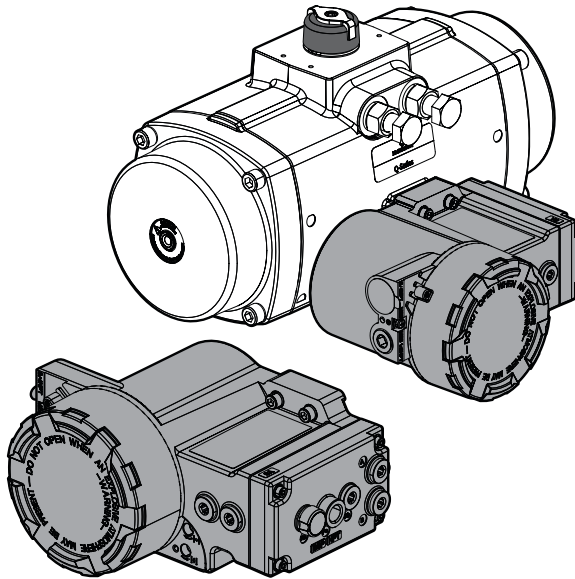


# Bettis Integrated Control Modules

QC41 24 V DC

QC42 115 V AC

QC43 230 V AC



## 1 Applicable Control modules:

QC41 - 24 V DC	- Weather Proof
	- Explosion Proof / Flame proof
QC42 - 115 V AC	- Weather Proof
	- Explosion Proof / Flame proof
QC43 - 230 V AC	- Weather Proof
	- Explosion Proof / Flame proof

**Note:**

Both executions can be equipped with one or two pilot valves:

- \* One pilot valve is default and suitable for normal operation of double-acting or spring-return actuators.
- \* Two pilot valves are required for Fail in Last Position function on double-acting actuators.

The enclosures of both Weather Proof and Explosion Proof / Flame proof modules, have a IP66 or NEMA 4X, ingress protected rating.

## 2 Before starting

- \* Actuator must be isolated both pneumatically and electrically before any (dis)assembly is begun.
- \* Installation, adjustment, putting into service, use, assembly, disassembly and maintenance of the control module must be done by qualified personnel.
- \* Be sure that the actuator is correctly mounted before connecting air supply and electrical wiring (see **Installation and Operation Manual Bettis Q-Series Valve Actuator, DOC.IOM.BQ.E**)
- \* Check the module label for the right execution (see Figure 2.2)
- \* Check the type of actuator: single or double-acting (see Figure 2.2).
- \* For mechanical installation of the module see installation instruction leaflet DOC.QC4.MTI.1, as shipped with the module.

### 2.1 Intended use

The Bettis Q-Series actuator is an integrated concept for the automation of quarter turn valves, dampers or other quarter turn applications. It consists of two basic parts (see Figure 2.1):

1. Pneumatic actuator
2. Control Module

The control module allows operation of the actuator and supplies position feedback signals.

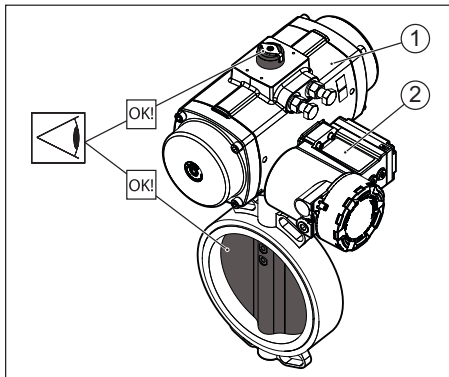


Fig. 2.1 Check proper mounting before connecting air supply and electrical wiring.

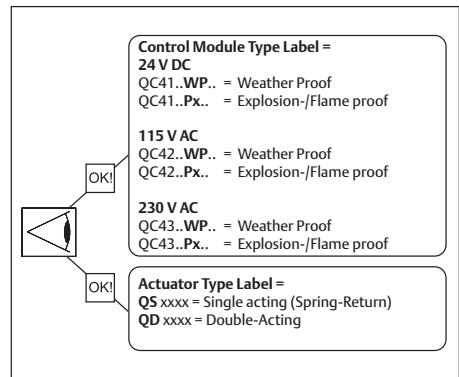


Fig. 2.2 Identification

## 2.2 Mechanical alignment and mounting of the control module

The control module is equipped with an alignment-edge on top of the module. This allows easy alignment and mounting of the control module on to the actuator housing.

### Procedure: (see Figure 2.3)

1. First take care that both mating faces from the actuator and control module are clean and free of dirt.
2. Check if the module has the required function
3. Remove the transparent film from the control module.
4. Ensure seals are placed correctly.
5. Level the screws with the surface.
6. Place the alignment-edge (1) of the control module at the top of the pneumatic interface.
7. Flip the module down taking care that the IPT Probe (see Figure 5; nr.2) on the actuator fits in the mating hole on the control module and loosely place the screws.
8. Tighten screws according force in sequence.

### Tightening moments

The Control Module should be fastened by using an Allen key and applying the following tightening moments:

- Allen Key No 5: 6.1 to 6.6 Nm (54 - 58.4 in-lbs)

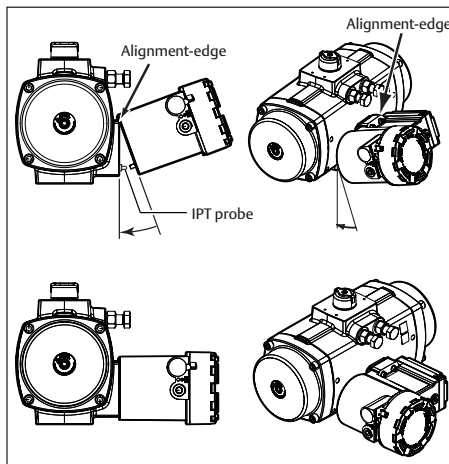


Fig. 2.3 Alignment and mounting of control module to actuator

### 3 Pneumatic connections



#### IMPORTANT

- 1 The actuator/valve combination can move after connecting the air supply.
  - 2 Ensure that the QC4x control modules are mounted properly to the actuator to achieve good functioning and the required ingress protection, before connecting the air supply.
  - 3 Check that the maximum supply pressure  $P_{max} = 8 \text{ bar}/116 \text{ psi}$
  - 4 Be sure that the minimum required supply pressure for the application is available at the actuator.
  - 5 Take appropriate measures to prevent condensation or moisture to entering the actuator or the control module. Condensation or moisture can damage these components and can result in failures.
  - 6 The exhaust ports Ra and Rb on the module (see Figure 3.1) are shipped from the factory with transport protection.
- \* If ingress protection IP66 or NEMA 4X is required, appropriate connections must be used in exhaust ports Ra and Rb.

#### 3.1 Operating media :

- \* Air or inert gasses.
- \* Air filtered at 50 micron.
- \* Dew point 10 K below operating temperature.
- \* For subzero applications take appropriate measures.

#### 3.2 Single acting (spring-return) or Double-Acting actuator :

- 1 Remove the transport sticker from the air supply (Ps).
- 2 Connect air supply to port (Ps).

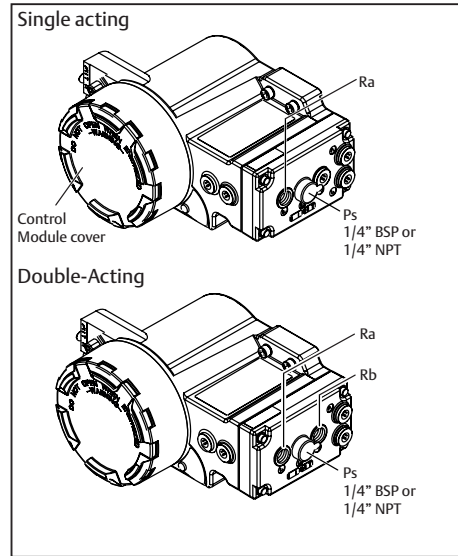


Fig. 3.1 Pneumatic connections

## 4 Electric Connections

The conventional Control Module contains a pilot valve for controlling the actuator and switches for position feedback.



### WARNING:

- \* If the Control Module is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- \* For electrical safety the marked protective conductor terminal inside or outside the Control Module housing shall be connected to earth.
- \* If required, mount earth wire (1) between top (2) and stainless steel washer (3) of earth wire connection (see Figure 4.2).
- \* To fulfill the electrical safety regulations according IEC 61010-1, a switch and circuit-breaker shall be included in the building installation. It is advised to indicate the location of the circuit breaker by means of a label on or nearby the installed Bettis Q-Series modules. The disconnection switch or circuit breaker shall disconnect all current-carrying conductors.
- \* Heat resistant cable and cable glands shall be used, suitable for temperatures of at least 80 °C
- \* Use and mount cable glands as required by national or local legislation.
- \* If IP66 or NEMA 4X ingress protection is required, then the electrical entries must be fitted with devices rated IP66 or NEMA 4X.

### 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 $\pm 10\%$ of nominal voltage
Over voltage category	II
Pollution degree	2 (3 when the cover remains closed)
Temperature	see Table 4.1



### Caution! : Risk of electric shock

- \* Installation, adjustment, putting into service, use, assembly, disassembly and maintenance of the control module is strictly reserved to qualified personnel.
- \* Do not attempt to install or repair any electric device without shutting off incoming power.

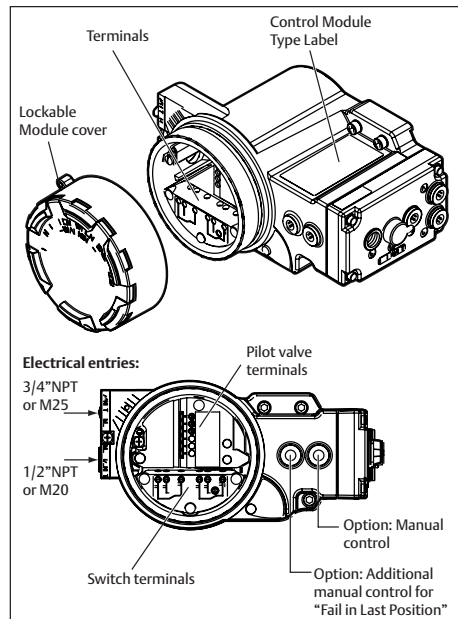


Fig. 4.1 Terminal connections behind cover.

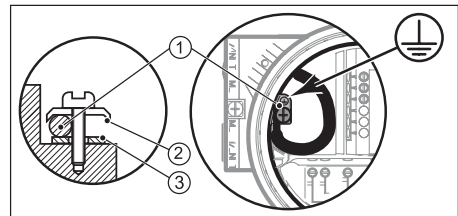


Fig. 4.2 Earth wire connection

#### 4.1 Bettis Q-Series QC4x modules Hazardous Area instructions



#### IMPORTANT

All installation, inspection, maintenance and repair of the equipment should be performed by suitably trained personnel.

The Control Modules must not be used in atmospheres that contains acetone, ethyl acetate or acetic acid vapors.

##### 4.1.1 ATEX/IECEx Intended use

The Control Modules QC4x..P5.. of the Bettis Q-Series pneumatic actuator is a Group II category 2 (ATEX) equipment with protection level Gb, Db (IECEx) and intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapors, mists or by air/dusts are likely to occur.

The pneumatic actuator part, together with the pneumatic module part of the Bettis Q-Series pneumatic actuators is a Group II category 2 equipment and intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapors, mists or by air/dusts are likely to occur.

Therefore it may be used in hazardous area classified Zones 1, 2 (Gasses) and/or 21, 22 (Dust).

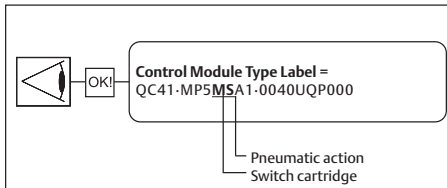


Fig. 4.4 Switch cartridge and pneumatic action identification

##### 4.1.2 Hazardous area Special safety instructions for safe use

1. For ATEX, all installation, inspection, maintenance and repair must be done by suitably trained personnel. For information refer to EN60079-14, EN60079-17, EN60079-19.
2. Substitution of component may impair suitability for Zone 2 Increased Safety.
3. Do not open cover of terminal compartment when an explosive atmosphere is present.

4. Cleaning this housing by rubbing should be done in a non-hazardous area,
5. Potential electrostatic charging hazard, clean only with a damp cloth - danger of propagating discharge.
6. The apparatus shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
7. All grounding and bonding installation requirements must be addressed.
8. The cable entry device and the closing elements of unused apertures must be of a certified flameproof type, suitable for the conditions of use and correctly installed.
9. Blind plugs or cable gland shall be engaged into the cable entries minimal 5.5 threads for M20x1.5 entries and minimal 5 threads for NPT entries.
10. Certified Ex t cable glands shall be use in a dust environment.
11. Heat resistant cable and cable glands shall be used, suitable for temperatures of at least 80 °C.
12. The maximum temperature of the supply air must stay below the maximum ambient temperature as marked on the control module (see Table 4.1).
13. The maximum temperature of the base actuator must stay below the maximum ambient temperature as marked on the control module (see Table 4.1).
14. Contact your local Emerson representative for information on the dimensions of the flame proof joints.
15. Precaution shall be taken to avoid danger of ignition due to electrostatic charges on the marking plate of the enclosure.

##### 4.1.3 FM Special safety instructions

1. Metric entries are not allowed. Metric entries are for IECEx or ATEX installations only.
2. Wiring must be done according NEC 500.

#### Note:

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).

Table 4.1 Ambient and maximum surface temperature rating.

Configuration				Temperature (°C)			
Module type	Switch cartridge	Pneumatic action	Max. Power dissipation	Min. ambient	Max. ambient	Max. Surface	Class
QC41 (24 V DC)	M, G O,C,N,H <sup>(1)</sup>	S,D,F	3.6W <sup>(1)</sup>	-25 °C / -13 °F	+60 °C / +140 °F	+80 °C / 176 °F	T6/T4
QC42, QC43 (115 or 230 V AC)		S,D	3.6W <sup>(1)</sup>	-25 °C / -13 °F	+60 °C / +140 °F	+80 °C / 176 °F	T6/T4
QC42, QC43 (115 or 230 V AC)		F	7.2W <sup>(2)</sup>	-25 °C / -13 °F	+60 °C / +140 °F	+80 °C / 176 °F	T6/T4

**Notes:**

- 1 1x or 2x 24 V DC pilot valves, or 1x 115/230 V AC pilot valve
- 2 2x 115 or 230 V AC pilot valves

**Pneumatic action**

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

**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

**4.1.4 Applied IECEx standards**

For Bettis Q-Series Control Module:

- QC4x...P5... (x = 1, 2 or 3)
- the following standards are applied:
- IEC 60079-0: 2017
  - IEC 60079-1: 2014-06
  - IEC 60079-31: 2013

**4.1.5 Product marking:**

Each control module is marked with the applicable ambient temperature marking (see Table 10.1).

**IECEx hazardous or Classified Location:**

Ex db IIB + H2 T4/T6 Gb  
Ex tb IIIC T80°C Db  
Certificate: IECEx DEK 11.0034X

**ATEX hazardous or Classified Location:**

CE 0518  
Ex II 2G Ex db IIB+H2 T4/T6 Gb  
Ex II 2D Ex tb IIIC T80°C Db  
Certificate: DEKRA 15ATEX0055X

**Inmetro hazardous or Classified Location:**

Explosion proof  
Ex db IIB+H2 T6 or T4 Gb IP66  
Ex tb IIIC T80°C Db IP66  
Certificate: IEx 17.0014X

**FM hazardous or Classified Location:**

XP CL I, II, III, DIV 1  
Groups BCDEFG, T4/T6  
Type 4X/IP66  
CL I, ZN 1, IIB+H2, T4/T6  
Certificate: FM17US0074X

**CSA hazardous or Classified Location:**

Class I, II, III, DIV 1  
Groups CDEFG, T4/T6  
Type 4X/IP66  
Ex d IIB+H2 T4/T6  
DIP A21 TA 80°C  
Certificate: CSA 12.2489009

## 4.2 Connecting Pilot valve(s)

The Control Module can be equipped with one or two pilot valves:

- \* One pilot valve is default and suitable for normal operation of double-acting or spring-return actuators
- \* Two pilot valves are required for Fail in Last Position for double-acting actuators.

### IMPORTANT

For hazardous area installations see instructions in paragraph 4.1

1. Before connecting the pilot valve, check the voltage on the control module label.
2. Remove control module cover (see Figure 4.1).
3. Guide the cable(s) through the electrical entry(ies).
  - Use and mount cable glands as required by national or local legislation.
4. For normal operation, make the electrical connections as shown in Figure 4.5.  
For double-acting actuators with Fail in Last Position function, make the electrical connections as shown in Figure 4.6
5. Mount the control module cover to the housing (see Figure 4.1) or continue with chapter 5. Take care that the cover seal is in place to comply to dust and water tightness according to IP66 or NEMA4X.
6. Lock the cover in position by turning the lock screw in, until it blocks.

### 4.2.1 Tools

**Table 4.2 Tool Table**

For terminals	Screw driver 0.6 x 3.5
Cover lock screw	Allen key nr 2

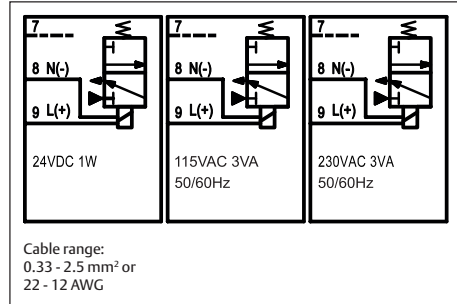


Fig. 4.5 Default Pilot valve wiring connections

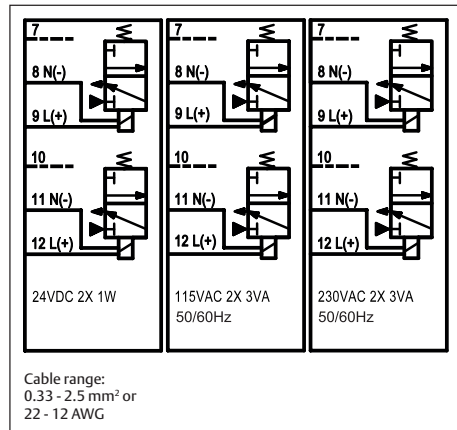


Fig. 4.6 Pilot valve wiring connections for Fail in Last Position



**4.3 Connecting Mechanical Feedback switches**

- Before connecting the switches, check the model code on the Control Module label.  
 QCXX.xxxMxx = Mechanical switches  
 QCXX.xxxGxx = Mechanical switches (gold plated)
- Guide the cable(s) through the electrical entry(ies).
  - Use and mount cable glands as required by national or local legislation.
- Make connections as shown in Figure 4.8 and Table 4.3/4.4
- Mount the Control Module cover. Take care that the cover seal is in place to comply to dust and water tightness according to IP66 or NEMA4X.

**IMPORTANT**

For hazardous area installations see instructions in paragraph 4.1

**Table 4.3 Mechanical switches**

Option code	M
Option code	G (gold contacts)
Type	Mechanical
Voltage	M: 277 V AC or 250 V DC (maximum)
	G: 125 V AC or 30 V DC (maximum)
Contacts	NO and NC
Temperature	See Table 4.1

**Notes:**

- 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.

**Table 4.4 Maximum currents mechanical switches**

Switch voltage	M type switch	G type switch
125 V AC	10 A (3 A <sup>1</sup> )	0.1 A <sup>2</sup>
250 V AC	10 A (3 A <sup>1</sup> )	-
30 V DC	0.5 A	0.1 A <sup>2</sup>
125 V DC	0.5 A	-
250 V DC	0.25 A	-

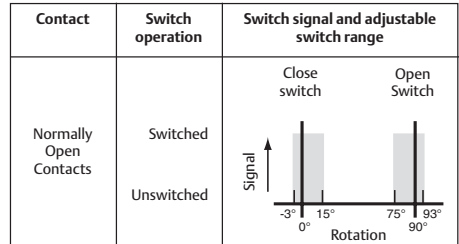
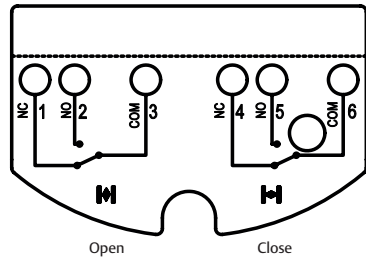


Fig 4.7 Adjustable switch range and factory settings

**Wiring diagram:**

- M = Mechanical
- G = Mechanical, gold contacts



Cable range : 0.33 - 2.5 mm<sup>2</sup> or 22 - 12 AWG

- Wiring diagram shown, is applicable for actuators with assembly code "CW". For actuators with assembly code "CC" (reverse acting) the "Open" and "Closed" switch connections are also reversed.
- Wiring diagram is shown in the actuators mid-stroke position.

Fig 4.8 Wiring diagram mechanical switches

**4.4 Connecting 2-Wire proximity switches**

- Before connecting the switches, check the model code on the Control Module label.  
 QCXX.xxxNxx = 2-Wire NAMUR proximity  
 QCXX.xxxHxx = 2-Wire 230 V AC proximity
- Guide the cable(s) through the electrical entry point(s).
  - Use and mount cable glands as required by national or local legislation.
- Make connections as shown in Figure 4.11 and Table 4.5 or 4.6.
- Mount the Control Module cover. Take care that the cover seal is in place to comply to dust and water tightness according to IP66 or NEMA4X.

**IMPORTANT**

For hazardous area installations see instructions in paragraph 4.1.

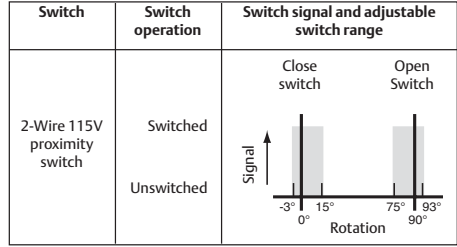


Fig 4.9 Switch characteristics 2-wire 230 V AC proximity switch

**Table 4.5 2-Wire NAMUR proximity switches**

Option code	N
Type	2-wire inductive, normally closed
Voltage	8 V DC nominal
Output	Unswitched: > 3 mA Switched: < 1 mA
Temperature	See Table 4.1
Compliant to	DIN EN 60947-5-6 (NAMUR)

**Table 4.6 2-Wire 230 V AC proximity switches**

Option code	H	
Voltage	20...250 V AC / 10...300 V DC (50...60 Hz AC)	
Current	Maximum	100 mA
	Peak	0,9A (20 ms/0,5 Hz)
	Leakage	< 1.7 mA
Temperature	See Table 4.1	

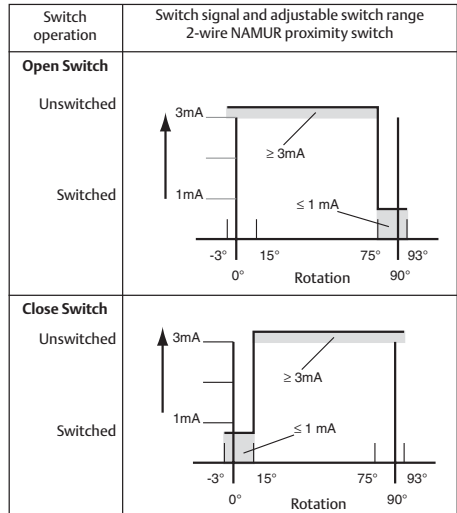


Fig 4.10 Switch characteristics 2-wire NAMUR proximity switch

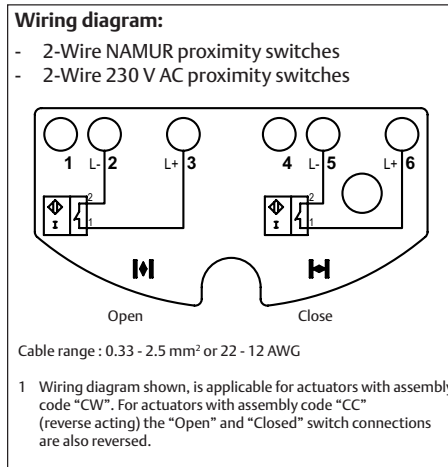


Fig 4.11 Wiring diagram 2-Wire proximity switches.

**4.5 “3-Wire” proximity switches**

1. Before connecting the switches, check the model code on the function module label.  
 QCXX.xxxOxx = 3-Wire PNP proximity  
 QCXX.xxxCxx = 3-Wire NPN proximity
2. Guide the cable(s) through the electrical entry(ies).
  - Use and mount cable glands as required by national or local legislation.
3. Make connections as shown in Figure 4.12 and Table 4.7
4. Mount the Control Module cover. Take care that the cover seal is in place to comply to dust and water tightness according to IP66 or NEMA4X.

**IMPORTANT**

For hazardous area installations see instructions in chapter X

**Table 4.7 3-Wire proximity switches**

Option code	O, V3 PNP
Option code	C, V3 NPN
Function	Make
Voltage	10 - 30 V
Current	100 mA maximum
	0 ... 0.5 mA typical (Off-state)
Temperature	See Table 4.1

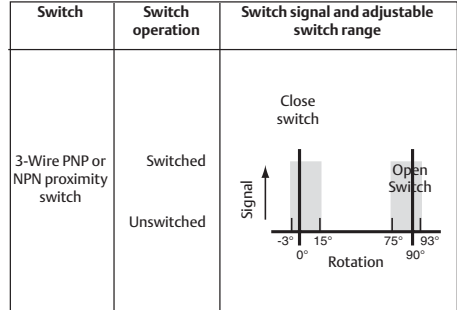
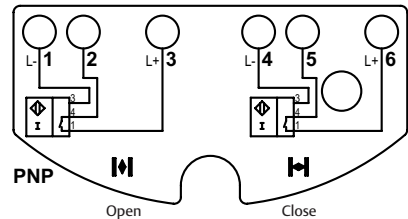


Fig. 4.12 Switch characteristics 3-wire PNP or NPN proximity switches.

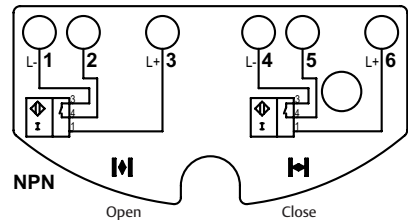
**Wiring diagram:**

3-Wire proximity switches PNP



**Wiring diagram:**

3-Wire proximity switches NPN



Cable range : 0.33 - 2.5 mm<sup>2</sup> or 22 - 12 AWG

1 Wiring diagram shown, is applicable for actuators with assembly code "CW". For actuators with assembly code "CC" (reverse acting) the "Open" and "Closed" switch connections are also reversed.

Fig. 4.12 Wiring diagram 3-wire PNP or NPN proximity switches.

## 5 Limit switch setting

### 5.1 Factory settings

- Mechanical stroke :  $90^{\circ} \pm 0.5^{\circ}$  (Actuator setting)  
 Switch points :  $\pm 15^{\circ}$  before each end of stroke (open and closed position, see Figure 5.1).  
 Adjustable range : See chapter 4.2 for the applicable switch type.

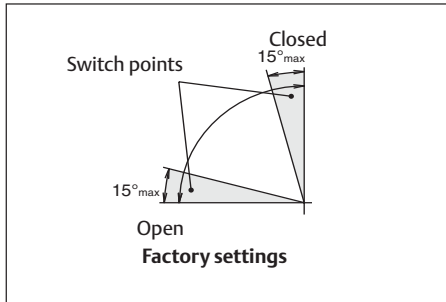


Fig. 5.1 Adjustable range and factory settings

If required the mechanical stroke and the limit switch setting can be re-adjusted.

- For mechanical stroke adjustment please see document DOC.IOM.BQ.E, available from [www.bettis.com](http://www.bettis.com).
- For re-adjusting the limit switches, see procedure below.

### 5.2 Before re-adjusting the limit switches.

#### IMPORTANT

- \* Before mounting the actuator on the valve, be sure that both the actuator and the valve have the same “open” or “closed” position.
- \* Set the Mechanical stroke before setting the limit switches.

### 5.2.1 Pneumatic and electrical connections

Make pneumatic and electrical connections before adjusting the limit switch setting.  
 See chapter 3 and 4.

### 5.2.2 Switch point setting and valve rotation direction.

The QC41, QC42 and QC43 are equipped with non-intrusive switch adjustment. The adjustment screws are accessible behind a small shield in the front of the module (see Figure 5.3). This means that the switch adjustment can be done without opening the module.

Normally valves are “Closed” after a clock wise rotation.

- In this case the top adjustment screw (see Figure 5.3), sets the switch point of the “Closed” position and bottom adjustment screw sets the switch point of the “Open” position.
- When you have a valve that is “Open” after a clock wise rotation, the position feedback will be reversed.

The Table below indicates which re-adjustment screw and terminals are related to the “Open” or “Closed” switch point setting (see Figure 16).

Table 5.1 Re-adjustment screws

Re-adjustment screw :	Terminals	Valve movement	
		“Close” after a clock wise rotation	“Open” after a clock wise rotation
Bottom	1, 2, and 3	Open position	Close position
Top	4, 5, and 6	Close position	Open position

### 5.2.3 Working principles Switch Operating Mechanism (see Figure 5.2)

The Switch Operating Mechanism is intended to operate the position feedback switches and allows adjustment of the switch points in the open and closed end positions. Factory setting is that the switches are activated 15° before the end of the open and closed stroke.

#### Switch Operation

The rotation of the actuators pinion operates the IPT device (1) which results in a linear movement. The linear movement of the IPT device operates lever (3). The lever amplifies the linear movement of the IPT device and operates the switch operating rod (5). Dowel pin (6) in the rod operated the levers of the open and closed switch elements (8 and 9).

The lever is of the “floating” type. When the IPT device operates the lever, it moves completely upwards until it meets the upper pivot block (4). At this point the lever will tip over and pull down the switch operating rod (5) and operates the bottom switch (7). When the IPT device moves back the springs cause the lever to move completely downwards until it meets the lower pivot block (2). At this point the lever will tip over and push up the switch operating rod (5) and operates the top switch (8).

#### Switch point adjustment

The position of the lower pivot block (2) can be changed by adjustment screw (10) and the position of the upper pivot block (4) can be changed by adjustment screw (9).

By adjusting the position of these pivot blocks the switch points will be changed.

The adjustment screws (9 and 10) can be found behind the shield (12) in front of the module. To access the adjustment screws loosen the screw (11) and rotate the shield (12) as shown.



**Caution: Do not force the adjustment screws when resistance is felt.**

During adjustment there are three situations that can damage the adjustment screw head and internal mechanisms when forcing the adjustment screws.

1. Pivot block (2) will be blocked at bottom if screw (10) is rotated too much counter clock wise.
2. Pivot block (3) will be blocked at top if screw (9) is rotated too much clock wise.
3. Pivot blocks (2 and 3) will interfere with each other, if the adjustment screws (9 and 10) are rotated too much in the direction according to their related arrows.

Situation 1 and 2 may happen in combination with situation 3.

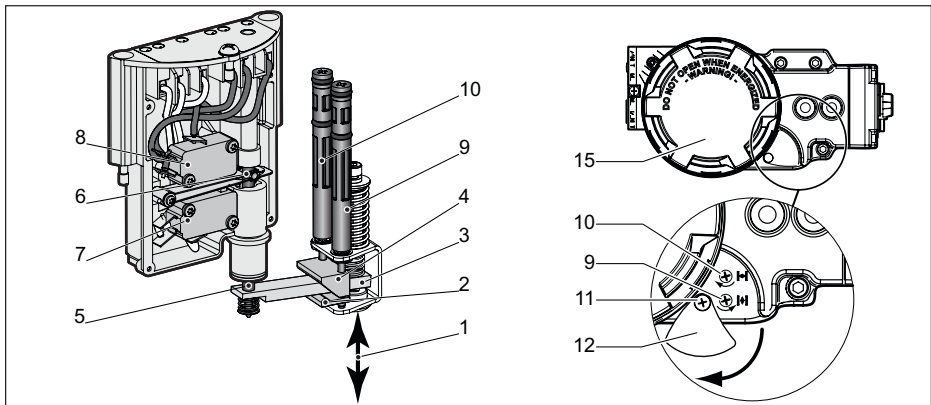


Fig. 5.2 Working principles Switch Operating Mechanism

### 5.3 Re-adjustment of switch points



#### IMPORTANT

The procedure below assumes:

- That the actuator and control modules are according the factory settings. If the switch setting is somehow lost or forgotten, then consult paragraph 6.3 to set the switch point setting back to factory setting.
- That the actuator / valve assembly is closed after a clock wise rotation (see chapter 5.2).

Below procedure assures that the position feedback complies more accurately with the valve position and will set the switch point at approximately 4° before the end of the stroke.

To set and detect the switch point, use a multi meter, connected to the switch terminals, to measure a resistance change as applicable per switch type (see applicable wiring diagram in chapter 4.2). For the proximity switches, you can use a proximity switch tester.

#### Procedure (see Figure 5.3):

1. Remove cover (15) and loosen the screw (11) of the shield (12) and turn the shield down.

#### Closed Position:

2. Move the actuator/valve assembly to the closed position by removing the control signal from pilot valve terminal 8 and 9 (see § 4.1).
3. Turn top screw (10) counter clock wise (**do not force the adjustment screw**) until the switch trips to the “off state” (no signal).
4. Turn top screw (10) clock wise (**do not force the adjustment screw**) until the switch trips to the “on state”. This position represents the actual, mechanical “closed” position of the valve.
5. Turn the screw minimal a 1/2 turn clock wise. The “closed” position switch point is now set.

#### Open Position:

6. Move the actuator to the open position by applying the applicable voltage to pilot valve terminal 8 and 9 (see § 4.1).

7. Turn bottom screw (9) clock wise (**do not force the adjustment screw**) until the switch trips to the “off state” (no signal).
8. Turn bottom screw (9) counter clock wise (**do not force the adjustment screw**) until the switch trips to the “on state”. This position represents the actual “open” position of the valve.
9. Turn the screw minimal a 1/2 turn counter clock wise. The “open” position switch point is now set.
10. Turn the shield (12) back over the adjustment screws and fasten it with the screw (11) and mount the main round cover back in place.

Table 5.2 Tool Table

Shield screw	Cross slotted Phillips nr. PH2
Adjustment screws	0.6 x 3.5 or Cross slotted Phillips nr. PH2

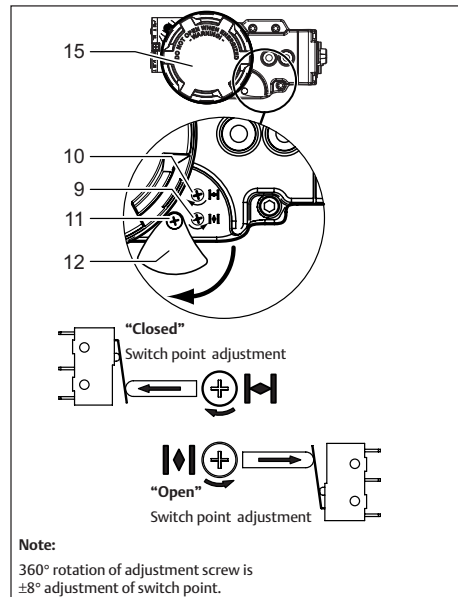


Fig. 5.3 Re-adjustment screws for “Open” and “Closed” position feedback

## 5.4 Check operation

### 5.4.1 Default (single) pilot valve

- 1 Connect pressure according chapter 3 and a control signal to terminals (7) 8 and 9 according § 4.1 Figure 4.3.
- 2 Actuator moves to “Open” position. “Open” limit switch is activated and “Close” limit switch is deactivated.
- 3 Remove voltage from terminals 9 and 8.
- 4 Actuator moves to “Close” position. “Close” limit switch is activated and “Open” limit switch is deactivated.
- 6 Mount the cover to the Control Module (see Figure 4.1).

### 5.4.2 Dual pilot valve (Fail in Last Position) operation

1. Connect pressure according chapter 3 and a control signal to terminals (7) 8 and 9 according § 4.1 Figure 4.4.
2. Actuator moves to “Open” position. “Open” limit switch is activated and “Close” limit switch is deactivated.
3. Remove voltage from terminals 9 and 8.
4. Actuator Stays in the “Open” position.
5. Connect pressure according chapter 3 and a control signal to terminals (10) 11 and 12 according § 4.1 Figure 4.4.
6. Actuator moves to “Closed” position. “Close” limit switch is activated and “Open” limit switch is deactivated.
7. Remove voltage from terminals 9 and 8.
8. Actuator Stays in the “Closed” position.
9. Mount the cover to the Control Module (see Figure 4.1).

## 6 Trouble shooting

### 6.1 The “Open” and “Closed” position feedback signals are reversed from the actual valve positions.

- 1 Check if the actuator is correctly mounted to the valve.  
Before mounting the actuator on the valve, the actuator and the valve should have the same “open” or ‘closed” position (see **Installation and Operation Manual Bettis Q-Series Valve Actuator DOC.IOM.BQ.E**).
- 2 Some valves may be operated in such a way that they are:
  - “Open” after a clock wise rotation and
  - “Closed” after a clock wise rotation.
- 3 Please see § 5.2 for setting the “Open” and “Closed” position feedback signals

### 6.2 The actuator does not give (good) position feedback signals.

- 1 Check if the actuator is correctly mounted to the valve.
- 2 Re-adjust the limit switch setting as per chapter 5.3

### 6.3 Factory setting of the switch points.

#### IMPORTANT

The procedure below assumes:

- That the actuator / valve assembly is closed after a clock wise rotation (see also § 5.1).
- The control module is pneumatically and electrically connected according chapter 3 and 4.

This procedure sets the switch point settings of the switches, back to the factory settings ( $\pm 15^\circ$  before each end of stroke), assuming a mechanical stroke of  $90^\circ \pm 0.5^\circ$  of the actuator.

To set and detect the switch point, use a multimeter, connected to the switch terminals, to measure a resistance change as applicable per switch type (see applicable wiring diagram in chapter 4.2). For the proximity switches, you can use a proximity switch tester.



**Procedure (see Figure 5.3):**

1. Remove cover (15) and loosen the screw (11) of the shield (12) and turn the shield down.

**Closed Position:**

2. Move the actuator/valve assembly to the closed position by removing the control signal from terminal 8 and 9 (see § 4.1).
3. Turn top screw (10) counter clock wise maximum 20 turns, (**do not force the adjustment screw**) until the switch trips to the “off state” (no signal).
4. Turn top screw (10) clock wise 1 3/4 turn (**do not force the adjustment screw**).  
The “closed” position switch point is now set to factory setting.

**Open Position:**

5. Move the actuator to the open position by applying the applicable voltage to terminal 8 and 9 (see § 4.1).
6. Turn bottom screw (9) clock wise maximum 20 turns, (**do not force the adjustment screw**) until the switch trips to the “on state” (no signal).
7. Turn bottom screw (9) counter clock wise 1 3/4 turn (**do not force the adjustment screw**)  
The “open” position switch point is now set to factory setting.
8. Turn the shield (12) back over the adjustment screws and fasten it with the screw (11) and mount cover (15) back in place.

**IMPORTANT**

**Do not force the adjustment screws**

During switch point adjustment, do not force the adjustment screws when you feel an obstruction. Forcing the adjustment screws can damage the cross head of the adjustment screw.

## 7 Maintenance

The Bettis Q-Series Control Modules are designed to operate without maintenance. For any further maintenance to the actuator see Installation and Operation Manual Bettis Q-Series Valve Actuator, DOC.IOM.BQ.E or contact your local Bettis Q-Series representative.

Installation, adjustment, putting into service, use, assembly, disassembly, maintenance and repair of the Control Module must be done by qualified personnel.

## 8 Optional Controls

### 8.1 Manual Control options

(see Figure 8.1)

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.

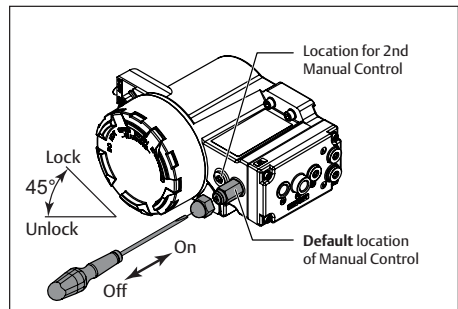


Fig. 8.1 Local Manual Control options

#### 8.1.1 Mounting Manual Control

- 1 To add a Manual Control, remove the plug(s) in front of the module and turn in the Manual Control.
  - 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.

### 8.1.2 Manual Control operation

- 1 The Manual Control has a "Push and Lock" function:
  - To operate the Manual Control, use a screw driver, push to activate and release to de-activate the pilot valves.
  - If required turn it 45°, to lock it in position and keep the actuator in its operated state.
- 2 In case of a Fail in Last Position configuration with two manual controls:
  - The manual control on the right side (default location) will pressurize the central air chamber and cause the actuator to rotate counter clock wise. For reverse acting Bettis Q-Series actuators (Assembly code CC) the actuator will rotate clock wise.
  - The manual control on the left side (Location for 2nd Manual Control) will pressurize the end cap air chambers and cause the actuator to rotate clock wise. For reverse acting Bettis Q-Series actuators (Assembly code CC) the actuator will rotate counter clock wise.
  - In order to operate one of the manual control, be sure the opposite manual control is de-activated and unlocked.
- 3 It is possible to rotate the screw multiple cycles. The unit will than toggle every 90° between "locked" (1) and "unlocked" (0).

### 8.2 Speed control option

(see Figure 8.2).

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.

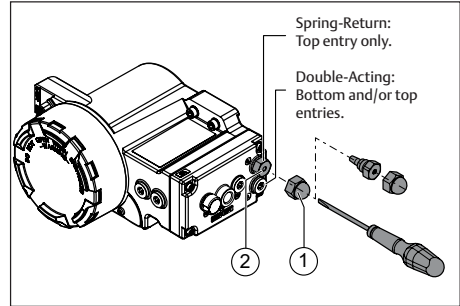


Fig. 8.2 Speed control operation

#### 8.2.1 Mounting Speed Control throttle(s):

- 1 Remove the plug(s) at the side of the module and turn in the throttle (1).
- 2 Spring-Return actuators: Use the top entry only.
- 3 Double-Acting actuators: Use both bottom and top entries.
  - For standard actuators, the top entry will throttle the closing stroke.
  - For standard actuators, the bottom entry will throttle the opening stroke.
  - For reverse acting actuators, the opposite strokes will be throttled.

#### 8.2.2 Adjusting Speed Control throttle(s):

- 1 Remove the nut cap (2).
- 2 Clockwise rotation of the adjustment screw reduces the speed.
- 3 Counter clockwise rotation of the adjustment screw increases the speed.
- 4 Replace the nut cap.

## 9 Related Information






Other documents containing information related to the Bettis Q-Series Module include:

- BQ1.604.10 Bettis Q-Series Control Module data sheets
- DOC.IOM.BQ.E Installation Operation and Maintenance Manual.

These documents are available, in multiple languages, for download from

[www.emerson.com/bettis](http://www.emerson.com/bettis)

## 10 EU - Declaration of Conformity

	Legal representative entity for the European Union: Emerson Automation Solutions, Actuation Technologies Holland Faszor 6, 8000 Székesfehérvár, Hungary	ROC nr. 11070 Rev. 5	
<b>EU DECLARATION OF CONFORMITY</b> Issued in accordance with the <b>Low Voltage Directive 2014/35/EU</b> <b>ATEX Directive 2014/34/EU</b>			
We hereby declare, that the products specified below meet the basic health and safety requirements of the above mentioned European Directives.			
Product description	: Bettis Q-Series Control module Exd		
Serial number	: Each Control module has an identifiable serial number		
Year of Construction	: Each Control module has an identifiable Year of Construction		
Manufacturer	: Emerson Process Management Valve Automation (M) Sdn. Bhd. Lot 13112, Mukim Labu, Kawasan Perindustrian Nilai, 71807 Nilai, Negeri Sembilan Malaysia		
<b>ATEX Directive 2014/34/EU</b>			
Types	: QC41...P5..., QC42...P5..., QC43...P5...		
ATEX Certificate No.	: DEKRA 15ATEX0055 X		
Marking	:  II 2G Ex db IIB + H2 T4/T6 Gb  II 2D Ex tb IIIC T80°C Db		
Applicable standards	: EN 60079-0: 2011 + A1 : 2013, EN IEC 60079-0 : 2018 EN 60079-1 : 2014, EN 60079-31 : 2014		
Notified body	: DEKRA Certification B.V., Notified body no : 0344 Meander 1051, 6825 MJ Arnhem, The Netherlands		
<b>LVD Directive 2014/35/EU</b>			
Types	: QC42...WP..., QC43...WP...		
Applicable standards	: EN 61010-1 : 2010		
Note	: The above listed ATEX certified products are excluded from the Low Voltage Directive		
Signed: 			
Name: S. Jones			
Position: Director, Rack and Pinion SBU Emerson Automation Solutions Actuation Technologies			
Date: 2020-04-07			
Place: Houston TX, U.S.A.			
VCCAQ-15298-EN			

**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 Faszor 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](http://www.emerson.com/actuationtechnologieslocations) or contact us at [info.actuationtechnologies@emerson.com](mailto:info.actuationtechnologies@emerson.com)

[www.emerson.com/bettis](http://www.emerson.com/bettis)

VCIOM-15387-EN ©2020 Emerson. All rights reserved.

The Emerson logo is a trademark and service mark of Emerson Electric Co. Bettis™ is a mark of one of the Emerson family of companies. All other marks are property of their respective owners.

The contents of this publication are presented for information purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the designs or specifications of our products at any time without notice.