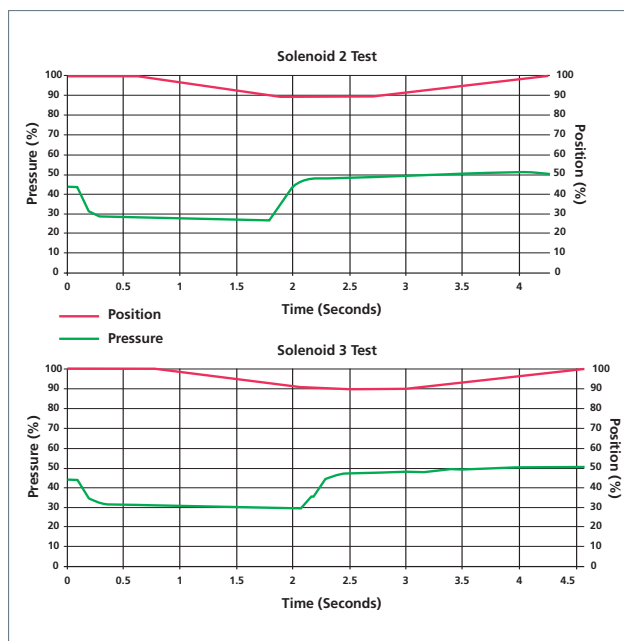
## Diagnostics

The operator can also gain information relating to the performance of the valve and actuator assembly. The PST system records the time to move the actuator to a pre-set position while also monitoring the pressure. This data is then compared to the original PST curve recorded during the commissioning stage. PST results are recorded in the data logger and shown on the display with an option for remote indication.

This provides the user with a high level of diagnostic data on all critical components within the actuator including the solenoid valves.

The PST can be initiated using any of the following three methods:

- Locally using the Rotork *Bluetooth®* Setting Tool Pro
- Hardwired switched digital input 20-40 VDC or 20-120 VAC
- Routed via Fieldbus network cards



# Skilmatic SI<sub>3</sub>-3

## Electric Fail-Safe Actuators

### SI<sub>3</sub> Torque Sizes and Operating Speeds

Model	Hydraulic Direction Torque Output (Nm)			Spring-Return Torque (Nm)			Hydraulic Direction Time (sec)			Spring Direction Time (sec)	
	BTO	RTO	ETO	BTC	RTC	ETC	Speed 1	Speed 2	Speed 3	From	To
Spring-Return Clockwise											
SI-3-085S-060F/C3	3,261	1,395	1,581	3,820	1,826	2,381	48	21	15	0.5	84
SI-3-085C-060F/C3	5,120	1,163	1,186	3,285	1,974	3,778	52	23	16	0.6	90
SI-3-085S-070F/C6	4,419	1,968	2,349	5,036	2,448	3,259	65	29	20	0.7	114
SI-3-085C-070F/C6	6,939	1,683	1,780	4,327	2,629	5,171	70	31	22	0.8	122
SI-3-085S-080F/C7	5,640	2,608	3,264	6,415	3,197	4,388	85	38	26	1.0	148
SI-3-085C-080F/C7	8,856	2,276	2,493	5,504	3,400	6,962	92	40	28	1.0	159
SI-3-130S-080F/C1	9,255	4,420	5,760	9,496	4,713	6,439	131	58	41	1.5	227
SI-3-130C-080F/C1	14,532	3,919	4,427	8,149	5,021	10,217	139	61	43	1.6	242
SI-3-130S-090F/C5	10,976	5,146	6,554	12,628	6,371	8,879	165	73	51	1.9	287
SI-3-130S-100F/C6	13,849	5,882	6,608	16,955	8,187	10,815	205	90	63	2.3	355
SI-3-130C-100F/C6	21,634	4,831	4,889	14,513	8,771	17,036	217	96	67	2.5	377
SI-3-161S-100F/C2	18,189	9,506	13,812	16,307	8,506	12,332	251	110	78	2.9	436
SI-3-161S-110F/C3	21,880	11,820	17,846	18,998	10,194	15,274	304	134	94	3.5	527
SI-3-161C-110F/C3	34,356	11,056	13,982	16,220	10,550	24,237	325	143	101	3.7	564
SI-3-161S-125F/C4	28,345	15,344	23,224	24,385	13,094	19,635	393	173	122	4.5	682
SI-3-161C-125F/C4	44,506	14,366	18,201	20,818	13,548	31,156	419	184	130	4.8	728

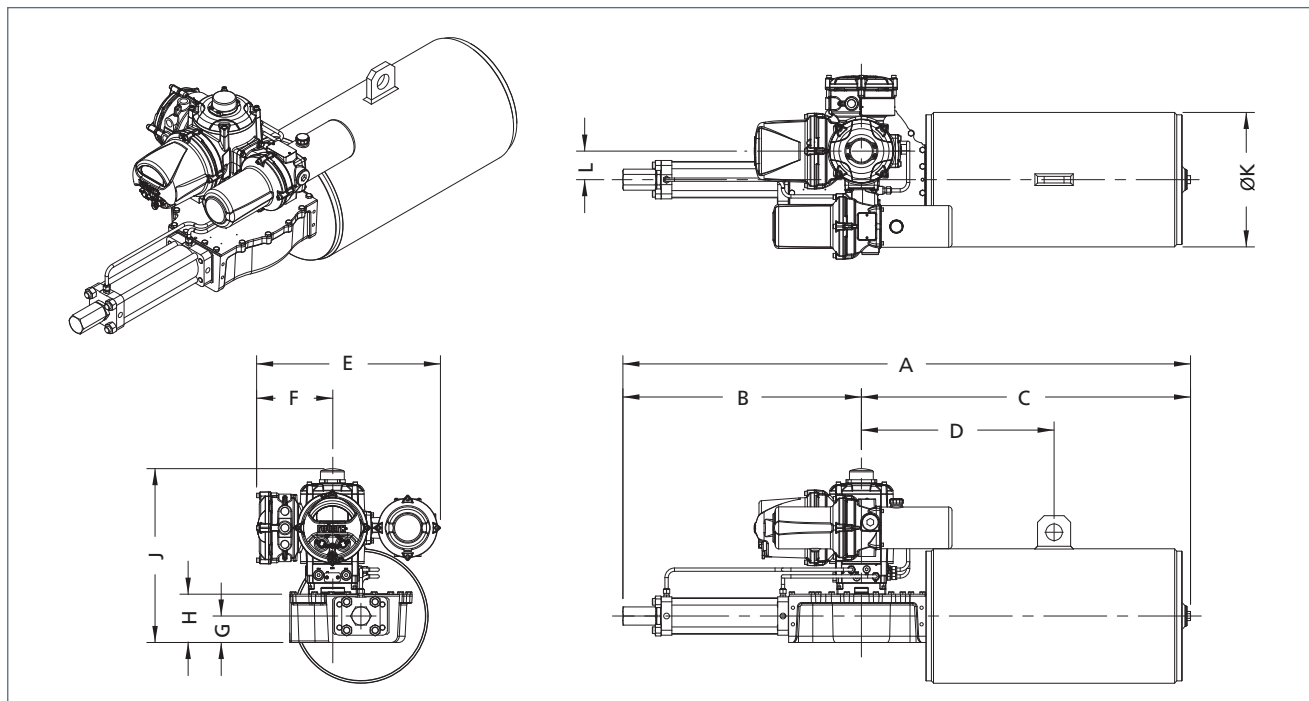
Model	Spring-Return Torque (Nm)			Hydraulic Direction Torque Output (Nm)			Hydraulic Direction Time (sec)			Spring Direction Time (sec)	
	BTO	RTO	ETO	BTC	RTC	ETC	Speed 1	Speed 2	Speed 3	From	To
Spring-Return Anti-Clockwise											
SI-3-085S-060F/O3	3,820	1,826	2,381	3,261	1,395	1,581	48	21	15	0.5	84
SI-3-085C-060F/O3	6,114	1,666	1,894	2,752	1,526	2,366	52	23	16	0.6	90
SI-3-085S-070F/O6	5,036	2,448	3,259	4,420	1,968	2,350	65	29	20	0.7	114
SI-3-085C-070F/O6	8,053	2,246	2,593	3,729	2,125	3,550	70	31	22	0.8	122
SI-3-085S-080F/O7	6,415	3,197	4,388	5,640	2,608	3,265	85	38	26	1.0	148
SI-3-100C-080F/O2	12,007	3,205	3,596	6,324	3,642	6,266	107	47	33	1.2	186
SI-3-130S-080F/O1	9,496	4,713	6,439	9,255	4,420	5,760	131	58	41	1.5	227
SI-3-130C-080F/O1	15,167	4,356	5,124	7,808	4,667	8,827	139	61	43	1.6	242
SI-3-130S-090F/O5	12,628	6,371	8,879	10,976	5,146	6,554	165	73	51	1.9	287
SI-3-130S-100F/O6	16,882	8,141	10,736	13,778	5,835	6,530	205	90	63	2.3	355
SI-3-130C-100F/O6	27,008	7,451	8,541	11,626	6,409	9,753	217	96	67	2.5	377
SI-3-161S-100F/O2	16,357	8,538	12,388	17,875	9,384	13,466	251	110	78	2.9	436
SI-3-161S-110F/O3	18,998	10,194	15,274	21,882	11,820	17,848	304	134	94	3.5	527
SI-3-161C-110F/O3	30,016	9,583	12,059	18,370	11,984	27,698	325	143	101	3.7	564
SI-3-161S-125F/O4	24,385	13,094	19,635	28,344	15,344	23,223	393	173	122	4.5	682
SI-3-161C-125F/O4	38,745	12,398	15,624	23,914	15,633	36,294	419	184	130	4.8	728

SI<sub>3</sub>4 customised electro-hydraulic actuators available, consult your nearest Rotork office.

Spring-return: up to 210,000 Nm

Double-acting: up to 600,000 Nm

### SI<sub>3</sub> Dimensions



Actuator Size	Actuator Dimensions (mm)											Weight (kg)
	A	B	C	D	E	F	G	H	J	K	L	
SI-3-085 <sup>1</sup> -060 <sup>2</sup> / <sub>3</sub>	1,599	717	882	519	556	229	80	146	522	324	85	286
SI-3-085 <sup>1</sup> -070 <sup>2</sup> / <sub>3</sub>	1,604	722	882	496	556	229	80	146	522	324	85	314
SI-3-085 <sup>1</sup> -080 <sup>2</sup> / <sub>3</sub>	1,703	717	986	576	556	229	80	146	522	406	85	370
SI-3-100C-070 <sup>2</sup> /O <sub>2</sub>	1,985	900	1,085	658	556	229	93	177	549	406	100	418
SI-3-130 <sup>1</sup> -080 <sup>2</sup> / <sub>3</sub>	2,255	980	1,275	689	556	229	113	200	576	457	130	593
SI-3-130 <sup>1</sup> -090 <sup>2</sup> / <sub>3</sub>	2,262	981	1,281	760	556	229	113	200	576	508	130	823
SI-3-130 <sup>1</sup> -100 <sup>2</sup> / <sub>3</sub>	2,262	981	1,281	760	556	229	113	200	576	508	130	875
SI-3-161 <sup>1</sup> -100 <sup>2</sup> / <sub>3</sub>	3,207	1,173	2,034	1,181	556	229	150	232	608	610	160	1,266
SI-3-161 <sup>1</sup> -110 <sup>2</sup> / <sub>3</sub>	3,003	1,139	1,864	1,097	556	229	150	232	608	610	160	1,218
SI-3-161 <sup>1</sup> -125 <sup>2</sup> / <sub>3</sub>	3,023	1,159	1,864	1,097	556	229	150	232	608	610	160	1,383

Note: <sup>1</sup> Select S for Symmetric, C for Canted yoke

<sup>2</sup> Temperature selection F, H, L or G

<sup>3</sup> Select C for spring-return Clockwise, O for spring-return Anti-clockwise

Contact Rotork for full SI-3 product specifications

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

**www.rotork.com**

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Fluid Power Actuators and Control Systems

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PUB021-041-00

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