

## Product data sheet

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March 2017

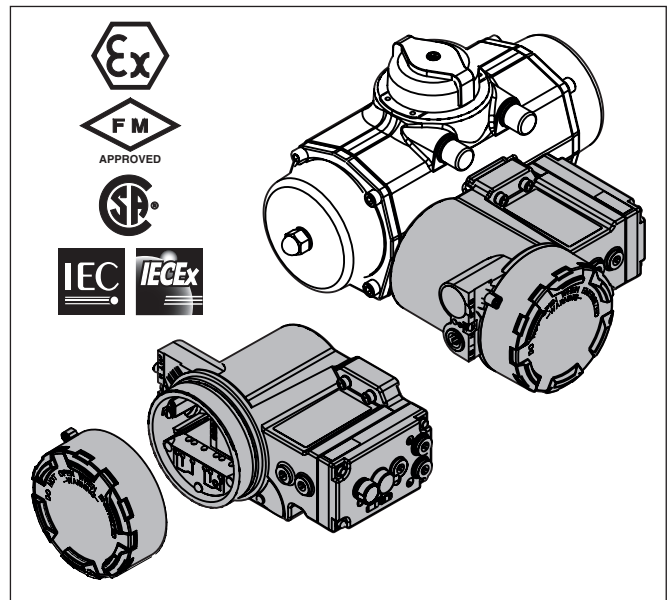
Q-Series

# 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:

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# Q-Series

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.

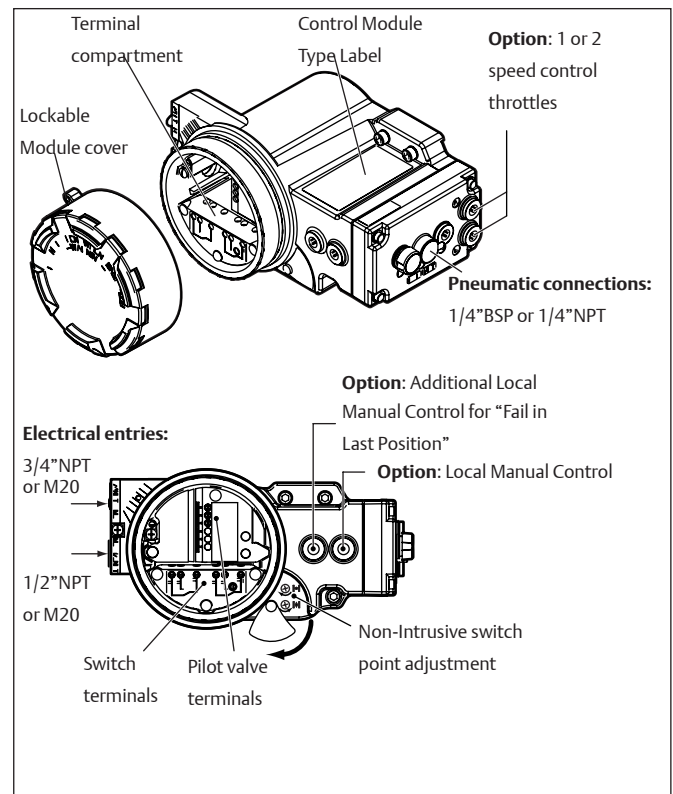
The pilot valves inside the control module are used to send the actuator to its open or closed position. One pneumatic connection is available to feed the control module.

### General specifications:

|                         |   |
|-------------------------|---|
| Material housing:       | Aluminium alloy   |
| Operating media:        | Air or inert gasses, filtered at 50µm (for QC54 5µm)  |
| Pneumatic entry:        | Metric units: G1/4"<br>Imperial units: 1/4"NPT  |
| Electrical connections: | Pilot valve(s): 6 pole terminal strip.<br>Switches: 6 pole terminal strip.  |
| Cable entries:          | Metric units: 2x M20x1.5<br>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:<br>See data sheet BQ1.603.08<br>Imperial/UNC:<br>See data sheet BQ1.603.09<br>DIN 3337:<br>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<br>(3 when the cover remains closed)   |



Control module overview

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# 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:

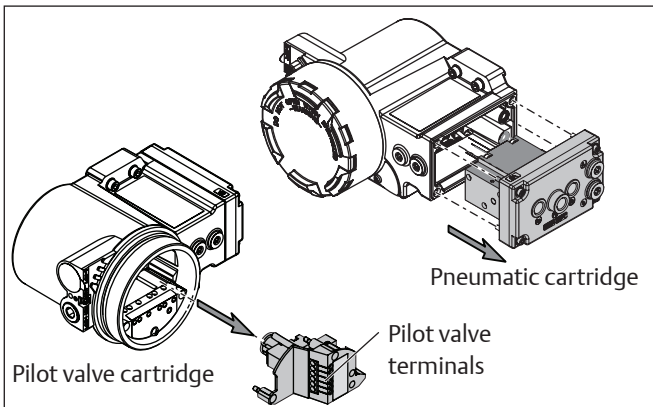
- 1 Spring return or
- 2 Double acting or
- 3 Double Acting - "Fail-in-Last-Position".

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

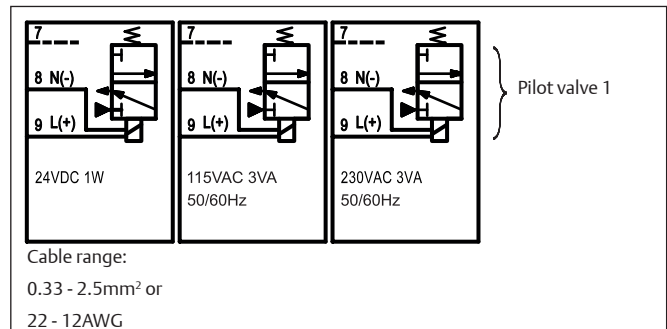
- 1 One pilot valve is default and suitable for normal operation of double acting or spring return actuators
- 2 Two pilot valves are required to achieve a "Fail-in-Last-Position" functionality on double acting actuators.

Table 1: Pilot valve specifications

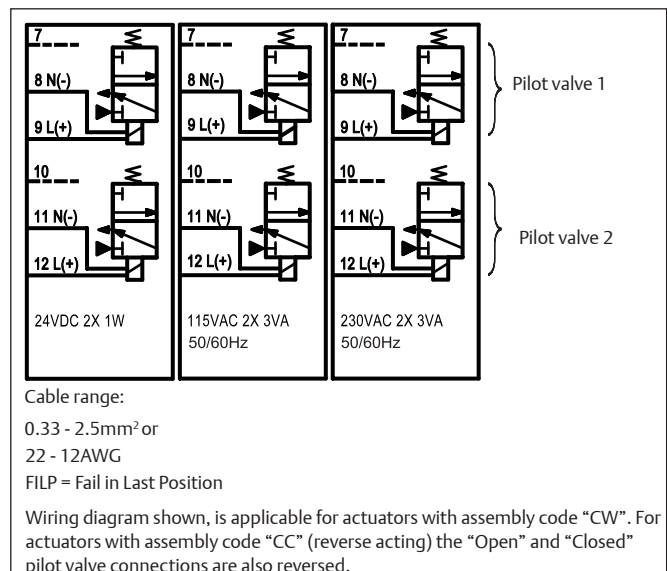
| Module | Voltages               | Power | Frequency |
|--------|------------------------|-------|-----------|
| QC41   | 24VDC ( $\pm 10\%$ )   | 1W    | NA        |
| QC42   | 115 VAC ( $\pm 10\%$ ) | 3VA   | 50/60Hz   |
| QC43   | 230 VAC ( $\pm 10\%$ ) | 3VA   | 50/60Hz   |



Pilot valve and pneumatic cartridge



One default pilot valve and wiring connections



Two pilot valves and wiring connections for Fail in Last Position

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### 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.

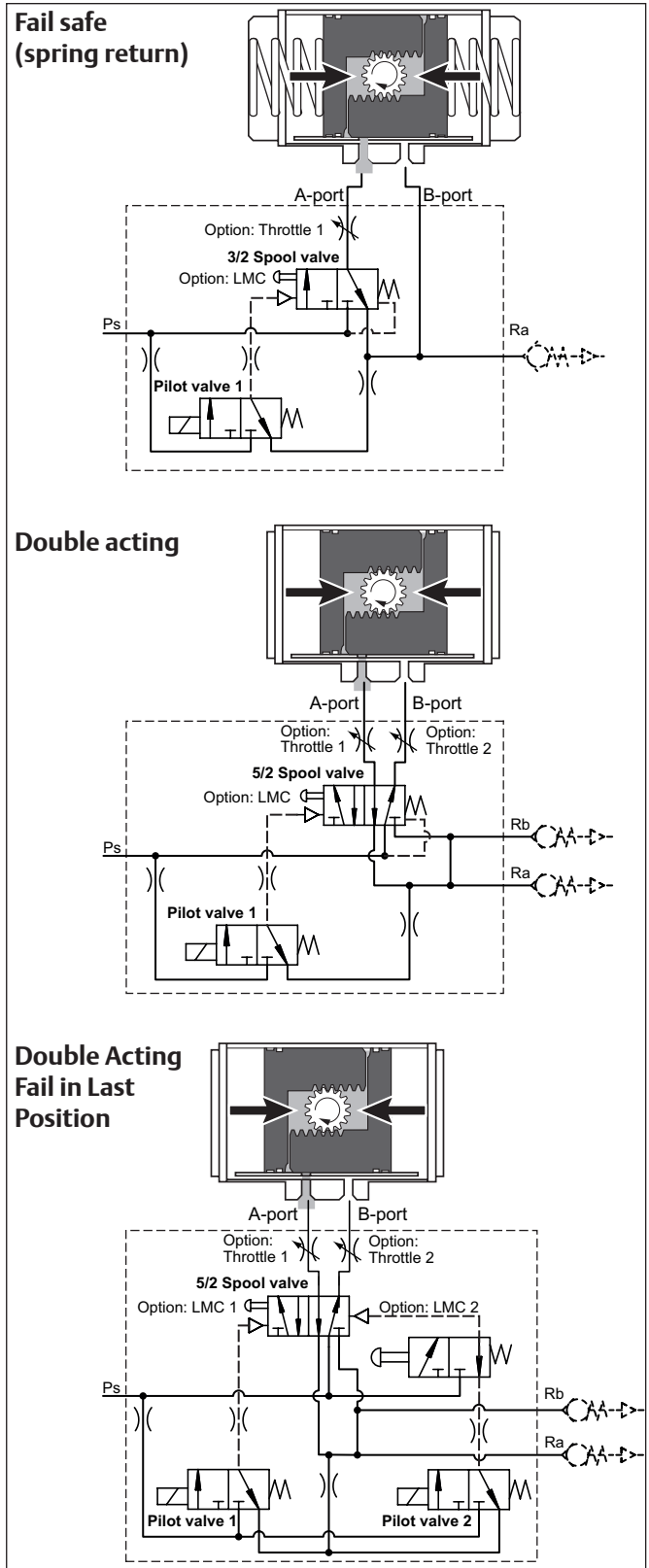
#### Manual Control

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<sup>3</sup>/h) or Cv value of 0.33 (US gall/min 1Psi) for approximate operating speed calculations.



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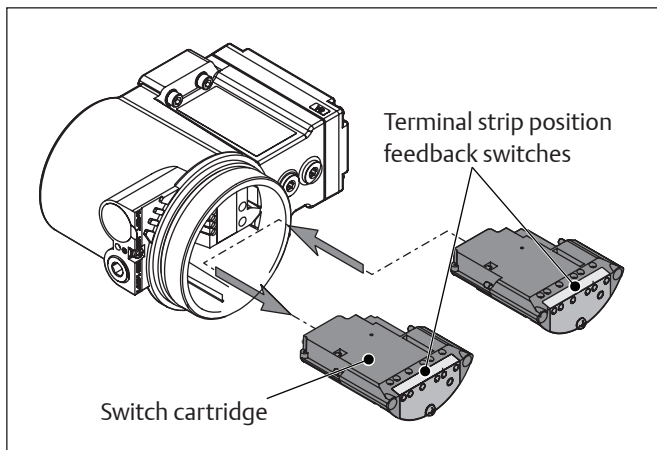
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# Position feedback

## Switch cartridges

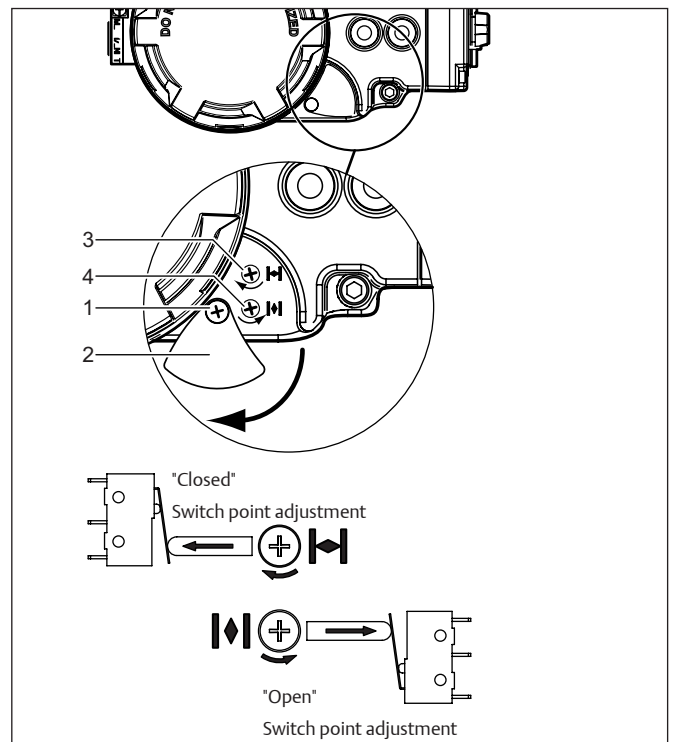
The position feedback is achieved by switch cartridges in the module. These cartridges contain switching elements which sense the open or closed position and are pre wired to the terminal strip. These easily exchangeable switch cartridges are available with various mechanical or proximity switching elements.



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.

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## Mechanical switches

Table 2: Mechanical switches

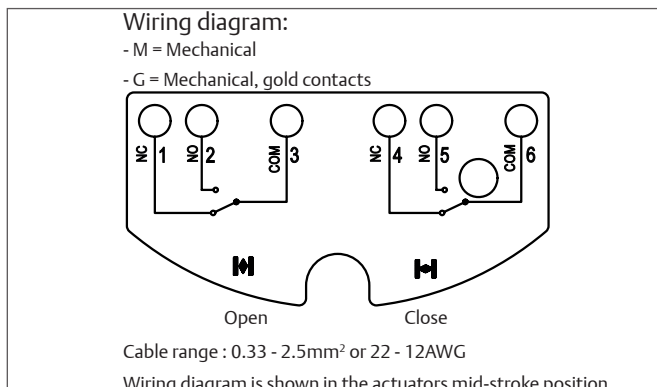
| Specification     | Description   |
|-------------------|---|
| Option code       | M   |
| Option code       | G (gold contacts)   |
| Type              | Mechanical  |
| Voltage           | M: 277 VAC or 250VDC (maximum)<br>G: 125 VAC or 30VDC (maximum)             |
| Contacts          | NO and NC   |
| Temperature range | -25°C to +65°C / -13°F to +149°F<br>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 <sup>1</sup> ) | 0.1 A <sup>2</sup> |
| 250 VAC        | 10 A (3 A <sup>1</sup> ) | -                  |
| 30 VDC         | 0.5 A                    | 0.1 A <sup>2</sup> |
| 125 VDC        | 0.5 A                    | -                  |
| 250 VDC        | 0.25 A                   | -                  |

**Note:**

- The mechanical (M-type) switches are rated for 3 A with inductive load.
- 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

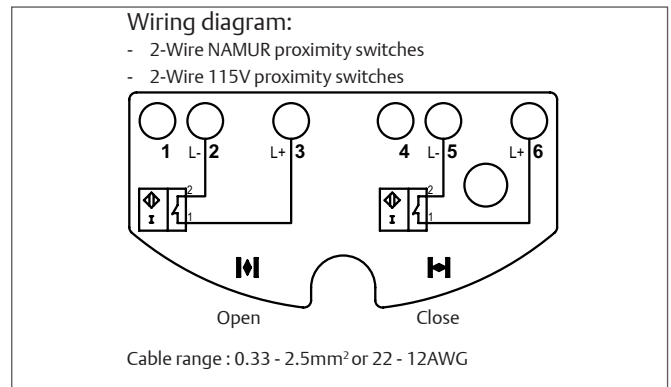
## 2-Wire Proximity switches

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<br>Switched , < 1 mA                                    |
| Temperature range | -25°C to +65°C / -13°F to +149°F<br>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<br>(50...60 Hz AC)  |
| Current           | Maximum                      100 mA<br>Peak                              0,9A (20ms / 0,5Hz), |
| Leakage           | < 1.7 mA  |
| Temperature range | -25°C to +65°C / -13°F to +149°F<br>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.

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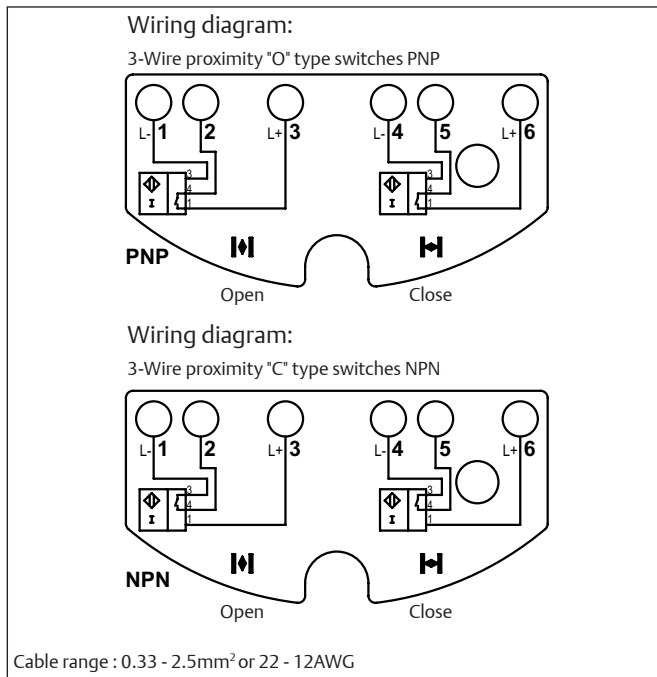
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## 3-Wire Proximity switches

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<br>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

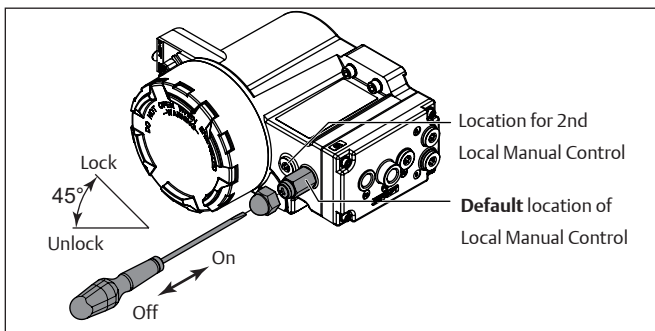
#### Description

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:

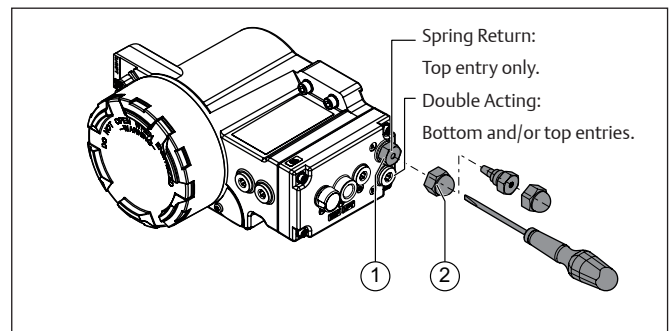
- 1 Nut cover
- 2 Main throttle with set screw.

#### 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.
- For 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



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# 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  
II 2G Ex db IIB+H2 T4/T6  
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             | S,D,F            | 3.6W <sup>(1)</sup>    | -25°C (-13°F)    | +60          | +80          | T6/T4 |
| QC42, QC43 (115 or 230VAC) |                  | S,D              | 3.6W <sup>(1)</sup>    | -25°C (-13°F)    | +60          | +80          | T6/T4 |
| QC42, QC43 (115 or 230VAC) | O, C, N, H       | F                | 7.2W <sup>(2)</sup>    | -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)

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