Bettis™ Q-Series Pneumatic Actuator and "Fully Integrated" Controls

Your First Choice for a Valve Operating System™

BETTIS™

EMERSON™

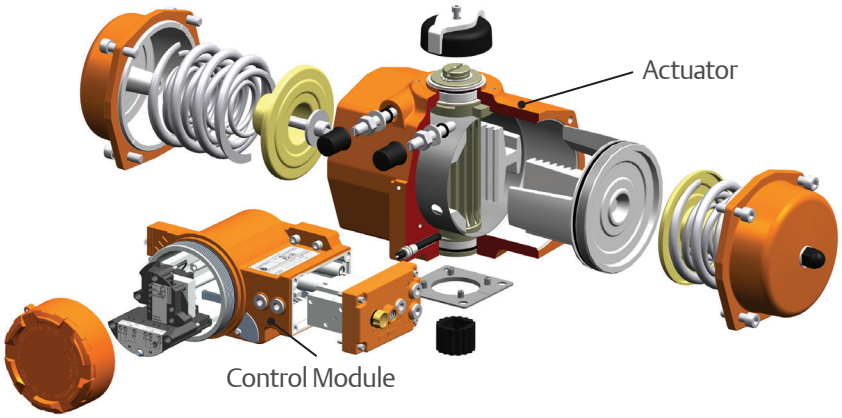
The Industry's Only "Fully Integrated" Pneumatic Valve Operating System™ (VOS)

Bettis™ Q-Series offers a new way of looking at valve automation by combining field-proven rack and pinion pneumatic actuator with the necessary controls in an integrated modular package.

Gone are the non-integrated accessories from multiple vendors, mounting brackets, cumbersome external cabling and tubing that allows you to:

- **Achieve up to 20% reduction** in installation and commissioning time
- **Automate valves with small VOS footprint** offering flexibility for retrofit into existing pipe runs

The bottom line is that with the Bettis Q-Series you can improve installation time, reduce VOS complexity and automate valves in even the tightest of piping configuration.



General Actuator Specifications:

- Proven corrosion protection - 1000-hour accelerated salt spray test per ASTM B117.
- Torque Range – 40 Nm to 1600 Nm in spring-return or double-acting configuration.
- Three nested end cap springs, embedded in a package, offer six different spring torques.
- Valve mounting options in accordance to ISO 5211 offers low-cost and versatile direct mounting to your valve.

General Control Module Specifications:

- **One control module fits all actuators sizes:** No more different switchboxes or solenoids for different sizes of actuators reducing stock levels significantly for spare parts.
- **Built-in Breather function:** The breather function provides corrosion protection of the actuator's spring chambers by preventing dirt or moisture from outside from being sucked into the spring chamber.
- **Manual Control (Override):** Allows local manual operation of the actuator-valve assembly when no control signal is available.
- **Speed Control:** allows to reduce the speed of the opening and closing stroke.
- **Hazardous Area Approvals:** FM, CSA, ATEX and IECEx control module approvals for use in Zone 1, 2, 21 or 22 and Class I Division 2 hazardous areas.

Specifications Control Modules QC41, QC42, QC43

- **A Range of Switch Cartridge Types:** Mechanical, Gold Plated, 2-Wire Proximity (20-250 VAC and 10-300 VDC), 2-Wire NAMUR, 3-Wire Proximity (NPN and PNP).
- **Non-Intrusive Switch Setting:** Screws to set switch points are available on the outside, next to the module cover. Allows switches to be adjusted without removing cover. For explosion proof/flame proof versions it avoids the need for hot-work down time and maintains integrity of explosion proof environment.
- **A Range of Pilot Valve Cartridges:** Pilot valves can be operated with 24VDC (QC41), 115VAC (QC42) or 230VAC (QC43).
- **Pneumatic Amplifier:** Integrated in the control module.
- **Fail in Last Position (FILP) Amplifier:** For double acting actuators to stay in the last commanded position in case of a power or signal failure.

Specifications bus communication Control Modules

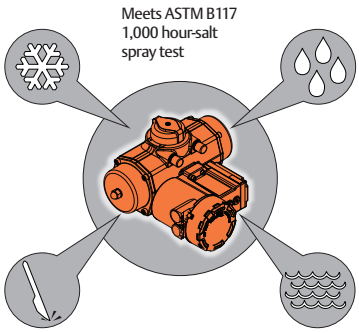
- **Fieldbus Foundation™ (QC54):** As part of Emerson's PlantWeb digital plant architecture, Bettis Q-Series uses FOUNDATION™ fieldbus digital communications to provide diagnostic information with PlantWeb and NAMUR alerts. The control module contains process based electronics and includes auto initialization function for easy commissioning.
- **AS-Interface (QC40):** The QC40 Module with ASI bus communication allows up to 62 devices per segment for ASI-2 protocol and comes with easy exchangeable position feedback switch cartridges. Inside LED indicators are available for status, power, open and close information of the module.

FOUNDATION

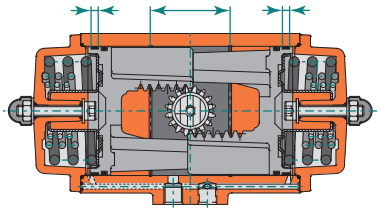
PlantWeb

ASi INTERFACE

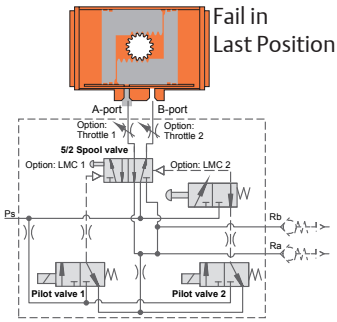
Ensured reliability through innovative product design



Hard anodized actuator body and module with protective finish protects from corrosive environments.

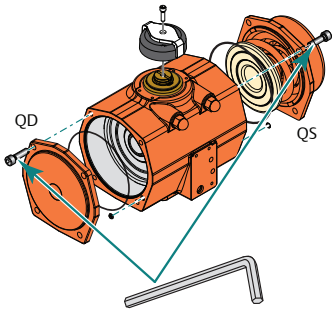


Extended Life - Nylatron® guide band and PTFE piston guide bands provides wear protection between housing and piston for extended service life.

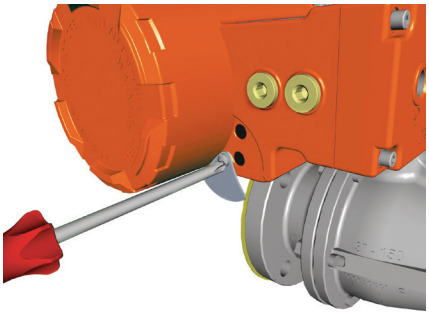


Fail in Last Position (FILP) upon loss of power ensure you hold the last commanded position (for use in double act ing actuators).

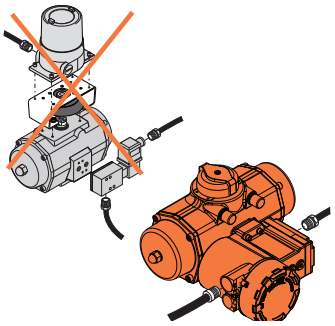
Quick start up benefit from our simplified design



Simple Conversion - With an Allen key wrench, convert double-acting to spring-return configuration.



Non-Intrusive Switch Setting: Avoids the need for hot-work down time and maintains integrity of explosion proof environment.



Plug and Play capability reduces the need for mounting brackets, cabling and tubing and adapters.

Increased personnel and process safety

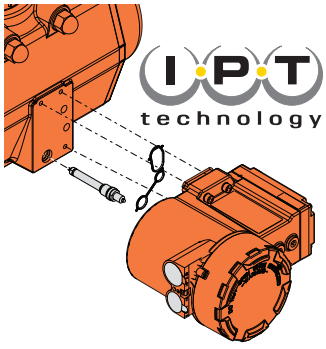
C US

IEC Ex

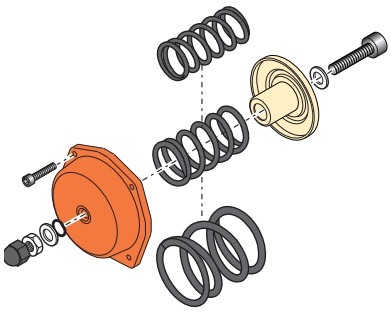
FM APPROVED

SEGURANÇA INMETRO CEPEL

Integrated controls in **explosion proof design module** offers FM, CSA, ATEX, IECEx approvals.

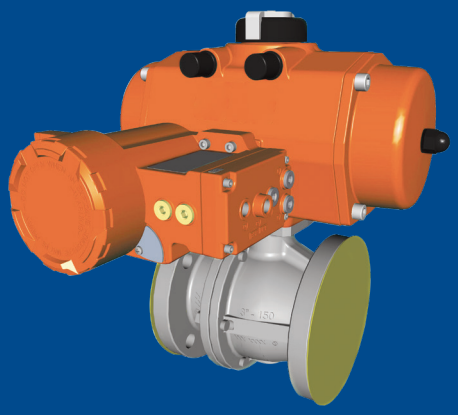


Patented Intelligent Position Tracking allows the integration of controls and feedback into one single product.



Encapsulated spring design provides superior field safety - when removed, springs remain part of the assembly.

This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).



The Bettis™ Q-Series Valve Operating System™ (VOS)

stands as a versatile, rugged, and efficient solution. It combines a field-proven rack and pinion pneumatic actuator with controls in an integrated modular package. The Bettis Q-Series solution offers true 'plug and play' capability without mounting brackets, cumbersome external cabling, and tubing.

Patented Intelligent Position Tracking allows the integration of controls and feedback into one single product.

Non-Intrusive Switch Setting: Avoids the need for hot-work down time and maintains integrity of explosion proof environment.

For complete technical and installation documentation scan QR.

www.emerson.com/bettis

World Area Configuration Centers (WACC) offer sales support, service, inventory and commissioning to our global customers. Choose the WACC or sales office nearest you:

NORTH & SOUTH AMERICA

19200 Northwest Freeway
Houston TX 77065
USA
T +1 281 477 4100

Av. Hollingsworth
325 Iporanga Sorocaba
SP 18087-105
Brazil
T +55 15 3413 8888

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6777 8211

No. 1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P. R. China
T +86 22 8212 3300

MIDDLE EAST & AFRICA

P. O. Box 17033
Jebel Ali Free Zone
Dubai
T +971 4 811 8100

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650

24 Angus Crescent
Longmeadow Business Estate East
P.O. Box 6908 Greenstone
1616 Modderfontein Extension 5
South Africa
T +27 11 451 3700

EUROPE

Holland Fasor 6
Székesfehérvár 8000
Hungary
T +36 22 53 09 50

Strada Biffi 165
29017 Fiorenzuola d'Arda (PC)
Italy
T +39 0523 944 411

For complete list of sales and manufacturing sites, please visit www.emerson.com/actuationtechnologieslocations or contact us at info.actuationtechnologies@emerson.com

BETTIS™

EMERSON™

DOC.4P.BQ.UK Rev C 06-18

Integrated Control modules

QC40 with AS-Interface digital bus communication.

Features

- **AS-Interface digital communication.**
- **Up to 62 devices per segment for AS-Interface Spec. V3.0 protocol**
- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Bettis actuator sizes both single and double acting actuators.**
- **Available as "Weather Proof" for indoors or outdoors use and "Non-Arcing/Non-Incendive" for areas with a potential explosion hazard.**
  - The robust aluminum alloy enclosure (IP66 / NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
    The hazardous area versions are available with:
  - **ATEX or IECEx** Ex nA approvals for use in Zone 2, 21 and 22
  - **CSA or FM** Non-Incendive approvals for use in Class I, Division 2.
- **Operates with exchangeable position feedback switches.**
- **Non-Intrusive switch point adjustment of the feedback switches. Allows to adjust switch points without opening the Control Module.**
- **LED indicators for Fail, Power, Open and Close position.**
- **Lockable Control Module cover.**
- **All the control and feedback connections can be wired through one single entry to the Control Module.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**
- **Modular functionality for easy update towards present and future bus systems.**

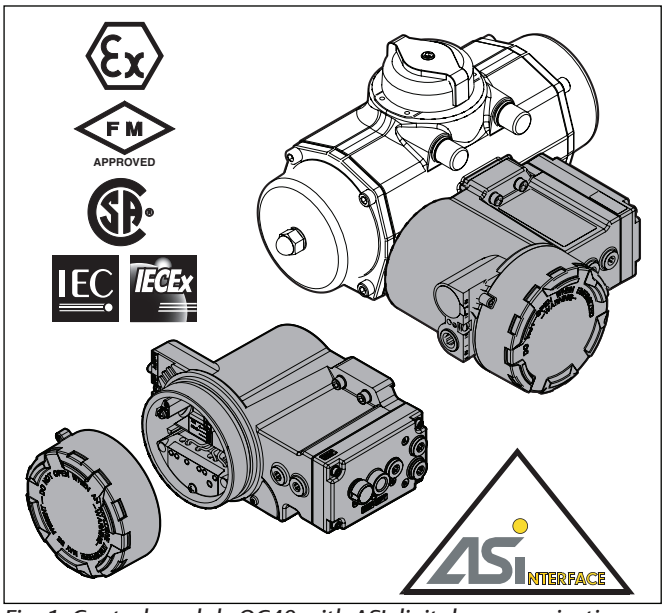


Fig. 1. Control module QC40 with ASI digital communication.

Description:

This Q-Series QC40 Control Module offers an integrated concept for valve automation. Its compact and robust construction incorporates basic control and feedback functionality and communicates through the AS-Interface Spec. V3.0, V2.11 protocol.

Construction

All electrical and pneumatic control components are located inside one module housing making it a compact and robust construction incorporating basic control and feedback functionality and is suitable for indoor and outdoor use.
The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting the AS-Interface signals. Two cable entries are available.
One pneumatic connection is available to feed the control module. The pilot valves inside the control module are used to send the actuator to its open or closed position.
These modules are available with ATEX, IECEx or Inmetro certification for use in Zone 2, 21, and 22, and additionally CSA or FM certified for use in Class I, Division 2.

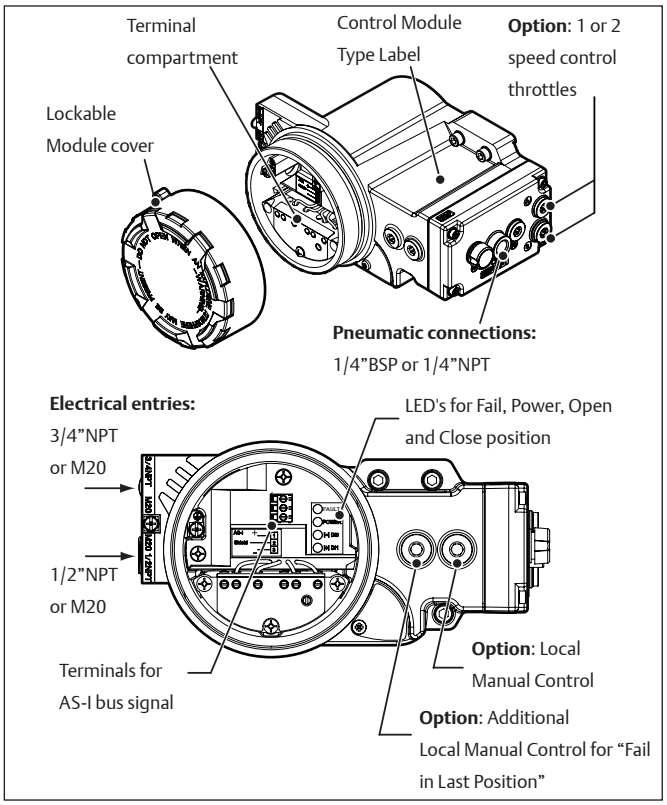


Fig. 2. Control module overview

General specifications:

Material housing:	Aluminium alloy
Operating media:	Air or inert gasses, filtered at 50µm (for QC54 5µm)
Pneumatic entry:	Metric units: G1/4" Imperial units: 1/4"NPT
Electrical connections :	Internal terminal strip for bus signal Internal and external earth connection Optional quick connectors: 7/8" or M12 connector (see page 9)
Cable entries:	Metric units: 2x M20x1.5 Imperial units: 1/2" and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X
Switch points:	Factory set at 15° before each end of travel (open and closed position).
Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.
Finish:	Chromated with polyurethane based coating.
Temperature range:	G-Type switch: -25°C to +60°C (-13°F to +140°F) N-Type switch: -25°C to +60°C (-13°F to +140°F)

Dimensions:

Metric:	See data sheet BQ1.603.08
Imperial/UNC:	See data sheet BQ1.603.09
DIN 3337:	See data sheet BQ1.603.10

Electrical safety requirements:

Use:	In- and outdoor.
Altitude:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation:	Up to ±10% of nominal voltage
Over voltage category:	II
Pollution degree:	2 (3 when the cover remains closed)

Communication Protocol:

Protocol:		AS-Interface
Number of devices:		31 for AS-Interface Spec. V2.11 protocol 62 for AS-Interface Spec. V3.0 protocol
Current	Minimum:	34 mA at 26.5V and 25°C
	Maximum:	140 mA at 26.5V and 25°C
	Nominal:	101 mA at 26.5V and 25°C to 60°C
	Protection:	Short circuit detection
ASI-Profile V3.0:		S-6.A.E (other profiles optional)

Table 1 - Factory settings:

Factory address	00	EID1	7
E/A-Code	6	EID2	E
E/A-Code	A	Parameter	00

Q-Series data bits		Functions	
	Type	DI's	DO's
D0	Bi-directional	Feedback "Closed"	Pilot Valve 2 Control
D1	Bi-directional	Feedback "Open"	Pilot Valve 1 Control
D2	Bi-directional	Not used	
D3	Bi-directional	Not used	

LED indicators for Open and Close position, Status, and Power.

- The Open and Close LED identify the position of the automated valve. These LED's are also useful for setting the switch points more accurately.
- Status feedback is provided according to the ASI standard For more detailed information on LED indications, see Installation Guide : DOC.IG.BQC40.1
- The power LED indicates if the AS-I cartridge is powered or not.

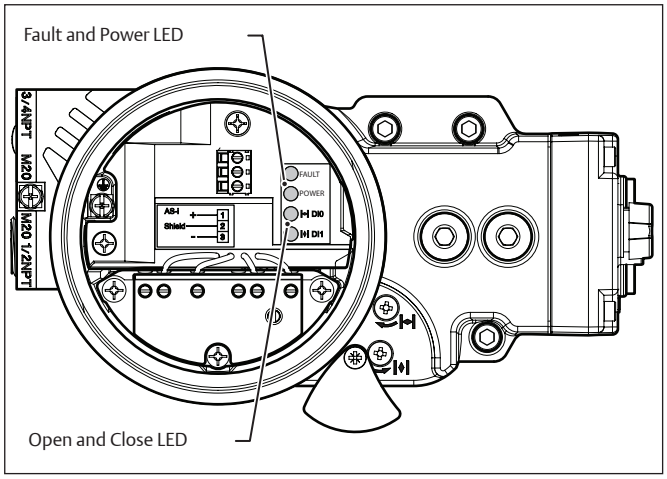


Fig. 3. LED indicators

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

1. Spring return or
2. Double acting or
3. Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

1. One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2. Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

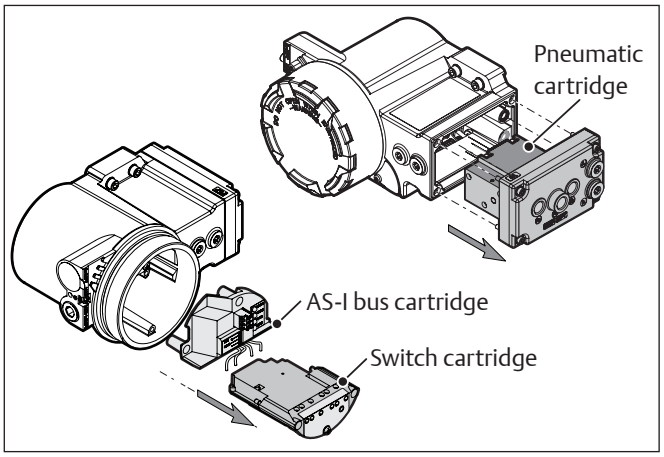


Fig. 4. Pilot valve and pneumatic cartridge

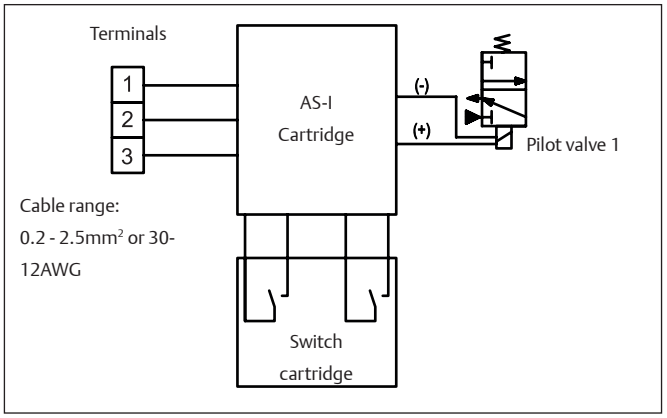


Fig. 5. One pilot valve and wiring connections for standard Double Acting or Spring Return applications

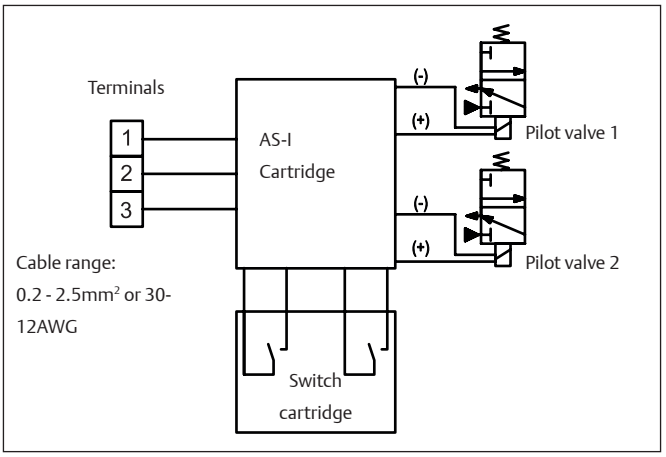


Fig. 6. Two pilot valves and wiring connections for Double Acting "Fail in Last Position" applications

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Bettis Q-Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in “Breather” function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators’ working life.

Pneumatic options

Speed Control

The QC40 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

For commissioning, emergency or maintenance purposes, the QC40 control module can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

Maximum Flow Rates of Q-Series Modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m_3/h) or Cv value of 0.33 (US gall/min 1 Psi) for approximate operating speed calculations.

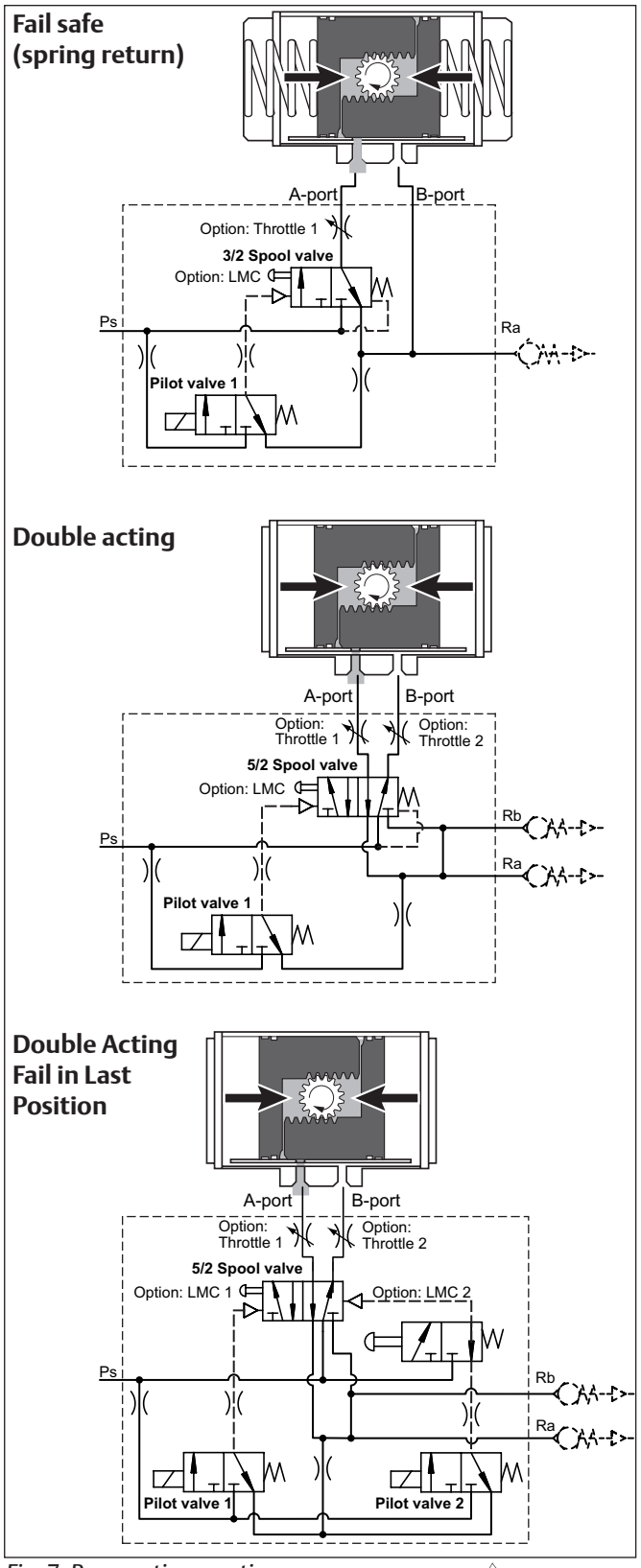


Fig. 7. Pneumatic operation

Position feedback

Switch cartridges

The position feedback is achieved by switch cartridges in the module. These cartridges contain switching elements which sense the open or closed position and are pre wired to the AS-I cartridge (see fig 5 and 6). These easily exchangeable switch cartridges are available with mechanical or proximity switching elements.

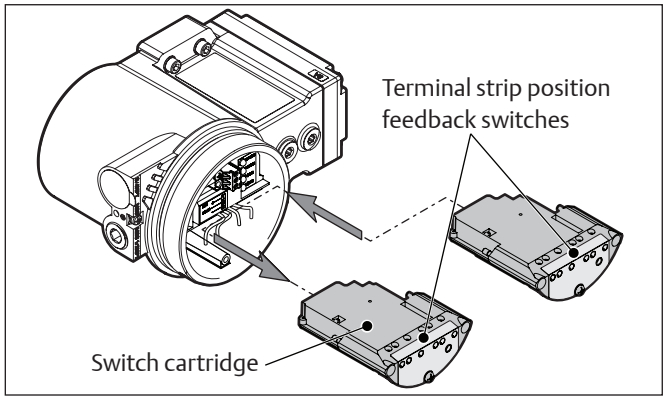


Fig. 8. Switch cartridges

Mechanical switches

Table 2: Mechanical switches

Specification	Description
Option code	G (gold contacts)
Type	Mechanical
Contacts	NO and NC
Temperature range	-25°C to +60°C / -13°F to +140°F

2-Wire Proximity switches

Table 3: 2-wire NAMUR proximity switches

Specification	Description
Option code	N
Type	2-wire inductive, normally closed
Temperature range	-25°C to +60°C / -13°F to +140°F
Compliant to	DIN EN 60947-5-6 (NAMUR)

Note:

1. The switch cartridge is internal powered by AS-i cartridge, external power/wire for switch signal is not required.

Non-Intrusive switch point adjustment

If required the switches can be adjusted without opening the module. This, so called, Non-Intrusive switch adjustment is located at the front of the module behind a locable (1) shield (2). Two adjustment screws are available for adjusting the Closed (3) and Open (4) position indication.

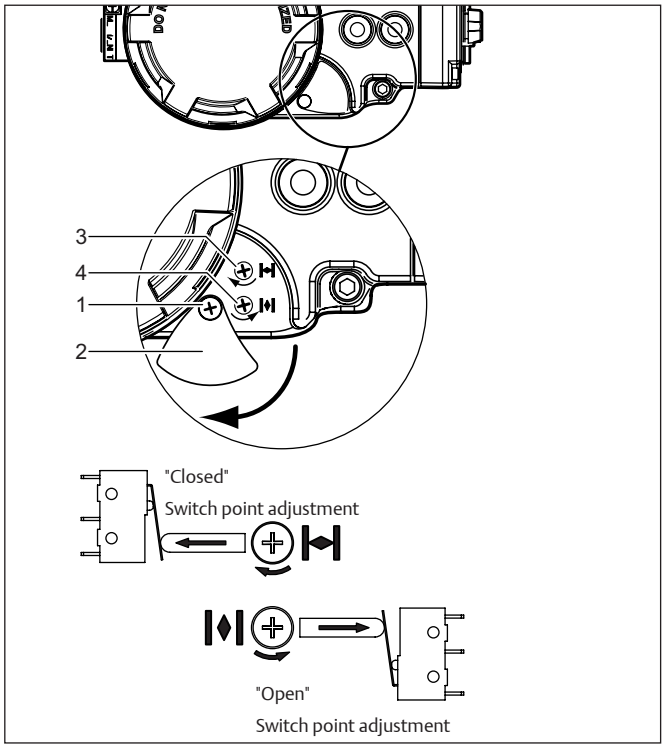


Fig. 9. Non-Intrusive switch point adjustment

Important:

- The above "Closed" and "Open" marked adjustment screws will adjust the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment screw will adjust the "Open" switch point. Similar, the "Open" marked adjustment screw will adjust the "Closed" switch point.

Control Module Options

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the QC40 control module can be supplied with one or two Manual Control options. These can operate the spool valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see page 7

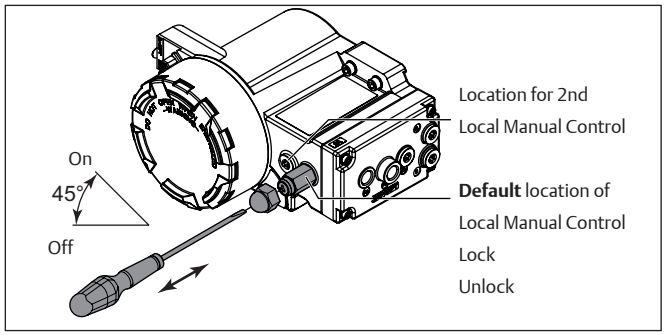


Fig. 10. Local Manual Control option

Speed Control

Description

The QC40 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

1 Nut cover
2 Main throttle with set screw.

Notes:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.

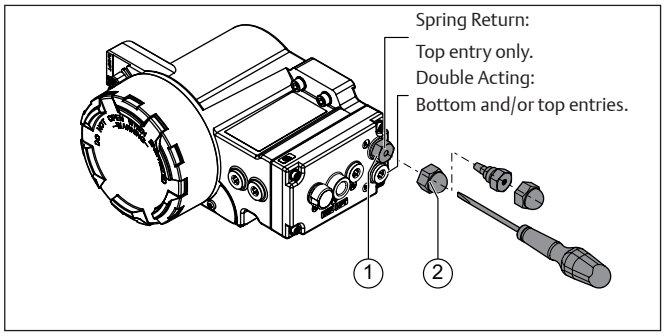


Fig. 11. Speed control options

Hazardous area executions

Control Module QC40 with AS-I bus communication is available with optional Non-Incendive/Non Sparking (NI) approvals as listed below:

IECEx

Certificate No.: IECEx DEK 16.0061 X

Non-Sparking

Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

ATEX

Certificate No.: DEKRA 16ATEX0100 X

Non-Sparking

CE

Ex II 3 G Ex nA IIC T4 Gc
Ex II 2 D Ex tb IIIC T80°C Db

FM

Certificate No.: FM16US0367X

Non Incendive

- Class I, II, III, Division 2, Groups ABCDEFG, T4,
- Class 1, Zone 2 AEX nA IIC T4 Gc

CSA

Certificate No.: CSA 17CA70125362X
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex nA nC IIC T4 Gc
Ex tb IIIC T80°C Db

INMETRO

Certificate No.: IEx 17.0084X

Non-Sparking

Ex nA IIC T4 Gc IP66
Ex tb IIIC T80 °C Db IP66

Ambient temperature:
T4 @ Ta = -25°C...+60°C IP66/Nema 4X

Wiring and Quick Connectors

AS-I Bus terminal wiring

The QC40 module can be connected to the system by hard wiring the module to the terminals The QC40 Module can optionally be equipped with prewired quick connectors. Two versions are available: 7/8" or M12 (male chassis part).

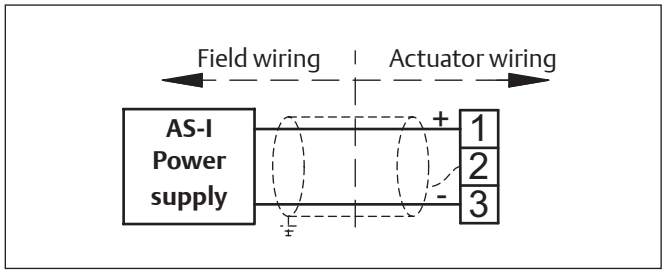


Fig 12. QC40 AS-I module wiring

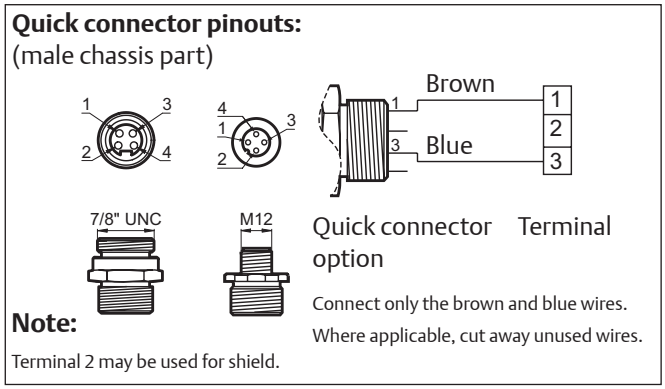


Fig 13. QC40 AS-I module quick connector pinouts

Wiring for hazardous areas

Detailed safe area, Intrinsically safe or Non-Incendive/ Non-Sparking wiring instructions, will be shipped with the product, see Installation Guide : DOC.IG.BQC40.1

Quick connectors

Quick connectors, as shown are excluded for non-Incendive or non-sparking use in hazardous area's classified as Zone 2 or 22 or Cl I, II, III, Div. 2.

Wiring dimensions

Solid wire: 2.5mm^2 max.
Stranded wire: 0.2-3.3mm^2 or 24-12 AWG

Current

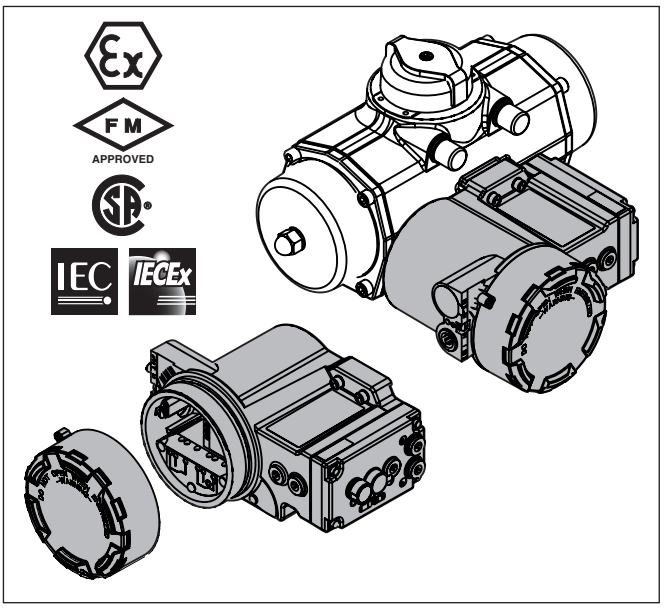
Minimum: 34 mA at 26.5V and 25°C
Maximum: 140 mA at 26.5V and 25°C
Nominal: 101 mA at 26.5V and 25°C to 60°C
Protection: Short circuit detection.

Integrated Control modules

QC41, QC42 and QC43

Features:

- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Bettis Q-Series actuator sizes.**
- **Available as "Weather Proof" for indoors or outdoors use and "Explosion Proof" for areas with a potential explosion hazard.**
  - The robust aluminum alloy enclosure (IP66 / NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
  - The Explosion Proof version is available with ATEX / IECEx Ex d approval for use in Zone 1, 2, 21 and 22 and/or FM / CSA Explosion proof approval for use in Class I, Division 1.
- **Various feedback switch options available.**
- **Non-Intrusive switch point adjustment of the feedback switches. Allows to adjust switch points without opening the Control Module.**
- **Lockable Control Module cover.**
- **All the control and feedback connections can be wired through one single entry to the Control Module.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**



Description:

These Bettis Q-Series conventionally wired control modules are the next step for the integrated concept of valve automation.
Next to the components for feedback switches, also all the pneumatic control components are located inside one module housing.
Its compact and robust construction incorporates basic control and feedback functionality and is suitable for indoor and outdoor use.
These modules are available with ATEX and IECEx certification for use in Zone 1, 2, 21 and 22, and additionally FM and CSA certified for use in Class I, Division 1.

Construction:

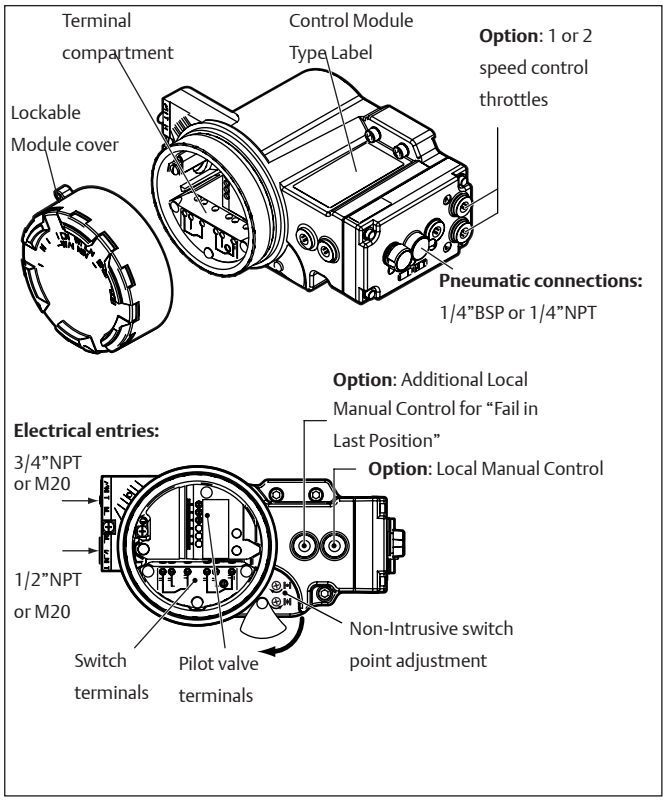
The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting control and feedback signals. Two cable entries are available.
The pilot valves inside the control module are used to send the actuator to its open or closed position. One pneumatic connection is available to feed the control module.

General specifications:

Material housing:	Aluminium alloy
Operating media:	Air or inert gasses, filtered at 50µm (for QC54 5µm)
Pneumatic entry:	Metric units: G1/4" Imperial units: 1/4"NPT
Electrical connections:	Pilot valve(s): 6 pole terminal strip. Switches: 6 pole terminal strip.
Cable entries:	Metric units: 2x M20x1.5 Imperial units: 1/2" and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X
Switch points:	Factory set at 15° before each end of travel (open and closed position).
- Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.
Finish:	Chromated, polyurethane based coating.
Temperature range:	Depends on the switches inside the module and or Hazardous Area approvals (See section "Position feedback"
Dimensions:	Metric: See data sheet BQ1.603.08 Imperial/UNC: See data sheet BQ1.603.09 DIN 3337: See data sheet BQ.1.603.10

Electrical safety requirements:

Use	:	In- and outdoor.
Altitude	:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity	:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation	:	Up to ±10% of nominal voltage
Over voltage category	:	II
Pollution degree	:	2 (3 when the cover remains closed)



Control module overview

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

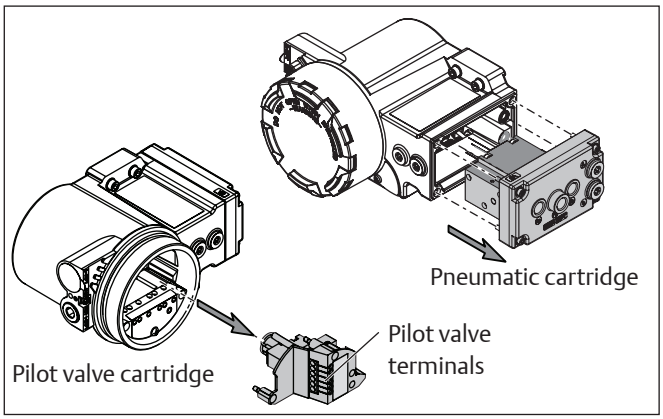
1 Spring return or
2 Double acting or
3 Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

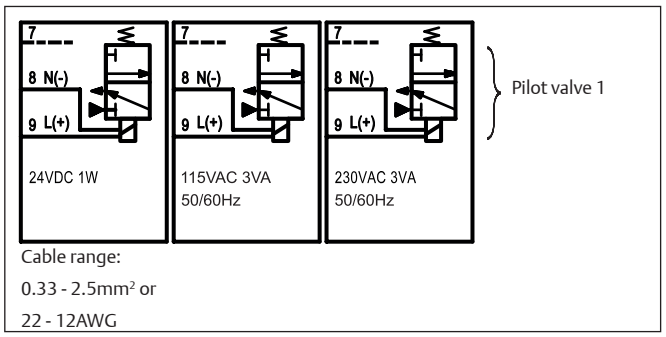
1 One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2 Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

Table 1: Pilot valve specifications

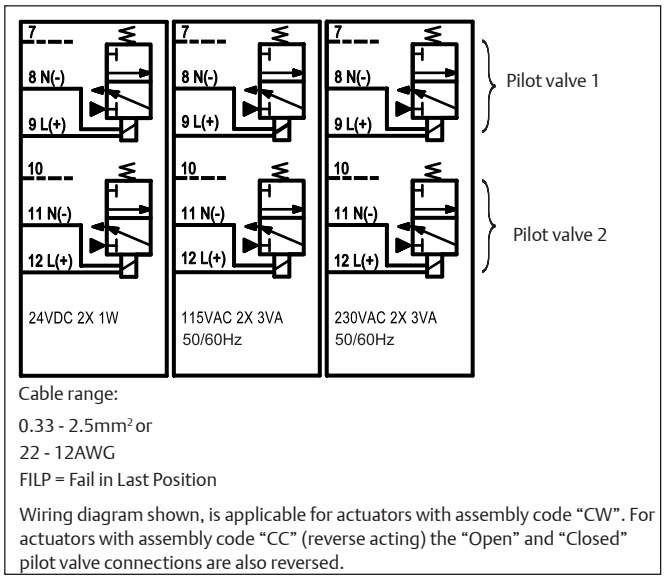
Module	Voltages	Power	Frequency
QC41	24VDC (±10%)	1W	NA
QC42	115 VAC (±10%)	3VA	50/60Hz
QC43	230 VAC (±10%)	3VA	50/60Hz



Pilot valve and pneumatic cartridge



One default pilot valve and wiring connections



Two pilot valves and wiring connections for Fail in Last Position

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Bettis Q-Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in "Breather" function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators' working life.

Pneumatic options

Speed Control

The Bettis Q-Series can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the "Opening" and "Closing" stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

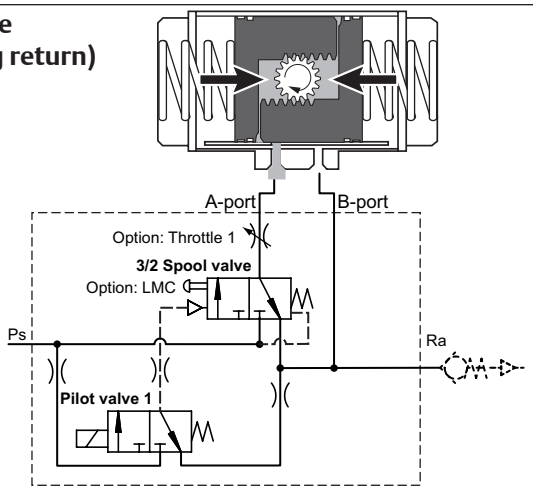
For commissioning, emergency or maintenance purposes, the Bettis Q-Series can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

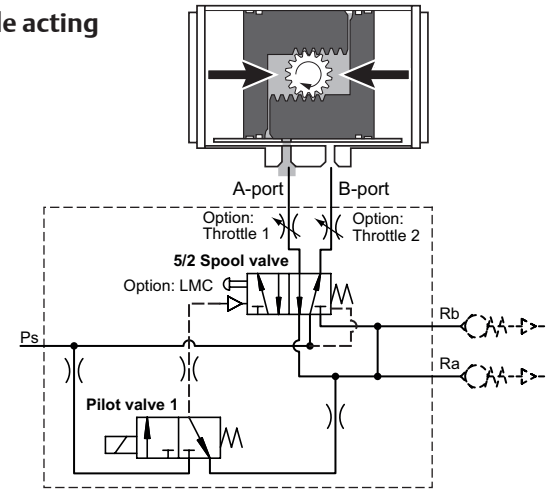
Maximum Flow rates of Q-Series modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m^3/h) or Cv value of 0.33 (US gall/min 1Psi) for approximate operating speed calculations.

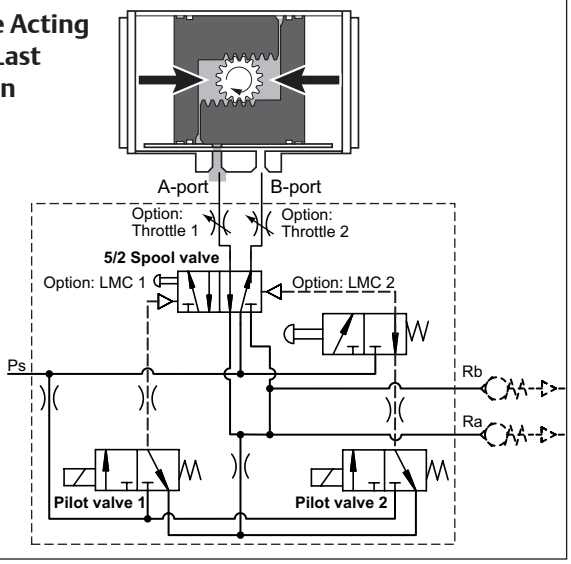
Fail safe (spring return)



Double acting



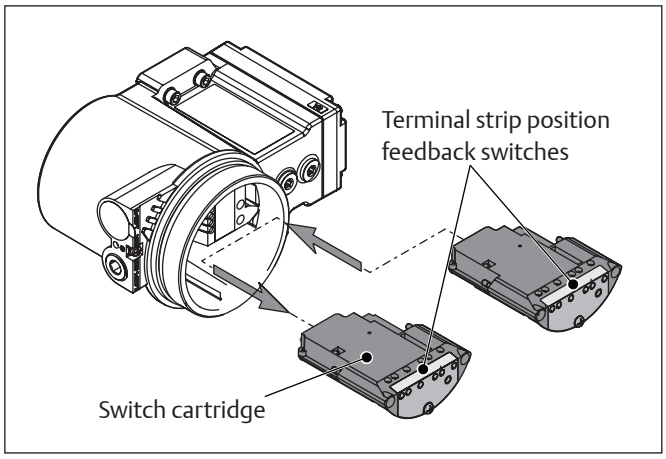
Double Acting Fail in Last Position



Position feedback

Switch cartridges

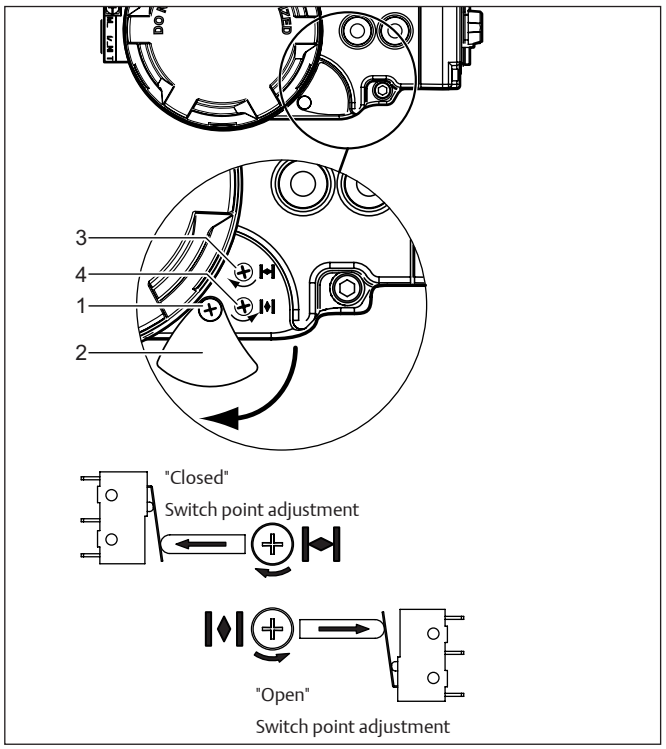
The position feedback is achieved by switch cartridges in the module. These cartridges contain switching elements which sense the open or closed position and are pre wired to the terminal strip. These easily exchangeable switch cartridges are available with various mechanical or proximity switching elements.



Switch cartridges

Non-Intrusive switch point adjustment

If required the switches can be adjusted without opening the module. This, so called, Non-Intrusive switch adjustment is located at the front of the module behind a locable (1) shield (2). Two adjustment screws are available for adjusting the Closed (3) and Open (4) position indication.



Non-Intrusive switch point adjustment

Important:

- The above "Closed" and "Open" marked adjustment screws will adjust the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment screw will adjust the "Open" switch point. Similar, the "Open" marked adjustment screw will adjust the "Closed" switch point.

Mechanical switches

Table 2: Mechanical switches

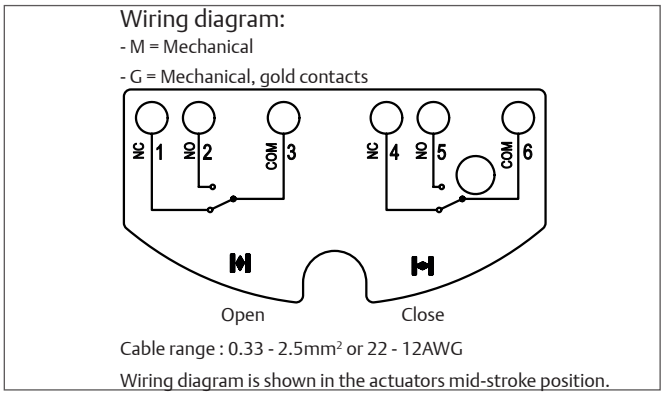
Specification	Description
Option code	M
Option code	G (gold contacts)
Type	Mechanical
Voltage	M: 277 VAC or 250VDC (maximum)
	G: 125 VAC or 30VDC (maximum)
Contacts	NO and NC
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7

Table 3: Maximum currents

Switch voltage	M type switch	G type switch
125 VAC	10 A (3 A[1])	0.1 A [2]
250 VAC	10 A (3 A[1])	-
30 VDC	0.5 A	0.1 A [2]
125 VDC	0.5 A	-
250 VDC	0.25 A	-

Note:

1. The mechanical (M-type) switches are rated for 3 A with inductive load.
2 The mechanical (G-type) switches have gold contacts. For applications where the benefits of gold contacts are required, the maximum current is 1 A.



Wiring diagram for mechanical switches

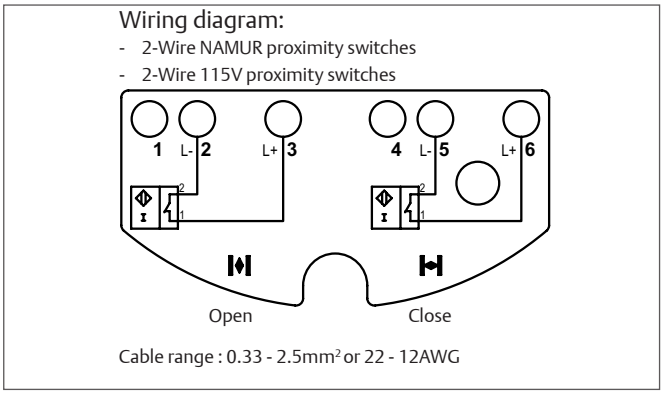
2-Wire Proximity switches

Table 4: 2-wire NAMUR proximity switches

Specification	Description
Option code	N
Type	2-wire inductive, normally closed
Voltage	8 VDC nominal
Output	Unswitched , > 3 mA
	Switched , < 1 mA
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7
Compliant to	DIN EN 60947-5-6 (NAMUR)

Table 5: 2-Wire 230V proximity switches

Specification	Description	
Option code	H	
Voltage	20...250VAC / 10...300VDC (50...60 Hz AC)	
Current	Maximum	100 mA
	Peak	0,9A (20ms / 0,5Hz),
Leakage	< 1.7 mA	
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7	



Wiring diagram for 2-Wire proximity switches

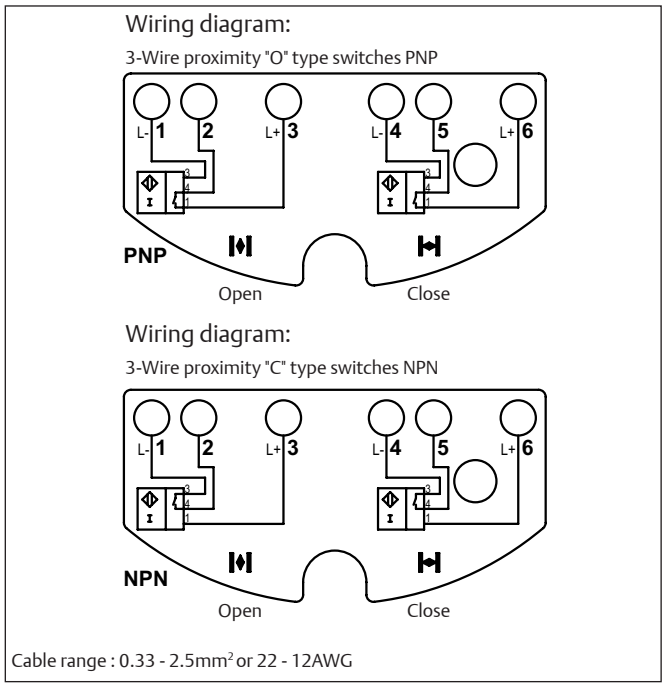
Important:

- The above "Closed" and "Open" marked adjustment terminals will indicate the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment terminals will indicate the "Open" switch point. Similar, the "Open" marked adjustment terminals will indicate the "Closed" switch point.

3-Wire Proximity switches

Table 4: 3-wire proximity switches

Specification	Description
Option code	O, V3 PNP
Option code	C, V3 NPN
Function	Make
Voltage	10 - 30V
Current	100 mA maximum
Off-state current	0 ... 0.5 mA typical
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7



Wiring diagram for 3-Wire proximity switches

Important:

- The above "Closed" and "Open" marked adjustment terminals will indicate the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment terminals will indicate the "Open" switch point. Similar, the "Open" marked adjustment terminals will indicate the "Closed" switch point.

Control Module Options

QC41, QC42 and QC43

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the Bettis Q-Series can be supplied with one or two Manual Control options. These can operate the pilot valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see page 11 of 11

Speed Control

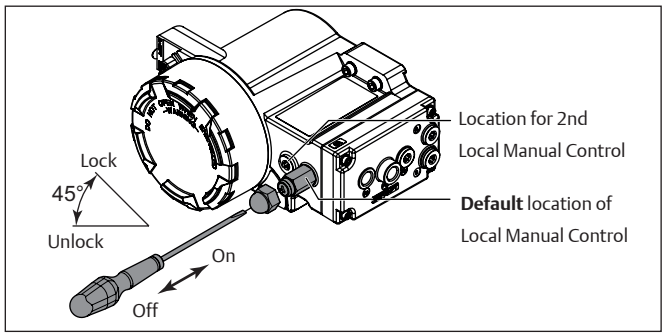
Description

The Bettis Q-Series can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

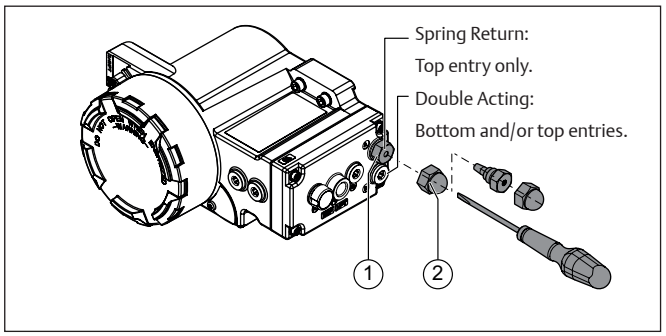
1 Nut cover
2 Main throttle with set screw.

Notes:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.



Local Manual Control option



Speed control options

Hazardous area specifications

Modules QC41, QC42 and QC43

Below specification are applicable for QC41, QC42 and QC43 modules with a hazardous area approval.

Hazardous area product marking;

IECEx hazardous or Classified Location:

Ex d IIB+H2 T4/T6 Gb
Ex t IIIC T80°C Db
IECEx DEK 15.0034X

ATEX hazardous or Classified Location:

CE 1180
Ex II 2G Ex db IIB+H2 T4/T6
Ex II 2D Ex tb IIIC T80°C
DEKRA 15ATEX0055X

FM hazardous or Classified Location:

CL I, II, III, DIV 1
Groups BCDEFG, T4/T6, Type 4X/6
CL I, ZN 1, IIB+H2, T4/T6

CSA hazardous or Classified Location:

Class I, II, III, DIV 1
Groups CDEFG, T4/T6, Type 4X/6
Ex d IIB+H2 T4/T6
DIP A21 TA 80°C
CSA 12.2489009

Notes:
1 Each control module is marked with the applicable ambient temperature marking.
2 Metric control modules are marked with ATEX and IECEx markings.
3 Imperial control modules are marked with ATEX, IECEx, FM and CSA markings.

Temperature rating

Table 7: Temperature rating for use in areas with a potential explosion hazard.

Configuration				Temperature (°C)			
Module type	**Switch cartridge**	**Pneumatic action**	**Max. Power dissipation**	**Min. ambient**	**Max. ambient**	**Max. Surface**	**Class**
QC41 (24VDC)	M, G O, C, N, H	S,D,F	3.6W (1	-25°C (-13°F)	+60	+80	T6/T4
QC42, QC43 (115 or 230VAC)		S,D	3.6W (1	-25°C (-13°F)	+60	+80	T6/T4
QC42, QC43 (115 or 230VAC)		F	7.2W (2	-25°C (-13°F)	+60	+80	T6/T4

Notes:
1 1x or 2x 24VDC pilot valves, or 1x 115/230 VAC pilot valve
2 2x 115 or 230 VAC pilot valves

Switch cartridge

M = Mechanical switches
G = Mechanical switches (gold contacts)
C = 3 wire PNP proximity switch
O = 3 wire NPN proximity switch
N = 2 wire proximity switch
H = 2 wire proximity switch

Pneumatic action

S = Spring Return (Single acting).
D = Double acting.
F = Double acting (Fail in Last Position)

BETTIS™ EMERSON™

Integrated Control modules

QC54 with FOUNDATION™ Fieldbus digital communication.

Features:

- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Q-Series actuator sizes.**
- **FOUNDATION™-Fieldbus digital communication.**
- **IPT-technology (Intelligent Position Tracking).**
- **Initialization by FOUNDATION™- Fieldbus or Push Button for easy setup of the actuator.**
  - Press and confirm press the "Auto-Init" button starts auto-initialization procedure.
  - Initialization sets automatically the switch points for the position feedback of the actuator.
  - Initialization checks if the actuator and control module configuration match. This procedure will detect the action type (Fail-Open, Fail-Close or Fail in last position) and generate an alert if there is a configuration issue.
- **Readjustable or Reversible position feedback using the re-reassignment buttons or by FOUNDATION™ Fieldbus.**
- **Adjustable switch points can be adjusted from 5% to 30% before the end of the stroke by FOUNDATION™ Fieldbus.**
- **Three indication LED's for "Status", "Open" and "Closed" position. Status LED indicates:**
  - Initialization procedure running (blinking),
  - Successful initialization procedure (LED is on) or
  - No or failed initialization (flashing) or
  - A particular unit in the field.
- **Control Module can be easily mounted to the actuator**

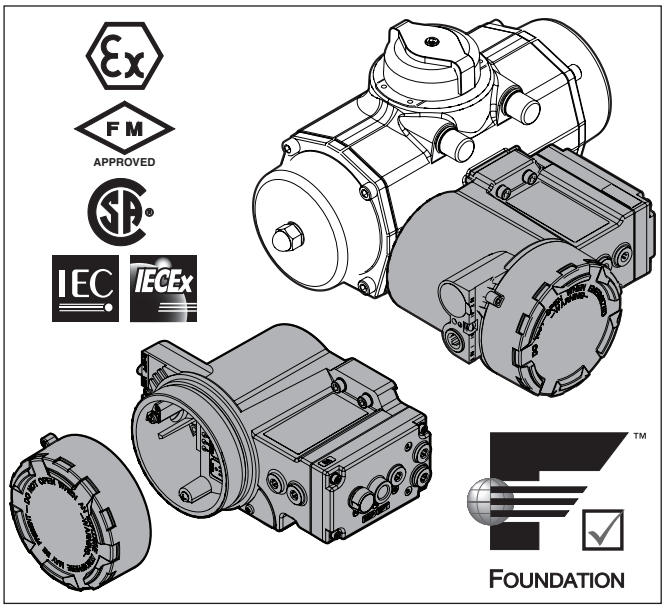


Fig. 1. Control module QC54 with FOUNDATION™-Fieldbus bus communication

- **Available as "Weather Proof" for indoors or outdoors use.**
  - The robust aluminum alloy enclosure (IP66/NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
    The hazardous area versions are available with:
  - **ATEX or IECEx** Ex ia or Ex nA approvals for use in Zone 1, 2, 21 and 22
  - **CSA or FM** Intrinsically safe or Non-Incendive approvals for use in Class I, Division 1 or Class I, Division 2.
- **Lockable Control Module cover.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**

BETTIS™

EMERSON™

Description:

This Q-Series QC54 Control Module offers an integrated concept for valve automation. Its compact and robust construction incorporates basic control and feedback functionality and communicates through the FOUNDATION™ Fieldbus protocol.

Construction:

All electrical and pneumatic control components are located inside one module housing making it a compact and robust construction incorporating basic control and feedback functionality and is suitable for indoor and outdoor use.

The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting the FOUNDATION™ Fieldbus signals. Two cable entries are available.

One pneumatic connection is available to feed the control module. The pilot valves inside the control module are used to send the actuator to its open or closed position.

These modules are available with ATEX, IECEx or Inmetro certification for use in Zone 2, 21, and 22, and additionally CSA or FM certified for use in Class I, Division 2.

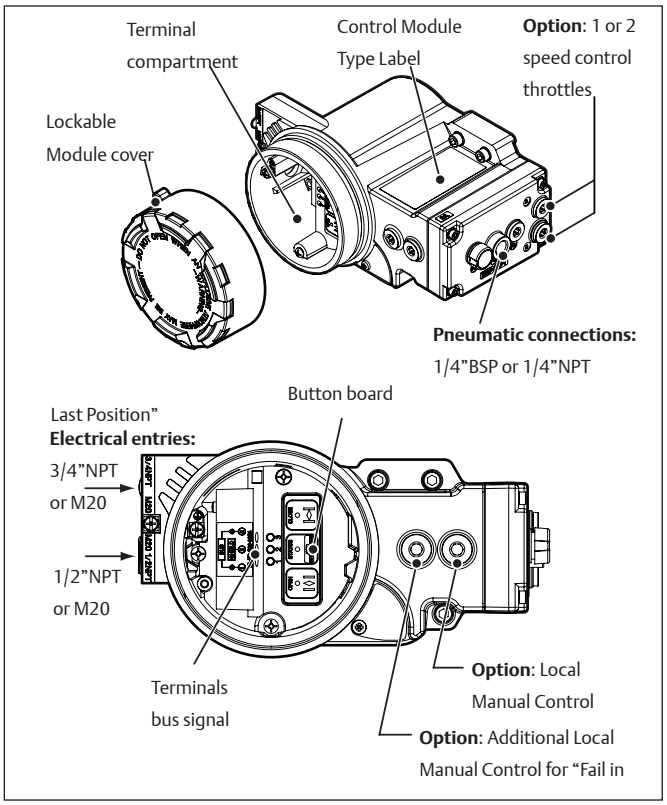


Fig. 2. Control module overview

General specifications:

Material housing:	Aluminium alloy
Operating media:	Air or inert gasses, filtered at 5µm
Pneumatic entry:	Metric units: G1/4" Imperial units: 1/4"NPT
Electrical connections :	Internal 3 pole terminal strip for bus signal Internal and external earth connection Optional quick connectors: 7/8" or M12 connector (see page 9)
Cable entries:	Metric units: 2x M20x1.5 Imperial units: 1/2" and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X
Switch points:	Factory set at 15° before each end of travel (open and closed position).
Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.
Finish:	Chromated with polyurethane based coating.
Temperature range:	-20°C to +50°C (-4°F to +122°F)

Dimensions:

Metric:	See data sheet 1.603.08
Imperial/UNC:	See data sheet 1.603.09
DIN 3337:	See data sheet 1.603.10

Electrical safety requirements:

Use:	In- and outdoor.
Altitude:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation:	Up to ±10% of nominal voltage
Over voltage category:	II
Pollution degree:	2 (3 when the cover remains closed)

Communication Protocol:

Protocol :	FOUNDATION™-Fieldbus
Transmission :	H1, IEC 61158-2
Maximum current :	18mA from bus
Required external : protection current	Restrict the power supply to <600mA.

Function blocks

The Control Module provides the following function blocks:
- Resource Block (RB)
- Transducer Block (TB)
- Analog Input (AI) Function Block
- Discrete Output (DO) Function Block
- 2x Discrete Input (DI) Function Block
- PID Function Block

Diagnostics and Alerts

Standard FOUNDATION™- Fieldbus diagnostics and alerts provided meets Emerson PlantWeb Alerts standard.
Applicable diagnostics include:
- Travel times for the Open stroke, Close stroke and Average travel times.
- Cycle Counters for Control Module, Pneumatic Module, Actuator and Valve
- Time in Position
- Various internal electronic health tests.
- Instrument temperature.

For more detailed information on diagnostics see page 10 and 11.

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

1. Spring return or
2. Double acting or
3. Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

1. One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2. Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

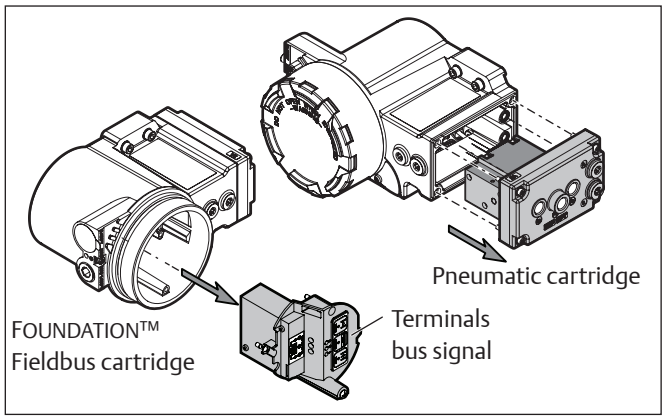


Fig. 3. Pilot valve and pneumatic cartridge

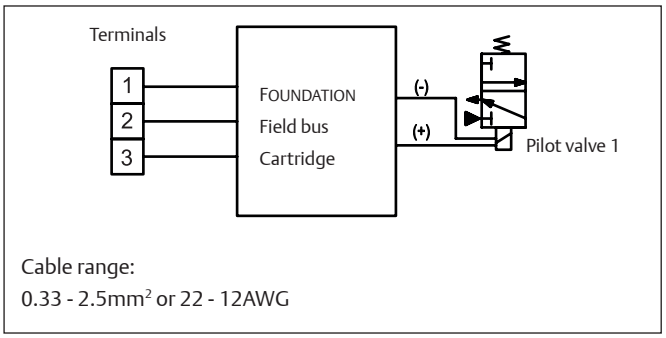


Fig. 4. One pilot valve and wiring connections for standard Double Acting or Spring Return applications

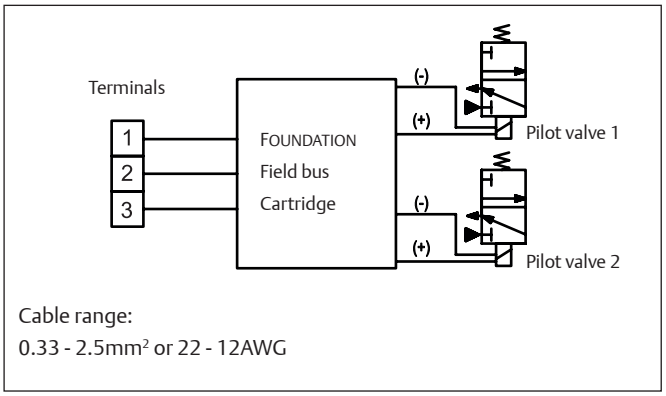


Fig. 5. Two pilot valves and wiring connections for Double Acting "Fail in Last Position" applications

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Q-Series Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in “Breather” function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators’ working life.

Pneumatic options

Speed Control

The QC54 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

For commissioning, emergency or maintenance purposes, the QC54 control module can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

Maximum Flow rates of Q-Series modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m_3/h) of Cv value of 0.33 (US gall/min 1Psi) for approximate operating speed calculations.

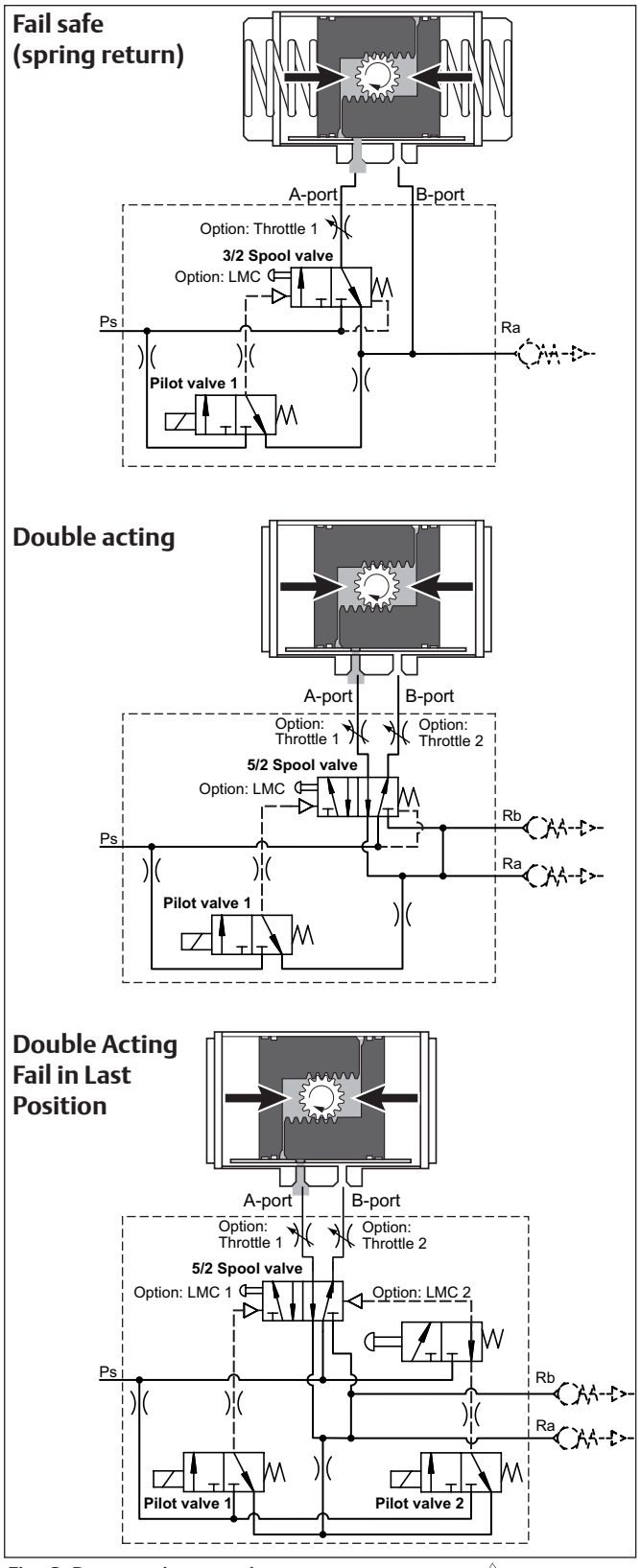
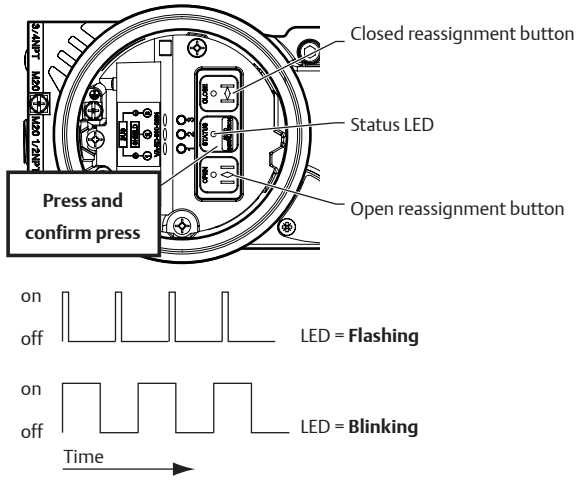


Fig. 6. Pneumatic operation

Switch point setting

The QC54 control modules are equipped with a button board that allows you to set or readjust the switch points for the position feed back.



* The default setting of The reassignment buttons is: enabled when the unit is in “Out of Service”.

* ”Open” and “Closed” LED are disabled.

Fig. 7. Button board

Button board functions:	
Initialization button:	Start Auto-Initialization procedure
Close button:	Re-adjustment of the "Closed" switch point
	Set to factory settings
Open button:	Re-adjustment of the "Closed" switch point
	Set to factory settings

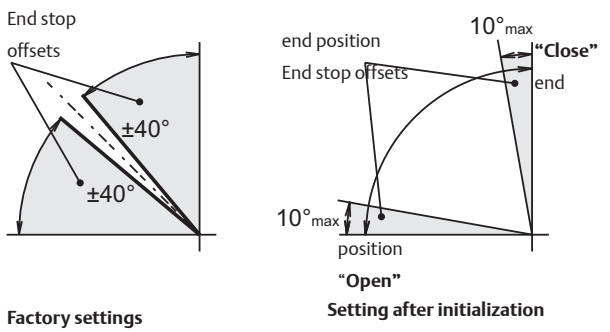


Fig. 8. Switch point setting

Auto-Initialization

Initialization sets automatically the switch points for the position feedback of the actuator and checks if the actuator and control module configuration match. This procedure will detect the action type (Fail-Open, Fail-Close or Fail in last position) and generate an alert if there are configuration issues.
This process is done automatically, by the module, however, the user must start it and the unit must be wired and powered.
Digital communication is not required but power supply is necessary (9V to 32V DC). The initialization process can be started in one of two ways:

1. Initialization using the local buttons (see fig. 7).
2. Initialization using a bus command (see Reference manual QC54, DOC.RM.QC54.E)

Indication LED's

Three indication LED's for "Status", "Open" and "Closed" position are available. The status LED indicates:
- Initialization procedure running (blinking),
- Successful initialization procedure (LED is on) or
- No or failed initialization (flashing)

Recognize Function

An additional function of the Status LED is the recognize function. To recognzie a particular unit in the plant, the "Recognizing LED" function can be activated in the transducer block. When this function is activated, the Status LED will blink for 300 seconds (5 minutes).

Changing Switch Point Setting

Readjustment of switch points

When switch point re-adjustment is required but it is not allowed that the actuator/valve unit cycles, the new switch point can be set by pressing the corresponding "Open" or "Closed" button.

Factory settings

Pressing both the Open and Close reassignment buttons, while powering up, will set the module back to its factory settings.

Control Module Options

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the QC54 control module can be supplied with one or two Manual Control options. These can operate the pilot valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see data sheet BQ1.607.01

Speed Control

Description

The QC54 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

1. Nut cover
2. Main throttle with set screw.

Note:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.

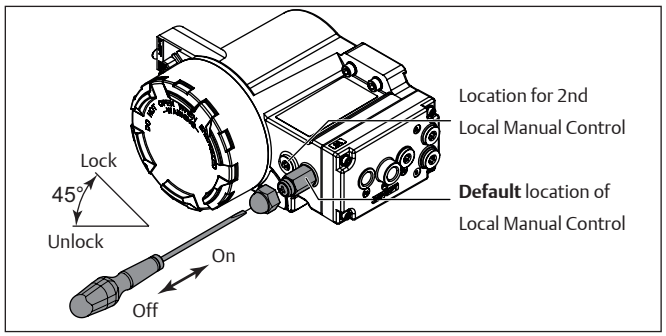


Fig. 9. Local Manual Control option

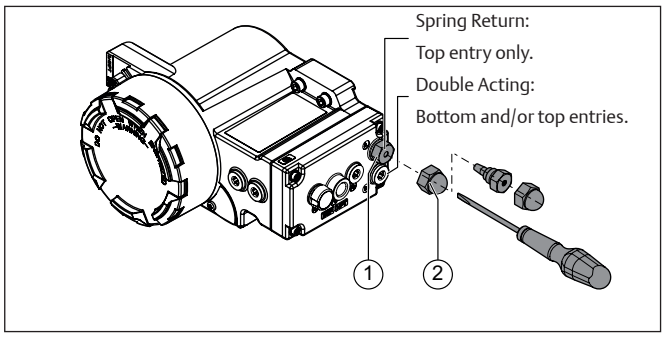
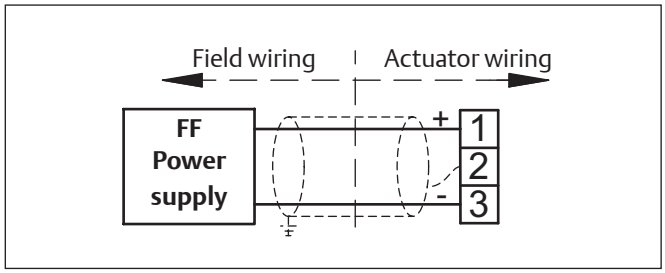


Fig. 10. Speed control options

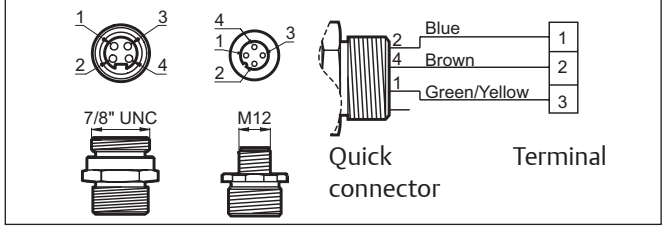
Wiring and Quick Connectors

FOUNDATION™ Fieldbus terminal wiring

The QC54 module can be connected to the system by hard wiring the module to the terminals The QC54 Module can optionally be equipped with prewired quick connectors. Two versions are available: 7/8" or M12 (male chassis part).



Quick connector pinouts:
(male chassis part)



Wiring for hazardous areas

Detailed safe area, Intrinsically safe or Non-Incendive/ Non-Sparking wiring instructions, will be shipped with the product, see Installation Guide : DOC.IG.BQC54.1

Quick connectors

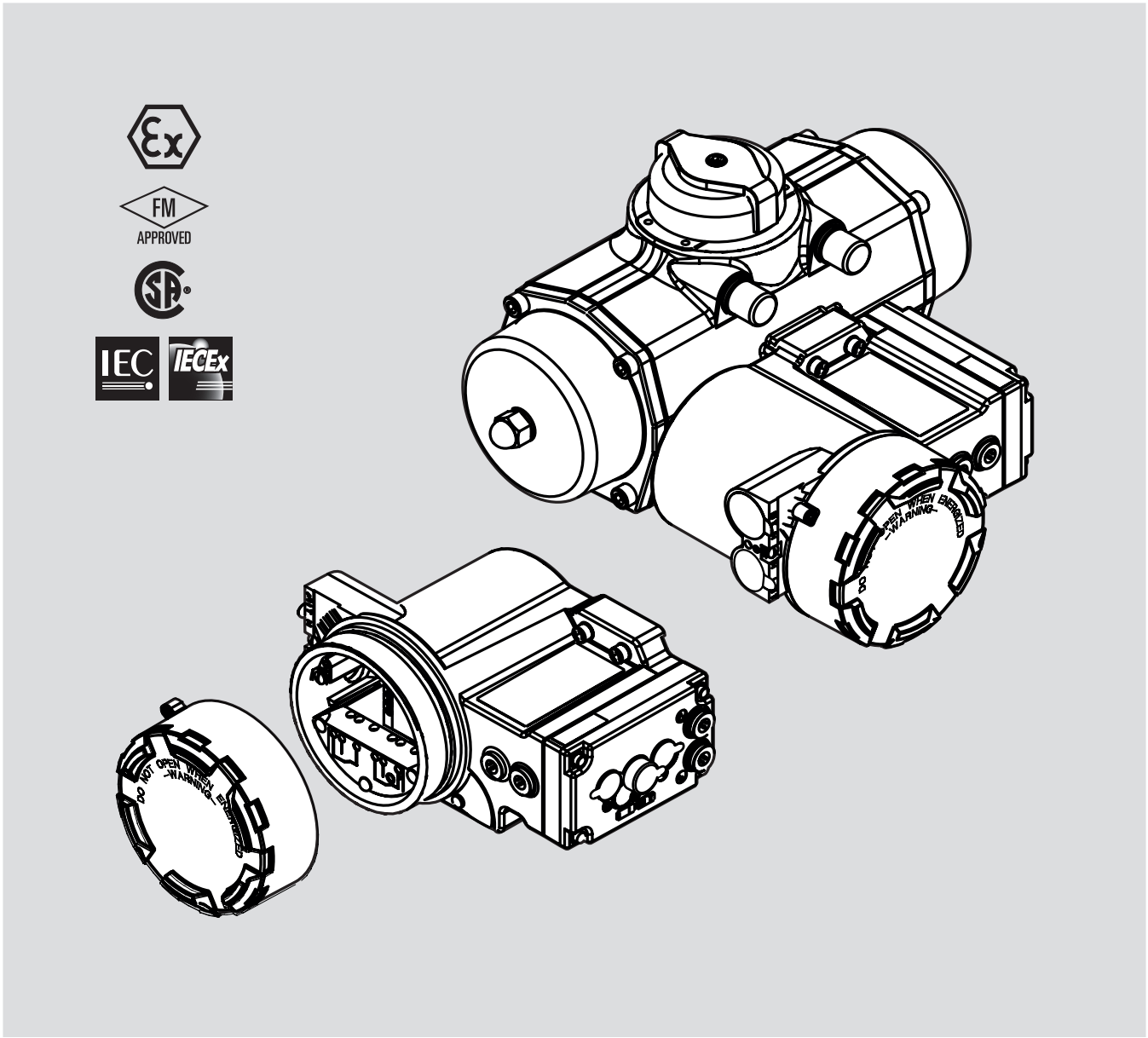
Quick connectors, as shown are excluded for non-Incendive or non-sparking use in hazardous area's classified as Zone 2 or 22 or Cl I, II, III, Div. 2.

Wiring dimensions

Solid wire : 2.5mm^2 max.
Stranded wire : 0.33 - 2.5mm^2 or 22 - 12 AWG

Product Data Sheet
BQ1.601.00 Rev. 3
November 2018

Bettis Q-Series Valve Actuator



BETTIS™

EMERSON™

Contents

Bettis Q-Series "fully integrated" actuator and control modules

General Overview

Description

The Bettis Q-Series package consists of an actuator with a module for control and position feed back and forms an integrated concept for “On/Off” valve automation.

1. Basic actuators

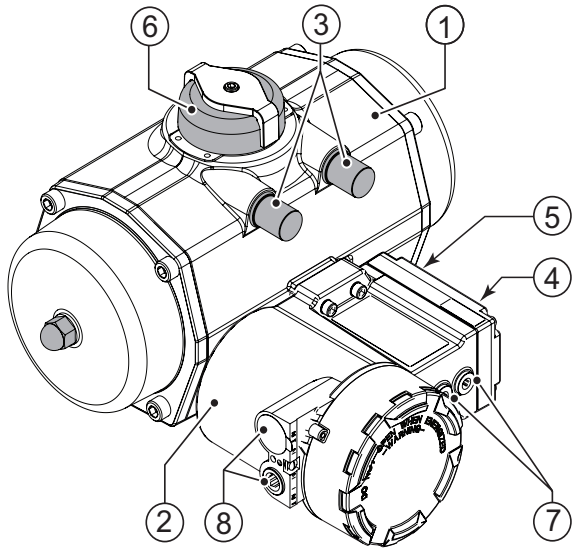
The basic actuator supplies the torque, required to open and close valves and is available in various sizes (rated 47 to 1676Nm at 5.5barg or 413 to 14874 In.lb. at 80pisg). Double acting and spring return executions are available. The spring return execution can be equipped with multiple spring sets to cover a pressure range from 2 to 8 barg (30 to 120 psig).

2. Control Modules

The Control Modules contain, next to the components for feedback switches, also all the pneumatic control components.
Its compact and robust construction incorporates basic control and feedback functionality and is suitable for indoor and outdoor use.

1. The enclosure of the control modules are rated IP66 / NEMA 4X according IEC 60529 and are suitable for indoor and outdoor use.
2. The QC41, QC42 and QC43 Explosion proof control modules are suitable for use in potentially explosive atmospheres and are available with FM, CSA, ATEX or IECEx approvals
3. The QC40 with AS-Interface bus communication is a available with Non-Sparking Ex nA or Non Incendive approvals and is suitable for use in potentially explosive atmospheres. For this QC40 ASI module FM, ATEX or IECEx approvals are available.
4. The QC54 with Foundation Fieldbus bus communication is a available with Non-Sparking Ex nA or Non Incendive or Intrinsically Safe approvals and is suitable for use in potentially explosive atmospheres. For this QC54 ASI module FM, ATEX or IECEx approvals are available.
5. Both the weather proof and certified control modules are available with the Fail-In-Last-Position control function for double acting actuators and the non intrusive switch point adjustment.

Bettis Q-Series valve actuator with Control Module



1 Basic Actuator
2 Control Module
3 Limit stop screws for “Open” and “Closed” position
4 G1/4” air connections
5 Optional: Built-in speed control
6 Visual position indication
7 Optional: Manual Control
8 Electrical entries

BETTIS™

EMERSON™

Actuator specifications:

Construction

- Ingress protection rated IP65 / NEMA4X and suitable for indoor and outdoor installation.

Finish

- Housing: Anodized with a polyurethan powder coating
- Pistons: Chromate treatment.
- Pinion: Hard anodized

Lubrication

- Factory lubricated for the normal life of the actuator.

Temperature

- Depends on the Control Module used. See applicable data sheets BQ1.604.xxx.

European Directives

- The basic actuator complies to PED 2014/68/EU, Machinery Directive 2006/42/EC and to ATEX 2014/34/EU and is marked: Ⓔx II 2 GD c IIC TX
- This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

Pressure

- Double acting: 2 to 8 bar / 30 to 120 psi
- Spring return:
  - with maximum spring set: 6 to 8 bar / 87 to 120 psi
  - with reduced spring set: 3 to 8 bar / 43 to 120 psi

Operating media

- Dry air or inert gasses, filtered to 50 microns.
- Dew point 10K below operating temperature. For subzero applications take appropriate measures to protect the installation.

Torque

- 40 to 1600 Nm. (300 to 11000 lbf.in) See sheets BQ1.602.01, BQ1.602.02 or BQ1.602.03.

Rotation

- Factory set at 90°±0.5°. Adjustable range: -3° to +15° and +75° to 93°
- Clockwise fail-to-close action, see sheet BQ1.606.04 for optional fail-to-open action (assembly codes).
- See BQ1.606.03 for other double acting assembly codes.
- For more info on failure modes see BQ1.606.02

Cycle life

- 500.000 cycles minimum

Control Modules:

The following versions of Control modules are available. Please check the indicated data sheet for more detailed information.

- QC41 24VDC	BQ1.604.10
- QC42 115VAC	BQ1.604.10
- QC43 230VAC	BQ1.604.10
- QC40 AS-Interface	BQ1.604.11
- QC54 Foundation Fieldbus	BQ1.604.12

Options

Speed control, Manual control, IECEx, ATEX, FM or CSA approvals, glands, quick connectors, exhaust port filters and silencers.

Functions:

Double or Single Acting (spring return)
Fail-in-Last position

Actuator range:

Suitable for Q40 to Q1600 (see note below).

Enclosure :

IP66 / NEMA4X

Pneumatic connections:

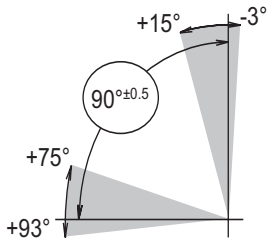
G1/4" or 1/4"NPT

"Breather" function:

Standard for single acting actuators

Options :

Speed control, exhaust port filters or silencers.



Q-Series Valve Actuator:
Rotation and adjustable range

Actuator data			Q40	Q65	Q100	Q150	Q200	Q350	Q600	Q950	Q1600
Bore		mm.	70	80	91	103	110	145	175	200	230
		inch	2,76	3,15	3,58	4,06	4,33	5,71	6,89	7,87	9,06
Stroke		mm.	18,8	22,0	25,1	31,4	37,7	37,7	44,0	50,3	62,8
		inch	0,74	0,87	0,99	1,24	1,48	1,48	1,73	1,98	2,47
Weight:	Double acting	kg.	1,8	2,4	3,1	4,5	5,8	10,4	19	26	43
		lb.	4,0	5,3	6,8	9,8	13	23	43	58	94
	Spring return	kg.	2,4	3,6	4,6	6,9	9,1	17	28	39	66
		lb.	5,3	7,9	10	15,1	20	37	61	85	145
Operating time		sec.	0,7	1,1	1,2	1,8	2,3	3,6	4,5	5,4	6,9
Air consumption per stroke											
at 1 atm (litres)	Central air chamber		0,16	0,33	0,35	0,84	0,8	1,8	2,9	4,7	7,3
	Endcap air chambers		0,22	0,36	0,49	0,78	1	1,9	3,1	4,9	8,0
at 1 atm (cu. in.)	Central air chamber		10	20	21	51	49	110	177	287	445
	Endcap air chambers		13	22	30	48	61	116	189	299	488

BETTIS™

EMERSON™

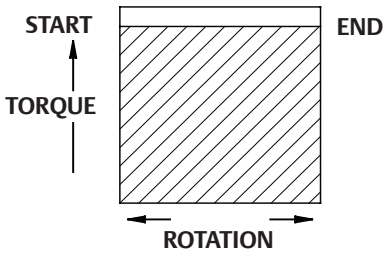
Bettis Q-Series Actuator Torque

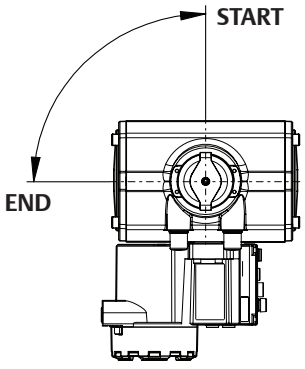
Double Acting Actuators - Nm

Actuator type	Torque (Nm)										
	Supply Pressure (bar g)										
	2	3	3.5	4	4.5	5	5.5	6	6.5	7	8
QD 40	17	25	29	34	38	42	47	51	55	59	68
QD 65	25	38	45	51	58	64	71	77	84	90	104
QD 100	38	57	66	76	86	95	105	115	124	134	153
QD 150	60	91	106	122	137	153	168	183	199	214	245
QD 200	82	124	146	167	188	209	230	251	272	293	335
QD 350	143	216	253	290	326	363	400	436	473	510	583
QD 600	243	368	430	492	554	617	679	741	804	866	991
QD 950	363	549	642	735	828	921	1014	1107	1200	1293	1479
QD 1600	600	907	1061	1214	1368	1522	1676	1829	1983	2137	2444

Actuator type	Torque (lbf.in)										
	Supply pressure (psig)										
	30	45	50	60	65	70	75	80	90	100	120
QD 40	153	231	257	309	335	361	387	413	465	518	622
QD 65	233	352	391	471	511	550	590	630	709	789	948
QD 100	344	520	579	696	755	814	873	931	1049	1166	1401
QD 150	551	833	927	1115	1209	1303	1397	1491	1680	1868	2244
QD 200	754	1140	1269	1526	1655	1784	1913	2041	2299	2556	3071
QD 350	1310	1981	2205	2652	2876	3100	3323	3547	3994	4442	5337
QD 600	2226	3366	3747	4507	4887	5267	5647	6028	6788	7548	9069
QD 950	3323	5025	5593	6727	7295	7862	8430	8997	10132	11267	13537
QD 1600	5493	8307	9245	11121	12059	12998	13936	14874	16750	18626	22379

Double acting torque diagram





Note:

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.
2. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

BETTIS™

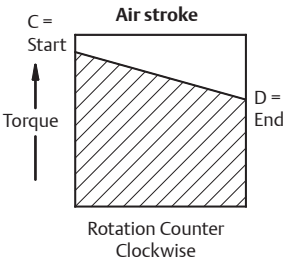
EMERSON™

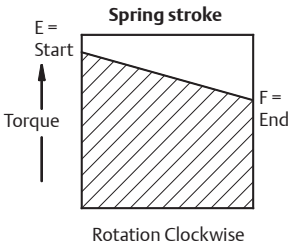
Bettis Q-Series Actuator Torque

Spring Return Actuators - Nm

Spring set nr.		Air Torque (Nm) Supply pressure (bar g)																Spring Torque	
Actuator Size		3		3.5		4		4.5		5		5.5		6		7		(Nm)	
		C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	E	F
QS 40	2	17	11	22	16	26	21	31	25	35	30	40	34	44	39	53	48	13	8
	3	12	4	17	8	21	13	26	17	31	22	35	27	40	31	49	40	20	12
	4	-	-	12	1	17	5	21	10	26	14	30	19	35	23	44	32	26	17
	5	-	-	-	-	-	-	17	2	21	7	26	11	30	16	39	25	33	21
	6	-	-	-	-	-	-	-	-	-	-	21	4	25	8	34	17	40	25
QS65	2	26	17	32	23	39	30	46	37	53	44	60	51	67	58	81	72	21	13
	3	18	4	25	11	32	18	39	25	45	32	52	39	59	46	73	60	32	20
	4	-	-	-	-	24	6	31	13	38	20	45	27	52	34	65	48	42	26
	5	-	-	-	-	-	-	23	1	30	8	37	15	44	22	58	35	53	33
	6	-	-	-	-	-	-	-	-	-	-	30	3	36	10	50	23	63	40
QS 100	2	39	27	49	37	60	47	70	57	80	67	90	78	100	88	121	108	29	18
	3	29	10	39	20	49	30	59	40	70	51	80	61	90	71	110	91	44	27
	4	-	-	28	3	39	13	49	24	59	34	69	44	79	54	100	75	58	36
	5	-	-	-	-	-	-	38	7	49	17	59	27	69	38	89	58	73	46
	6	-	-	-	-	-	-	-	-	38	0	48	11	59	21	79	41	88	55
QS 150	2	63	41	79	58	95	74	112	90	128	107	144	123	161	139	193	172	48	29
	3	46	14	62	30	79	47	95	63	111	79	128	96	144	112	177	145	72	44
	4	-	-	-	-	62	19	78	36	94	52	111	68	127	85	160	117	95	58
	5	-	-	-	-	-	-	-	-	78	24	94	41	110	57	143	90	119	73
	6	-	-	-	-	-	-	-	-	-	-	-	-	94	30	126	62	143	88
QS 200	2	85	57	107	79	130	101	152	124	174	146	197	168	219	191	264	236	65	41
	3	61	19	84	41	106	64	129	86	151	109	173	131	196	153	240	198	98	61
	4	-	-	60	4	83	26	105	49	127	71	150	93	172	116	217	160	131	82
	5	-	-	-	-	-	-	82	11	104	33	126	56	149	78	193	123	163	102
	6	-	-	-	-	-	-	-	-	-	-	103	18	125	41	170	85	196	123
QS 350	2	144	96	183	135	221	174	260	213	299	251	338	290	377	329	454	407	116	74
	3	101	30	140	68	179	107	217	146	256	185	295	224	334	263	412	340	174	112
	4	-	-	97	2	136	41	175	80	214	118	252	157	291	196	369	274	232	149
	5	-	-	-	-	-	-	132	13	171	52	210	91	248	130	326	207	289	186
	6	-	-	-	-	-	-	-	-	-	-	167	24	206	63	283	141	347	223
QS 600	2	249	166	315	232	381	298	447	364	513	430	579	496	645	562	777	694	195	122
	3	179	54	245	120	311	186	377	252	443	318	509	384	575	450	707	582	292	183
	4	-	-	174	8	240	74	306	140	372	206	438	272	504	338	636	470	389	245
	5	-	-	-	-	-	-	236	28	302	94	368	160	434	226	566	358	487	306
	6	-	-	-	-	-	-	-	-	-	-	298	48	364	114	496	246	584	367
QS 950	2	375	248	474	347	572	446	671	544	769	643	868	741	966	840	1163	1037	290	179
	3	272	82	371	181	469	279	568	378	666	476	765	575	863	673	1060	870	434	269
	4	-	-	268	14	366	113	465	211	563	310	662	408	760	507	957	704	579	359
	5	-	-	-	-	-	-	362	45	460	143	559	242	657	340	854	537	724	448
	6	-	-	-	-	-	-	-	-	-	-	455	75	554	174	751	371	869	538
QS 1600	2	617	416	780	579	943	742	1106	905	1269	1068	1432	1231	1594	1394	1920	1719	474	299
	3	445	144	608	307	771	470	934	633	1097	796	1260	959	1423	1121	1748	1447	711	449
	4	-	-	436	35	599	198	762	361	925	523	1088	686	1251	849	1576	1175	947	598
	5	-	-	-	-	-	-	590	88	753	251	916	414	1079	577	1405	903	1184	748
	6	-	-	-	-	-	-	-	-	-	-	744	142	907	305	1233	630	1421	897

Spring return torque diagrams





Note:

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
   Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.
2. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

BETTIS™

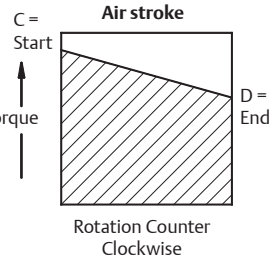
EMERSON™

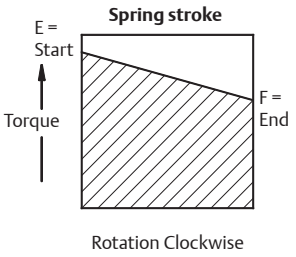
Bettis Q-Series Actuator Torque

Spring Return Actuators - lbf.in

Spring set nr.		Air Torque (lbf.in) Supply pressure (psig)												Spring Torque (lbf.in)	
Actuator Size		40		60		80		90		100		120			
		C	D	C	D	C	D	C	D	C	D	C	D	E	F
QS 40	2	133	82	243	193	354	303	409	358	464	414	575	524	117	73
	3	-	-	201	125	312	236	367	291	422	346	533	457	176	110
	4	-	-	159	58	270	169	325	224	380	279	491	390	234	146
	5	-	-	-	-	227	101	283	156	338	212	448	322	293	183
	6	-	-	-	-	-	-	241	89	296	144	406	255	351	220
QS 65	2	196	117	364	285	533	454	617	538	701	622	870	790	186	117
	3	-	-	297	178	466	347	550	431	634	515	802	683	279	176
	4	-	-	230	71	398	240	482	324	567	408	735	576	372	234
	5	-	-	-	-	331	133	415	217	499	301	668	470	465	292
	6	-	-	-	-	-	-	348	110	432	194	601	363	558	351
QS 100	2	303	192	552	441	801	690	926	814	1050	939	1299	1188	258	161
	3	211	44	460	293	709	541	833	666	957	790	1206	1039	387	242
	4	-	-	367	144	616	393	740	518	865	642	1114	891	516	323
	5	-	-	-	-	523	245	648	369	772	494	1021	743	646	403
	6	-	-	-	-	430	96	555	221	679	345	928	594	775	484
QS 150	2	485	297	884	696	1283	1094	1482	1294	1681	1493	2080	1892	423	259
	3	-	-	735	453	1134	852	1333	1051	1533	1250	1931	1649	634	388
	4	-	-	587	210	985	609	1185	808	1384	1007	1783	1406	845	517
	5	-	-	-	-	837	366	1036	565	1235	764	1634	1163	1056	647
	6	-	-	-	-	-	-	887	322	1087	522	1485	920	1268	776
QS 200	2	656	406	1201	952	1747	1497	2020	1770	2293	2043	2838	2589	579	362
	3	-	-	994	619	1539	1165	1812	1438	2085	1710	2631	2256	868	542
	4	-	-	786	287	1332	832	1604	1105	1877	1378	2423	1923	1158	723
	5	-	-	-	-	1124	500	1396	772	1669	1045	2215	1591	1447	904
	6	-	-	-	-	-	-	1189	440	1462	713	2007	1258	1736	1085
QS 350	2	1105	684	2053	1632	3001	2580	3475	3054	3949	3528	4897	4476	1025	658
	3	-	-	1675	1043	2623	1991	3097	2465	3571	2939	4519	3887	1537	987
	4	-	-	1297	454	2245	1402	2719	1877	3193	2351	4141	3299	2049	1317
	5	-	-	-	-	1866	814	2340	1288	2814	1762	3762	2710	2561	1646
	6	-	-	-	-	-	-	1962	699	2436	1173	3384	2121	3074	1975
QS 600	2	1920	1183	3531	2794	5142	4405	5947	5211	6753	6016	8364	7628	1723	1082
	3	-	-	2909	1804	4520	3415	5325	4221	6131	5026	7742	6637	2585	1624
	4	-	-	2287	814	3898	2425	4703	3230	5509	4036	7120	5647	3446	2165
	5	-	-	-	-	3276	1434	4081	2240	4887	3046	6498	4657	4308	2706
	6	-	-	-	-	-	-	3459	1250	4265	2055	5876	3666	5169	3247
QS 950	2	2898	1777	5303	4182	7708	6587	8910	7789	10113	8992	12518	11396	2563	1587
	3	-	-	4391	2709	6796	5114	7998	6316	9201	7519	11606	9924	3844	2381
	4	-	-	3479	1236	5883	3641	7086	4844	8288	6046	10693	8451	5125	3175
	5	-	-	-	-	4971	2168	6174	3371	7376	4573	9781	6978	6407	3968
	6	-	-	-	-	-	-	5262	1898	6464	3100	8869	5505	7688	4762
QS 1600	2	4765	2988	8741	6964	12716	10939	14704	12927	16692	14915	20668	18890	4193	2646
	3	-	-	7220	4554	11195	8530	13183	10517	15171	12505	19147	16481	6289	3970
	4	-	-	5699	2144	9675	6120	11662	8108	13650	10096	17626	14071	8385	5293
	5	-	-	-	-	8154	3711	10141	5698	12129	7686	16105	11662	10481	6616
	6	-	-	-	-	-	-	8621	3289	10608	5277	14584	9252	12578	7939

Spring return torque diagrams





Note:

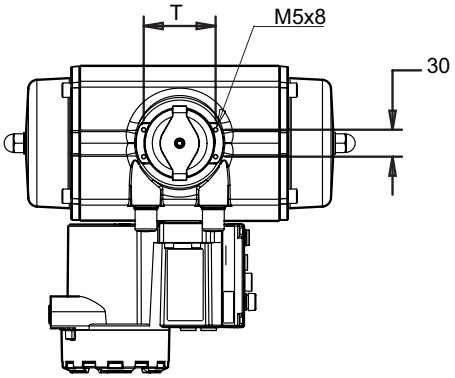
1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
   Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.
2. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

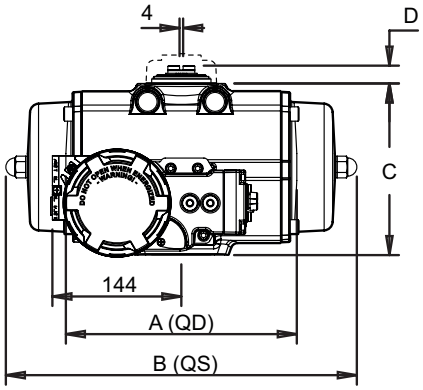
BETTIS™

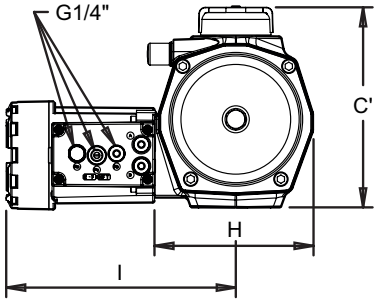
EMERSON™

Bettis Q-Series Valve Actuator Dimensions

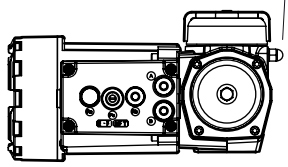
Metric Actuators - ISO5211







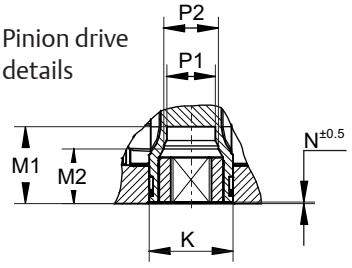
limit stops on Q40 & Q65

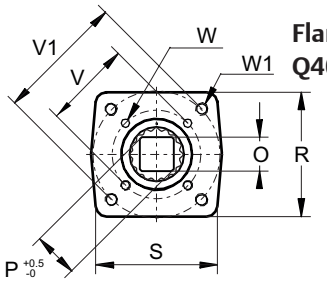


Note:

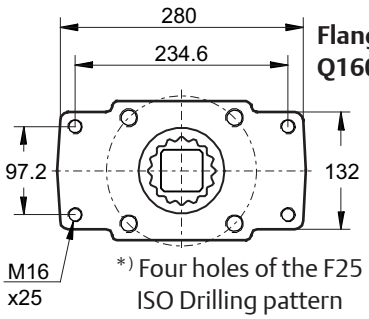
1. Dimensions are metric (mm).
2. The limit stop screws on the Q40 and Q65 are on the opposite side to those on the larger actuators.
3. Top flange according VDI/VDE 3845 (NAMUR)

Pinion drive details





Flange for Q40 - Q950



Flange for Q1600

*) Four holes of the F25 ISO Drilling pattern

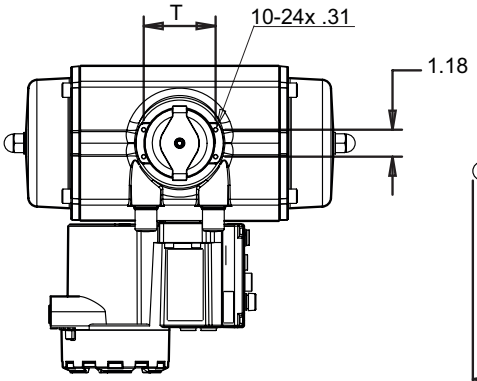
Dim	Bettis Q-Series actuator models								
in mm.	Q40	Q65	Q100	Q150	Q200	Q350	Q600	Q950	Q1600
A QD	180	199	221	254	283	305	387	424	516
B QS	204	249	267	310	346	387	416	460	568
C	104	117	141	150	161	191	245	276	337
C'	137	150	175	184	194	225	289	319	380
D	20	20	20	20	20	20	30	30	30
E	56	56	56	65	66	66	84	88	95
F	16	18	18	22	30	30	35	35	45
G	9,5	9	11	10	9	10	19,5	19	28,5
H	90	102	115	129	135	177	209	234	268
I	212	218	225	232	235	256	272	284	301
J	40	40	34	46	45	46	53	40	70
K	33	33	38	55	55	55	68	75	95
M1	34.5	34.5	34.5	50	50	50	52	64	82
M2	-	-	27	-	37	37	-	-	-
N	1	1	1.5	1.0	1.5	1.5	1.5	1.5	1.5
O max.	14.11	14.11	19.13	19.13	22.13	27.13	27.13	36.16	46.16
O min.	14.00	14.00	19.00	19.00	22.00	27.00	27.00	36.00	46.00
P	18.1	18.1	25.2	25.2	28.2	36.2	36.2	48.2	60.2
P1	18.1	18.1	23.1	28.5	32.1	32.1	36.5	48.5	60.5
P2	-	-	25.2	-	36.2	36.2	-	-	-
R	65	70	70	90	90	114	124	130	154
S	65	70	70	90	90	114	124	142	280
T	80	80	80	80	80	80	130	130	130
PCD	F05/F07	F05/F07	F05/F07	F07/F10	F07/F10	F07/F10	F10/F12	F10/F14	F16/F25*
V	50	50	50	70	70	70	102	102	165
V1	70	70	70	102	102	102	125	140	-
W	M6x10	M6x10	M6x10	M8x13	M8x13	M8x13	M10x16	M10x16	M20x30
W1	M8x13	M8x13	M8x13	M10x16	M10x16	M10x16	M12x20	M16x25	-

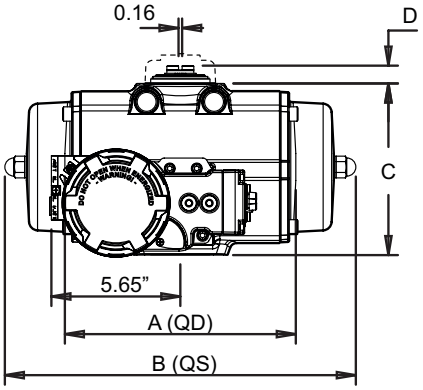
BETTIS™

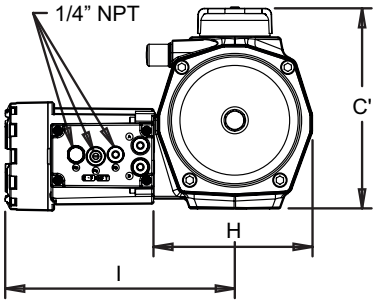
EMERSON™

Bettis Q-Series Valve Actuator Dimensions

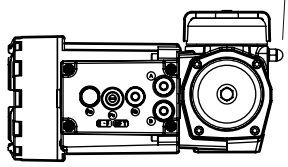
Imperial Actuators - ISO5211







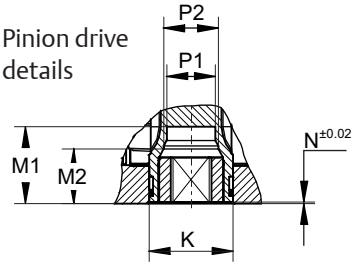
limit stops on Q40 & Q65

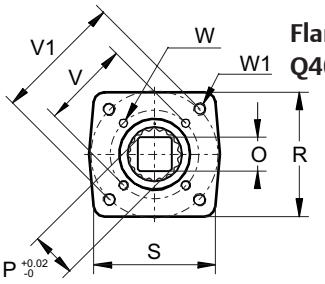


Note:

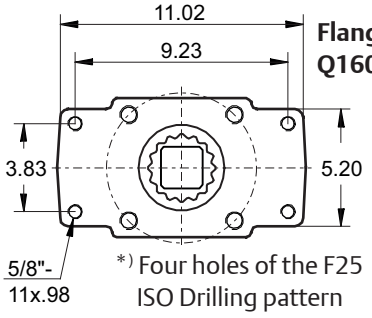
1. Dimensions are in inches.
2. The limit stop screws on the Q40 and Q65 are on the opposite side to those on the larger actuators.
3. Top flange according VDI/VDE 3845 (NAMUR)

Pinion drive details





Flange for Q40 - Q950



Flange for Q1600

*) Four holes of the F25 ISO Drilling pattern

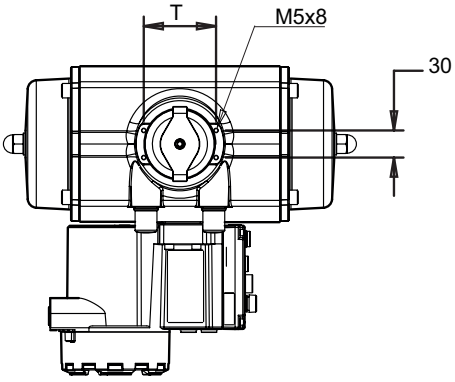
Dim in inches	Bettis Q-Series actuator models								
	Q40	Q65	Q100	Q150	Q200	Q350	Q600	Q950	Q1600
A QD	7.09	7.83	8.70	10.00	11.14	12.01	15.24	16.69	20.31
B QS	8.03	9.80	10.51	12.20	13.62	15.24	16.38	18.09	22.34
C	4.09	4.59	5.55	5.91	6.34	7.52	9.65	10.87	13.27
C’	5.39	5.92	6.89	7.24	7.64	8.86	11.38	12.56	14.96
D	0.79	0.79	0.79	0.79	0.79	0.79	1.18	1.18	1.18
E	2.20	2.20	2.20	2.56	2.60	2.60	3.31	3.46	3.74
F	0.63	0.71	0.71	0.87	1.18	1.18	1.38	1.38	1.77
G	0.37	0.35	0.43	0.39	0.35	0.39	0.77	0.75	1.12
H	3.54	4.02	4.53	5.08	5.31	6.97	8.23	9.21	10.55
I	8.65	8.9	9.16	9.45	9.57	10.43	11.08	11.59	12.29
J	1.56	1.56	1.32	1.81	1.78	1.81	2.08	1.58	2.75
K	1.30	1.30	1.50	2.17	2.17	2.17	2.68	2.95	3.74
M1	1.36	1.36	1.36	1.97	1.97	1.97	2.05	2.52	3.23
M2	-	-	1.06	-	1.46	1.46	-	-	-
N	0.04	0.04	0.06	0.04	0.06	0.06	0.06	0.06	0.06
O max.	0.556	0.556	0.753	0.753	0.871	1.068	1.068	1.424	1.817
O min.	0.551	0.551	0.748	0.748	0.866	1.063	1.063	1.417	1.811
P	0.71	0.71	0.99	0.99	1.11	1.43	1.43	1.90	2.37
P1	0.71	0.71	0.91	1.12	1.26	1.26	1.44	1.91	2.38
P2	-	-	0.99	-	1.43	1.43	-	-	-
R	2.56	2.76	2.76	3.54	3.54	4.49	4.88	5.12	6.06
S	2.56	2.76	2.76	3.54	3.54	4.49	4.88	5.59	11.02
T	3.15	3.15	3.15	3.15	3.15	3.15	5.12	5.12	5.12
PCD	F05/F07	F05/F07	F05/F07	F07/F10	F07/F10	F07/F10	F10/F12	F10/F14	F16/F25*
V	1.969	1.969	1.969	2.756	2.756	2.756	4.016	4.016	6.496
V1	2.756	2.756	2.756	4.016	4.016	4.016	4.921	5.512	-
W	1/4”-20x.39	1/4”-20x.39	1/4”-20x.39	5/16”-18x.39	5/16”-18x.39	5/16”-18x.39	3/8”-16x.63	3/8”-16x.63	3/4”-10x1.14
W1	5/16”-18x.39	5/16”-18x.39	5/16”-18x.39	3/8”-16x.63	3/8”-16x.63	3/8”-16x.63	1/2”-13x.79	5/8”-11x.98	-

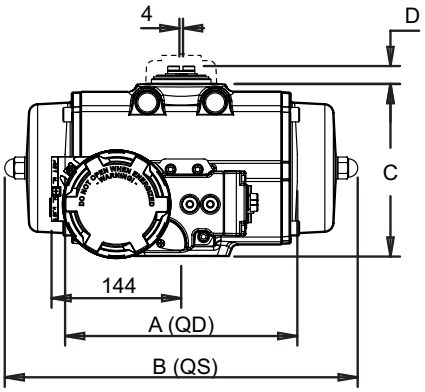
BETTIS™

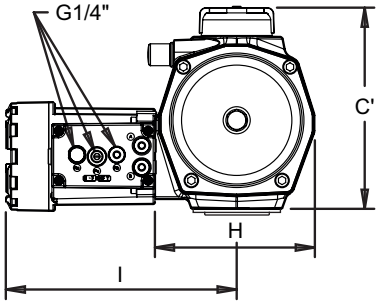
EMERSON™

Bettis Q-Series Valve Actuator Dimensions

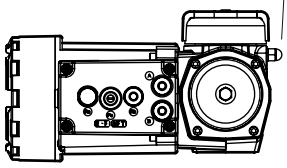
Metric Actuators - DIN3337

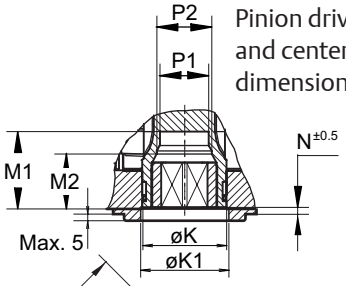




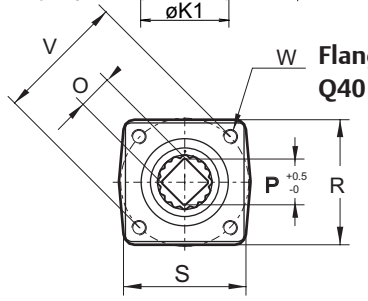


limit stops on Q40 & Q65

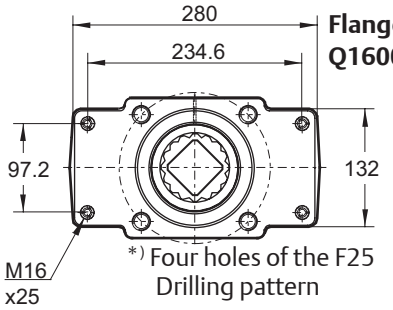




Pinion drive details and center plate dimensions



Flange for Q40 - Q950



Flange for Q1600

*) Four holes of the F25 Drilling pattern

Note:

1. Dimensions are metric (mm).
2. The limit stop screws on the Q40 and Q65 are on the opposite side to those on the larger actuators.
3. Top flange according VDI/VDE 3845 (NAMUR)

Dim	Bettis Q-Series actuator models								
in mm.	Q40	Q65	Q100	Q150	Q200	Q350	Q600	Q950	Q1600
A QD	180	199	221	254	283	305	387	424	516
B QS	204	249	267	310	360	387	477	517	637
C	104	116,5	141	150	161	191	245	276	337
C'	137	150,4	175	184	194	225	289	319	380
D	20	20	20	20	20	20	30	30	30
E	56	56	56	65	66	66	84	88	95
F	16	18	18	22	30	30	35	35	45
G	9,5	14	11	10	9	10	19,5	19	28,5
H	86	102	108	129	128	173	207	231	265
I	212	218	225	232	235	256	272	284	301
J	40	40	34	46	45	46	53	40	70
K	33	33	38	55	55	55	68	75	95
K1	32	32	40	50	54	54	68	75	95
M1	34,5	34,5	34,5	50	50	50	52	64	82
M2	-	-	27	-	37	37	-	-	-
N	1	1	1,5	1	1,5	1,5	1,5	1,5	1,5
O max.	14,11	14,11	17,13	17,13	22,13	22,13	27,13	36,16	46,16
O min.	14,00	14,00	17,00	17,00	22,00	22,00	27,00	36,00	46,00
P	18,1	18,1	22,2	22,2	28,2	28,2	36,2	48,2	60,2
P1	18,1	18,1	23,1	28,5	32,1	32,1	36,5	48,5	60,5
P2	-	-	25,2	-	36,2	36,2	-	-	-
Q	35	70	55	55	70	70	85	100	130
R	65	70	70	90	90	114	124	130	154
S	65	80	70	90	90	114	124	142	280
T	80	50	80	80	80	80	130	130	130
PCD	F05	F05	F07	F07	F10	F10	F12	F14	F16
V	50	50	70	70	102	102	125	140	165
W	M6x10	M6x10	M8x13	M8x13	M10x16	M10x16	M12x20	M16x25	M20x30
Optional dimensions									
K1'	40	40	32	54	50	50	-	-	-
Q'	55	35	35	70	55	55	-	-	-
PCD	F07	F07	F05	F10	F07	F07	F10	F10	F25*
V'	70	70	50	102	70	70	102	102	-
W'	M8x13	M8x13	M6x10	M10x16	M8x13	M8x13	M10x16	M10x16	-

BETTIS™

EMERSON™

Bettis Q-Series Valve Actuator Options

Drive Inserts

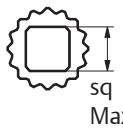
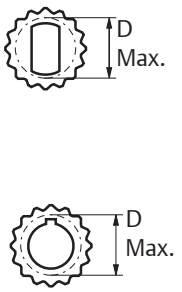
Description

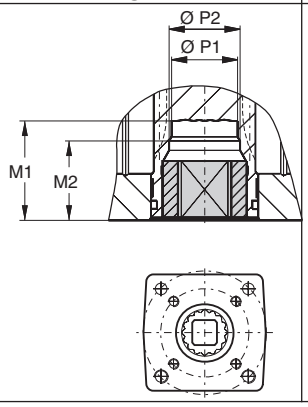
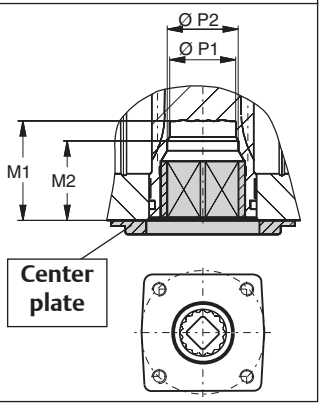
All actuators are fitted with drive inserts. This enables actuators to be directly mounted onto suitable valves and eliminates the need for a bracket and coupling type mounting kit. The use of direct mounts significantly cuts the cost of the valve/actuator assembly.

Standard actuators are fitted with square drive inserts in accordance with ISO 5211 (or DIN 3337), but a wide variety of other inserts are also available. Special inserts may have oversize or undersize squares, double-D and shaft key way forms. Drive inserts can be supplied on factory built actuators or as loose items and are easily replaceable at distributor or end user level.

Where direct mounts are not possible, for instance on valves with exposed gland packing, the use of inserts often simplifies the design of the mounting kit.

Material : Aluminum alloy
Finish : Anodized

Standard available insert shapes	Optional available insert shapes
	

Insert mounting acc. ISO 5211	Insert mounting acc. DIN 3337
	

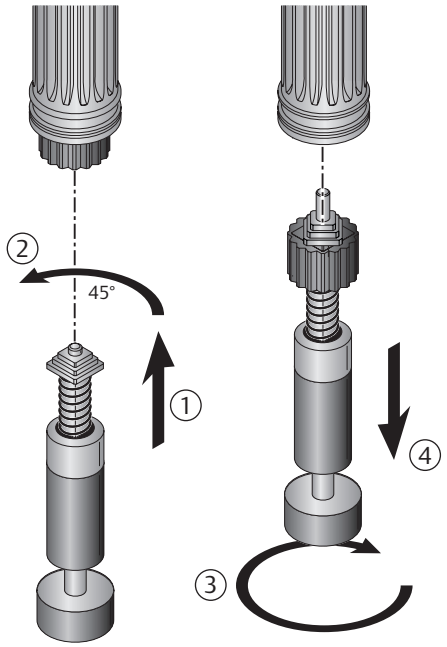
	Inserts with inner-square-dimensions per actuator type																	
	Q40		Q65		Q100		Q150		Q200		Q350		Q600		Q950		Q1600	
	mm.	inch	mm.	inch	mm.	inch	mm.	inch	mm.	inch	mm.	inch	mm.	inch	mm.	inch	mm.	inch
	Standard inserts dimensions																	
ISO5211	14	0.551	14	0.551	19	0.748	19	0.748	22	0.866	27	1.063	27	1.063	36	1.417	46	1.811
DIN3337	14	0.551	14	0.551	17	0.669	17	0.669	22	0.866	22	0.866	27	1.063	36	1.417	46	1.811
	Optional insert dimensions																	
	10	0.394	10	0.394	12	0.472	14	0.551	14	0.551	14	0.551	14	0.551	22	0.866	-	-
	12	0.472	12	0.472	14	0.551	16	0.630	16	0.630	16	0.630	16	0.630	-	-	-	-
	-	-	-	-	16	0.630	22	0.866	17	0.669	17	0.669	17	0.669	-	-	-	-
	-	-	-	-	-	-	24	0.945	19	0.748	19	0.748	19	0.748	-	-	-	-
	-	-	-	-	-	-	27	1.063	24	0.945	24	0.945	24	0.945	-	-	-	-
	Maximum insert dimensions																	
M1	34.5	1.36	34.5	1.36	34.5	1.36	50	1.97	50	1.97	50	1.97	50	1.97	65	2.56	81	3.19
M2	-	-	-	-	27	1.06	37.0	1.46	37.0	1.46	37.0	1.46	-	-	-	-	-	-
P1	18.1	0.71	21.2	0.83	23.5	0.93	28.5	1.12	32.2	1.27	32.2	1.27	36.8	1.45	48.3	1.90	60.5	2.38
P2	-	-	-	-	25.2	0.99	36.2	1.43	36.3	1.43	36.3	1.43	-	-	-	-	-	-
Sq max.	16	0.630	16	0.630	19	0.748	27.0	1.063	27.0	1.063	27.0	1.063	27.0	1.063	36.0	1.417	46.0	1.811
D max.	21	0.827	21	0.827	23.6	0.929	33.6	1.323	33.6	1.323	33.6	1.323	33.6	1.323	45.0	1.772	60.0	2.362

BETTIS™ EMERSON™

Insert Removal tool

Description

The standard Bettis Q-Series actuators are equipped with Square-Drive inserts according ISO5211. When assembled at the factory, the inserts are press-fitted on an edge in the pinion bottom. In order to be able to replace these standard inserts, these insert removal tools will help you to easily remove the standard insert from the pinion bottom.



Availability

The insert removal tools are available in two versions and can be used up to actuator size 600. For larger actuator sizes, up to size 2500, it is recommended to use a generic pulley puller.

Intended use:

These insert removal tools are intended to be used just before the installation of the actuator onto a valve and where the default insert needs to be replaced by an insert with a different size or shape.

Operation:

The insert removal tools are equipped with 3 square bits that fit exactly in the insert square of the actuator. Make sure the square bits are as high as possible on the threaded rod. Then you can insert (1) and rotated 45° (2) the tool and one of the square bits will hook under the insert.

The knob (3) on the tool can now be rotated until the insert get loose (4) and it can be removed from the pinion's bottom.

Specifications:

Tool part nr.:	Squares:	Actuator sizes:
VA590.00.001	11, 14 and 17	25, 40, 65, 100, 150
VA590.00.002	19, 22 and 27	100, 150 200, 350, 600

Materials:

Body, Knob and bits: Carbon steel, Zinc Plated

Bettis Q-Series Valve Actuator Options

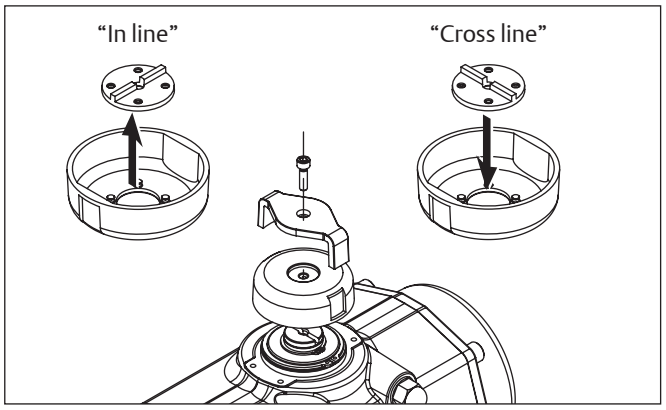
Position Indication - Center Plate

Visual position indicator

Bettis Q-Series valve actuators can be equipped with a large visual position indicator which allows clear indication of the valves position at almost any position.
The Bettis Q-Series indicator is designed for position indication of actuators mounted “in line” with the pipe line and mounted “cross line” with the pipe line. To do this the inner part can be removed, turned 90° and pushed back in place.
When supplied, the position indicator will be mounted “in line” as standard. See data sheet BQ1.606.04 for other indicator mounting options.

Specifications:

Material disk : Nylon PA6, Black
Material arrow : Nylon PA6, White

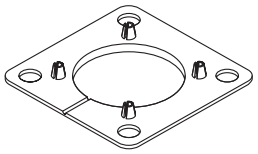


Center plate for DIN3337 applications

Bettis Q-Series actuators can be equipped with a centre plate which takes care that actuator and valve (or valve mounting kit) are aligned when mounted. For most of the actuator sizes two center plates are available.

Specifications:

Material plate : Nylon PA6, Black



Center plate

	Bettis Q-Series actuator models							
	Q40	**Q65**	**Q100**	**Q200**	**Q350**	**Q600**	**Q950**	**Q1600**
Std	F05	F05	F07	F10	F10	F12	F14	F16
Option	F07	F07	F05	F07	F07	-/-	-/-	-/-

BETTIS™

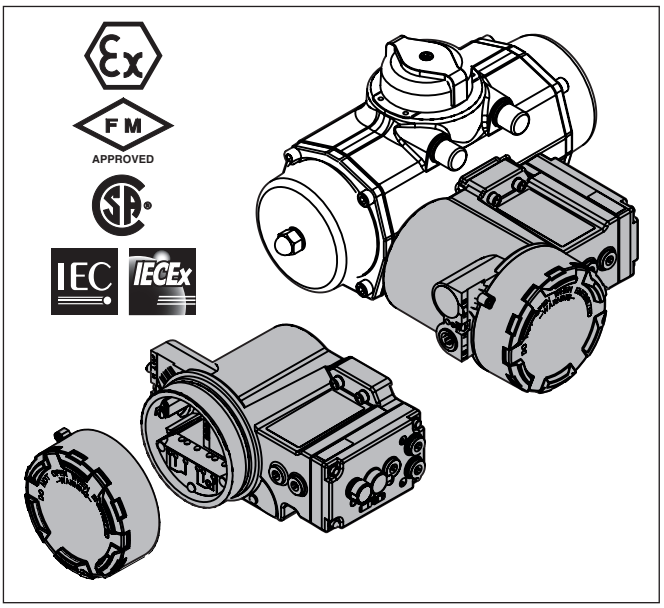
EMERSON™

Integrated Control modules

QC41, QC42 and QC43

Features:

- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Bettis Q-Series actuator sizes.**
- **Available as "Weather Proof" for indoors or outdoors use and "Explosion Proof" for areas with a potential explosion hazard.**
  - The robust aluminum alloy enclosure (IP66 / NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
  - The Explosion Proof version is available with ATEX / IECEx Ex d approval for use in Zone 1, 2, 21 and 22 and/or FM / CSA Explosion proof approval for use in Class I, Division 1.
- **Various feedback switch options available.**
- **Non-Intrusive switch point adjustment of the feedback switches. Allows to adjust switch points without opening the Control Module.**
- **Lockable Control Module cover.**
- **All the control and feedback connections can be wired through one single entry to the Control Module.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**



BETTIS™

EMERSON™

Description:

These Bettis Q-Series conventionally wired control modules are the next step for the integrated concept of valve automation.
Next to the components for feedback switches, also all the pneumatic control components are located inside one module housing.
Its compact and robust construction incorporates basic control and feedback functionality and is suitable for indoor and outdoor use.
These modules are available with ATEX and IECEx certification for use in Zone 1, 2, 21 and 22, and additionally FM and CSA certified for use in Class I, Division 1.

Construction:

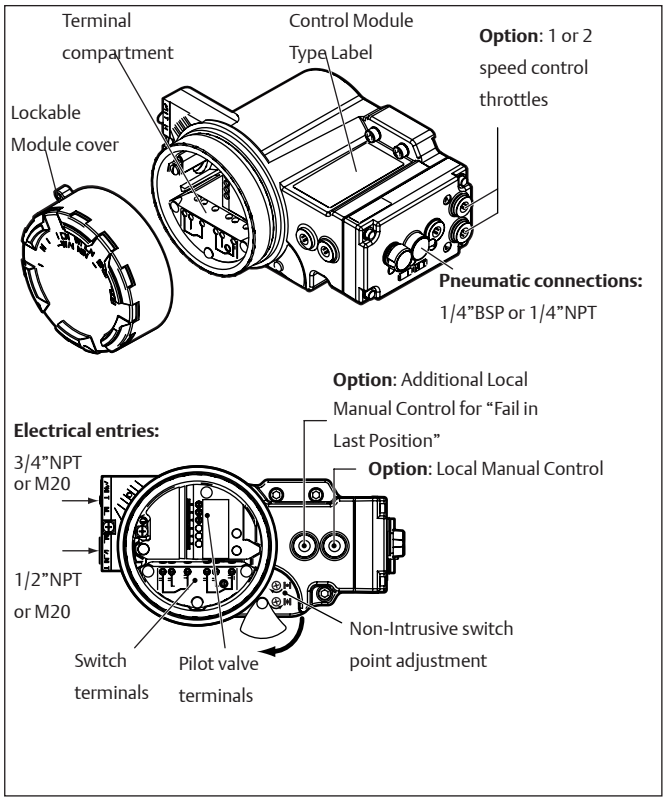
The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting control and feedback signals. Two cable entries are available.
The pilot valves inside the control module are used to send the actuator to its open or closed position. One pneumatic connection is available to feed the control module.

General specifications:

Material housing:	Aluminium alloy	
Operating media:	Air or inert gasses, filtered at 50µm (for QC54 5µm)	
Pneumatic entry:	Metric units:	G1/4"
	Imperial units:	1/4”NPT
Electrical connections:	Pilot valve(s):	6 pole terminal strip.
	Switches:	6 pole terminal strip.
Cable entries:	Metric units:	2x M20x1.5
	Imperial units:	1/2” and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X	
Switch points:	Factory set at 15° before each end of travel (open and closed position).	
Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.	
Finish:	Chromated, polyurethane based coating.	
Temperature range:	Depends on the switches inside the module and or Hazardous Area approvals (See section "Position feedback"	
Dimensions:	Metric:	
	See data sheet BQ1.603.08	
	Imperial/UNC:	
	See data sheet BQ1.603.09	
	DIN 3337:	
	See data sheet BQ.1.603.10	

Electrical safety requirements:

Use	:	In- and outdoor.
Altitude	:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity	:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation	:	Up to ±10% of nominal voltage
Over voltage category	:	II
Pollution degree	:	2 (3 when the cover remains closed)



Control module overview

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

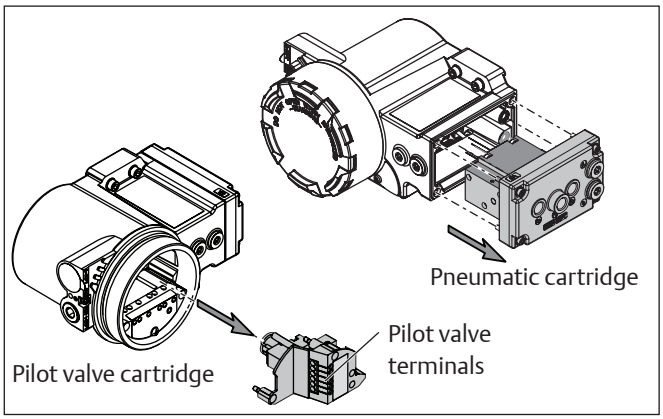
1. Spring return or
2. Double acting or
3. Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

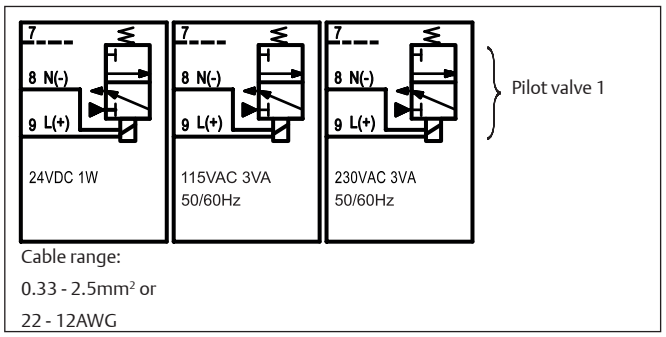
1. One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2. Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

Table 1: Pilot valve specifications

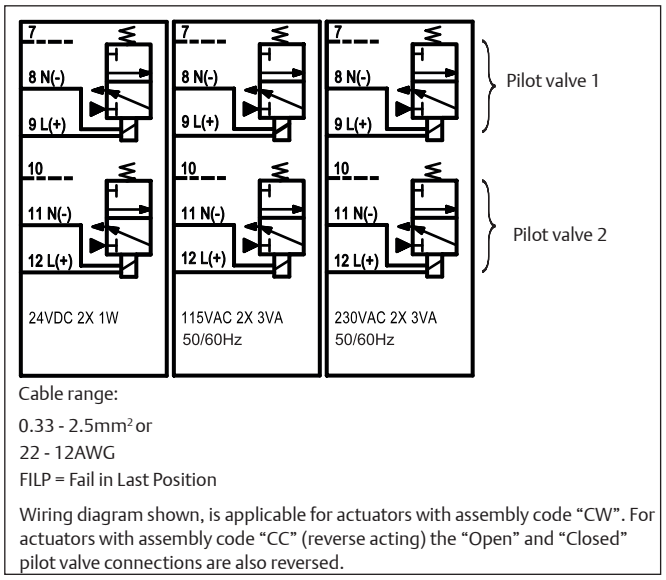
Module	Voltages	Power	Frequency
QC41	24VDC (±10%)	1W	NA
QC42	115 VAC (±10%)	3VA	50/60Hz
QC43	230 VAC (±10%)	3VA	50/60Hz



Pilot valve and pneumatic cartridge



One default pilot valve and wiring connections



Two pilot valves and wiring connections for Fail in Last Position

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Bettis Q-Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in "Breather" function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators' working life.

Pneumatic options

Speed Control

The Bettis Q-Series can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the "Opening" and "Closing" stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

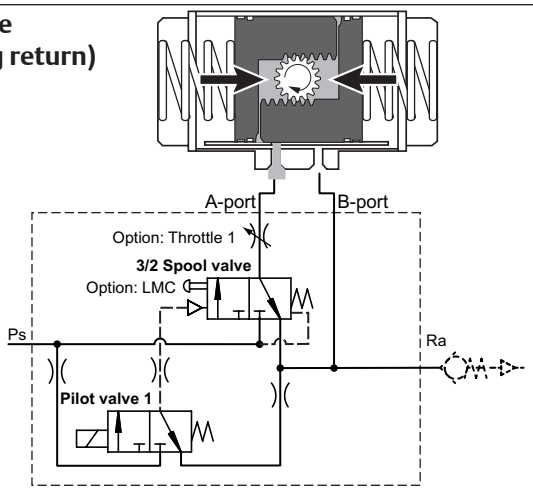
For commissioning, emergency or maintenance purposes, the Bettis Q-Series can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

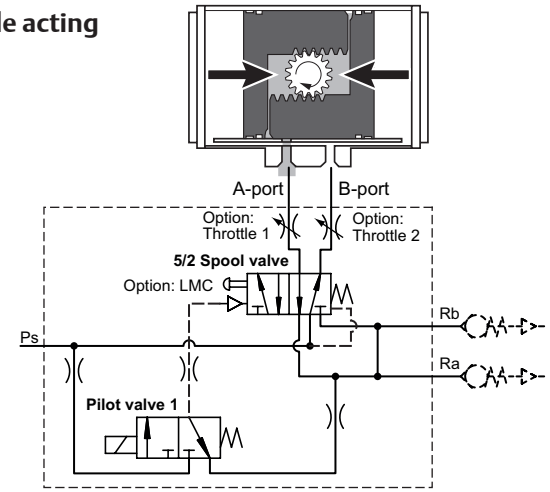
Maximum Flow rates of Q-Series modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m^3/h) or Cv value of 0.33 (US gall/min 1Psi) for approximate operating speed calculations.

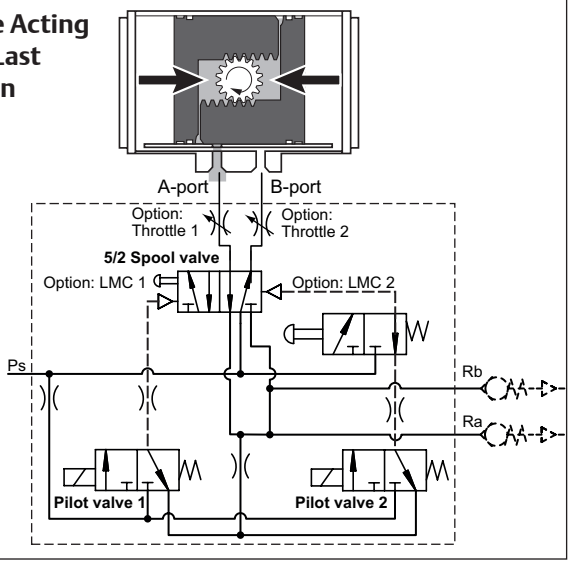
Fail safe (spring return)



Double acting



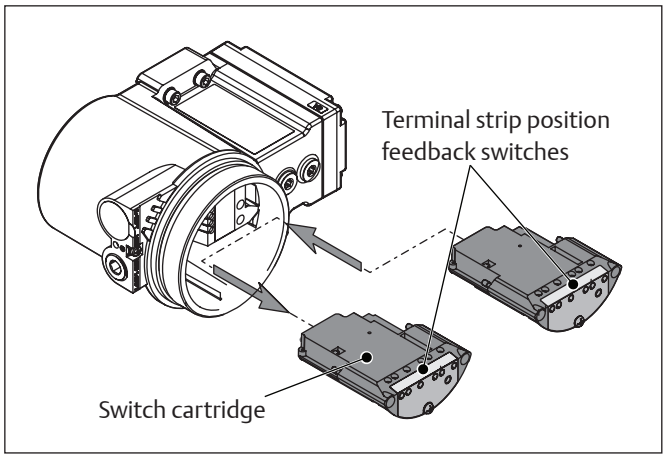
Double Acting Fail in Last Position



Position feedback

Switch cartridges

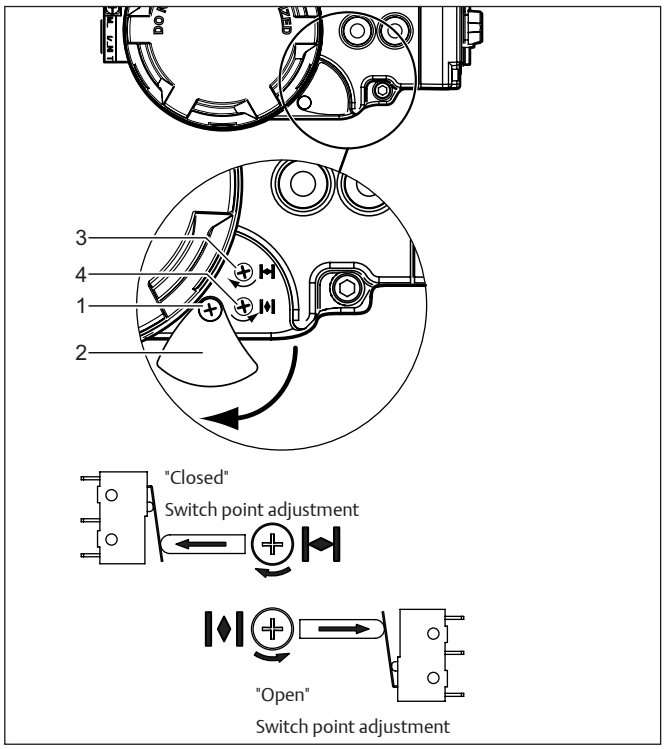
The position feedback is achieved by switch cartridges in the module. These cartridges contain switching elements which sense the open or closed position and are pre wired to the terminal strip. These easily exchangeable switch cartridges are available with various mechanical or proximity switching elements.



Switch cartridges

Non-Intrusive switch point adjustment

If required the switches can be adjusted without opening the module. This, so called, Non-Intrusive switch adjustment is located at the front of the module behind a locable (1) shield (2). Two adjustment screws are available for adjusting the Closed (3) and Open (4) position indication.



Non-Intrusive switch point adjustment

Important:

- The above "Closed" and "Open" marked adjustment screws will adjust the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment screw will adjust the "Open" switch point. Similar, the "Open" marked adjustment screw will adjust the "Closed" switch point.

Mechanical switches

Table 2: Mechanical switches

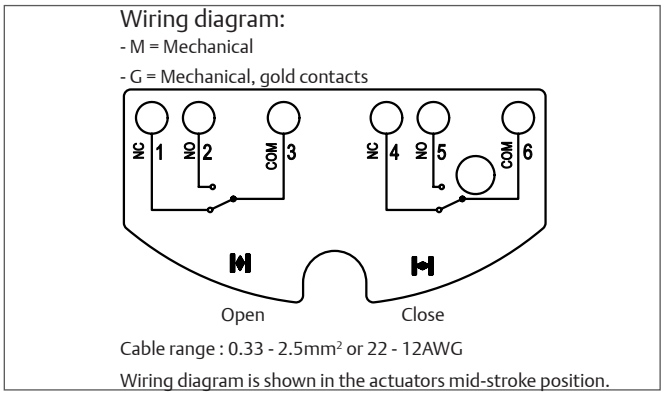
Specification	Description
Option code	M
Option code	G (gold contacts)
Type	Mechanical
Voltage	M: 277 VAC or 250VDC (maximum)
	G: 125 VAC or 30VDC (maximum)
Contacts	NO and NC
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7

Table 3: Maximum currents

Switch voltage	M type switch	G type switch
125 VAC	10 A (3 A[1])	0.1 A [2]
250 VAC	10 A (3 A[1])	-
30 VDC	0.5 A	0.1 A [2]
125 VDC	0.5 A	-
250 VDC	0.25 A	-

Note:

1. The mechanical (M-type) switches are rated for 3 A with inductive load.
2. The mechanical (G-type) switches have gold contacts. For applications where the benefits of gold contacts are required, the maximum current is 1 A.



Wiring diagram for mechanical switches

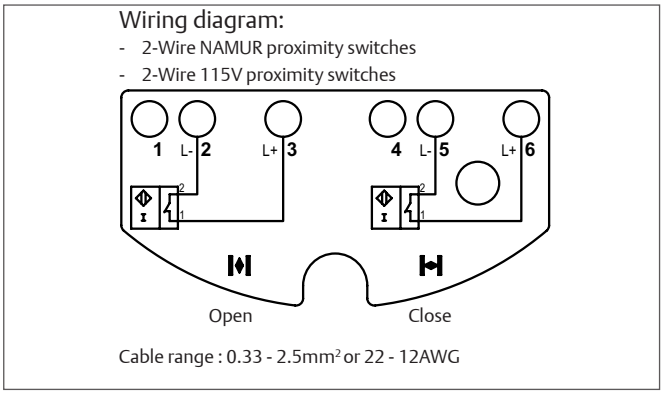
2-Wire Proximity switches

Table 4: 2-wire NAMUR proximity switches

Specification	Description
Option code	N
Type	2-wire inductive, normally closed
Voltage	8 VDC nominal
Output	Unswitched , > 3 mA
	Switched , < 1 mA
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7
Compliant to	DIN EN 60947-5-6 (NAMUR)

Table 5: 2-Wire 230V proximity switches

Specification	Description	
Option code	H	
Voltage	20...250VAC / 10...300VDC (50...60 Hz AC)	
Current	Maximum	100 mA
	Peak	0,9A (20ms / 0,5Hz),
Leakage	< 1.7 mA	
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7	



Wiring diagram for 2-Wire proximity switches

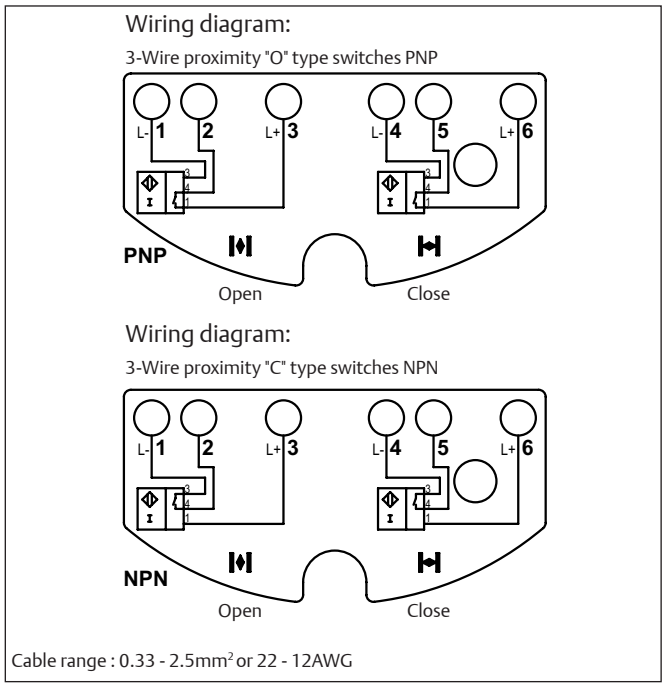
Important:

- The above "Closed" and "Open" marked adjustment terminals will indicate the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment terminals will indicate the "Open" switch point. Similar, the "Open" marked adjustment terminals will indicate the "Closed" switch point.

3-Wire Proximity switches

Table 6: 3-wire proximity switches

Specification	Description
Option code	O, V3 PNP
Option code	C, V3 NPN
Function	Make
Voltage	10 - 30V
Current	100 mA maximum
Off-state current	0 ... 0.5 mA typical
Temperature range	-25°C to +65°C / -13°F to +149°F For use in hazardous areas, see table 7



Wiring diagram for 3-Wire proximity switches

Important:

- The above "Closed" and "Open" marked adjustment terminals will indicate the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment terminals will indicate the "Open" switch point. Similar, the "Open" marked adjustment terminals will indicate the "Closed" switch point.

Control Module Options

QC41, QC42 and QC43

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the Bettis Q-Series can be supplied with one or two Manual Control options. These can operate the pilot valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see page 11 of 11

Speed Control

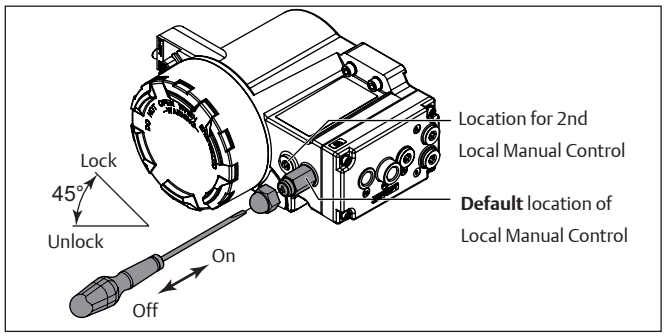
Description

The Bettis Q-Series can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

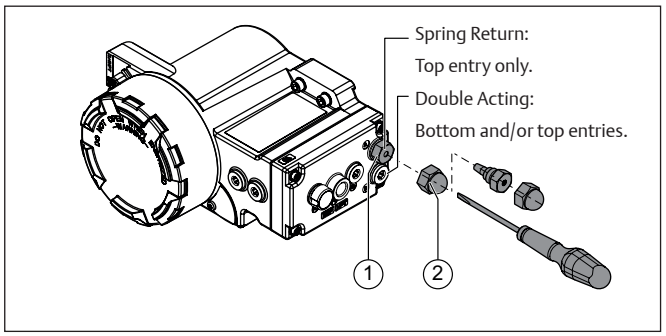
1 Nut cover
2 Main throttle with set screw.

Notes:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.



Local Manual Control option



Speed control options

Hazardous area specifications

Modules QC41, QC42 and QC43

Below specification are applicable for QC41, QC42 and QC43 modules with a hazardous area approval.

Hazardous area product marking;

IECEx hazardous or Classified Location:

Ex d IIB+H2 T4/T6 Gb
Ex t IIIC T80°C Db
IECEx DEK 15.0034X

ATEX hazardous or Classified Location:

CE 1180
Ex II 2G Ex db IIB+H2 T4/T6
Ex II 2D Ex tb IIIC T80°C
DEKRA 15ATEX0055X

FM hazardous or Classified Location:

CL I, II, III, DIV 1
Groups BCDEFG, T4/T6, Type 4X/6
CL I, ZN 1, IIB+H2, T4/T6

CSA hazardous or Classified Location:

Class I, II, III, DIV 1
Groups CDEFG, T4/T6, Type 4X/6
Ex d IIB+H2 T4/T6
DIP A21 TA 80°C
CSA 12.2489009

Notes:

1 Each control module is marked with the applicable ambient temperature marking.
2 Metric control modules are marked with ATEX and IECEx markings.
3 Imperial control modules are marked with ATEX, IECEx, FM and CSA markings.

Temperature rating

Table 7: Temperature rating for use in areas with a potential explosion hazard.

Configuration				Temperature (°C)			
Module type	Switch cartridge	Pneumatic action	Max. Power dissipation	Min. ambient	Max. ambient	Max. Surface	Class
QC41 (24VDC)	M, G O, C, N, H	S,D,F	3.6W (1	-25°C (-13°F)	+60	+80	T6/T4
QC42, QC43 (115 or 230VAC)		S,D	3.6W (1	-25°C (-13°F)	+60	+80	T6/T4
QC42, QC43 (115 or 230VAC)		F	7.2W (2	-25°C (-13°F)	+60	+80	T6/T4

Notes:

1 1x or 2x 24VDC pilot valves, or 1x 115/230 VAC pilot valve
2 2x 115 or 230 VAC pilot valves

Switch cartridge

M = Mechanical switches
G = Mechanical switches (gold contacts)
C = 3 wire PNP proximity switch
O = 3 wire NPN proximity switch
N = 2 wire proximity switch
H = 2 wire proximity switch

Pneumatic action

S = Spring Return (Single acting).
D = Double acting.
F = Double acting (Fail in Last Position)

BETTIS™ EMERSON™

Integrated Control modules

QC40 with AS-Interface digital bus communication.

Features

- **AS-Interface digital communication.**
- **Up to 62 devices per segment for AS-Interface Spec. V3.0 protocol**
- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Bettis actuator sizes both single and double acting actuators.**
- **Available as "Weather Proof" for indoors or outdoors use and "Non-Arcing/Non-Incendive" for areas with a potential explosion hazard.**
  - The robust aluminum alloy enclosure (IP66 / NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
    The hazardous area versions are available with:
  - **ATEX or IECEx** Ex nA approvals for use in Zone 2, 21 and 22
  - **CSA or FM** Non-Incendive approvals for use in Class I, Division 2.
- **Operates with exchangeable position feedback switches.**
- **Non-Intrusive switch point adjustment of the feedback switches. Allows to adjust switch points without opening the Control Module.**
- **LED indicators for Fail, Power, Open and Close position.**
- **Lockable Control Module cover.**
- **All the control and feedback connections can be wired through one single entry to the Control Module.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**
- **Modular functionality for easy update towards present and future bus systems.**

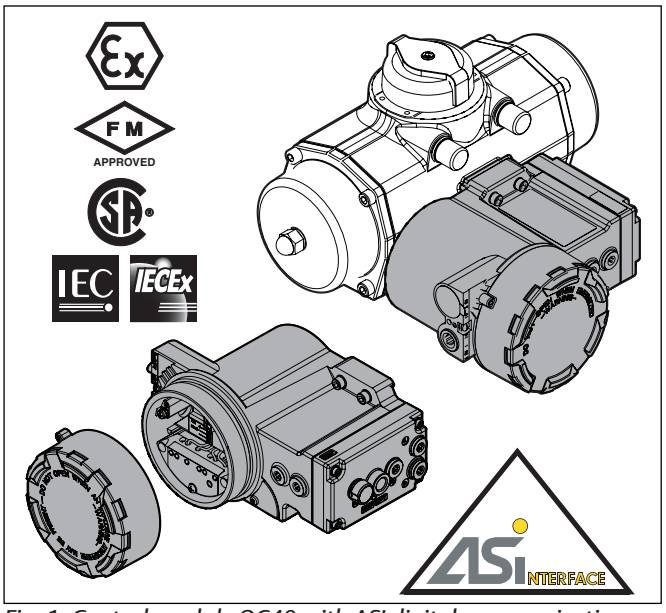


Fig. 1. Control module QC40 with ASI digital communication.

Description:

This Q-Series QC40 Control Module offers an integrated concept for valve automation. Its compact and robust construction incorporates basic control and feedback functionality and communicates through the AS-Interface Spec. V3.0, V2.11 protocol.

Construction

All electrical and pneumatic control components are located inside one module housing making it a compact and robust construction incorporating basic control and feedback functionality and is suitable for indoor and outdoor use.
The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting the AS-Interface signals. Two cable entries are available.
One pneumatic connection is available to feed the control module. The pilot valves inside the control module are used to send the actuator to its open or closed position.
These modules are available with ATEX, IECEx or Inmetro certification for use in Zone 2, 21, and 22, and additionally CSA or FM certified for use in Class I, Division 2.

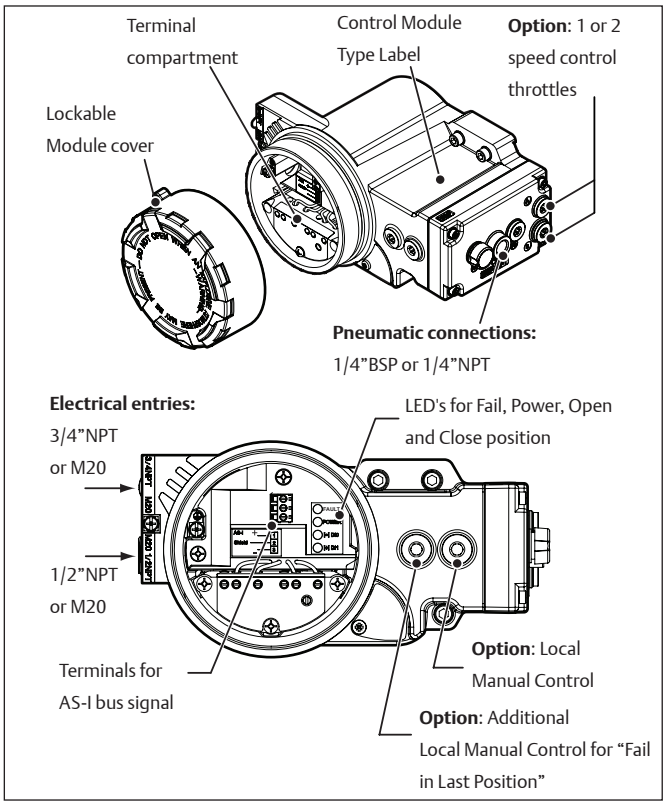


Fig. 2. Control module overview

General specifications:

Material housing:	Aluminium alloy
Operating media:	Air or inert gasses, filtered at 50µm (for QC54 5µm)
Pneumatic entry:	Metric units: G1/4" Imperial units: 1/4"NPT
Electrical connections :	Internal terminal strip for bus signal Internal and external earth connection Optional quick connectors: 7/8" or M12 connector (see page 9)
Cable entries:	Metric units: 2x M20x1.5 Imperial units: 1/2" and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X
Switch points:	Factory set at 15° before each end of travel (open and closed position).
Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.
Finish:	Chromated with polyurethane based coating.
Temperature range:	G-Type switch: -25°C to +60°C (-13°F to +140°F) N-Type switch: -25°C to +60°C (-13°F to +140°F)

Dimensions:

Metric:	See data sheet BQ1.603.08
Imperial/UNC:	See data sheet BQ1.603.09
DIN 3337:	See data sheet BQ1.603.10

Electrical safety requirements:

Use:	In- and outdoor.
Altitude:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation:	Up to ±10% of nominal voltage
Over voltage category:	II
Pollution degree:	2 (3 when the cover remains closed)

Communication Protocol:

Protocol:		AS-Interface
Number of devices:		31 for AS-Interface Spec. V2.11 protocol 62 for AS-Interface Spec. V3.0 protocol
Current	Minimum:	34 mA at 26.5V and 25°C
	Maximum:	140 mA at 26.5V and 25°C
	Nominal:	101 mA at 26.5V and 25°C to 60°C
	Protection:	Short circuit detection
ASI-Profile V3.0:		S-6.A.E (other profiles optional)

Table 1 - Factory settings:

Factory address	00	EID1	7
E/A-Code	6	EID2	E
E/A-Code	A	Parameter	00

Q-Series data bits		Functions	
	Type	DI's	DO's
D0	Bi-directional	Feedback "Closed"	Pilot Valve 2 Control
D1	Bi-directional	Feedback "Open"	Pilot Valve 1 Control
D2	Bi-directional	Not used	
D3	Bi-directional	Not used	

LED indicators for Open and Close position, Status, and Power.

- The Open and Close LED identify the position of the automated valve. These LED's are also useful for setting the switch points more accurately.
- Status feedback is provided according to the ASI standard For more detailed information on LED indications, see Installation Guide : DOC.IG.BQC40.1
- The power LED indicates if the AS-I cartridge is powered or not.

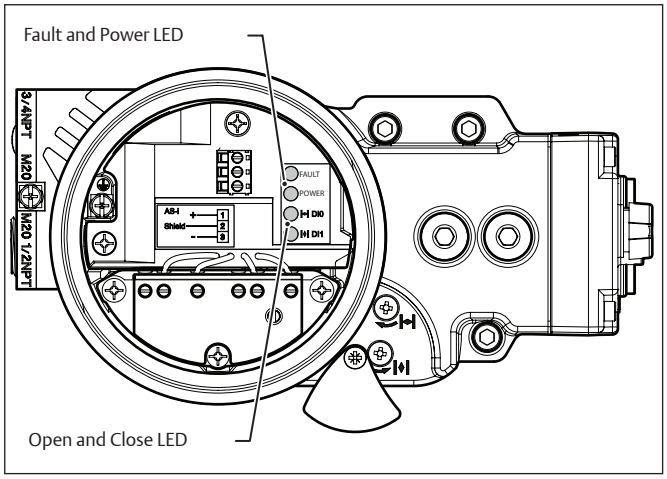


Fig. 3. LED indicators

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

1. Spring return or
2. Double acting or
3. Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

1. One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2. Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

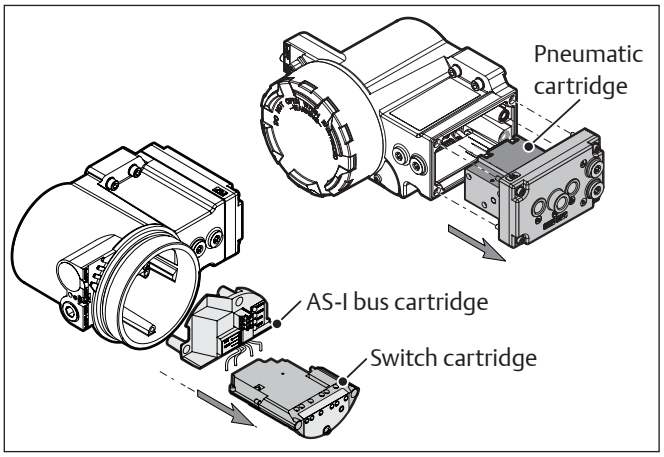


Fig. 4. Pilot valve and pneumatic cartridge

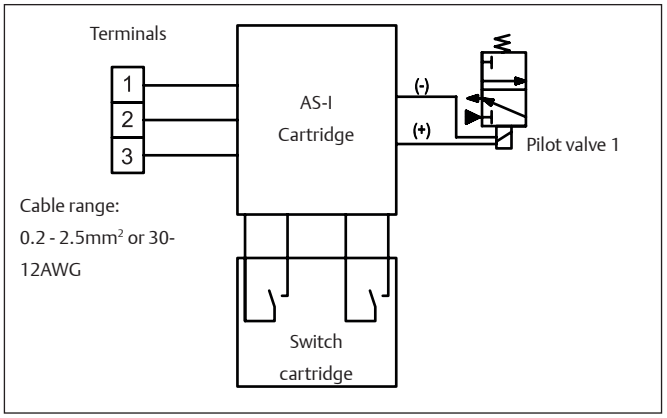


Fig. 5. One pilot valve and wiring connections for standard Double Acting or Spring Return applications

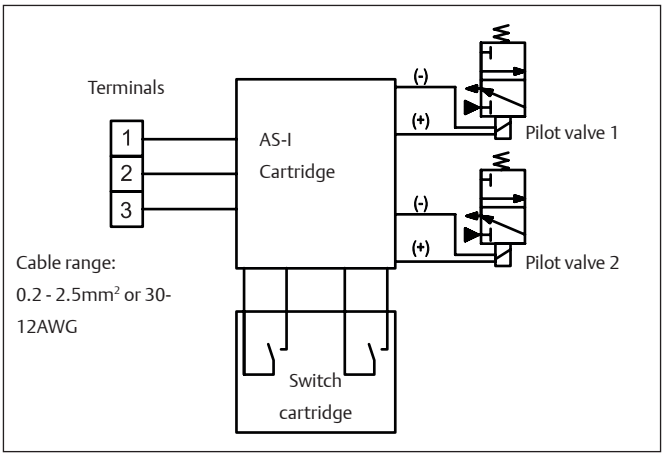


Fig. 6. Two pilot valves and wiring connections for Double Acting "Fail in Last Position" applications

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Bettis Q-Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in “Breather” function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators’ working life.

Pneumatic options

Speed Control

The QC40 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

For commissioning, emergency or maintenance purposes, the QC40 control module can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

Maximum Flow Rates of Q-Series Modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m_3/h) or Cv value of 0.33 (US gall/min 1 Psi) for approximate operating speed calculations.

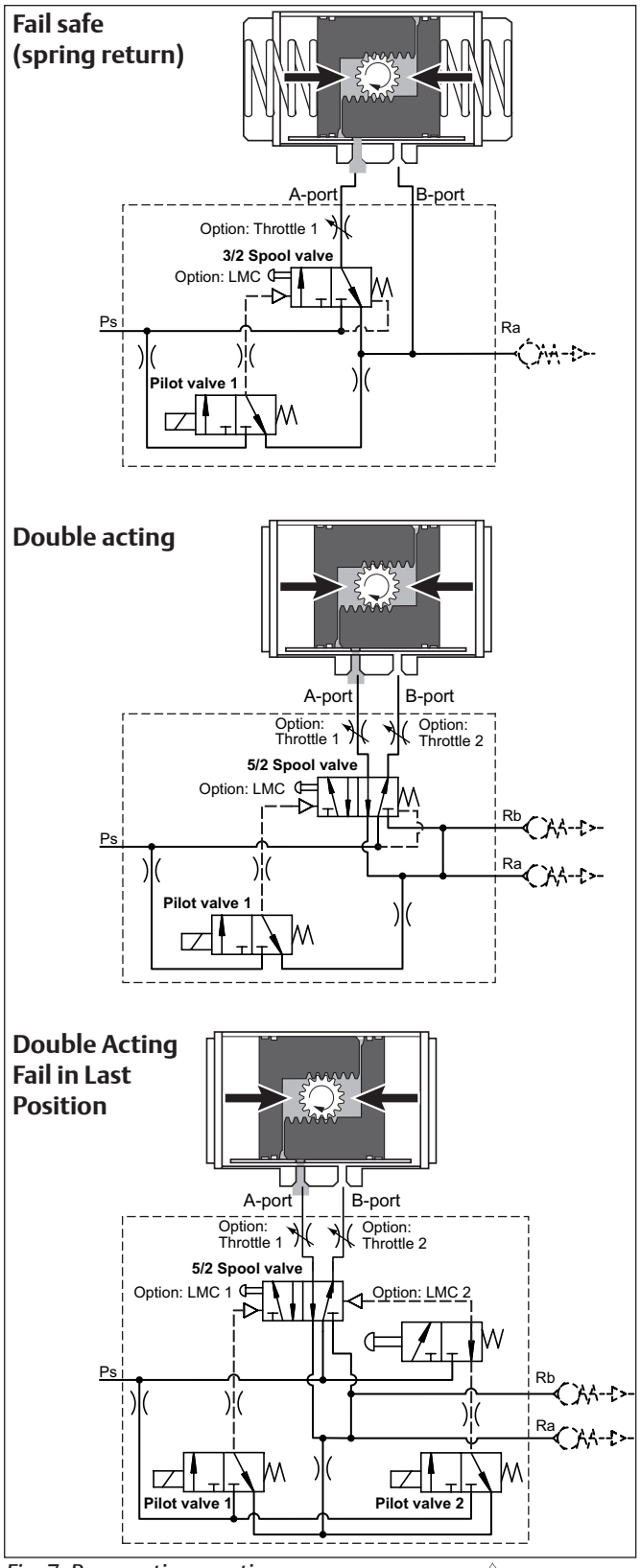


Fig. 7. Pneumatic operation

Position feedback

Switch cartridges

The position feedback is achieved by switch cartridges in the module. These cartridges contain switching elements which sense the open or closed position and are pre wired to the AS-I cartridge (see fig 5 and 6). These easily exchangeable switch cartridges are available with mechanical or proximity switching elements.

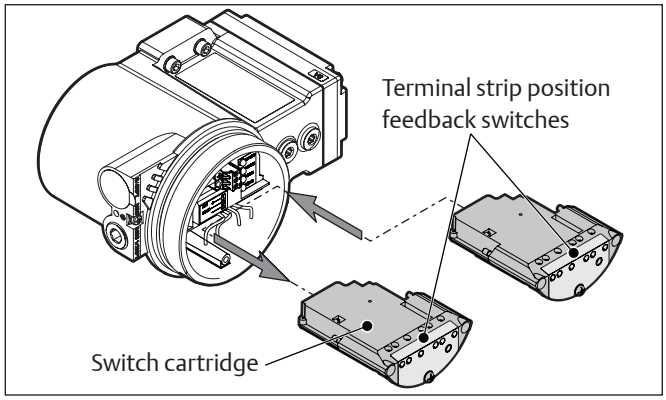


Fig. 8. Switch cartridges

Mechanical switches

Table 2: Mechanical switches

Specification	Description
Option code	G (gold contacts)
Type	Mechanical
Contacts	NO and NC
Temperature range	-25°C to +60°C / -13°F to +140°F

2-Wire Proximity switches

Table 3: 2-wire NAMUR proximity switches

Specification	Description
Option code	N
Type	2-wire inductive, normally closed
Temperature range	-25°C to +60°C / -13°F to +140°F
Compliant to	DIN EN 60947-5-6 (NAMUR)

Note:

1. The switch cartridge is internal powered by AS-i cartridge, external power/wire for switch signal is not required.

Non-Intrusive switch point adjustment

If required the switches can be adjusted without opening the module. This, so called, Non-Intrusive switch adjustment is located at the front of the module behind a locable (1) shield (2). Two adjustment screws are available for adjusting the Closed (3) and Open (4) position indication.

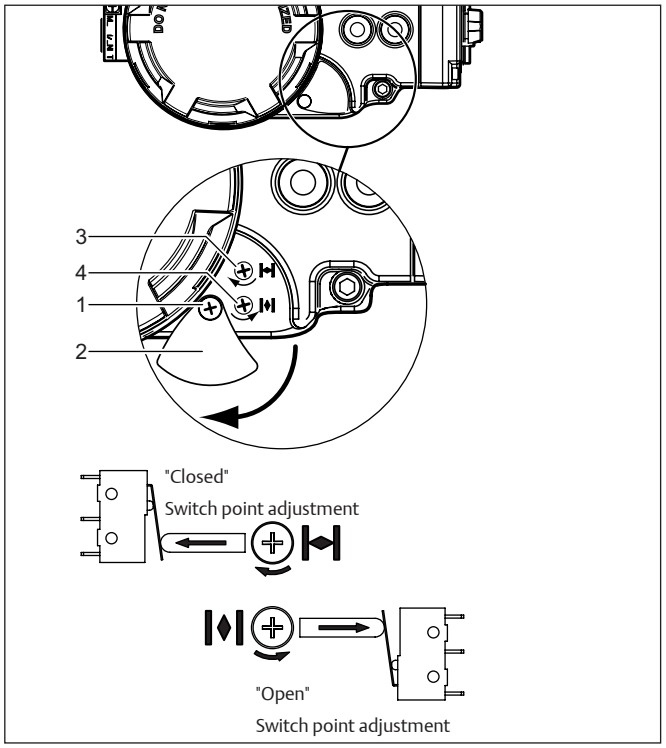


Fig. 9. Non-Intrusive switch point adjustment

Important:

- The above "Closed" and "Open" marked adjustment screws will adjust the valve's "Closed" or "Open" switch point, if the valve closes after a Clock Wise (CW) rotation.
- If the valve closes after a Counter Clock Wise (CCW) rotation, the "Closed" marked adjustment screw will adjust the "Open" switch point. Similar, the "Open" marked adjustment screw will adjust the "Closed" switch point.

Control Module Options

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the QC40 control module can be supplied with one or two Manual Control options. These can operate the spool valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see page 7

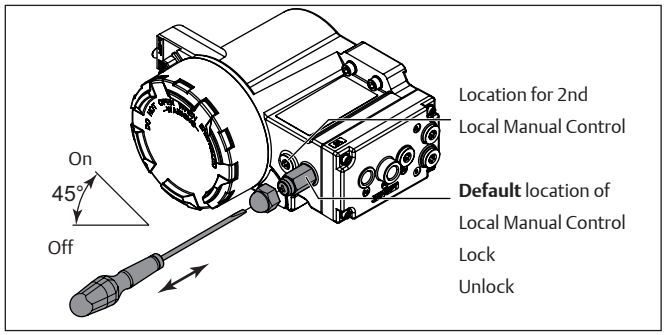


Fig. 10. Local Manual Control option

Speed Control

Description

The QC40 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

1 Nut cover
2 Main throttle with set screw.

Notes:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.

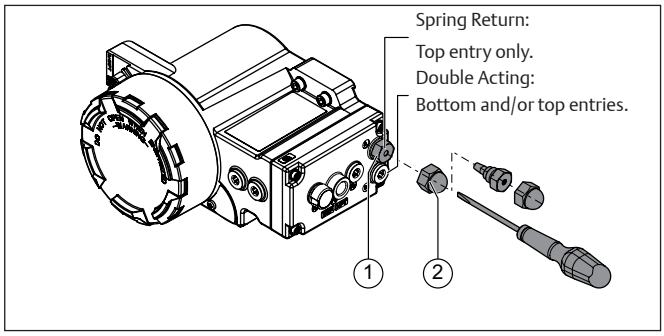


Fig. 11. Speed control options

Hazardous area executions

Control Module QC40 with AS-I bus communication is available with optional Non-Incendive/Non Sparking (NI) approvals as listed below:

IECEx

Certificate No.: IECEx DEK 16.0061 X

Non-Sparking

Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

ATEX

Certificate No.: DEKRA 16ATEX0100 X

Non-Sparking

CE

Ex II 3 G Ex nA IIC T4 Gc
Ex II 2 D Ex tb IIIC T80°C Db

FM

Certificate No.: FM16US0367X

Non Incendive

- Class I, II, III, Division 2, Groups ABCDEFG, T4,
- Class 1, Zone 2 AEX nA IIC T4 Gc

CSA

Certificate No.: CSA 17CA70125362X
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex nA nC IIC T4 Gc
Ex tb IIIC T80°C Db

INMETRO

Certificate No.: IEx 17.0084X

Non-Sparking

Ex nA IIC T4 Gc IP66
Ex tb IIIC T80 °C Db IP66

Ambient temperature:
T4 @ Ta = -25°C...+60°C IP66/Nema 4X

Wiring and Quick Connectors

AS-I Bus terminal wiring

The QC40 module can be connected to the system by hard wiring the module to the terminals The QC40 Module can optionally be equipped with prewired quick connectors. Two versions are available: 7/8" or M12 (male chassis part).

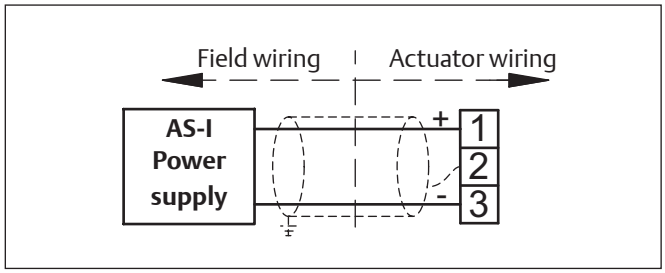


Fig 12. QC40 AS-I module wiring

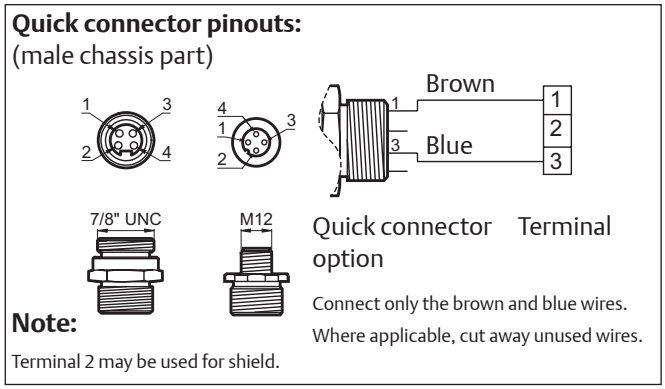


Fig 13. QC40 AS-I module quick connector pinouts

Wiring for hazardous areas

Detailed safe area, Intrinsically safe or Non-Incendive/ Non-Sparking wiring instructions, will be shipped with the product, see Installation Guide : DOC.IG.BQC40.1

Quick connectors

Quick connectors, as shown are excluded for non-Incendive or non-sparking use in hazardous area's classified as Zone 2 or 22 or Cl I, II, III, Div. 2.

Wiring dimensions

Solid wire: 2.5mm^2 max.
Stranded wire: 0.2-3.3mm^2 or 24-12 AWG

Current

Minimum: 34 mA at 26.5V and 25°C
Maximum: 140 mA at 26.5V and 25°C
Nominal: 101 mA at 26.5V and 25°C to 60°C
Protection: Short circuit detection.

Integrated Control modules

QC54 with FOUNDATION™ Fieldbus digital communication.

Features:

- **Basic actuator functions for:**
  - Spring return applications, or
  - Double acting applications or,
  - Double acting Fail in Last Position applications.
- **Suitable for all Q-Series actuator sizes.**
- **FOUNDATION™-Fieldbus digital communication.**
- **IPT-technology (Intelligent Position Tracking).**
- **Initialization by FOUNDATION™- Fieldbus or Push Button for easy setup of the actuator.**
  - Press and confirm press the "Auto-Init" button starts auto-initialization procedure.
  - Initialization sets automatically the switch points for the position feedback of the actuator.
  - Initialization checks if the actuator and control module configuration match. This procedure will detect the action type (Fail-Open, Fail-Close or Fail in last position) and generate an alert if there is a configuration issue.
- **Readjustable or Reversible position feedback using the re-reassignment buttons or by FOUNDATION™ Fieldbus.**
- **Adjustable switch points can be adjusted from 5% to 30% before the end of the stroke by FOUNDATION™ Fieldbus.**
- **Three indication LED's for "Status", "Open" and "Closed" position. Status LED indicates:**
  - Initialization procedure running (blinking),
  - Successful initialization procedure (LED is on) or
  - No or failed initialization (flashing) or
  - A particular unit in the field.
- **Control Module can be easily mounted to the actuator**

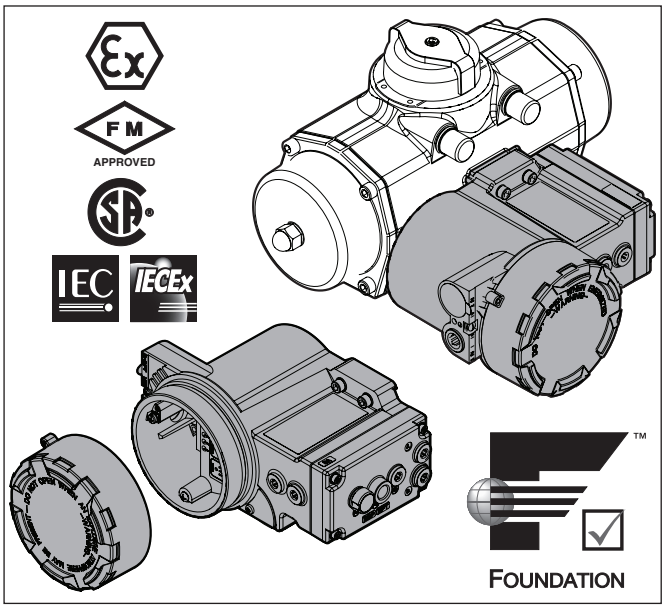


Fig. 1. Control module QC54 with FOUNDATION™-Fieldbus bus communication

- **Available as "Weather Proof" for indoors or outdoors use.**
  - The robust aluminum alloy enclosure (IP66/NEMA4X rated), protects the IPT system, pneumatic components, the feedback switches and terminals and makes it suitable for indoor and outdoor use.
    The hazardous area versions are available with:
  - **ATEX or IECEx** Ex ia or Ex nA approvals for use in Zone 1, 2, 21 and 22
  - **CSA or FM** Intrinsically safe or Non-Incendive approvals for use in Class I, Division 1 or Class I, Division 2.
- **Lockable Control Module cover.**
- **One larger entry (3/4"NPT) is available for larger multi-core cables on imperial units.**

BETTIS™

EMERSON™

Description:

This Q-Series QC54 Control Module offers an integrated concept for valve automation. Its compact and robust construction incorporates basic control and feedback functionality and communicates through the FOUNDATION™ Fieldbus protocol.

Construction:

All electrical and pneumatic control components are located inside one module housing making it a compact and robust construction incorporating basic control and feedback functionality and is suitable for indoor and outdoor use.

The Control Module is mounted at the side of the basic actuator housing. Inside, wiring terminals are available for connecting the FOUNDATION™ Fieldbus signals. Two cable entries are available.

One pneumatic connection is available to feed the control module. The pilot valves inside the control module are used to send the actuator to its open or closed position.

These modules are available with ATEX, IECEx or Inmetro certification for use in Zone 2, 21, and 22, and additionally CSA or FM certified for use in Class I, Division 2.

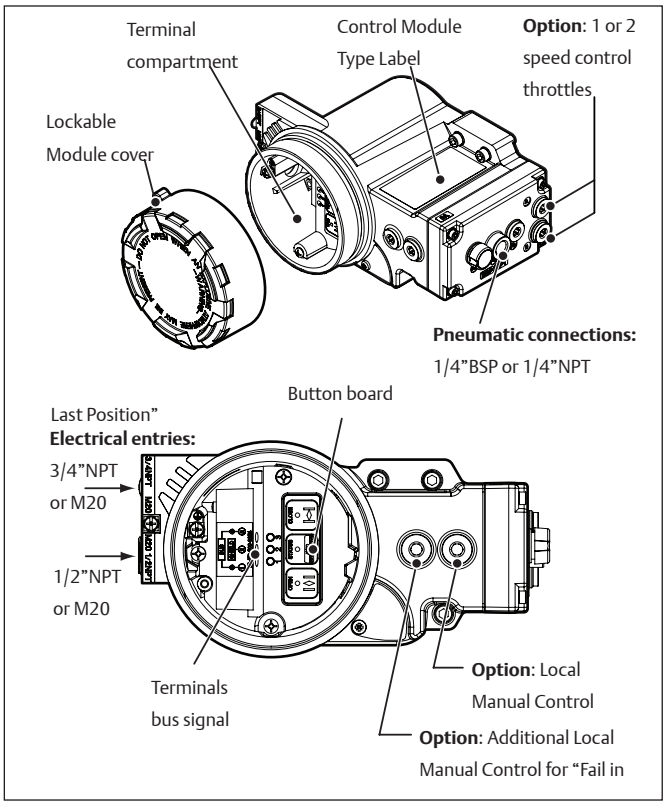


Fig. 2. Control module overview

General specifications:

Material housing:	Aluminium alloy
Operating media:	Air or inert gasses, filtered at 5µm
Pneumatic entry:	Metric units: G1/4" Imperial units: 1/4"NPT
Electrical connections :	Internal 3 pole terminal strip for bus signal Internal and external earth connection Optional quick connectors: 7/8" or M12 connector (see page 9)
Cable entries:	Metric units: 2x M20x1.5 Imperial units: 1/2" and 3/4"NPT
Enclosure:	Rated IP66 - NEMA4X
Switch points:	Factory set at 15° before each end of travel (open and closed position).
Adjustable range:	Between -3° to 15° and +75° to +93° of the end position.
Finish:	Chromated with polyurethane based coating.
Temperature range:	-20°C to +50°C (-4°F to +122°F)

Dimensions:

Metric:	See data sheet 1.603.08
Imperial/UNC:	See data sheet 1.603.09
DIN 3337:	See data sheet 1.603.10

Electrical safety requirements:

Use:	In- and outdoor.
Altitude:	Operating full power available up to 2000 meter (6000 feet).
Maximum relative humidity:	80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).
Mains supply fluctuation:	Up to ±10% of nominal voltage
Over voltage category:	II
Pollution degree:	2 (3 when the cover remains closed)

Communication Protocol:

Protocol :	FOUNDATION™-Fieldbus
Transmission :	H1, IEC 61158-2
Maximum current :	18mA from bus
Required external : protection current	Restrict the power supply to <600mA.

Function blocks

The Control Module provides the following function blocks:
- Resource Block (RB)
- Transducer Block (TB)
- Analog Input (AI) Function Block
- Discrete Output (DO) Function Block
- 2x Discrete Input (DI) Function Block
- PID Function Block

Diagnostics and Alerts

Standard FOUNDATION™- Fieldbus diagnostics and alerts provided meets Emerson PlantWeb Alerts standard.
Applicable diagnostics include:
- Travel times for the Open stroke, Close stroke and Average travel times.
- Cycle Counters for Control Module, Pneumatic Module, Actuator and Valve
- Time in Position
- Various internal electronic health tests.
- Instrument temperature.

For more detailed information on diagnostics see page 10 and 11.

Pneumatic control

Pneumatic control variations

The Control Module contains all the necessary pneumatic components to control the actuator and control the incoming and outgoing airflow. Pneumatically the modules are available for three applications:

1. Spring return or
2. Double acting or
3. Double Acting - "Fail-in-Last-Position".

To achieve these functions, each Control Module can be fitted with one or two pilot valves depending on the required functionality:

1. One pilot valve is default and suitable for normal operation of double acting or spring return actuators
2. Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

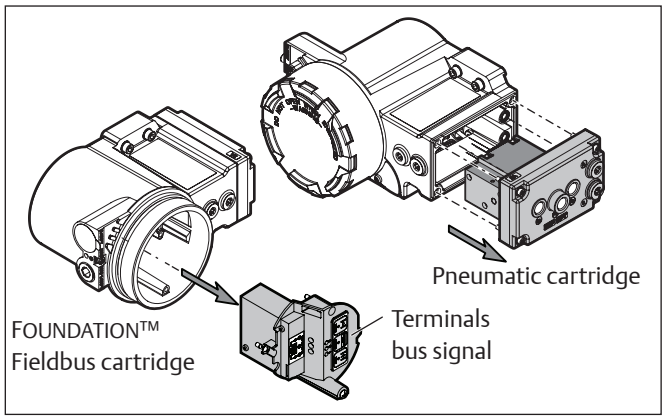


Fig. 3. Pilot valve and pneumatic cartridge

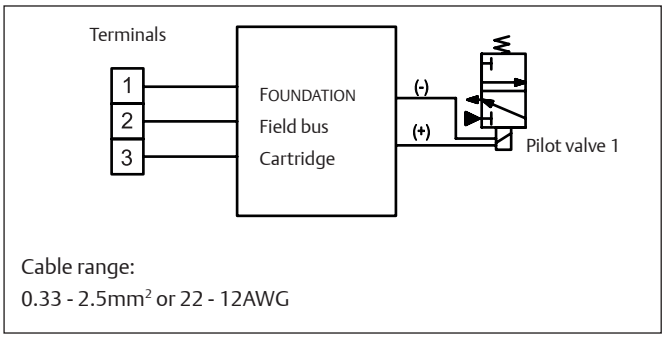


Fig. 4. One pilot valve and wiring connections for standard Double Acting or Spring Return applications

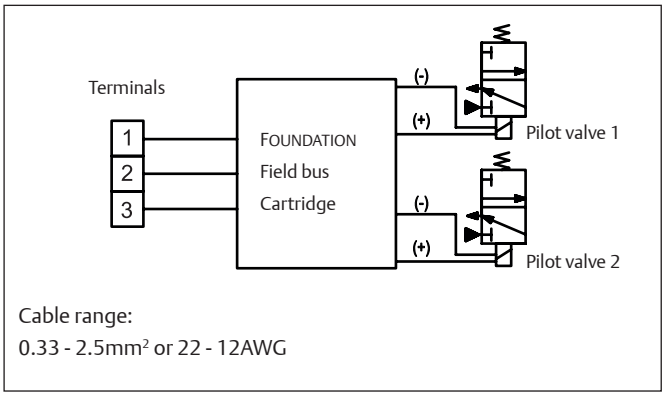


Fig. 5. Two pilot valves and wiring connections for Double Acting "Fail in Last Position" applications

Pneumatic components

The pneumatic components inside the module consist out of one or two pilot valves and a 3/2 spool valve or 5/2 bistable spool valve. The spool valves are pneumatically operated by the pilot valves.
To assure trouble-free operation, the spool valves are equipped with big ports. This enables a large air flow and makes it less sensitive for contamination of the internals. The large air flow also fast cycle times and enables it to be utilized for the entire Q-Series Series actuator range.

Internal corrosion protection:

The spring return models have standard a built in “Breather” function. During the spring stroke, the exhaust air from the center chamber (A-Port) is first fed to the spring chamber (B-port) preventing air from outside from being sucked into the spring chamber. This reduces the possibility of internal corrosion and maximizes the actuators’ working life.

Pneumatic options

Speed Control

The QC54 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously.

Silencers and vents

The exhaust ports Ra and Rb on the module are shipped from the factory with transport protection.
The module can be equipped with either silencers or vents.

Manual Control

For commissioning, emergency or maintenance purposes, the QC54 control module can be supplied with Manual Control options. These options can operate the actuator when there is air pressure available, but no control signal or power supply.

- For normal operation the module should be fitted with one Manual Control.
- For Double Acting with a Fail-in-Last-Position function, two Manual Control can be fitted.

Maximum Flow rates of Q-Series modules

The maximum flow rates depends mainly on the flow rates of the Bettis Q-Series modules. You can use Kv 0.28 (m_3/h) of Cv value of 0.33 (US gall/min 1Psi) for approximate operating speed calculations.

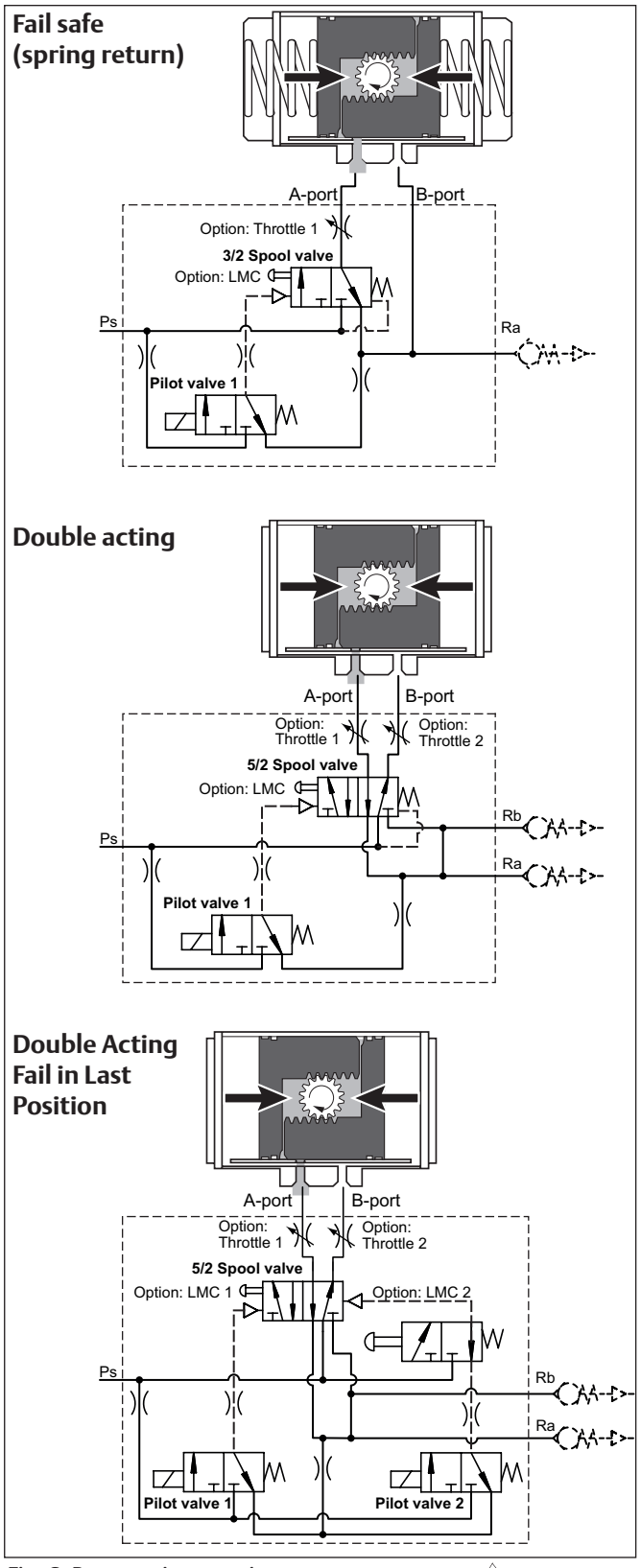
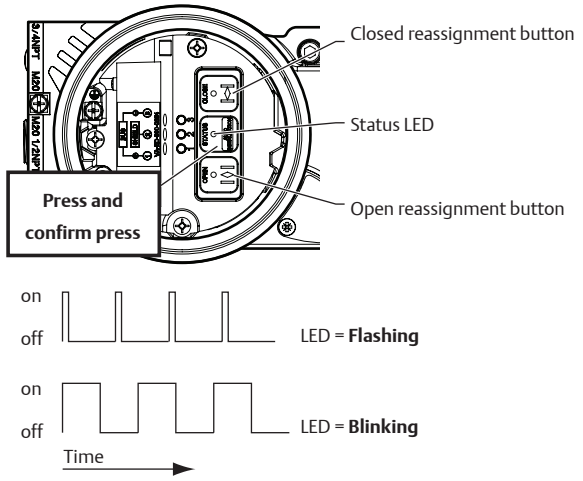


Fig. 6. Pneumatic operation

Switch point setting

The QC54 control modules are equipped with a button board that allows you to set or readjust the switch points for the position feed back.



* The default setting of The reassignment buttons is: enabled when the unit is in “Out of Service”.

* ”Open” and “Closed” LED are disabled.

Fig. 7. Button board

Button board functions:	
Initialization button:	Start Auto-Initialization procedure
Close button:	Re-adjustment of the "Closed" switch point
	Set to factory settings
Open button:	Re-adjustment of the "Closed" switch point
	Set to factory settings

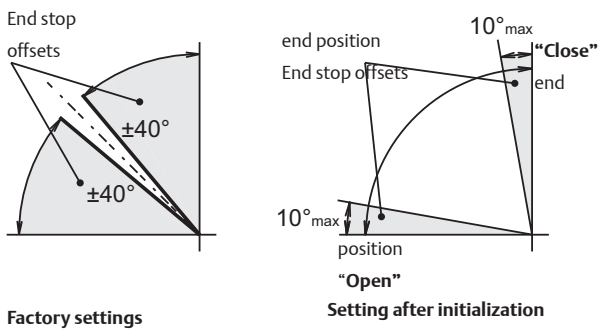


Fig. 8. Switch point setting

Auto-Initialization

Initialization sets automatically the switch points for the position feedback of the actuator and checks if the actuator and control module configuration match. This procedure will detect the action type (Fail-Open, Fail-Close or Fail in last position) and generate an alert if there are configuration issues.
This process is done automatically, by the module, however, the user must start it and the unit must be wired and powered.
Digital communication is not required but power supply is necessary (9V to 32V DC). The initialization process can be started in one of two ways:

1. Initialization using the local buttons (see fig. 7).
2. Initialization using a bus command (see Reference manual QC54, DOC.RM.QC54.E)

Indication LED's

Three indication LED's for "Status", "Open" and "Closed" position are available. The status LED indicates:
- Initialization procedure running (blinking),
- Successful initialization procedure (LED is on) or
- No or failed initialization (flashing)

Recognize Function

An additional function of the Status LED is the recognize function. To recognzie a particular unit in the plant, the "Recognizing LED" function can be activated in the transducer block. When this function is activated, the Status LED will blink for 300 seconds (5 minutes).

Changing Switch Point Setting

Readjustment of switch points

When switch point re-adjustment is required but it is not allowed that the actuator/valve unit cycles, the new switch point can be set by pressing the corresponding "Open" or "Closed" button.

Factory settings

Pressing both the Open and Close reassignment buttons, while powering up, will set the module back to its factory settings.

Control Module Options

Local Manual Control

Description

For commissioning, emergency or maintenance purposes, the QC54 control module can be supplied with one or two Manual Control options. These can operate the pilot valve(s) inside the module and as such operate the actuator, when there is air pressure available, but no control signal or power supply.

Notes:

- One Local Manual Control is required for normal operation of Double acting or Spring return actuators.
- For Double acting actuator with a Fail-in-last position function, a second Local Manual Control can be mounted.
- These options can be ordered together with the Control Module or as a kit to be mounted later.
- For option ordering codes, see data sheet BQ1.607.01

Speed Control

Description

The QC54 control module can be supplied with a Speed Control option. One throttle is required for Spring Return actuators and up to two for Double Acting actuators.
The speed control throttle controls the air flow in and out of an air chamber and as such limits the speed of the “Opening” and “Closing” stroke simultaneously. This throttle consists of :

1. Nut cover
2. Main throttle with set screw.

Note:

- For Spring Return actuators with one speed control throttle, it is not possible to set both the stroke cycle times to an equal time.
- Four Double Acting actuators it is possible to mount two speed control throttles.
- The actual stroke cycle times depend on the actual load on the actuator during the different strokes.

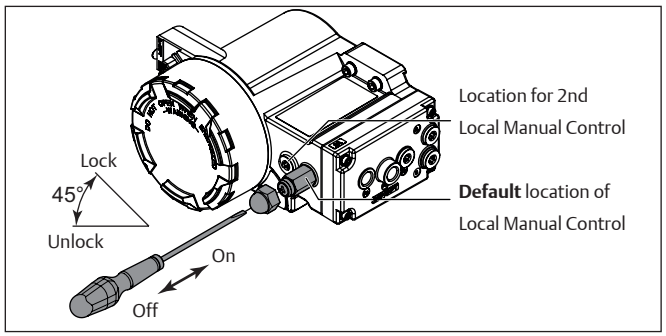


Fig. 9. Local Manual Control option

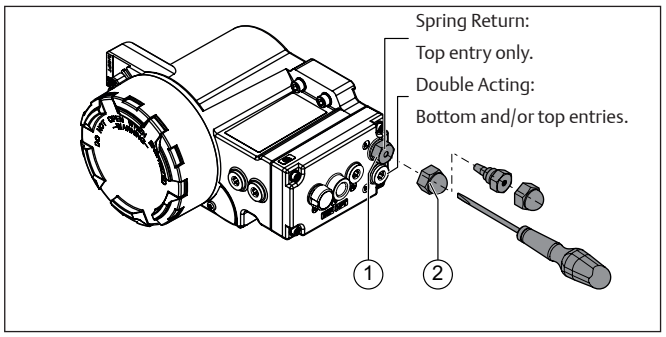
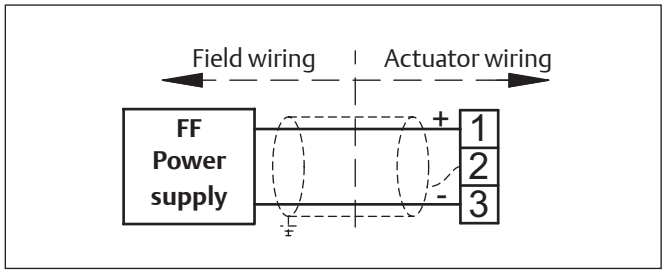


Fig. 10. Speed control options

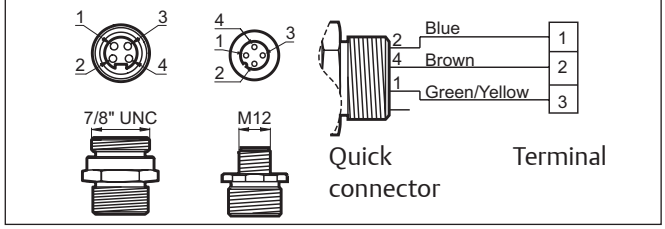
Wiring and Quick Connectors

FOUNDATION™ Fieldbus terminal wiring

The QC54 module can be connected to the system by hard wiring the module to the terminals The QC54 Module can optionally be equipped with prewired quick connectors. Two versions are available: 7/8" or M12 (male chassis part).



Quick connector pinouts:
(male chassis part)



Wiring for hazardous areas

Detailed safe area, Intrinsically safe or Non-Incendive/ Non-Sparking wiring instructions, will be shipped with the product, see Installation Guide : DOC.IG.BQC54.1

Quick connectors

Quick connectors, as shown are excluded for non-Incendive or non-sparking use in hazardous area's classified as Zone 2 or 22 or Cl I, II, III, Div. 2.

Wiring dimensions

Solid wire : 2.5mm^2 max.
Stranded wire : 0.33 - 2.5mm^2 or 22 - 12 AWG

Hazardous area executions

Control Module QC54 with FOUNDATION™ Fieldbus is available with optional intrinsically safe (IS) or Non-Incendive/ Non Sparking (NI) approvals as listed below:

IECEx

Certificate No.:
IECEx DEK16.0032X

Intrinsically safe *
Ex ia IIC T4 Ga
Ex ia IIIC T80°C Da
Ex ic IIC T4 Gc

Non-Sparking
Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

ATEX

Certificate No.:
DEKRA 16ATEX0064X

Intrinsically safe *
Ⓔx II 1 G Ex ia IIC T4 Ga
Ⓔx II 1 D Ex ia IIIC T80°C Da
Ⓔx II 3 G Ex ic IIC T4 Gc

Non-Sparking
Ⓔx II 2 D Ex tb IIIC T80°C Db
Ⓔx II 3 G Ex nA IIC T4 Gc

FM

Certificate No.:
FM16US0367X

Type 4X

Intrinsically safe *
- Intrinsically safe,Class I, II, III Div.1, Groups ABCDEFG, T4, Type4/IP66
- Class 1, Zone 1, AEx ia IIC T4

Non Incendive
- Class I, II, III, Division 2, Groups ABCDFG, T4
- Class 1, Zone 2, Group IIC T4

CSA

Certificate No.:
CSA 17CA70167494X

Intrinsically safe *
Class I, Division 1, Groups A, B, C and D T4;
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex ia IIC T4 Ga
Ex ia IIIC T80°C Da
Ex ic IIC T4 Gc

Non Incendive
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

INMETRO

Certificado: IEx 17.0085X
Intrinsically safe *
Ex ia IIC T4 Ga IP66
Ex ia IIIC T80 °C Da IP66
Certificate No.: IEx 17.0085X
Non Incendive
Ex nA IIC T4 Gc IP66
Ex tb IIIC T80 °C Db IP66

Ambient temperature:
T4 @ Ta = -20°C...+50°C IP66/nema 4x

Note:
* The assembly of a Q-Series Actuator with the intrinsically safe QC54 Control Module, may be used in (ATEX) classified Zones 1, 2 (Gasses) and/or 21, 22 dust (Dust).

FISCO systems
The Q-Series QC54 is suitable for use in a FISCO system in accordance with IEC 60079-27

BETTIS™

EMERSON™

Diagnostics and PlantWeb Alerts

QC54 FOUNDATION™ Fieldbus

Diagnostics

The Q-Series QC54 Control Module with FOUNDATION™ Fieldbus communication has diagnostic capabilities. These process parameters can give information about communication condition, valve and/or actuator unit. It enables to predict failures in advance and makes maintenance easier to schedule. The following diagnostics are available for the QC54 control module:

1. **Timer parameters:**
   1. Open and Closed travel time
   2. High and low limits of Open and Closed travel time
   3. Average travel times of last 30 strokes of Open and Closed travel.
   4. High and low limits of average Open and Closed travel time
2. **Cycle Counters**
   1. Control Module - Counts how many times the Control Module cycles (read only).
   2. Pneumatic Module - Counts how many times the Pneumatic Module cycles.
   3. Actuator - Counts how many times the actuator cycles.
   4. Valve - Counts how many times the valve cycles.
3. **Time In Position**
4. **Various internal electronic health tests**

PlantWeb Alerts

PlantWeb Alerts are alerts that have been predefined and categorized for the user. These device alerts can be used to help troubleshoot the instrument (see also page 4). There are three categories:

- **Failed alerts,**
  A failed alert indicates a failure within the device that will make the device, or some part of the device, non-operational.
- **Maintenance alerts**
  A maintenance alert indicates that the device, or some part of the device, needs maintenance soon.
- **Advisory alerts**
  An advisory alert indicates a condition that does not have a direct impact on the device's primary function. If the condition is ignored, the device will eventually fail.

These alerts, when enabled, can participate in the DeltaV alarm interface tools such as the alarm banner, alarm list, and alarm summary.

Diagnostics and PlantWeb Alerts

Alerts & recommended actions									
Alerts			Alert default setting						
			Advisory		Maintenance		Fail		
Parameter name	DeltaV text	Recommended actions	enable	mask (show)	enable	mask (show)	enable	mask (show)
Internal alerts									
bad_position_sensor	Bad Position Sensor Error	Feedback problem, replace control module when possible	n	n	y	y	n	n
bad_temperature_sensor	Bad Temperature Sensor Error	Temperature sensor problem, replace Control module when possible	n	n	y	y	n	n
system_temperature_exceeded	System Temperature Exceeded	Take corrective actions to bring temperature within specified range.	n	n	y	y	n	n
software_error	Software Error	Software error has been detected, replace control module when possible.	n	n	y	n	n	n
travel_deviation	Travel Deviation	Lost position, Check air pressure	y	y	n	n	n	n
shutdown_is_set	Shutdown Is Set	Internal communications problem, check shutdown configuration for restart, Replace Control module.	n	n	n	n	y	y
pilot valve_error	Pilot valve error	pilot valve number mismatch or pilot valve failure has been detected	n	n	y	y	n	n
Buttonboard_error	Buttonboard Error	Error is undefined, replace control module when possible	n	n	y	n	n	n
Counter alerts									
cm_life_exceeded	Control Module Life Cycle Exceeded	Control module life cycle exceeded, replace control module	n	n	y	y	n	n
pm_life_exceeded	Pneumatic Module Life Cycle Exceeded	Pneumatic module life cycle exceeded, replace pneumatic module.	n	n	n	n	n	n
act_life_exceeded	Actuator Life Cycle Exceeded	Actuator life cycle exceeded, replace actuator.	n	n	n	n	n	n
valve_life_exceeded	Valve Life Cycle Exceeded	Valve life cycle exceeded,valve requires maintenance.	n	n	n	n	n	n
Timer alerts									
time_in_position_exceeded	Time in position exceeded	Time in position exceeded, take appropriate action.	n	n	n	n	n	n
open_travel_time_exceeded	Open travel timer exceeded	Open travel timer exceeded, check valve system.	n	n	n	n	n	n
close_travel_time_exceeded	Close travel timer exceeded	Close travel timer exceeded, check valve system.	n	n	n	n	n	n
Initialization alert									
assembly error	Assembly error	pneumatic function mismatch, check module and actuator configuration	n	n	y	y	n	n
initialization_failed	Initialization Failure	Device failed initialization; Check airpressure, check actuator sizing, check valve system	y	y	n	n	n	n

Alerts & recommended actions (continued)									
Alerts			Alert default setting						
			Advisory		Maintenance		Fail		
Parameter name	DeltaV text	Recommended actions	enable	mask (show)	enable	mask (show)	enable	mask (show)	
Internal IO failure alert									
io_failure	Internal Io Failure	Internal communications are lost, device will act according to shutdown configuration.	y	y	n	n	n	n	
rb_NV_write_deferred	Output Board NV Memory Failure	NV Write Deferred: A high number of writes has been detected to non-volatile memory. To prevent premature failure of the memory, the write operations have been deferred. The data will be saved about every 3 hours. This condition usually exists because a program has been written that writes to control block parameters not normally expected to be written to on a cyclic basis. Any such automated write sequence should be modified to write the the parameter(s) only when needed. It is recommended that you limit the number of periodic writes to all static or non-volatile parameters such as HI_HI_LIM, LOW_CUT, SP, TRACK_IN_D, OUT, IO_OPTS, BIAS, STATUS_OPTS, SP_HI_LIM, and so on.	n	n	n	n	y	y	
PWA_simulate_active	PWA Simulate Active	If PWA simulate mode has been activated. The PWA active parameters can now be written as well as the resource block detailed status parameters and the internal alerts in the Transducer Block where the PWA active alarms originate from.	n	n	n	n	y	y	
rb_nv_memory_failure	Output Board NV Memory Failure	"Output Board NV Memory Failure: Non-volatile EEPROM data corruption was detected on the Fieldbus Electronics Board. Default values were loaded into the faulty block. 1. Check the device configuration for changes in the block parameter values. 2. Reset the device to clear the error. 3. Download a Device Configuration. NOTE: If the failure reoccurs it may indicate a faulty EEPROM memory chip."	y	y	n	n	n	n	
rb_nv_electronics_failure	Output Board Electronics Failure	Output Board Electronics Failure:	y	y	n	n	n	n	
		The Device has detected a fault with an electrical component on the Fieldbus Electronics Module Assembly. Replace the Device.							
diag_opt_PWA_simulate	PWA Simulate								
func_opt_simulate	Simulate Switch	Since the hardware simulate switch may be impractical to access, a software option is being provided.							
misc_opt_base_record	Base Record	When the base record option is enabled, operator can write/read parameters to/from the sensor board that are not available via the FF parameter list.							

Namur NE-107 Alarms

This section describes the parameter interaction to implement a Bettis Q-Series QC54 Control module to the NAMUR NE-107 requirements as a parameter group in the Resource Block. There are four alarm categories defined as per the NE-107 specification, Failed, Off Specification, Maintenance, and Check function.

Maintenance Although the output signal is valid, the wear reserve is nearly exhausted or a functions will soon be restricted due to operational conditions e.g. build-up of deposits.

Off Specification Off-spec means that the device is operating outside its specified range or an internal diagnostic indicates deviations from measured or set values due to internal problems in the device or process characteristics (e.g. bubble formation in flow metering or valve sticking).

Check Function Output signal temporarily invalid (e.g. frozen) due to on-going work on the device.

Failed Output signal invalid due to malfunction in the field device or its peripherals.

Each of these categories share 32 conditions that can be defined by the device manufacturer. Each condition may be mapped or not mapped for each category. If a condition is mapped then it is indicated in the * ACTIVE parameter. If the condition in the * ACTIVE parameter is not masked by the corresponding bit in the *_MASK parameter then the condition will be queued for broadcast using the corresponding *ALM parameter at the associated priority indicated by *PRI parameter. The 4 categories are defined below.

The conditions are not expected to identify explicitly the root cause of the condition, but rather to identify it in terms of:

- Replace the device
- Replace a part of the device
- Correct a configuration problem
- Fix something outside of the device

The above list is all that the operator needs to know to restore his process functionality and if there are more than 31 device conditions they should be grouped by definition into these bit

Parameter Mnemonic	Obj Type	Data Type/ Structure	Use/Model	Store	Size	Valid Range	Initial Value	Permission	Other	Range Check
FD_CHECK_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_CHECK_ALM	R	DS-87	C/Alarm	D	15					
FD_CHECK_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_CHECK_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_CHECK_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_EXTENDED_ACTIVE_n	S	Bit String	C/Contained	D	4				Read only	
FD_EXTENDED_MAP_n	S	Bit String	C/Contained	S	4					
FD_FAIL_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_FAIL_ALM	R	DS-87	C/Alarm	D	15					
FD_FAIL_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_FAIL_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_FAIL_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_MAINT_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_MAINT_ALM	R	DS-87	C/Alarm	D	15					
FD_MAINT_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_MAINT_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_MAINT_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_OFFSPEC_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_OFFSPEC_ALM	R	DS-87	C/Alarm	D	15					
FD_OFFSPEC_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_OFFSPEC_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_OFFSPEC_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_RECOMMEN_ACT	S	Unsigned16	C/Contained	D	2	1 – manf spec	0		Read only	
FD_SIMULATE	R	DS-89	C/FD Simulate	D	9		disabled			
FD_VER	S	Unsigned16	C/Contained	S	2				Read only	

Bettis Q-Series valve actuator

Parts and materials - Actuator

Description	Qty.	Description	Specification	Notes
Body	1	Aluminum Alloy	EN AC-AlSi10Mg (Cu)	1/5
Pinion	1	Aluminum Alloy	EN AW 7075 T6	2
Upper pinion part	1	Aluminum Alloy	EN AW 7075 T6	2
Guide band housing	2*	Nylatron	PA6.6 + MoS2	-
Washer pinion	2*	CRMZX100	-	-
Bearing ring	2*	Delrin®	POM	-
Limit stop cam	1	Steel	42CrMo4V	-
Piston	2	Aluminum Alloy	EN AC-AlSi7Mg	6
End cap QS	2	Aluminum Alloy	EN AC-AlSi7Mg	1
End cap QD	2	Aluminum Alloy	EN AC-AlSi7Mg	1
Guide band piston	2*	PTFE, Carbon filled	PTFE + 25% C	-
O-ring piston	2*	Nitrile Rubber	NBR	-
O-ring end cap	2*	Nitrile Rubber	NBR	-
O-ring upper pinion part	1*	Nitrile Rubber	NBR	-
O-ring pinion top	1*	Nitrile Rubber	NBR	-
O-ring pinion bottom	1*	Nitrile Rubber	NBR	-
O-ring B-port	2*	Nitrile Rubber	NBR	-
O-ring retainer bolt	4*	Nitrile Rubber	NBR	-
O-ring limit stop bolt	2*	Nitrile Rubber	NBR	-
Outer spring	2	Carbon Spring Steel	EN 10270-1 SH	3
Middle spring	2	Carbon Spring Steel	EN 10270-1 SH	3
Inner spring	2	Carbon Spring Steel	EN 10270-1 SH	3
Spring retainer	2	Steel	St. DC01 EN10139	4
Washer springpack	2	Steel	C35	4
Springpack retainer bolt	2	Stainless Steel	AISI 304 (DIN W nr 1.4301)	-
Washer	4*	Nylon	PA6	-
Nut	4	Stainless Steel	AISI 304 (DIN W nr 1.4301)	-
Nut cover	2	Polyethylene	PE	-
End cap screws	8	Stainless Steel	AISI 304 (DIN W nr 1.4301)	-
Retaining ring pinion large	1*	Carbon Spring Steel	C45, DIN 17200	3
Retaining ring pinion small	1*	Carbon Spring Steel	C45, DIN 17200	3
Limit stop screw	1	Stainless Steel	AISI 304 (DIN W nr 1.4301)	-
Indicator cap	1	Nylon	PA6	-
Indicator arrow	1	Nylon	PA6	-
Indicator insert	1	Nylon	PA6	-
Type plate	1	Stainless Steel	AISI 303 (DIN W nr 1.4305)	-
Hammer drive	1	Stainless Steel	AISI 303 (DIN W nr 1.4305)	-
Insert	1	Aluminum Alloy	EN AW 6082 T5	5

Notes

1 See Corrosion protection below
2 Hard anodized.
3 Deltatone® or Epoxy (black) coating.
4 Zinc plated and passivated.
5 Anodized.
6 Chromatized

Control & Pneumatic Modules

For material specification of the Pneumatic Modules see page 2

Corrosion protection

The applied paint system has passed a 1000 hour salt spray test as detailed by ASTM B117. For a detailed description of the Corrosion protection system see data sheet BQ1.606.05.

Repair kit

Parts marked with an * are included in the repair kit

BETTIS™

EMERSON™

Bettis Q-Series actuator

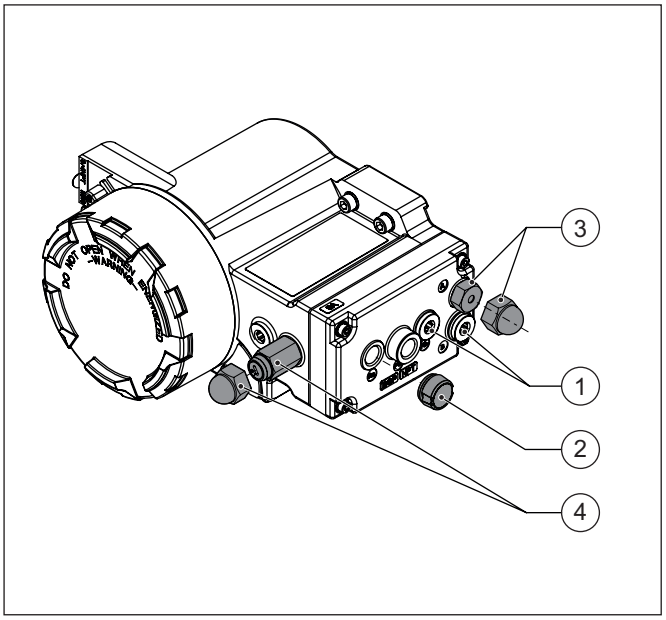
Parts and materials - Modules

Base Materials

Bodies:	Aluminium
Finish:	2 Component with an epoxy primer and polyurethane enamel top coating.
Pneumatic cartridge:	Aluminium
Valve seats	NBR
Fasteners	Stainless Steel

External parts

1. Plug	NPT:	Steel, Nickel plated
2. Exhaust	Base :	Nylon PA6
	Cover:	Zinc Nickel plated and transparent passivated
	Option:	Plastic silencer (nylon)
3. Speed Control:		Stainless Steel (AISI 303)
4. Manual Control:		Red anodized aluminum
5. Nut Covers:		Nylon PA6



Parts and materials - Modules

Bettis Q-Series valve actuator

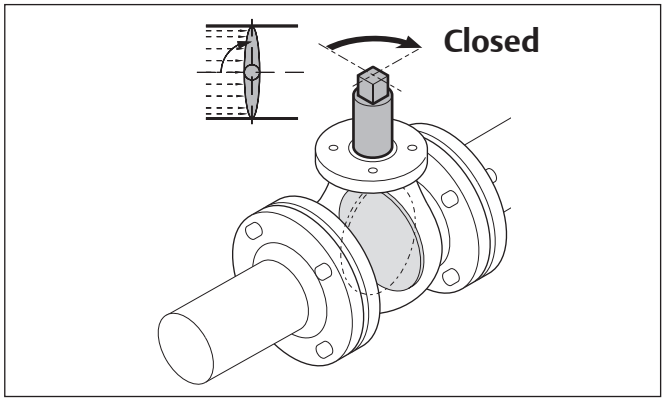
Failure modes

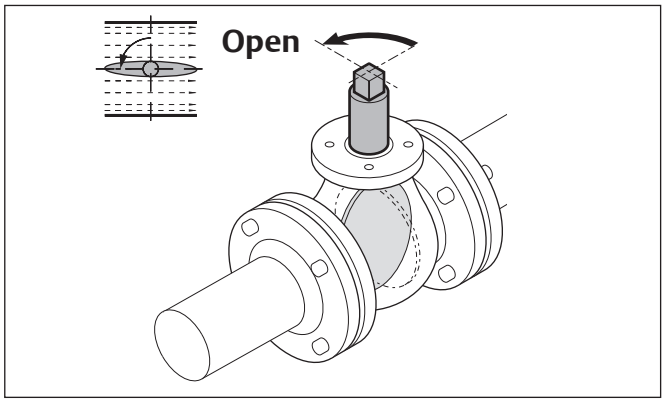
Valve rotation

Valves are normally manufactured so that:

1. The valve is closed : after a clock wise rotation*
2. The valve is open : after a counter clock wise rotation*

*) = views from above





Position after a failure

The position of the actuator after a failure depends on:
1. Principles of operation
   Spring Return or Double Acting
2. Actuator assembly code
   See BQ1.606.03 for Double Acting
   See BQ1.606.04 for Spring Return
3. Kind of failure See table.

Principle of operation:	Assembly code :	Kind of failure :	Position :
Double acting actuator	**CW**	Pressure	not defined
		Signal	Closed
		Supply voltage	Closed
	CC	Pressure	not defined
		Signal	Open
		Supply voltage	Open
Single acting actuator (Spring Return)	**CW**	Pressure	Closed
		Signal	Closed
		Supply voltage	Closed
	CC	Pressure	Open
		Signal	Open
		Supply voltage	Open

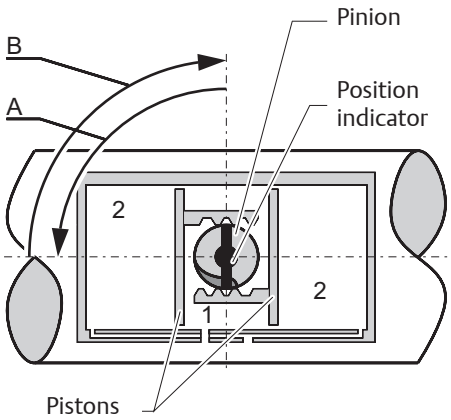
BETTIS™

EMERSON™

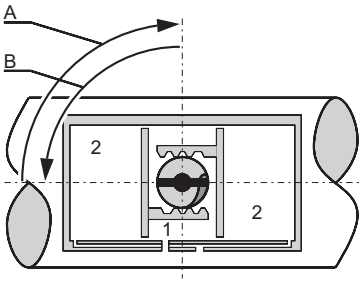
Actuator assembly codes

Double acting assembly codes

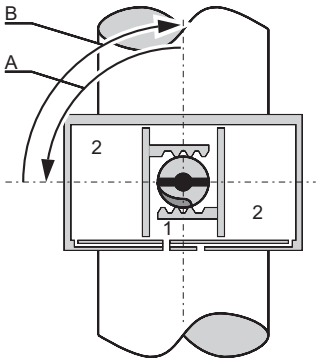
Standard assembly code: (= **Clock Wise** Rotation)	**CW**
Visual indicator mounted: (= for In line position indication	**I**



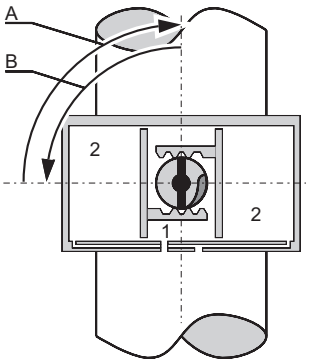
Optional assembly code: (= **Counter Clock Wise** Rotation)	**CC**
Visual indicator mounted: (= for In line position indication	**I**



Optional assembly code: (= **Clock Wise** Rotation)	**CW**
Visual indicator mounted: (= for Cross line position indication	**C**



Optional assembly code: (= **Counter Clock Wise** Rotation)	**CC**
Visual indicator mounted: (= for Cross line position indication	**C**



A = **Pilot valve operated** in Control Module
B = **Pilot valve not operated** in Control Module

- Central air chamber (1) pressurized
- End cap air chambers (2) pressurized

All views are from above. Pistons are shown in inner position

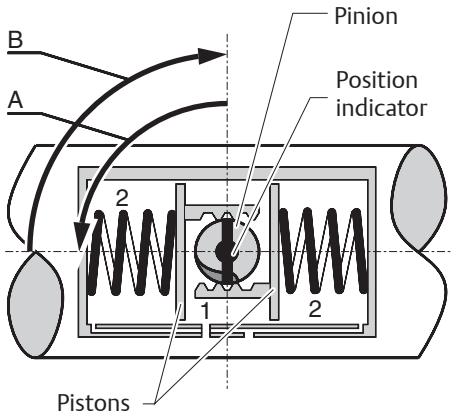
BETTIS™

EMERSON™

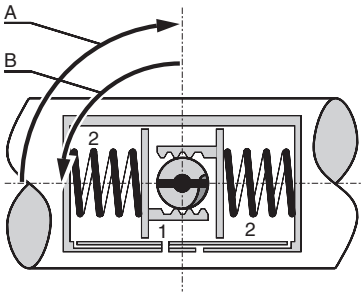
Actuator assembly codes

Single acting (Spring Return) assembly codes

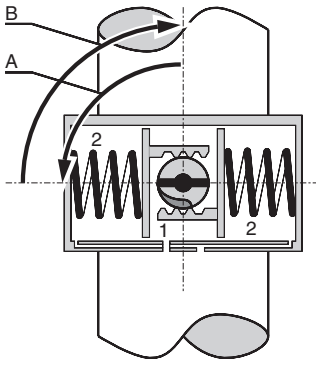
Standard assembly code:	**CW**
(= Clock Wise Rotation / Spring to Close)	
Visual indicator mounted: (= for In line position indication	**I**



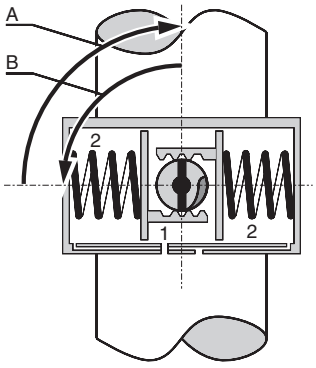
Optional assembly code: (= **Counter Clock Wise** Rotation/ Spring to Open)	**CC**
Visual indicator mounted: (= for In line position indication	**I**



Optional assembly code: (= **Clock Wise** Rotation / Spring to Close)	**CW**
Visual indicator mounted: (= for Cross line position indication	**C**



Optional assembly code: (= **Counter Clock Wise** Rotation/ Spring to Open)	**CC**
Visual indicator mounted: (= for Cross line position indication	**C**



A = **Pilot valve operated** in Control Module
B = **Pilot valve not operated** in Control Module

- Central air chamber (1) pressurized
- Spring Stroke (2)

All views are from above. Pistons are shown in inner position

Bettis Q-Series Valve Actuator

Corrosion Protection

Description

The corrosion protection system of Bettis Q-Series actuators consist of the following treatments or materials:

1. Pretreatment

The actuator housings are anodized inside and outside, to give them a durable and superb protection against wear and corrosion.

2. De-greasing

All aluminum parts are de-greased before the coating is applied by washing with an alkaline solution to assure the best bonding between the aluminum surface and the coating.

3. Finish

3.1 Actuator

- Polyurethane powder coating for exterior use.
- The powder coating is applied cold using automatic electrostatic spray equipment and is cured for about 10 minutes at minimum 200°C (392°F) offering excellent light and weather resistance.

3.2 Module

- Polyurethane coating for exterior use.
- The coating offers excellent light and weather resistance.
- Good chemical resistance against most bases, acids, solvents, alkalis and oils at normal temperatures.
- Excellent exterior mechanical durability.

4. High grade & hard anodized aluminum pinion.

Actuators with high grade & hard anodized aluminum pinions, passed a 1000 hours salt spray test.

5. Stainless steel or coated steel parts.

External parts are stainless steel or coated alloy steel.

6. Corrosion protected springs on Spring Return actuators

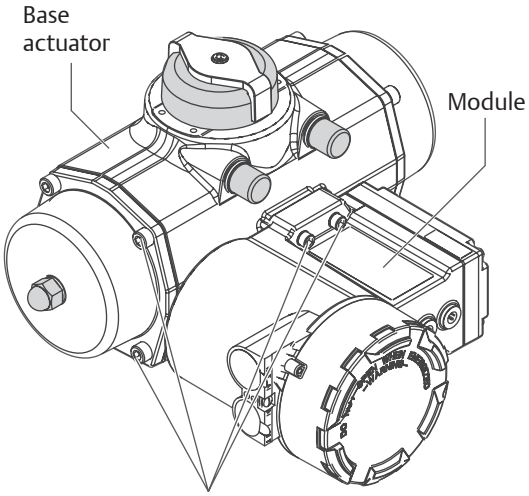
All the springs of spring return actuator are Deltatone® or epoxy (black) coated to prevent the corrosion of the springs and assure a long cycle life.

Technical data base actuator

Finish:	Polyurethane powder coating
Thickness:	80 to 160 micrometer (3.1 to 6.2 mils).
Salt spray test:	1000 hours (ASTM B117)
Color:	Orange
Materials:	
Housing:	Anodized aluminium alloy
Pistons:	Chromatized
Pinion:	High grade aluminum alloy, hard anodized
Fasteners:	Stainless steel or coated alloy steel.
Type plate:	Stainless steel

Technical data Control Module

Finish:	2 Component with an epoxy primer and polyurethane enamel top coating.
Thickness:	80 to 160 micrometer (3.1 to 6.2 mils).
Salt spray test:	1000 hours (ASTM B117)
Color:	Orange
Materials:	
Housing:	Anodized aluminium alloy
Fasteners:	Stainless steel or coated alloy steel.
Type plate:	Vinyl



BETTIS™

EMERSON™

Bettis Q-Series Valve Actuator

How to Order

Bettis Q-Series and its accessories can be ordered in different ways. Please follow below instruction to define the confirugation code for ordering Bettis Q-Series Valve Operating Systems.

Bettis Q-Series with Integrated Controls

To order Bettis Q-Series, two main parts have to be defined or configured:

1. The base actuator.
2. The control module

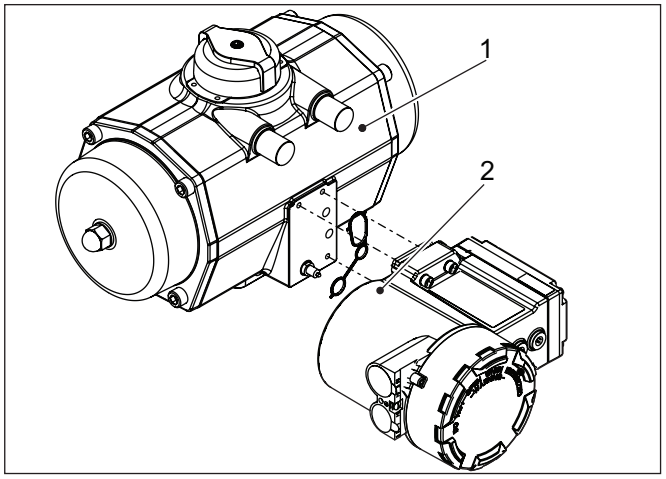
Procedure:

1. Select the required Actuator Action
   - Spring Return (a.k.a. Single acting)
   - Double acting
   - Double acting, Fail in Last Position
2. Determine the Actuator Size
   - Use the actuator torque data sheets or approved sizing program.
3. Select additional actuator configurations/options
   See page 2 of 7
   Note: To make the actuator suitable for Control modules select "XX" in the Pneumatic interface segment.
4. Select the Required Control Module
   - Select the required Control Module functionality based on the table below:

Module	Description	See page:
QC41	Conventional Module + 24 VDC Pilot valve	3 of 7
QC42	Conventional Module + 110 VAC Pilot valve	3 of 7
QC43	Conventional Module + 230 VAC Pilot valve	3 of 7
QC40	ASI Module (Metric)	4 of 7
QC40	ASI Module (Imperial)	5 of 7
QC54	Foundation Fieldbus Module (Metric)	6 of 7
QC54	Foundation Fieldbus Module (Imperial)	7 of 7

5. Select additional configurations/options
   - Be sure to include the "Installed" (I)option to mount the Control Module to the Bettis Q-Series Actuator.
   - Be sure to include the IPT device with the control module. This IPT device should be the same size as the actuator size, to which the module is mounted.

You have now selected a complete Bettis Q-Series Valve Operating Systems with Integrated Controls.



Sample model string:
Actuator: QS0350.U04STKCW.XX270DI
Control Module: QC41MWPMSK1.0350INS0IP10

Model String Configuration

Base Actuator

QS	0350	•	U	04	ST	K	CW	•	XX	S27	0	D	I

Actuator Type
Actuator Size
Connections
Spring Set
Temperature Range
Future Expansions
Assembly Code

Valve Mounting
Visual Indication
Valve Flange
Insert Size
Pneumatic Interface

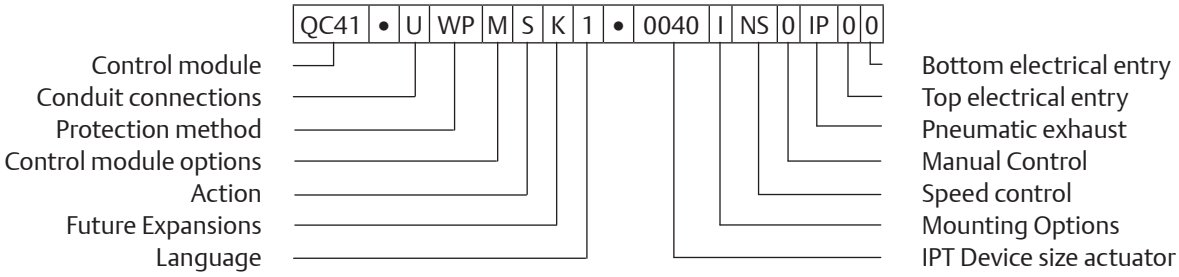
Actuator Type			
QD	Double Acting		
QS	Spring Return		
Actuator Size			
0040	Size 40	**0350**	Size 350
0065	Size 65	**0600**	Size 600
0100	Size 100	**0950**	Size 950
0150	Size 150	**1600**	Size 1600
0200	Size 200		
Connections			
M	Metric Actuator (ISO 5211)		
U	Imperial actuator (ISO 5211 / UNC)		
Spring Set (note5)			
00	Double Acting		
01	SpringSet 01	**04**	SpringSet 04
02	SpringSet 02	**05**	SpringSet 05
03	SpringSet 03	**06**	SpringSet 06
Temperature Range			
ST	Standard Temp. Range -20° to +80°C (-4° to 176°F)		
Future Expansion			
K	Bettis Orange		
Assembly Code (note 1)			
CW	Clockwise rotation (Spring to Close)		
CC	Counter-Clockwise rotation (Spring to Open)		

Pneumatic Interface			
XX	Actuator suitable for Control modules		
Insert Size Code (note 2)			
S10	Square 10 mm (0.39")	**S22**	Square 22 mm (0.87")
S12	Square 12 mm (0.47")	**S24**	Square 24 mm (0.94")
S14	Square 14 mm (0.55")	**S27**	Square 27 mm (1.06")
S16	Square 16 mm (0.63")	**S36**	Square 36 mm (1.42")
S17	Square 17 mm (0.67")	**S46**	Square 46 mm (1.81")
S19	Square 19 mm (0.75")		
Valve Flange Code			
00	ISO 5211 (No Centerplate)		
05	DIN3337 F05 (Centerplate / insert @ 45°)		
07	DIN3337 F07 (Centerplate / insert @ 45°)		
10	DIN3337 F10 (Centerplate / insert @ 45°)		
12	DIN3337 F12 (Centerplate / insert @ 45°)		
14	DIN3337 F14 (Centerplate / insert @ 45°)		
16	DIN3337 F16 (Centerplate / insert @ 45°)		
Visual Indication Code			
D	Standard Indicator		
X	No Indicator		
Valve Mounting Code			
I	In line with the pipe line		
C	Cross line with the pipe line		

Notes:
1. Assembly code CW is "Spring-to-Close", in combination with integrated modules.
   Assembly code CC is "Spring-to-Open", in combination with integrated modules.
   Failure mode of FieldQ with NAMUR plate depends on what solenoid is used.
2. See Insert Supplement for Additional Insert Options.

Model String Configuration

Conventional Wired Control Module



Control module	
QC41	Control module with 24 VDC pilot valve
QC42	Control module with 115 VAC pilot valve
QC43	Control module with 230 VAC pilot valve
Connections	
M	Metric: Conduit: 2x M20x1.5 - Pneumatic: 1/4" BSP
U	Imperial - Conduit: Top: 3/4"NPT; Bottom 1/2"NPT Pneumatic entry 1/4"NPTT
Protection method	
WP	Weather Proof IP66/NEMA4X
P5	Flame- or Explosion proof approval (note 1)
Control module options (position feedback)	
M	Mechanical switch
G	Mechanical switch (Gold Plated)
O	3-wire prox. switch PNP
C	3-wire prox. switch NPN
N	2-wire prox. switch (NAMUR)
H	2-wire prox. switch (20-140 VAC/10-140 VDC)
Action	
S	Single acting (Spring Return)
D	Double acting
F	Double acting Fail "In Last Position"
Future Expansions Code	
K	Standard Orange
Language Code	
1	English

IPT Device size for actuator:	
0040	Q40 actuator
0065	Q65 actuator
0100	Q100 actuator
0150	Q150 actuator
0200	Q200 actuator
0350	Q350 actuator
0600	Q600 actuator
0950	Q950 actuator
1600	Q1600 actuator
0000	No IPT probe
Mounting Options	
U	Uninstalled
I	Installed/Tested to actuator
Speed control	
NS	No Speed Control
N1	Spring Return (1x throttle)
N2	Double acting (2x throttle)
Manual Control	
0	No Manual Control
1	1x "Push&Lock", anodized aluminum
2	2x "Push&Lock", anodized aluminum
3	1x "Push&Lock", Stainless Steel
4	2x "Push&Lock", Stainless Steel
Pneumatic exhaust	
IP	IP65/NEMA4 rated exhaust
IN	Non metalic exhaust / Check valve
Top conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
Bottom conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug

Notes:

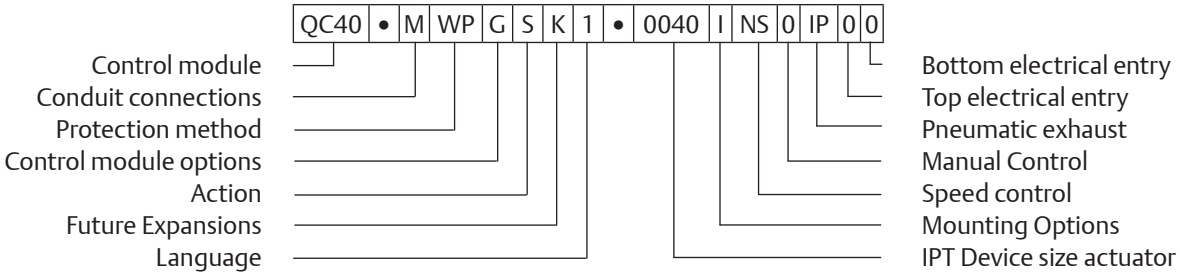
1. QC4x **"P5" Modules with Metric conduit connections** come with ATEX and IECEx approvals and allow for use in Zone 1, 2, 21, 22.
   QC4x **"P5" Modules with NPT conduit connections** come with ATEX, IECEx, FM and CSA approvals allow for use in Class 1 Division 1 classified hazardous areas.
2. 2x Manual Control are only required incase of Double acting with Fail in Last Position function.
3. Glands & Plugs options are a responsibility of the installer. Appropriate instructions can be found in the Installation Guide DOC.IG.QC41.1.
4. No separate pneumatic module required.

BETTIS™

EMERSON™

Metric Model String Configuration

QC40 with ASI Digital Bus Communication



Control module	
QC40	Control module with AS-I communication
Connections	
M	Metric: Conduit: 2x M20x1.5 - Pneumatic: 1/4" BSP
Protection method	
WP	Weatherproof IP66 / NEMA4X
P4	Non-Incendive / Non Arcing
B4	Non Arcing Inmetro approval
Control module options (position feedback)	
G	Mechanical switch (Gold Plated)
N	2-wire prox. switch (NAMUR)
Action	
S	Single acting (Spring Return)
D	Double acting
F	Double acting Fail "In Last Position"
Future Expansions Code	
K	Standard Orange
Language Code	
1	English
IPT Device size for actuator:	
0040	Q40 actuator
0065	Q65 actuator
0100	Q100 actuator
0150	Q150 actuator
0200	Q200 actuator
0350	Q350 actuator
0600	Q600 actuator
0950	Q950 actuator
1600	Q1600 actuator
0000	No IPT probe

Mounting Options	
U	Uninstalled
I	Installed/Tested to actuator
Speed control	
NS	No Speed Control
N1	Spring Return (1x throttle)
N2	Double acting (2x throttle)
Manual Control	
0	No Manual Control
1	1x "Push&Lock", anodized aluminum
2	2x "Push&Lock", anodized aluminum
3	1x "Push&Lock", Stainless Steel
4	2x "Push&Lock", Stainless Steel
Pneumatic exhaust	
IP	IP65/NEMA4 rated exhaust
IN	Non metalic exhaust / Check valve
Top conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")
Bottom conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")

Notes:

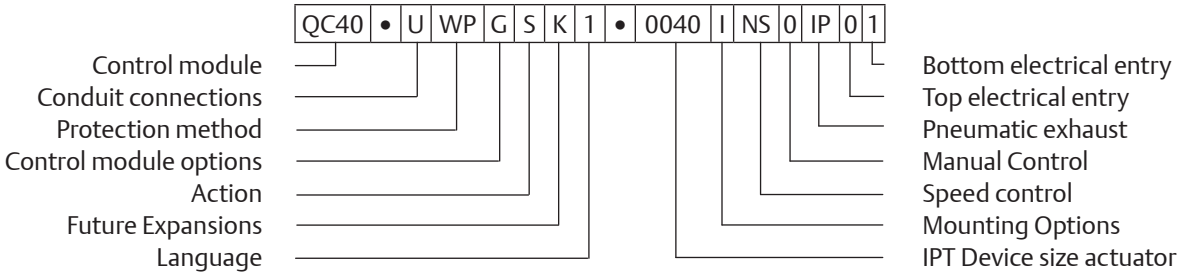
1. **QC40 "P4" Modules** come with ATEX, IECEx or FM approvals and allow for use in Zone 2 or 22 or Class1, Division 2 classified hazardous areas.
   QC40 "B4" Modules come with INMETRO approvals and allow for use in Zone 2 or 22 classified hazardous areas.
2. 2x Manual Control are only required in case of Double acting with Fail in Last Position function.
3. Quick Connector options (Glands & Plugs) are only available with QC40 (ASI) or QC54 (FF).
   The Quick Connectors, as listed, are excluded from areas with a potential explosion hazard caused by gases, dust or fibers.
   Appropriate instructions can be found in the Installation Guide DOC.IG.BQC40.1.
4. For applications below -20°C (-4°F), the base actuator must be fitted with Low Temperature seals.
   For use in atmospheres with a potential explosion hazard, the minimum temperature is -25°C / -13°F.
5. Single Piece (QC4X) modules do not require separate pneumatic module (pneumatic function is integrated).

BETTIS™

EMERSON™

Imperial Model String Configuration

QC40 with ASI Digital Bus Communication



Control module	
QC40	Control module with AS-I communication
Connections	
U	Imperial - Conduit: Top: 3/4""NPT; Bottom 1/2""NPT Pneumatic entry 1/4"NPT
Protection method	
WP	Weatherproof IP66 / NEMA4X
P4	Non-Incendive / Non Arcing
B4	Non Arcing Inmetro approval
Control module options (position feedback)	
G	Mechanical switch (Gold Plated)
N	2-wire prox. switch (NAMUR)
Action	
S	Single acting (Spring Return)
D	Double acting
F	Double acting Fail "In Last Position"
Future Expansions Code	
K	Standard Orange
Language Code	
1	English
IPT Device size for actuator:	
0040	Q40 actuator
0065	Q65 actuator
0100	Q100 actuator
0150	Q150 actuator
0200	Q200 actuator
0350	Q350 actuator
0600	Q600 actuator
0950	Q950 actuator
1600	Q1600 actuator
0000	No IPT probe

Mounting Options	
U	Uninstalled
I	Installed/Tested to actuator
Speed control	
NS	No Speed Control
N1	Spring Return (1x throttle)
N2	Double acting (2x throttle)
Manual Control	
0	No Manual Control
1	1x "Push&Lock", anodized aluminum
2	2x "Push&Lock", anodized aluminum
3	1x "Push&Lock", Stainless Steel
4	2x "Push&Lock", Stainless Steel
Pneumatic exhaust	
IP	IP65/NEMA4 rated exhaust
IN	Non metalic exhaust / Check valve
Top conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
Bottom conduit (Glands & Plugs, note 3)	
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")

Notes:

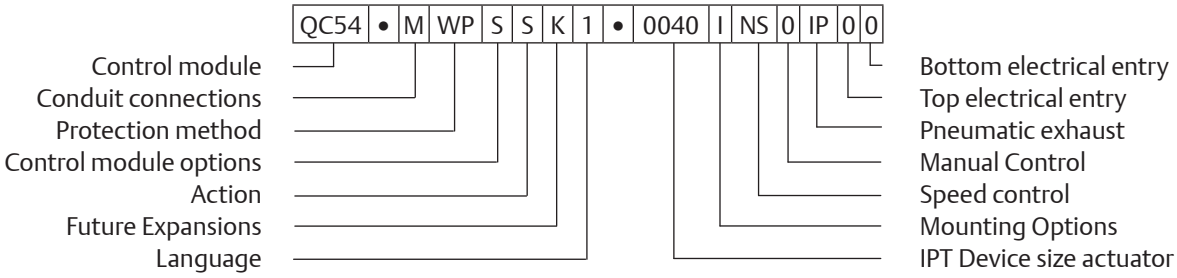
1. **QC40 "P4" Modules** come with ATEX, IECEx or FM approvals and allow for use in Zone 2 or 22 or Class1, Division 2 classified hazardous areas.
   QC40 "B4" Modules come with INMETRO approvals and allow for use in Zone 2 or 22 classified hazardous areas.
2. 2x Manual Control are only required in case of Double acting with Fail in Last Position function.
3. Quick Connector options (Glands & Plugs) are only available with QC40 (ASI) or QC54 (FF).
   The Quick Connectors, as listed, are excluded from areas with a potential explosion hazard caused by gases, dust or fibers.
   Appropriate instructions can be found in the Installation Guide DOC.IG.BQC40.1.
4. For applications below -20°C (-4°F), the base actuator must be fitted with Low Temperature seals.
   For use in atmospheres with a potential explosion hazard, the minimum temperature is -25°C / -13°F.
5. Single Piece (QC4X) modules do not require separate pneumatic module (pneumatic function is integrated).

BETTIS™

EMERSON™

Metric Model String Configuration

QC54 with Foundation Fieldbus™ Bus Communication



Control module	
QC54	Control module with Foundation Fieldbus communication
Connections	
M	Metric: Conduit: 2x M20x1.5 - Pneumatic: 1/4" BSP
Protection method	
WP	Weatherproof IP66 / NEMA4X
P4	Non-Incendive / Non Arcing Ex nA
P1	Intrinsically Safe / Ex i
B4	Non Arcing Ex nA
B1	Intrinsically Safe / Ex i
Control module options	
S	Standard configuration
Action	
S	Single acting (Spring Return)
D	Double acting
F	Double acting Fail "In Last Position"
Future Expansions Code	
K	Standard Orange
Language Code	
1	English
IPT Device size for actuator:	
0040	Q40 actuator
0065	Q65 actuator
0100	Q100 actuator
0150	Q150 actuator
0200	Q200 actuator
0350	Q350 actuator
0600	Q600 actuator
0950	Q950 actuator
1600	Q1600 actuator
0000	No IPT probe

Mounting Options	
U	Uninstalled
I	Installed/Tested to actuator
Speed control	
NS	No Speed Control
N1	Spring Return (1x throttle)
N2	Double acting (2x throttle)
Manual Control	
0	No Manual Control
1	1x "Push&Lock", anodized aluminum
2	2x "Push&Lock", anodized aluminum
3	1x "Push&Lock", Stainless Steel
4	2x "Push&Lock", Stainless Steel
Pneumatic exhaust	
IP	IP65/NEMA4 rated exhaust
IN	Non metalic exhaust / Check valve
Top conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")
Bottom conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")

Notes:

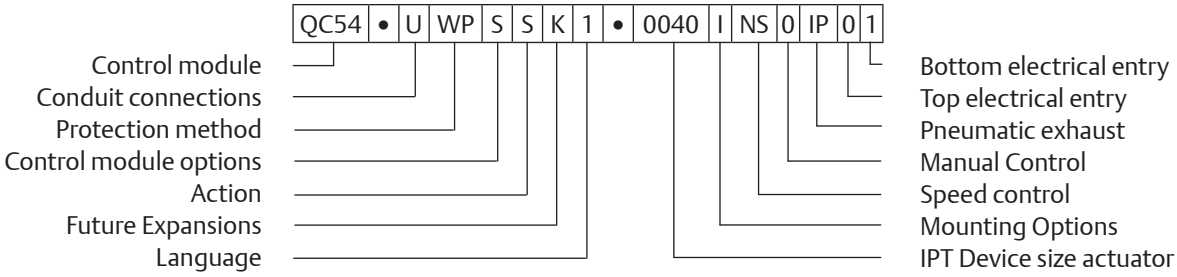
1. **QC54 "P1" Modules** come with ATEX, IECEx or FM approvals and allow for use in Zone 1, 2, 21, 22 or Class 1, Division 1 classified hazardous areas.
   QC54 "B1" Modules come with INMETRO approvals and allow for use in Zone 1, 2, 21 or 22 classified hazardous areas.
   QC54 "P4" Modules come with ATEX, IECEx or FM approvals and allow for use in Zone 2 or 22 or Class1, Division 2 classified hazardous areas.
   QC54 "B4" Modules come with INMETRO approvals and allow for use in Zone 2 or 22 classified hazardous areas.
2. 2x Manual Control are only required in case of Double acting with Fail in Last Position function.
3. Quick Connector options (Glands & Plugs) are only available with QC40 (ASI) or QC54 (FF).
   The Quick Connectors, as listed, are excluded from areas with a potential explosion hazard caused by gases, dust or fibers.
   Appropriate instructions can be found in the Installation Guide DOC.IG.BQC54.1.
4. For applications below -20°C (-4°F), the base actuator must be fitted with low temperature seals.
   For use in atmospheres with a potential explosion hazard, the minimum temperature is -25°C / -13°F.
5. Single Piece (QC4X, QC40 or QC54) modules do not require separate pneumatic module
   (pneumatic function is integrated).

BETTIS™

EMERSON™

Imperial Model String Configuration

QC54 with Foundation Fieldbus™ bus communication



Control module	
QC54	Control module with Foundation Fieldbus communication
Connections	
U	Imperial - Conduit: Top: 3/4""NPT; Bottom 1/2""NPT Pneumatic entry 1/4"NPT
Protection method	
WP	Weatherproof IP66 / NEMA4X
P4	Non-Incendive / Non Arcing Ex nA
P1	Intrinsically Safe / Ex i
B4	Non Arcing Ex nA
B1	Intrinsically Safe / Ex i
Control module options	
S	Standard configuration
Action	
S	Single acting (Spring Return)
D	Double acting
F	Double acting Fail "In Last Position"
Future Expansions Code	
K	Standard Orange
Language Code	
1	English
IPT Device size for actuator:	
0040	Q40 actuator
0065	Q65 actuator
0100	Q100 actuator
0150	Q150 actuator
0200	Q200 actuator
0350	Q350 actuator
0600	Q600 actuator
0950	Q950 actuator
1600	Q1600 actuator
0000	No IPT probe

Mounting Options	
U	Uninstalled
I	Installed/Tested to actuator
Speed control	
NS	No Speed Control
N1	Spring Return (1x throttle)
N2	Double acting (2x throttle)
Manual Control	
0	No Manual Control
1	1x "Push&Lock", anodized aluminum
2	2x "Push&Lock", anodized aluminum
3	1x "Push&Lock", Stainless Steel
4	2x "Push&Lock", Stainless Steel
Pneumatic exhaust	
IP	IP65/NEMA4 rated exhaust
IN	Non metalic exhaust / Check valve
Top conduit (Glands & Plugs, note 3)	
0	Transport plug
1	Metal blind plug
Bottom conduit (Glands & Plugs, note 3)	
1	Metal blind plug
4	Eurofast (M12)
5	Minifast (7/8")

Notes:

1. **QC54 "P1" Modules** come with ATEX, IECEx or FM approvals and allow for use in Zone 1, 2, 21, 22 or Class 1, Division 1 classified hazardous areas.
   QC54 "B1" Modules come with INMETRO approvals and allow for use in Zone 1, 2, 21 or 22 classified hazardous areas.
   QC54 "P4" Modules come with ATEX, IECEx or FM approvals and allow for use in Zone 2 or 22 or Class1, Division 2 classified hazardous areas.
   QC54 "B4" Modules come with INMETRO approvals and allow for use in Zone 2 or 22 classified hazardous areas.
2. 2x Manual Control are only required in case of Double acting with Fail in Last Position function.
3. Quick Connector options (Glands & Plugs) are only available with QC40 (ASI) or QC54 (FF).
   The Quick Connectors, as listed, are excluded from areas with a potential explosion hazard caused by gases, dust or fibers.
   Quick Connector options are only available for the bottom 1/2" entry. Appropriate instructions can be found in the Installation Guide DOC.IG.QC54.1.
4. For applications below -20°C (-4°F), the base actuator must be fitted with low temperature seals.
   For use in atmospheres with a potential explosion hazard, the minimum temperature is -25°C / -13°F.
5. Single Piece (QC4X, QC40 or QC54) modules do not require separate pneumatic module (pneumatic function is integrated).

BETTIS™

EMERSON™

World Area Configuration Centers (WACC) offer sales support, service, inventory and commissioning to our global customers.
Choose the WACC or sales office nearest you:

NORTH & SOUTH AMERICA

19200 Northwest Freeway
Houston TX 77065
USA
T +1 281 477 4100

Av. Hollingsworth
325 Iporanga Sorocaba
SP 18087-105
Brazil
T +55 15 3413 8888

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6777 8211

No. 1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P. R. China
T +86 22 8212 3300

MIDDLE EAST & AFRICA

P. O. Box 17033
Jebel Ali Free Zone
Dubai
T +971 4 811 8100

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650

24 Angus Crescent
Longmeadow Business Estate East
P.O. Box 6908 Greenstone
1616 Modderfontein Extension 5
South Africa
T +27 11 451 3700

EUROPE

Holland Fasor 6
Székesfehérvár 8000
Hungary
T +36 22 53 09 50

Strada Biffi 165
29017 Fiorenzuola d'Arda (PC)
Italy
T +39 0523 944 411

For complete list of sales and manufacturing sites, please visit www.emerson.com/actuationtechnologieslocations or contact us at info.actuationtechnologies@emerson.com

www.emerson.com/bettis

BETTIS™

EMERSON™

Hazardous area executions

Control Module QC54 with FOUNDATION™ Fieldbus is available with optional intrinsically safe (IS) or Non-Incendive/ Non Sparking (NI) approvals as listed below:

IECEx

Certificate No.:
IECEx DEK16.0032X

Intrinsically safe *
Ex ia IIC T4 Ga
Ex ia IIIC T80°C Da
Ex ic IIC T4 Gc

Non-Sparking
Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

ATEX

Certificate No.:
DEKRA 16ATEX0064X

Intrinsically safe *
Ⓔx II 1 G Ex ia IIC T4 Ga
Ⓔx II 1 D Ex ia IIIC T80°C Da
Ⓔx II 3 G Ex ic IIC T4 Gc

Non-Sparking
Ⓔx II 2 D Ex tb IIIC T80°C Db
Ⓔx II 3 G Ex nA IIC T4 Gc

FM

Certificate No.:
FM16US0367X

Type 4X

Intrinsically safe *
- Intrinsically safe,Class I, II, III Div.1, Groups ABCDEFG, T4, Type4/IP66
- Class 1, Zone 1, AEx ia IIC T4

Non Incendive
- Class I, II, III, Division 2, Groups ABCDFG, T4
- Class 1, Zone 2, Group IIC T4

CSA

Certificate No.:
CSA 17CA70167494X

Intrinsically safe *
Class I, Division 1, Groups A, B, C and D T4;
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex ia IIC T4 Ga
Ex ia IIIC T80°C Da
Ex ic IIC T4 Gc

Non Incendive
Class I, Division 2, Groups A, B, C and D, T4;
Class II, Division 1, Group E, F and G, T80°C;
Class III, Division 1, T80°C
Ex nA IIC T4 Gc
Ex tb IIIC T80°C Db

INMETRO

Certificado: IEx 17.0085X
Intrinsically safe *
Ex ia IIC T4 Ga IP66
Ex ia IIIC T80 °C Da IP66
Certificate No.: IEx 17.0085X
Non Incendive
Ex nA IIC T4 Gc IP66
Ex tb IIIC T80 °C Db IP66

Ambient temperature:
T4 @ Ta = -20°C...+50°C IP66/nema 4x

Note:
* The assembly of a Q-Series Actuator with the intrinsically safe QC54 Control Module, may be used in (ATEX) classified Zones 1, 2 (Gasses) and/or 21, 22 dust (Dust).

FISCO systems
The Q-Series QC54 is suitable for use in a FISCO system in accordance with IEC 60079-27

Diagnostics and PlantWeb Alerts

QC54 FOUNDATION™ Fieldbus

Diagnostics

The Q-Series QC54 Control Module with FOUNDATION™ Fieldbus communication has diagnostic capabilities. These process parameters can give information about communication condition, valve and/or actuator unit. It enables to predict failures in advance and makes maintenance easier to schedule. The following diagnostics are available for the QC54 control module:

1. **Timer parameters:**
    1. Open and Closed travel time
    2. High and low limits of Open and Closed travel time
    3. Average travel times of last 30 strokes of Open and Closed travel.
    4. High and low limits of average Open and Closed travel time
2. **Cycle Counters**
    1. Control Module - Counts how many times the Control Module cycles (read only).
    2. Pneumatic Module - Counts how many times the Pneumatic Module cycles.
    3. Actuator - Counts how many times the actuator cycles.
    4. Valve - Counts how many times the valve cycles.
3. **Time In Position**
4. **Various internal electronic health tests**

PlantWeb Alerts

PlantWeb Alerts are alerts that have been predefined and categorized for the user. These device alerts can be used to help troubleshoot the instrument (see also page 4). There are three categories:

- **Failed alerts,**
  A failed alert indicates a failure within the device that will make the device, or some part of the device, non-operational.
- **Maintenance alerts**
  A maintenance alert indicates that the device, or some part of the device, needs maintenance soon.
- **Advisory alerts**
  An advisory alert indicates a condition that does not have a direct impact on the device's primary function. If the condition is ignored, the device will eventually fail.

These alerts, when enabled, can participate in the DeltaV alarm interface tools such as the alarm banner, alarm list, and alarm summary.

Diagnostics and PlantWeb Alerts

Alerts & recommended actions									
Alerts			Alert default setting						
			Advisory		Maintenance		Fail		
Parameter name	DeltaV text	Recommended actions	enable	mask (show)	enable	mask (show)	enable	mask (show)
Internal alerts									
bad_position_sensor	Bad Position Sensor Error	Feedback problem, replace control module when possible	n	n	y	y	n	n
bad_temperature_sensor	Bad Temperature Sensor Error	Temperature sensor problem, replace Control module when possible	n	n	y	y	n	n
system_temperature_exceeded	System Temperature Exceeded	Take corrective actions to bring temperature within specified range.	n	n	y	y	n	n
software_error	Software Error	Software error has been detected, replace control module when possible.	n	n	y	n	n	n
travel_deviation	Travel Deviation	Lost position, Check air pressure	y	y	n	n	n	n
shutdown_is_set	Shutdown Is Set	Internal communications problem, check shutdown configuration for restart, Replace Control module.	n	n	n	n	y	y
pilot valve_error	Pilot valve error	pilot valve number mismatch or pilot valve failure has been detected	n	n	y	y	n	n
Buttonboard_error	Buttonboard Error	Error is undefined, replace control module when possible	n	n	y	n	n	n
Counter alerts									
cm_life_exceeded	Control Module Life Cycle Exceeded	Control module life cycle exceeded, replace control module	n	n	y	y	n	n
pm_life_exceeded	Pneumatic Module Life Cycle Exceeded	Pneumatic module life cycle exceeded, replace pneumatic module.	n	n	n	n	n	n
act_life_exceeded	Actuator Life Cycle Exceeded	Actuator life cycle exceeded, replace actuator.	n	n	n	n	n	n
valve_life_exceeded	Valve Life Cycle Exceeded	Valve life cycle exceeded,valve requires maintenance.	n	n	n	n	n	n
Timer alerts									
time_in_position_exceeded	Time in position exceeded	Time in position exceeded, take appropriate action.	n	n	n	n	n	n
open_travel_time_exceeded	Open travel timer exceeded	Open travel timer exceeded, check valve system.	n	n	n	n	n	n
close_travel_time_exceeded	Close travel timer exceeded	Close travel timer exceeded, check valve system.	n	n	n	n	n	n
Initialization alert									
assembly error	Assembly error	pneumatic function mismatch, check module and actuator configuration	n	n	y	y	n	n
initialization_failed	Initialization Failure	Device failed initialization; Check airpressure, check actuator sizing, check valve system	y	y	n	n	n	n

Alerts & recommended actions (continued)									
Alerts			Alert default setting						
			Advisory		Maintenance		Fail		
Parameter name	DeltaV text	Recommended actions	enable	mask (show)	enable	mask (show)	enable	mask (show)	
Internal IO failure alert									
io_failure	Internal Io Failure	Internal communications are lost, device will act according to shutdown configuration.	y	y	n	n	n	n	
rb_NV_write_deferred	Output Board NV Memory Failure	NV Write Deferred: A high number of writes has been detected to non-volatile memory. To prevent premature failure of the memory, the write operations have been deferred. The data will be saved about every 3 hours. This condition usually exists because a program has been written that writes to control block parameters not normally expected to be written to on a cyclic basis. Any such automated write sequence should be modified to write the the parameter(s) only when needed. It is recommended that you limit the number of periodic writes to all static or non-volatile parameters such as HI_HI_LIM, LOW_CUT, SP, TRACK_IN_D, OUT, IO_OPTS, BIAS, STATUS_OPTS, SP_HI_LIM, and so on.	n	n	n	n	y	y	
PWA_simulate_active	PWA Simulate Active	If PWA simulate mode has been activated. The PWA active parameters can now be written as well as the resource block detailed status parameters and the internal alerts in the Transducer Block where the PWA active alarms originate from.	n	n	n	n	y	y	
rb_nv_memory_failure	Output Board NV Memory Failure	"Output Board NV Memory Failure: Non-volatile EEPROM data corruption was detected on the Fieldbus Electronics Board. Default values were loaded into the faulty block. 1. Check the device configuration for changes in the block parameter values. 2. Reset the device to clear the error. 3. Download a Device Configuration. NOTE: If the failure reoccurs it may indicate a faulty EEPROM memory chip."	y	y	n	n	n	n	
rb_nv_electronics_failure	Output Board Electronics Failure	Output Board Electronics Failure:	y	y	n	n	n	n	
		The Device has detected a fault with an electrical component on the Fieldbus Electronics Module Assembly. Replace the Device.							
diag_opt_PWA_simulate	PWA Simulate								
func_opt_simulate	Simulate Switch	Since the hardware simulate switch may be impractical to access, a software option is being provided.							
misc_opt_base_record	Base Record	When the base record option is enabled, operator can write/read parameters to/from the sensor board that are not available via the FF parameter list.							

Namur NE-107 Alarms

This section describes the parameter interaction to implement a Bettis Q-Series QC54 Control module to the NAMUR NE-107 requirements as a parameter group in the Resource Block. There are four alarm categories defined as per the NE-107 specification, Failed, Off Specification, Maintenance, and Check function.

Maintenance Although the output signal is valid, the wear reserve is nearly exhausted or a functions will soon be restricted due to operational conditions e.g. build-up of deposits.

Off Specification Off-spec means that the device is operating outside its specified range or an internal diagnostic indicates deviations from measured or set values due to internal problems in the device or process characteristics (e.g. bubble formation in flow metering or valve sticking).

Check Function Output signal temporarily invalid (e.g. frozen) due to on-going work on the device.

Failed Output signal invalid due to malfunction in the field device or its peripherals.

Each of these categories share 32 conditions that can be defined by the device manufacturer. Each condition may be mapped or not mapped for each category. If a condition is mapped then it is indicated in the * ACTIVE parameter. If the condition in the * ACTIVE parameter is not masked by the corresponding bit in the *_MASK parameter then the condition will be queued for broadcast using the corresponding *ALM parameter at the associated priority indicated by *PRI parameter. The 4 categories are defined below.

The conditions are not expected to identify explicitly the root cause of the condition, but rather to identify it in terms of:

- Replace the device
- Replace a part of the device
- Correct a configuration problem
- Fix something outside of the device

The above list is all that the operator needs to know to restore his process functionality and if there are more than 31 device conditions they should be grouped by definition into these bit

Parameter Mnemonic	Obj Type	Data Type/ Structure	Use/Model	Store	Size	Valid Range	Initial Value	Permission	Other	Range Check
FD_CHECK_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_CHECK_ALM	R	DS-87	C/Alarm	D	15					
FD_CHECK_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_CHECK_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_CHECK_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_EXTENDED_ACTIVE_n	S	Bit String	C/Contained	D	4				Read only	
FD_EXTENDED_MAP_n	S	Bit String	C/Contained	S	4					
FD_FAIL_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_FAIL_ALM	R	DS-87	C/Alarm	D	15					
FD_FAIL_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_FAIL_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_FAIL_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_MAINT_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_MAINT_ALM	R	DS-87	C/Alarm	D	15					
FD_MAINT_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_MAINT_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_MAINT_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_OFFSPEC_ACTIVE	S	Bit String	C/FD Active	D	4				Read only	
FD_OFFSPEC_ALM	R	DS-87	C/Alarm	D	15					
FD_OFFSPEC_MAP	S	Bit String	C/Contained	S	4			ALARM		
FD_OFFSPEC_MASK	S	Bit String	C/Contained	S	4			ALARM		
FD_OFFSPEC_PRI	S	Unsigned8	C/Alert Priority	S	1	0 - 15	0	ALARM		Yes
FD_RECOMMEN_ACT	S	Unsigned16	C/Contained	D	2	1 – manf spec	0		Read only	
FD_SIMULATE	R	DS-89	C/FD Simulate	D	9		disabled			
FD_VER	S	Unsigned16	C/Contained	S	2				Read only	