



Skilmatic **SI** intelligent actuators offer a unique combination of the renowned features of Rotork actuation, such as the double-sealing system and non-intrusive infrared commissioning capability, with the benefits of control and safety from Skilmatic range.

The **SI-2.1Q** range is compact and robust, electrically operated failsafe, spring-return, quarter-turn actuators. Designed to provide a 90 degree travel for two-position, ESD or modulating applications. The actuators are suitable for all types of quarter-turn valves and are supplied with a mounting flange to ISO 5211.

The **SI-2.1Q** is watertight and dust-tight up to IP67 / NEMA 6 with the option of IP68 and includes the Rotork double-seal system with separated termination and cable gland compartment. The actuators are also available certified explosionproof for hazardous area gas group **IIB** and **IIC** applications.



## Skilmatic SI-2.1Q

Spring-Return Electric Quarter-Turn Actuator  
(380 to 4407 Nm)

### Features

- Self-contained electrically operated actuator with internal low pressure electro hydraulic control module
- Spring-return, failsafe or lock in position
- Spring-return speed options – single or dual valve combinations
- Single-phase, three-phase and DC power supply
- Watertight and explosionproof for gas group IIB & IIC
- Double-sealed control module – with separate terminal compartment
- Non-intrusive commissioning and configuration setting tool
- Local LCD dual screen display – for position indication, internal pressure and fault diagnostics
- Local controls – lockable Local/Stop/Remote selector switch with local Open/Closed switch
- Modulating control – 4-20 mA input and output with a resolution < 0.25 %
- Digital control – two position and emergency shutdown options for functional safety instrumented systems
- Output relays for monitoring, fault alarms and Open/Closed limits
- Optional Fieldbus communications
- Built in datalogger – Recording events, trends and alarms
- Partial stroking capabilities for ESD applications activated remotely or locally via the setting tool
- Functional safety – SIL certified

## Skilmatic SI-2.1Q

Consisting of a self-contained electro-hydraulic control module and Scotch yoke spring-return drive, the actuators combine the simplicity of electrical operation, with the precision of hydraulic control, and reliability of spring-powered failsafe action. The spring-return mechanism provides the most reliable means of positioning a valve to the safe condition and can be provided as failsafe close, open or lock in last position on power or signal failure. The actuators are available as spring-return clockwise or anticlockwise, with end of spring torque from 380 Nm (3,363 lbf.in) to 4,407 Nm (39,002 lbf.in).

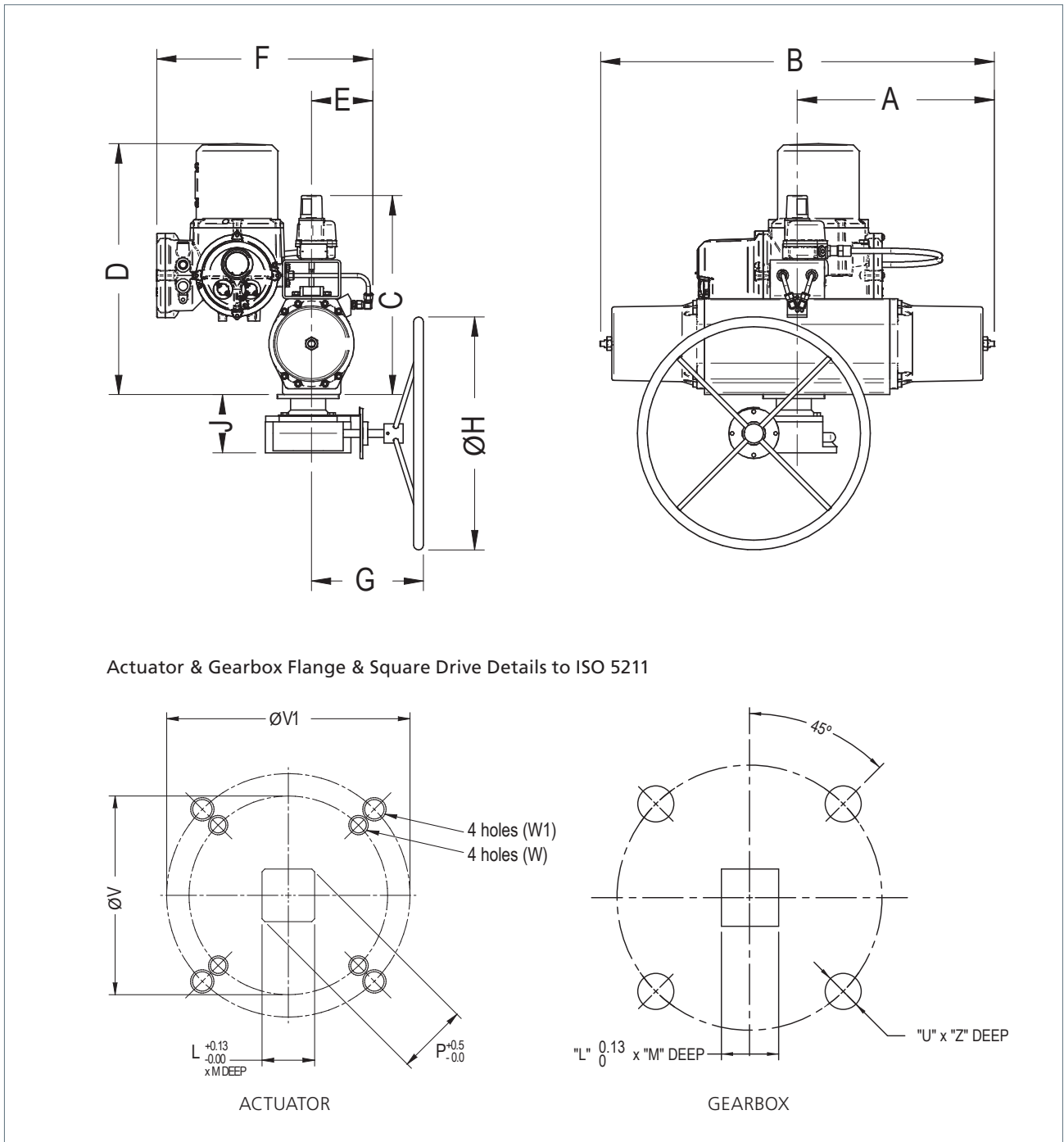
The actuators can be programmed with the *Bluetooth*® wireless setting tool to accept an analogue or digital input, with ESD and partial stroking or network cards options. A wide range of functions can also be selected through the setting tool such as zero and span limits, dead band, hysteresis, interrupter timer, ESD options, partial stroke testing and alarms. The actuator is provided with a built in datalogger to record the configuration settings and the last 1,024 events with 32 bits of status for each event. The data can be downloaded via the *Bluetooth* setting tool. Optional internal fieldbus communication boards are also available for the Rotork *Pakscan*™, DeviceNet®, Profibus®, Foundation Fieldbus® and Modbus® digital control systems.

Specifically designed for on/off duties particularly where failsafe ESD action is required, lockable local controls are provided as standard and on safety critical applications the local selection can be overridden depending on the actuator configuration. The actuator can also be configured for ESD manual reset. Electro-mechanical ends of stroke limit switches are also provided.

Operating from a standard single-phase, three-phase or 24 VDC supply the actuators are also ideal for modulating control applications, the control module provides a pulsed hydraulic signal to accurately position the spring-opposed cylinder. Resulting in accurately positioning a valve with a resolution better than 0.25 of a degree. A manual override gearbox or hydraulic hand pump is available on all sizes. (gearboxes available up to SI-2.1-Q80 only).



## SI-2.1-Q60 to Q80 Dimensions and Mounting Details



| CODE           | A   | B    | C   | D   | E   | F   | F*  | G   | H   | J   | L  | M  | P  | ØV  | ØV1 | W        | W1       | U X Z    | Weight (kg) |
|----------------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|-----|-----|----------|----------|----------|-------------|
| <b>Q61/Q60</b> | 285 | 570  | 382 | 534 | 133 | 525 | 616 | 257 | 600 | 134 | 27 | 37 | 37 | 102 | 125 | M10 X 17 | M12 X 21 | M12 X 16 | 62          |
| <b>Q70</b>     | 510 | 655  | 495 | 647 | 157 | 564 | 657 | 297 | 600 | 149 | 36 | 64 | 49 | 140 | N/A | M16 X 25 | N/A      | M16 X 18 | 98          |
| <b>Q80</b>     | 510 | 1020 | 494 | 647 | 157 | 556 | 641 | 415 | 600 | 175 | 46 | 64 | 61 | 125 | 165 | M12 X 25 | M20 X 32 | M20 X 18 | 127         |

For 3-Phase units use F\* instead of F.

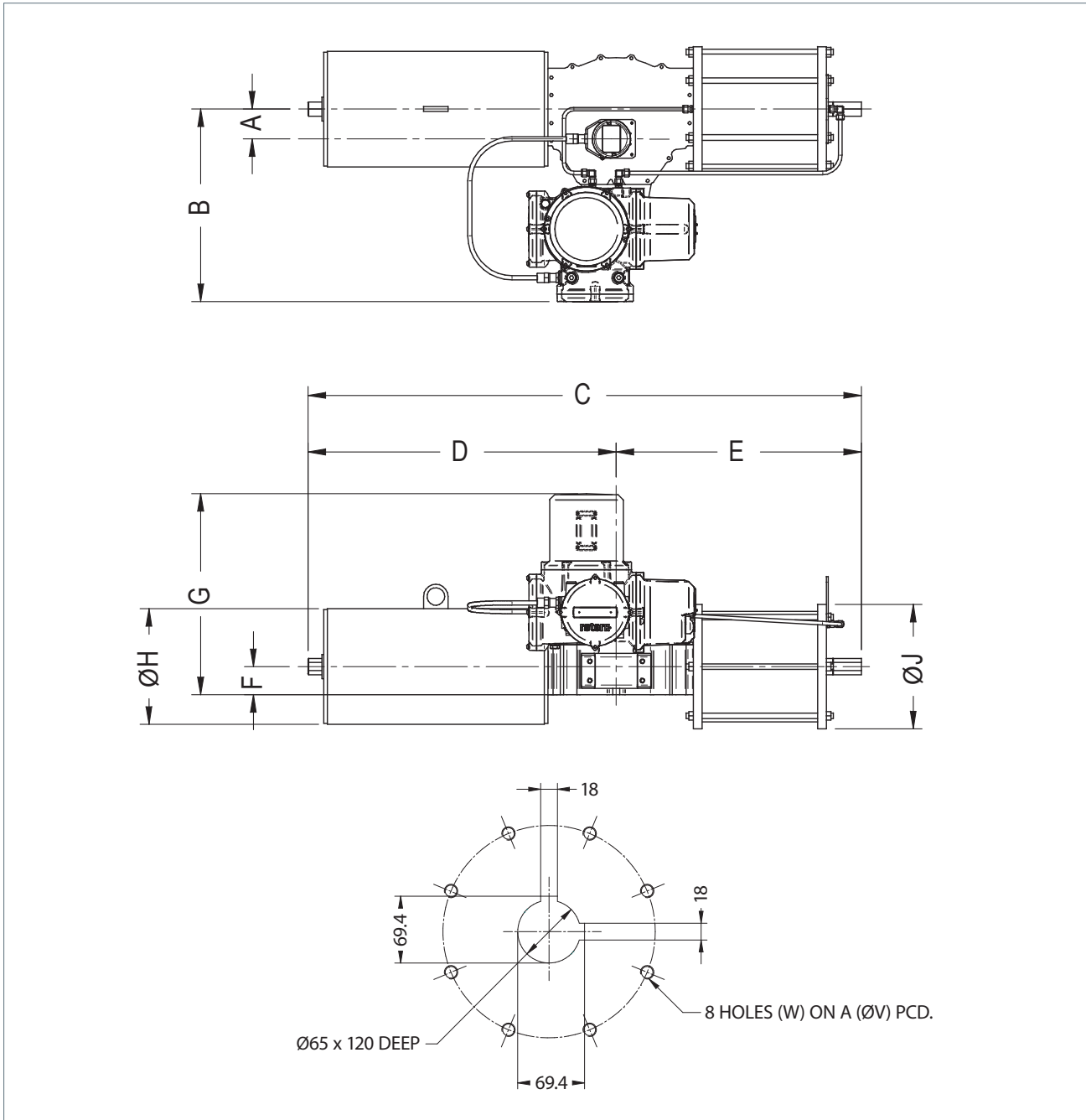
Q70 have additional mounting hole pattern: 170 x 110 mm, 4 x M16 x 25 deep.

Q80 have additional mounting hole pattern: 234.7 x 97.2 mm, 4 x M16 x 25 deep.

Manual override gearbox is optional.

All dimensions in mm.

## SI-2.1-Q110 to Q112 Dimensions and Mounting Details



| CODE | A  | B   | B*  | C    | D   | E   | F   | G   | H   | J   | ØV  | W        | Weight (kg) |
|------|----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|----------|-------------|
| Q110 | 85 | 550 | 635 | 1580 | 880 | 700 | 165 | 569 | 330 | 355 | 254 | M16 X 15 | 350         |
| Q111 | 85 | 550 | 635 | 1615 | 895 | 720 | 163 | 569 | 325 | 415 | 254 | M16X15   | 400         |
| Q112 | 85 | 550 | 635 | 1715 | 995 | 720 | 205 | 569 | 410 | 415 | 254 | M16X15   | 500         |

For 3-Phase units use B\* instead of B.  
Optional Manual override hydraulic hand pump is not shown.

All dimensions in mm.

# Ordering Code

## Ordering Code Example

SI-2.1-Q80 - 0 0 2 - 1 0 - 0 0 - A A

### Failure Mode

- 0 = Failsafe on loss of power supply (in direction of spring) (note 6)
- 1 = Fail in Position on loss of power supply (note 7)

### Spring-return Speed & ESD Options

- 0 = Speed A – Single internal solenoid (note 6)
- 1 = Speed B – Dual internal solenoid (note 6 & 8)
- 2 = Speed C – Single internal & external solenoid (note 4 & 9)
- 3 = Speed D – Slow acting internal solenoid – Consult sales office
- 5 = Speed E – Quick acting spring-return – Consult sales office
- 6 = Speed A – Hardwired single internal ESD solenoid (note 7)
- 7 = Speed C – Hardwired single internal & external solenoid (note 4 & 7)

### Supply Voltage

- 0 = Single-phase 115 VAC ± 10% 50/60 Hz
- 1 = Single-phase 230 VAC ± 10% 50/60 Hz
- 2 = 24 VDC ± 10%
- 3 = Three-phase 380-480 VAC ± 10% 50/60 Hz

### Control

- 0 = Standard digital control (Open / Closed / partial stroke)
- 1 = Analogue control 4-20 mA or 0-10 VDC (note 3 & 5)
- 2 = *Pakscan* (note 5)
- 3 = *Pakscan* – analogue input (note 5)
- 4 = Modbus single channel (note 5)
- 5 = Modbus dual channel (note 5)
- 6 = Profibus dual channel (note 5)
- 7 = DeviceNet (note 5)
- 8 = Foundation Fieldbus (note 5)
- 9 = Profibus single channel (note 5)

### Certifications

- 0 = WT – Watertight IP67
- 1 = ATEX – European – Hazardous area Gas group IIB (IP67)
- 1C = ATEX – European – Hazardous area Gas group IIC (IP67) (note 11)
- 2 = IEC Ex – International – Hazardous area Gas group IIB (IP67)
- 2C = IEC Ex – International – Hazardous area Gas group IIC (IP67) (note 11)
- 3 = FM – US – Hazardous area Gas group IIB (IP67) (note 10)
- 3C = FM – US – Hazardous area Gas group IIC (IP67) (note 10)
- 4 = CSA – Canada – Hazardous area Gas group IIB (IP67) (note 10)
- 4C = CSA – Canada – Hazardous area Gas group IIC (IP67) (note 10)
- 5 = EAC – Russia TR TS Hazardous area Gas Group IIB
- 5C = EAC – Russia TR TS Hazardous area Gas Group IIC -20 to +60 (IP67) (note 11)
- 6 = INMETRO – Brazil – apply factory
- 6C = INMETRO – Brazil – apply factory

### Cable Entries

- 0 = M25 x 1.5P
- 1 = M20 x 1.5P
- 2 = ½" NPT
- 3 = ¾" NPT
- 4 = 1" NPT

### Hydraulic Fluid/Operating Temperature

- |                      |                        |  |                         |
|----------------------|------------------------|--|-------------------------|
| 0 = Mineral fluid    | -10 to +65 °C (note 2) | 4 = Silicone fluid                         | -30 to +60 °C (note 11) |
| 3 = Food grade fluid | -10 to +60 °C (note 2) | 5 = Silicone fluid / Low temperature seals | -40 to +60 °C (note 11) |

### Mounting

- A = Vertical stem above valve
- B = Vertical stem below-valve
- C1 = Valve stem & pipeline horizontal
- C2 = Valve stem horizontal, pipeline vertical
- D = Vertical stem above valve with valve mounting kit
- E = Valve stem vertical below valve with valve mounting kit
- F1 = Valve stem & pipeline horizontal with valve mounting kit
- F2 = Valve stem horizontal, pipeline vertical with valve mounting kit

### Accessories

- A = None
- B = Manual override hydraulic hand pump
- C = Manual override (Gearbox)
- D = WT – Watertight IP68 - 7m for 72 hours (note 4)
- F = Two additional volt free SPDT limit switches (four total)
- G = Hardware ESD configuration (Failsafe actuators only) (note 6)
- H = All cable entries plugged
- J = Viton seals
- K = Paint colour change to standard specification
- L1 = Coastal Paint & Exd IIC applications (2 pack Epoxy 150 to 200 microns)
- L2 = Offshore Paint, watertight & Exd IIB applications (2 pack Epoxy to 250 to 350 microns)
- M = Proximity limit switches replacing standard V3 micro switches
- N = Flow control valve – to adjust and increase the stroke speed in the spring direction
- O = Optional low power external solenoid valve option for 'Spring-Return Speed & ESD Options' code 2 or 7 – consult sales office
- P = High flow – Two external solenoid valves – available if option 5 "Spring-Return Speed & ESD Options" is selected for Q80 to Q112
- R = Steel actuator drive option Q60 to Q80
- T = Remote mounted EH power module (Max distance 5m from actuator drive)

## Ordering Code

### Notes:

- 1 Select one option from each section except 'Accessories' which is multiple options.
- 2 Stroke speed is typical for all actuators with no load at 20 °C. Speed can vary  $\pm 10\%$  (or 1 second, whichever is greater) at 20 °C. Stroke speeds with mineral and food grade fluid are affected by subzero temperatures and can change by up to 50%. If this is not acceptable select silicone fluid.
- 3 All actuators are available with 4-20 or 20-4 mA output, powered internally by an isolated 24 VDC supply or external customer supply.
- 4 All actuators are watertight to IP67, SI-2.1Q60 to 80 are available to IP68 except external solenoid option. (Spring-Return Speed and ESD Options – code 2 & 7).
- 5 Analogue control, local controls, partial stroking and communication circuits are not part of the Functional Safety circuit.
- 6 Functional safety applications (SIL) – Failsafe on loss of power supply. (Failure Mode code 0).  
Select Spring-Return Speed and ESD Options – code 0, 1, 2 or 3 and Accessories – code G.
- 7 Functional safety application (SIL) – Fail in last position on loss of power supply. (Failure Mode code 1).  
Select Spring-Return Speed and ESD Options - code 6 or 7. The actuator will failsafe on loss of 24 VDC ESD input signal.
- 8 For applications requiring redundant solenoid valves, (Spring-Return Speed and ESD Options – code 1), please refer to single solenoid speed 'A' for critical safety speed on functional safety systems.
- 9 Spring-Return stroke speed 'C' can be reduced, consult the sales office for details.
- 10 External solenoid option FM & CSA certified, available to a minimum -20 °C.
- 11 Explosionproof actuators for gas group IIC, available only for temperature -20 to +65 °C.

## Performance Data

| Code           |              | Torque Nm (lbf.in) |              |              |              |              |              | Possible Max Hydraulic @12 bar relief valve setting | Hydraulic Stroke Speed | Stroke Speed (seconds)             |         |         |
|----------------|--------------|--------------------|--------------|--------------|--------------|--------------|--------------|---|------------------------|------------------------------------|---------|---------|
|                |              | BTO                | RTO          | ETO          | BTC          | RTC          | ETC          |   |                        | Spring-return Speed (note 2 and 9) |         |         |
|                |              |                    |              |              |              |              |              |   |                        | Speed A                            | Speed B | Speed C |
| Clockwise      | SI-2.1-Q60   | 1007 (8903)        | 395 (3492)   | 563 (4978)   | 500 (4421)   | 260 (2298)   | 380 (3359)   | 1290 (11406)  | 14                     | 14                                 | 10      | 6       |
|                | SI-2.1-Q61   | 907 (8019)         | 326 (2882)   | 434 (3837)   | 630 (5570)   | 340 (3006)   | 480 (4244)   | 1188 (10504)  | 14                     | 13                                 | 9       | 6       |
|                | SI-2.1-Q70   | 2003 (17710)       | 813 (7188)   | 1124 (9938)  | 1160 (10256) | 570 (5039)   | 800 (7073)   | 2565 (22679)  | 27                     | 27                                 | 18      | 8       |
|                | SI-2.1-Q80   | 4218 (37295)       | 1625 (14368) | 2278 (20142) | 2350 (20778) | 1150 (10168) | 1605 (14191) | 5399 (47738)  | 52                     | 54                                 | 37      | 17      |
|                | SI-2.1-Q110  | 4671 (41301)       | 2303 (20363) | 3122 (27605) | 3819 (33767) | 1825 (16136) | 2380 (21044) | 6230 (55086)  | 73                     | 75                                 | 52      | 12      |
|                | SI-2.1-Q111  | 6840 (60483)       | 3512 (31049) | 4995 (44168) | 5031 (44487) | 2445 (21615) | 3254 (28773) | 9075 (80242)  | 102                    | 107                                | 78      | 17      |
| SI-2.1-Q112    | 5676 (50190) | 2632 (23268)       | 3304 (29216) | 6431 (56864) | 3207 (28353) | 4406 (38953) | 7888 (69746) | 108   | 101                    | 66                                 | 16      |         |
| Anti-Clockwise | SI-2.1-QA60  | 500 (4421)         | 260 (2298)   | 380 (3359)   | 1007 (8903)  | 395 (3492)   | 563 (4978)   | 1290 (11406)  | 14                     | 14                                 | 10      | 6       |
|                | SI-2.1-QA61  | 630 (5570)         | 340 (3006)   | 480 (4244)   | 907 (8019)   | 326 (2882)   | 434 (3837)   | 1188 (10504)  | 14                     | 13                                 | 9       | 6       |
|                | SI-2.1-QA70  | 1160 (10256)       | 570 (5039)   | 800 (7073)   | 2003 (17710) | 813 (7188)   | 1124 (9938)  | 2565 (22679)  | 27                     | 27                                 | 18      | 8       |
|                | SI-2.1-QA80  | 2350 (20778)       | 1150 (10168) | 1605 (14191) | 4218 (37295) | 1625 (14368) | 2278 (20142) | 5399 (47738)  | 52                     | 54                                 | 37      | 17      |
|                | SI-2.1-QA110 | 3893 (34422)       | 1872 (16554) | 2461 (21755) | 4589 (40579) | 2252 (19909) | 3033 (26817) | 6230 (55086)  | 73                     | 75                                 | 52      | 12      |
|                | SI-2.1-QA111 | 5031 (44481)       | 2444 (21611) | 3253 (28766) | 6841 (60490) | 3512 (31053) | 4996 (44176) | 9075 (80242)  | 102                    | 107                                | 78      | 17      |
| SI-2.1-QA112   | 6451 (57040) | 3219 (28462)       | 4427 (39143) | 5698 (50382) | 2645 (23387) | 3327 (29417) | 7888 (69746) | 108   | 101                    | 66                                 | 16      |         |

# Specification

## Certification

ATEX - II 2 G Ex de\* IIB T4 (Tamb = -50 to +65 °C)  
ATEX - II 2 G Ex de\* IIC T4 (Tamb = -20 to +65 °C)  
EN60079-0, EN60079-1, EN60079-7, EN13463-1

IEC - Ex de\* IIB T4 -GbTa -50 to +65 °C  
IEC - Ex de\* IIC T4 -GbTa -20° to +65 °C  
IEC – 60079-0:2007-10, 60079-1:2007-04, 60079-7:2006-07

FM - Class I, Zone1 AEx de\* IIB T4 (Ta -40 to +65 °C)  
FM - Class I, Zone1 AEx de\* IIC T4 (Ta -20 to +65 °C)  
Class 3600: 2011, ANSI/ISA 60079-0: 2009,  
ANSI/ISA 60079-1: 2009, ANSI/ISA 60079-7: 2008,  
Class 3810: 2005, ANSI/NEMA-250: 1991

CSA – Ex de\* IIB T4, - 40 °C ≤ Ta ≤ 65 °C  
CSA – Ex de\* IIC T4, - 20 °C ≤ Ta ≤ 65 °C  
Product Class 2258 02 (approval apply to the power module –  
Full actuator assembly will be subject to CSA inspection).

TRTS EAC - Ex de\* IIB T4 (Tamb = -40 to +65 °C)  
TRTS EAC - Ex de\* IIC T4 (Tamb = -20 to +65 °C)  
EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-18

\* 'e' increased safety available on single-phase & DC supply voltage only.  
Certification temperatures are not operating temperatures; see operating  
temperature, page 5.

### Bluetooth Setting tool:

Ex ia IIC T4 (intrinsically safe)  
FM, INT SAFE Class I, II DIV1 Group A B C D  
CSA, EEia, Class I, II Div 1 Group A B C D

### Functional Safety:

The Skilmatic range has been certified to meet the full  
functional safety requirements of IEC 61508 Parts 1-7 and  
is suitable for use in a SIL 2/3 system depending on the  
configuration.

Please refer to the appropriate safety manual for full failure rate data and  
any restrictions of use.

### Enclosure:

Watertight to IP67 / NEMA 6, double-sealed protection with  
separate cable gland and termination compartment. Optional  
Watertight models to IP68, 7 meters/72 hours, for SI2.1Q60  
to Q80, for alternative depth/ pressures consult factory.

## Materials

Control Module: Aluminium

### Actuator – Q60 to 80

Actuator Body: Anodised Aluminium

Piston: Aluminium

Driving Shaft: Zinc plated Steel

Seals: Nitrile, optional materials for high and  
low temperature applications

### Actuator – Q110 to 112

Actuator Housing: Carbon Steel

Drive Shaft: Carbon Steel

Piping: 316 Stainless Steel (hard piped)

Paint Finish: Standard Grey, powder coated  
electrical compartments with two pack  
epoxy hydraulic compartment and  
actuator drive, minimum 90 microns  
(see page 5 for additional paint options)

## Mechanical

### Operating Temperature:

See page 5

Torque / Speed: See page 6

Stroke: 0°± 2.5% to 90° ± 2.5%

Weight: See dimensional detail (page 3 & 4)

Failure Mode: Failsafe in the direction of the spring or  
Fail in last position

Action: Spring-return clockwise or  
anti-clockwise

Hydraulic Fluid: See page 5

Maximum Working Pressure:  
12 bar (175 psi)

Manual Override: Optional gearbox – Gearbox on  
SI-2Q60 to Q80 or hydraulic hand  
pump on SI-2Q60 to Q130

### Internal Pressure Transmitter:

Displayed as a percentage of maximum  
working pressure

Mounting: Valve stem vertical or horizontals  
(see page 5)

## Electrical

Electrical Supply: Single-phase 115 or 230 VAC,  
Three-phase 380 to 480 VAC or 24 VDC

Supply Tolerance: Supply voltage ± 10%,  
frequency 50/60 Hz ±5%

Power Consumption: Available upon request

Motor Protection: Thermal cutouts, insulation class F

Cable Entries: Power module has a minimum of two  
spare entries. See page 5 plus two  
plugged M20 cable entries.  
See Drg No SMW-SI-010 for options.  
Switchbox spare entry will be plugged  
ATEX - M20. FM/ CSA - ½" NPT

Position Feedback: 1K ohm. Conductive plastic

#### Electrical (cont'd)

##### Remote Digital Inputs:

Open, Close, maintain, ESD and Partial Stroke – Std 20 to 60 VAC/DC or 60 to 120 VAC. Other voltages consult factory. 5 mA minimum duration 300ms (DC inputs must be +ve switched)

##### Limit Switches:

Two adjustable electro-mechanical SPDT Volt free switches. Rating 5A minimum at 230 VAC. Optional proximity switches are available (See page 5)

##### Non-Intrusive Setting:

Sealed control module with infrared / *Bluetooth* setting from the Rotork *Bluetooth* setting tool. All values are held within EEPROM to maintain settings within the memory on power failure. Datalogger configurations and recorders can be downloaded via the *Bluetooth* setting tool

##### Display:

Rotork LCD dual display with 32 character text to allow viewing of the valve position, internal pressure and diagnostics screens. LED's are provided to indicate limits and intermediate state in the remote mode

#### Control

##### Control Options:

Remote Digital (Open, Close, maintain), Emergency shutdown and Partial stroking. Or Analogue Modulating - Input 4-20 mA or 0-10 VDC

##### Resolution:

<0.2% of full scale

##### Repeatability:

<0.2%

##### Duty Rating:

90%

##### Output:

4-20 or 20-4 mA, powered internally by an isolated 24 VDC supply or external customer supply

##### Function Settings:

Control options, Deadband and Hysteresis adjustable 0–99%, Partial stroking adjustable 0–99%, interrupt timer and ESD action

##### Interrupt Timer:

To slow the rate of closing and / or opening over. 0–99% of stroke, with the time pulse ON and OFF duration selectable from 100ms to 99sec. Timer does not operate with loss on power

##### Local Controls:

Lockable Local/Stop/Remote selector switch and local Open/Closed switch

##### Alarm and Limit Relays:

*Relays:* Volt free normally open or normally closed contacts rated 5 mA to 5A 120/230 VAC, 30 VDC

##### Alarm Monitor Relay:

De-energised on loss mains power, hardware, local controls, position sensor fault, and EEPROM error. Optional signal inverted to de-energise monitor relay for low power applications

##### Three Independent Alarm and Status Relay:

Can be configured to customer specific alarms and status indication.

##### Fieldbus Communication Options (internally mounted):

*Pakscan:* Rotork fieldbus system for remote control and status indication over a fault tolerant two-wire serial link. Loop distance up to 20 km. (See PUB059-048)

*Modbus:* Single and dual communication highways RS485. Modbus protocol RTU (See PUB091-001)

*Profibus DP:* Fully compatibility with EN 50170 (See PUB088-001)

*Foundation Fieldbus:* An IEC61158-2 compliant Foundation interface module allows connection to a foundation network. (See PUB089-001)

*DeviceNet:* ODVA certified DeviceNet interface, with full status data feedback, digital and analogue control (See PUB090-001)

For modulating applications consult factory regarding resolution on all fieldbus cards

Rotork reserves the right to change the specifications without notice.

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

[www.rotork.com](http://www.rotork.com)

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