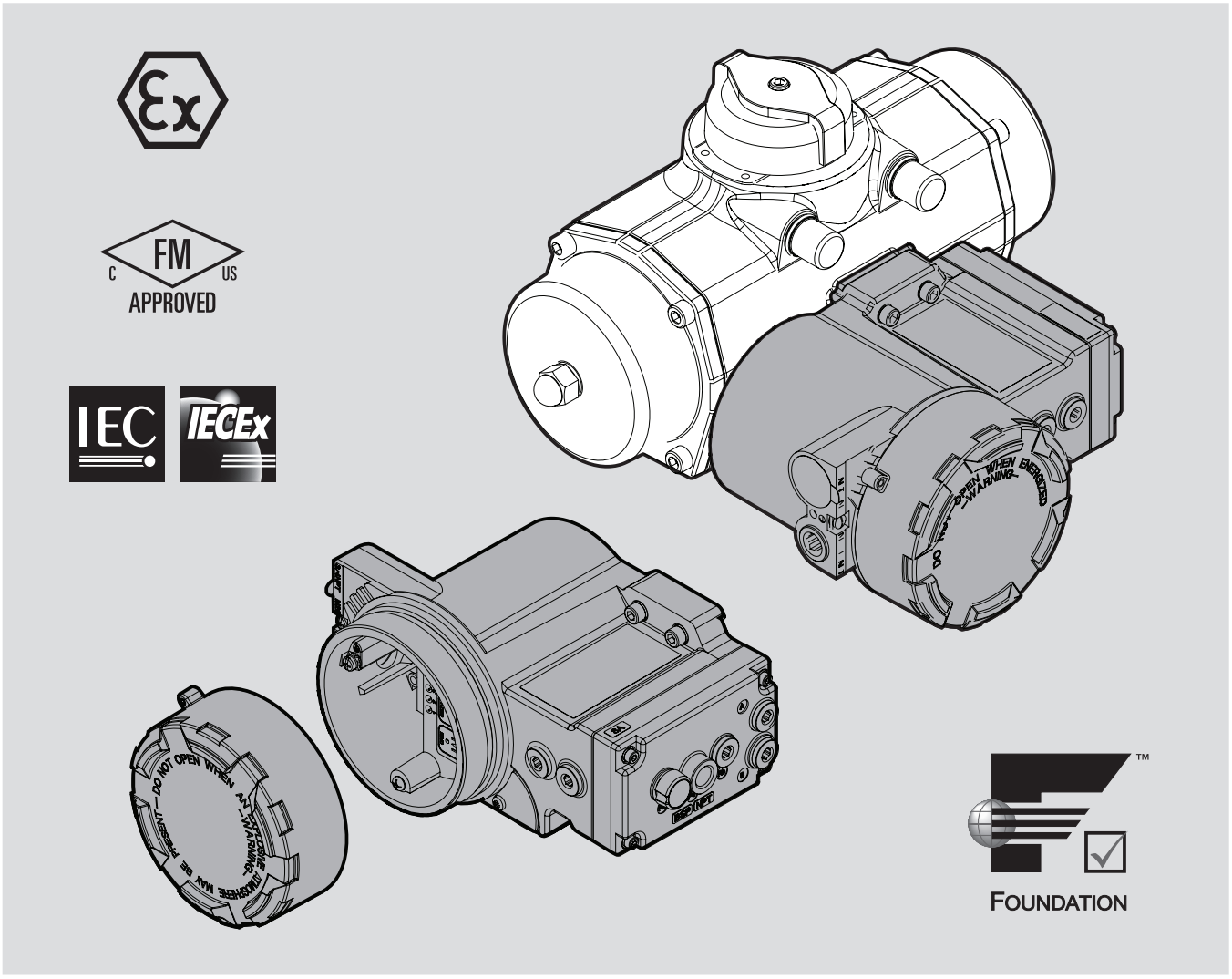
Reference manual
DOC.RM.BQC54.E Rev: 1
February, 2016

Bettis Q-Series Valve Actuator

QC54, Foundation Fieldbus Control Module



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CONTENTS

A ESSENTIAL INSTRUCTIONS

READ THIS SECTION BEFORE

A.1 Before you start

- Bettis Q-Series pneumatic actuators must be isolated both pneumatically and electrically before any (dis)assembly is begun.
- It is not permitted to connect a pressure vessel with unreduced media to the Bettis Q-Series pneumatic actuator.
- Bettis Q-Series actuators must not be connected to an air supply greater than 8 bar g or 120 psig
- This manual does not provide instructions for installations in hazardous areas. See applicable sections of Installation Guide DOC.IG. QC54.1 or installations in hazardous areas.
- Installation, adjustment, putting into service, use, assembly, disassembly and maintenance of the pneumatic actuator must be done by qualified personnel.

A.2 Orientation (see fig. A1)

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 three basic parts:

1. Pneumatic actuator
2. Control Module

A.3 Applicable control modules

QC54 - FOUNDATION Fieldbus™ Weather proof

QC54 - FOUNDATION Fieldbus™ Non-Incendive or Non Sparking

QC54 - FOUNDATION Fieldbus™ Intrinsically safe

Check the module label for the right execution.

A.4 Installation, operation and maintenance reference documents

Before mounting, installing, commissioning or (dis) assembling the actuator consult the following documents:

- All chapters of this Reference manual and
- Installation Guide of the supplied Control Module.
- For installation in hazardous area's: Hazardous Area Control Drawing installation instructions, as shipped with the Control module.

All these items are available from www.emersonprocess.com/bettis or through your local Valve Automation representative).

A.5 Operating medium

- Air or inert gasses.
- Air filtered at 5 micron.
- Dew point 10 K bellow operating temperature.
- For subzero applications take appropriate measures.

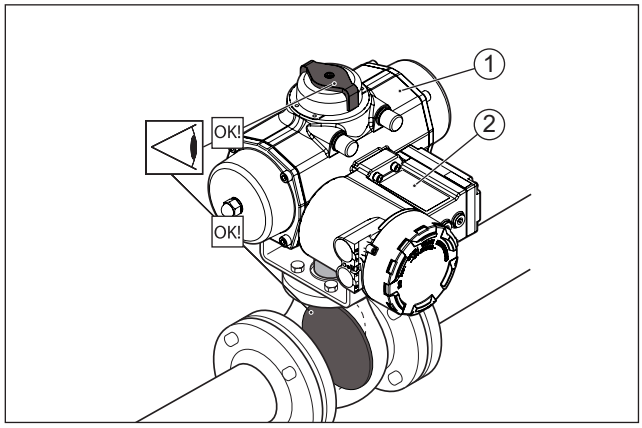

Fig A.1 Orientation

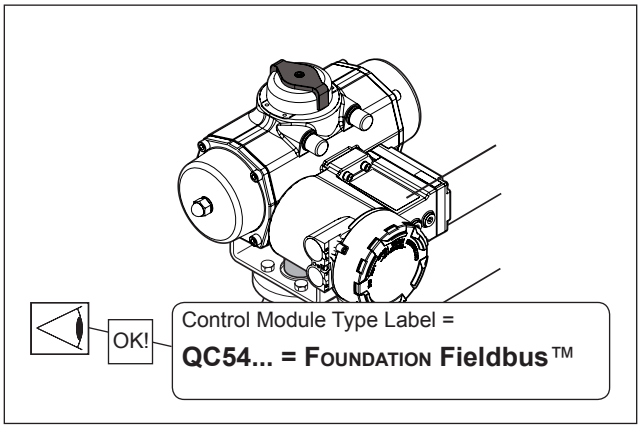

Fig A.2 Module check

A.6 Product integrity

- Assembly or disassembly is only allowed for replacing seals and guide bands (soft parts).
- Under the European Pressure Equipment Directive, conversion of actuators may only be performed by companies or personnel, authorized by Emerson Process Management .

A.7 Hazardous areas

Improper installation in a hazardous area can cause an explosion.

- Assembly, disassembly and maintenance must be done outside potentially explosive area's
- For information about installation in a hazardous area, refer to the appropriate sections of the Installation Guide, as shipped with the control module.

A.8 Warning ; Moving parts

- Applying pressure to the actuator or
- Applying a control signal to the Control module, may cause the actuator/valve assembly to operate.

A.9 Prevent moisture entering the actuator

Condensation or moisture that enters the actuator, the pneumatic module or the control module can damage these components and can result in failures. Therefore:

- Try not to mount the actuator with the conduit openings or the air entries, pointing upward.
- Ensure integrity of gaskets and o-rings.
- Install drip loops in conduit or cable.
- Seal all conduit openings whether used or not.

A.10 Warning ; Magnetic material

- Do not put the Bettis Q-Series in direct contact with magnetic material. This can cause damage or malfunction.

A.11 Warning ; Temperature range

- Do not exceed the temperature limits of the module as specified in this manual or in the Installation Guide DOC.IG.QC54.1.
This can cause damage or malfunction.

1 Module Description

1.1 FieldQ™ FOUNDATION Fieldbus™ QC54 Control Module

This manual contains installation, operating, and maintenance information for the FieldQ™ FOUNDATION Fieldbus™ QC54 control module (Fig. 1).

Only qualified personnel should install, operate, and maintain this module. If you have any questions concerning these instructions or for information not contained in this instruction manual, contact your local Valve Automation sales office or sales representative for more information.

The FieldQ module is an interoperable, process-controlling, communicating, microprocessor-based, module. In addition to its primary function of controlling the position of the valve, the FieldQ module, using FOUNDATION Fieldbus™ communications protocol, gives easy access to information critical to process operation, as well as process control. You can gain information from the principal component of the process, the control valve itself, by using a personal computer or operator's console within the control room.

Using a compatible field bus configuration device, you can obtain information about the health of the module and the actuator and valve control elements. You can also obtain asset information about the module. You can set input and output configuration parameters. Using the FOUNDATION Fieldbus™ protocol, information from the module can be readily integrated into a control system.

The FieldQ module is an assembly in an IP66 / NEMA4X enclosure that provides input and output signals to control and monitor the FieldQ actuator. The module is self-contained providing control and position feedback via the Field bus interface.

Figure 1.2 provides a view of the module with key connection points labeled. Connect to the module by removing the cover, inserting the wiring through the electrical entries and connecting each wire to the proper location on the terminal board.
More information about installing a module can be found in chapter 2.

After installing the module, the module can be commissioned by following the instructions as per chapter 3. All functions of the module are explained in more detail in Chapter 4 which includes the full Resource block and Transducer block tables.

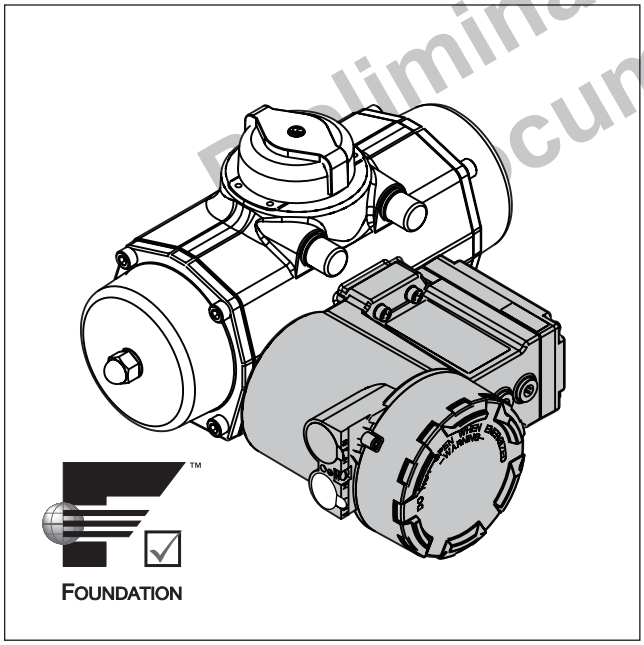

Fig 1.1 Bettis Q-Series FOUNDATION Fieldbus™ Module

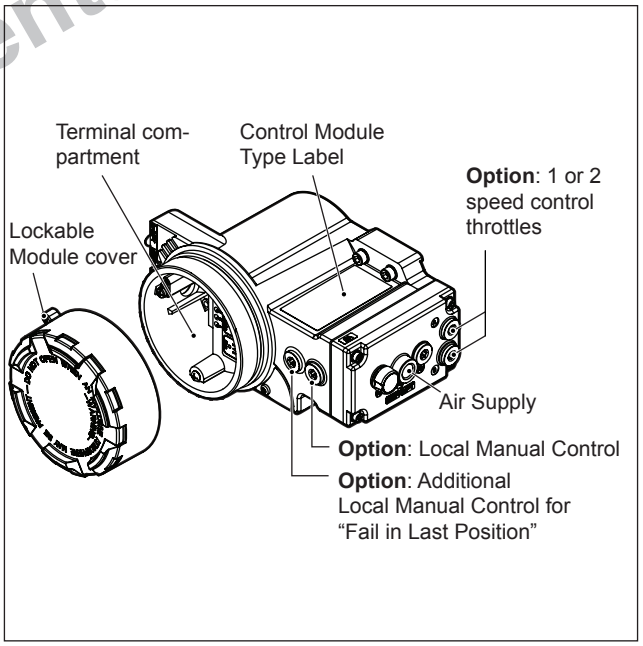

Fig 1.2 QC54 Control Module overview

1.2 FOUNDATION Fieldbus™ Communication

The Bettis Q-Series QC54 module uses the FOUNDATION Fieldbus™ protocol to communicate with other field devices and the host system. FOUNDATION Fieldbus™ is an all-digital, serial, two-way communication system, which interconnects field equipment such as transmitters, valve controllers, and process controllers. Field bus is a local-area network (LAN) for devices used in both process and manufacturing automation with built-in capability to distribute the control application across the network.

The field bus environment is the base level group of digital networks in the hierarchy of plant networks. The field bus retains the desirable features of analog systems such as:

- A standardized physical interface to the wire
- Bus-powered devices on a single wire pair
- Intrinsic safety options

In addition, use of FOUNDATION Fieldbus™ enables:

- Increased capabilities due to full digital communications
- Reduced wiring and wire terminations due to multiple devices on a single pair of wires
- Increased selection of suppliers due to interoperability
- Reduced loading on control room equipment available by distributing control and input/output functions to field devices
- Speed options for process control and manufacturing applications

For more information on the operation of the FOUNDATION Fieldbus™, refer to your DeltaV documentation and the FOUNDATION Fieldbus™ specifications.

1.3 Device Description and Methods

This manual describes device setup using the Device Descriptions (DD) specified by the FOUNDATION Fieldbus™ protocol. Parameter access and methods are also described in this manual. FOUNDATION Fieldbus™ uses the DD, Function Blocks, and a Capabilities File to achieve interoperability between the module and field bus components from other manufacturers in the control systems including hosts and other devices. The DD provides information to describe the data interface to the device while the Capabilities File provides information about the device to enable the creation of a control strategy without a physical device (off-line configuration).

For field bus devices, in addition to providing parameter definitions and other information required by the control system to communicate with the device, the DD may also include methods. Methods can be used for a variety of functions including remote restarting of the control module. Methods are a predetermined sequence of steps using a structured programming language and the interface definition for the module.

How the method prompts and how messages appear is determined by the host system. For information on using methods on the host system, see Appendix E and the appropriate host system documentation.

1.4 Node Address

The default node address of the Bettis Q-Series QC54 module is 247 (status = standby).

Use the host system to commission the module and assign it a working address. For information on using the host system for device commissioning and assigning addresses, see the appropriate host system documentation.

1.5 FOUNDATION Fieldbus™ function blocks

Function blocks, within a field bus device, perform the various functions required for process control, such as process variable input, output, and control functions such as Proportional/Integral/Derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes. Then, function blocks can be combined into a process that can be implemented within a single device or in multiple devices via the field bus network.

The following function blocks are implemented in the Bettis Q-Series module.

- 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

Function Block parameters and usage is described in the host system documentation. Please refer to this documentation for detailed information on function blocks.

1.5.1 Resource Block

The Resource Block contains hardware and electronics information. There are no linkable inputs or outputs to the Resource Block.

1.5.2 Transducer Block

The Transducer Block is the primary interface to the control function of the device. This Transducer Block contains all the parameters necessary to configure the device and set diagnostics parameters.

1.5.3 Analog Input (AI) Block

The Analog Input (AI) function block processes field device measurements and makes this data available to other function blocks.

The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. The AI block is widely used for scaling functionality.

1.5.4 Discrete Output (DO) Block

The Discrete Output (DO) function block processes a discrete set point then outputs the set point to a specified I/O channel to produce an output signal. The DO function block supports mode control, output tracking, and simulation. There is no process alarm detection in the block. In operation, the DO function block determines its set point, sets the output, and, as an option, checks a read back signal from the field device to confirm the physical output operation.

1.5.5 Discrete Input (DI) Block

The Discrete Input (DI) function block processes a single discrete input from a field device and makes it available to other function blocks. The DI function block supports mode control, signal status propagation, and simulation.

1.6 Related Information

1.6.1 FOUNDATION Fieldbus™ Installation and wiring guidelines

FOUNDATION Fieldbus™ Technical Overview (available from the Fieldbus Foundation)

1.6.2 Other Related Information

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

1.604.02	Control Module data sheet
DOC.IG.QC54.1	Installation Guide QC54 Control Module with FOUNDATION Fieldbus™

These documents are free available for download from **www.emersonprocess.com/bettis** or contact your local Bettis Q-Series representative.

1.7 Specifications, FOUNDATION Fieldbus™ Hardware

Electrical Input, Field bus Interface

Voltage Level	: 9 to 32 volts
Nominal Current	: 18 mA, maximum
Reverse Polarity Protection	: Unit is not polarity sensitive
Required external protection	: Restrict the power supply current to <600mA.

Environmental conditions :

Temperature	-20°C to +50°C (-4°F to +122°F)
Humidity	0 to 85% at 25°C(+77°F) de-rate to 50% above 40°C (104°F) (non-condensing).
Altitude	Operating full power available up to 2000 meter (6000 feet).
Use	In- and outdoor.

Function Blocks Available

- Analog Input (AI)
- Discrete Input (DI)
- Discrete Output (DO)
- PID to Proportional/Integral/Derivative

Digital Communication Protocol

Manchester-encoded digital signal that conforms to IEC 1158-2 and ISA 50.02

Electrical Entry

2 x M20, 1/2” NPT, 3/4" NPT

Electrical connections

Terminal Block

Optional quick connectors

Housing

Material	: Aluminum Alloy
Finish	: Chromated with polyurethane based coating.

Enclosure : IP66 / NEMA4X

2 Installation

2.1 Introduction

The Bettis Q-Series FOUNDATION Fieldbus™ Control module is a two-wire device powered by the bus.

For various application guides like installation and wiring guidelines please check:

www.fieldbus.org/About/FoundationTech/Resources/

The following sections provide instructions on pneumatic and electric installations. For instructions on commissioning, see chapter 3.

2.2 Applicable control modules

QC54 - FOUNDATION Fieldbus™ Weatherproof

QC54 - FOUNDATION Fieldbus™ Non-Incendive or Non Sparking

QC54 - FOUNDATION Fieldbus™ Intrinsically safe

2.3 Before starting

* Be sure that the actuator is correctly mounted on the valve before connecting air supply and electrical wiring (see Installation & Operation Manual Bettis Q-Series Valve Actuator, DOC.IOM.BQ.E)
* Check the module label for the right execution (see fig. 2.2)
* Check the type of actuator: single or double acting (see fig. 2.2)

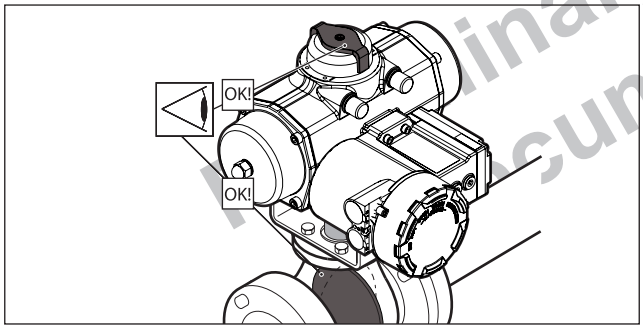

Fig. 2.1: Check proper mounting before connecting air supply and electrical wiring.

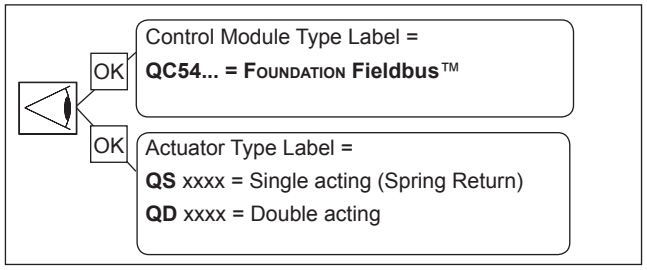

Fig. 2.2 Identification

2.4 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 fig 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)

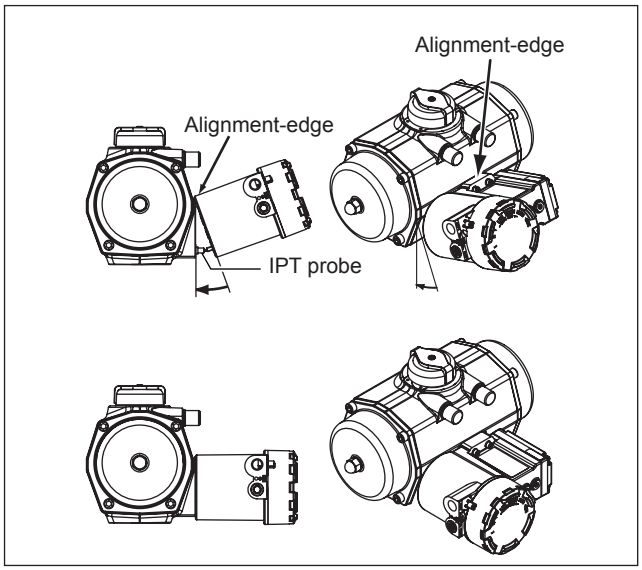

Fig. 2.3 Alignment and mounting of control module to actuator

2.5 Pneumatic connections

IMPORTANT

1. **The actuator/valve combination can move after connecting the air supply.**
2. **Ensure that the QC54 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 Pmax = 8bar/116Psi**
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.**
7. **If ingress protection IP66 or NEMA4X is required, appropriate connections must be used in exhaust ports Ra & Rb.**

2.5.1 Operating media :

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

2.5.2 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).

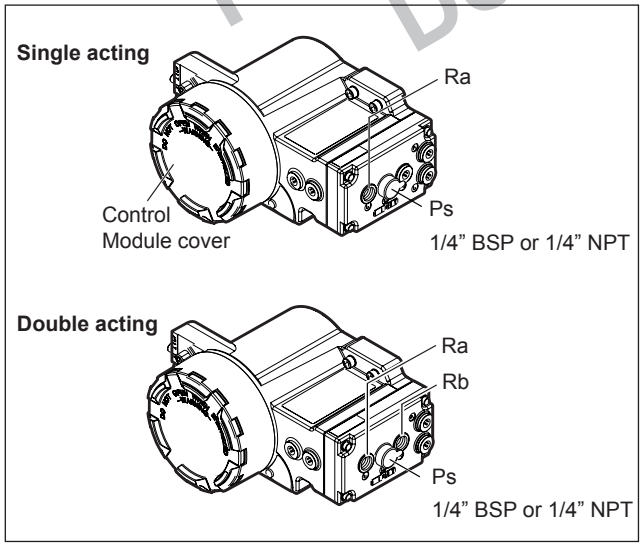

Fig. 2.4: Pneumatic connections

2.6 Electric Connections

2.6.1 Electrical Input, Fieldbus Interface

Voltage range *	9 to 32 volts
Maximum current	18 mA
Reverse polarity protection	Unit is not polarity sensitive.
Required external protection	Restrict the power supply current to <600mA.
Environmental conditions :	
Temperature *	-20°C to +50°C (-4°F to +122°F)
Humidity	0 to 85% at 25°C(+77°F) de-rate to 50% above 40°C (104°F) (non-condensing).
Altitude	Operating full power available up to 2000 meter (6000 feet).
Use	In- and outdoor.

* In case the Control module is used in Hazardous locations, check the chapters 10, 11 or 12 of the installation guide DOC.IG.QC54.1 for the applicable temperature or voltage range.

2.6.2 Electrical data for the hazardous area executions

In case the control module is used in Hazardous locations, check the chapters 10, 11 or 12 of the installation guide DOC.IG.QC54.1 for detailed instructions.

Non Incendive/Non Sparking

- **QC54 FF** **Chapter 10**

Intrinsically safe

- **QC54 FF** **Chapter 11**
- **QC54 FF (FISCO)** **Chapter 12**

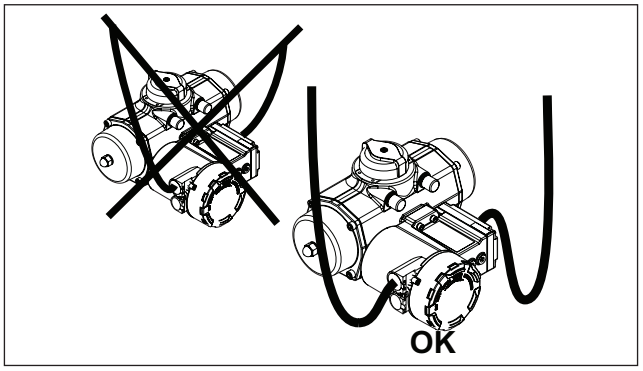

Fig. 2.5 Install drip loops

WARNING:

- **Do not put the Control module in direct contact with magnetic material. This can cause damage or malfunction of the position feedback.**
- **If the Control Module is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**
- **If required, mount earth wire (1) between top (2) and bottom (3) ring of earth wire connection (see figure 2.6).**

2.6.5 Procedure

1 Remove control module cover (see figure 2.7)

2 Guide the cable(s) through the electrical entry(ies).

- Use and mount cable glands as required by national or local legislation.
- When IP66/NEMA4X ingress protection is required, the electrical entries must be fitted with glands rated IP66/NEMA4X or higher.

3 Connect the FOUNDATION Fieldbus™ signal to the applicable terminals (see figure 2.7).

- For 7/8" or M12 quick connector pinout, see fig 2.9.
- For hazardous area connections, see the control drawings as indicated in chapter 2.6.2.

4 Mount the control module cover to the housing (see figure 2.7) or continue with chapter 3. Take care that the cover seal is in place to comply to dust and water tightness according IP66 / NEMA4X.

2.6.6 FOUNDATION Fieldbus™ installation and wiring guidelines

For various application guides like installation and wiring guidelines please check:

www.fieldbus.org/About/FoundationTech/Resources/

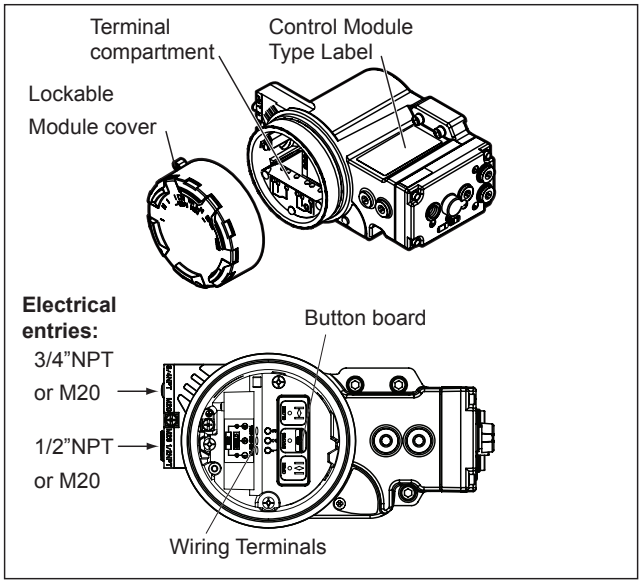

Fig. 2.7 Installing wiring

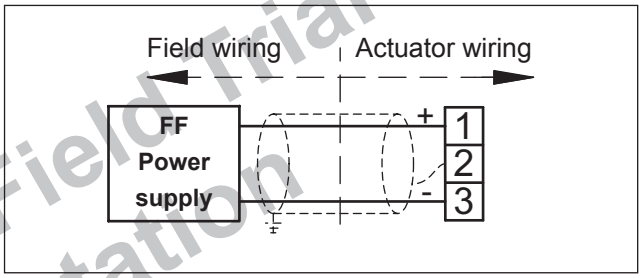

Fig. 2.8 Terminal and quick connector connections

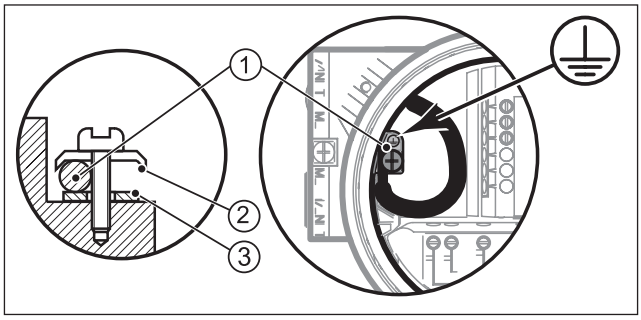

Fig. 2.6 Earth wire connections

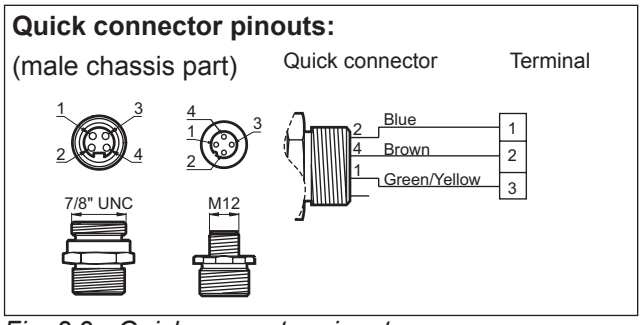

Fig. 2.9 Quick connector pinouts

3 Commissioning

In order to commission the QC54 module three steps need to be done in advance:

1 Implementation of the device driver in the host system.

2 Initialization of the Bettis Q-Series QC54 module.

3 Function block assignment to channels.

3.1 Implementation of the device driver in the host system.

Two versions of the DD-driver files are available for the QC54 module:

- **QC54 Standard DD Rev 4** - DD files for use with other Foundation FieldBus host systems and tools
- **QC54 PlantWeb DD Rev 4** - DD files tailored specifically for use with Emerson PlantWeb Systems (DeltaV).

These DD drivers are available for download from **www.emersonprocess.com/bettis.**

Please, see the documentation of your host system, how to implement these device drivers in your host system.

3.2 Initialization (calibration) procedure

Initialization sets automatically the switch points for the position feedback of the actuator (see fig. 3.1)

Additionally, 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.

This process is done automatically, by the module, however, the user must start it and the unit must be wired according chapter 2.
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 §3.2.1).
2. Initialization using a bus command (see §3.2.2).

WARNING:

- **During the initialization (calibration) routine the actuator / valve combination will cycle several times.**
- **Before initialization (calibration) check whether the actuator and valve have the same "Open" and "Closed" positions.**
- **Ensure that the valve stroke is not obstructed before the initialization (calibration) routine is started.**

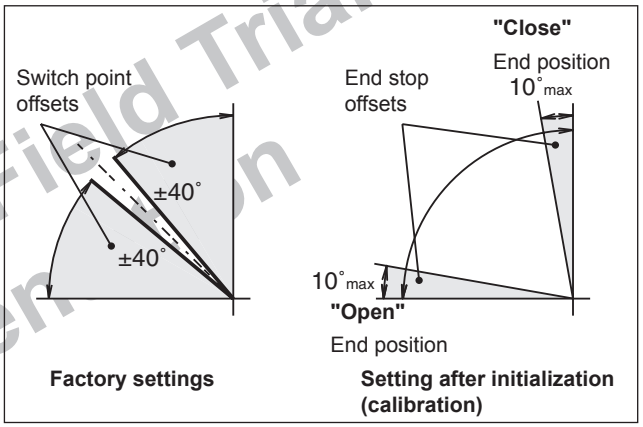

Fig 3.1 Switch point characteristics

3.2.1 Initialization (calibration) using local buttons

For "Initialization (calibration) using the local buttons" digital communication is not required but power supply is necessary (9V to 32V DC).

1 Press and confirm press the “Status/Auto-Initialization” button
2 Status LED will blink.
3 Actuator will cycle 2 or 3 times.
4 At the end of the routine the Status LED switches to constant on, meaning the initialization was successful.

Table 3.1 Status LED indications

Status	Status LED action
OK (init successful)	Constant on
Initializing	Blinking (see fig. 5.1)
Init error	Flashing (see fig. 5.1)
Init default	Flashing (see fig. 5.1)
Identification	Flashing for 300 sec.

Remarks:

- If the button board does not work, check the mode of Transducer Block, make it OOS (Out Of Service). Make sure the button board is enabled in OOS mode. (see §3.4.1).
- If the Open or Closed LED is flashing, the auto initialization (calibration) routine has failed, see §3.4.2.
- If the read out in the PLC or DCS is reversed, see §3.4.3.
- If the device is in operation and after a while the "Open" or "Closed" feedback is lost, see §3.4.4.
- If the initialization (calibration) can not be started via the push buttons, see §3.4.5.

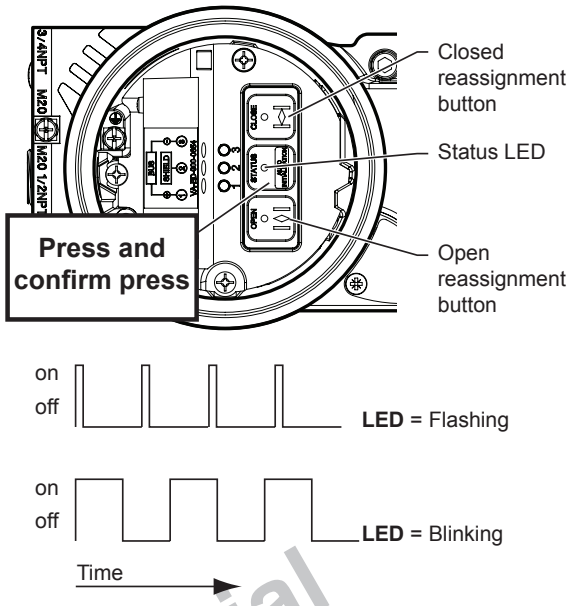

Fig. 3.2 Reassignment buttons (located behind front cover of module).

Table 3.2 Button board functionality

Action	Reassignment buttons
Initialize	Press and confirm press the “Status/Auto-Initialization” button.
Set to factory default	Push both reassignment buttons and hold while powering up. Release buttons when Status LED is solid.
Switch point re-adjustment	A new switch point can be set by pressing the corresponding “Open” or “Closed” button (actuator will not cycle).

3.2.2 Calibration (Initialization) using Bus Command

1 Select "Calibration" in Configure tab.
2 Press the Calibrate button and the transducer block will be set to "Out of Service" mode and actuator will move.
3 When the calibration is running, Calibration Status will indicate running and the Status LED will blink.
4 Actuator will cycle two or three times.
5 When the calibration is successful, Calibration Status will indicate successful and Status LED is on.
6 The Transducer Block will set to "Auto" mode automatically.

Remark:

- If the auto calibration has failed, the status LED on the module is flashing and the status of parameter AUTO_INITIALIZATION (Auto Calibration) will indicate a possible cause, see §3.4.2
- After initializing check if the feedback matches the actual valve position. If the position feedback in the PLC or DCS is reversed, see §3.4.3.
- If readjustment of the positions is needed, without cycling the actuator, see §3.4.4
- If it is not possible to finish the auto-initialization routine, the switch points can be set, according §3.4.3

3.3 Function block assignments

1 Set the required Function Block(s) to “Out of Service”.
2 Set the required channel number(s). The following are the basic channel assignments that should be used when using the FF QC54 Control Module:
3 Assign Channels and signals to the appropriate function blocks (see table 3.3)
4 Download the Function Block(s) to the “system”.
5 Set the Function Block(s) to “Auto”.

3.3.1 Check functioning

Before function test:

- Check or set “Resource Block” to “Auto”.
- The unit must be connected to a host system and power must be connected (see chapter 3).
- The unit must be successfully initialized (Status of Transducer Block AUTO_INITIALIZATION (Auto Calibration) must be successful.

1 Set the Transducer Block to “Out of Service”.
2 Set the DO Function Block to “Out of Service”.
3 Set channel number of the DO Function Block block to 1 ("Output Command").
4 Download the settings to the system.
4 Set the Function Block to the “Auto” mode.
6 Set parameter "SP_D" to “ open”.
7 Actuator moves to "Open" position.
8 Set parameter "SP_D" to “ closed”.
9 Actuator moves to "Closed" position.
10 Set the Transducer Block to “Auto”.

3.3.2 Recognizing LED

To recognize a particular Bettis Q-Series actuator in the plant “Recognizing LED” function can be activated in the Transducer Block . When this function is activated, the status LED will blink for 5 minutes. To start the LED:

1 Set “FLASH_LED”-parameter to start.
2 Status LED on the unit will blink for 5 minutes.
3 After 5 minutes the “FLASH_LED”-parameter will change back to finished.

Table 3.3 Function block assignments

Function block	Signal	Channel
DO	Command to the actuator to open or close	1
DI	Feedback from the actuator indicating open, close, opening or closing	2
	Switch 2 (Open) state from the actuator indicate active or inactive	3
	Switch 1 (Closed) state from the actuator indicate active or inactive	4
AI	Temperature of the electronics (default in°C).	5

3.4 Troubleshooting

3.4.1 "Factory default settings", using the button board.

To set the control module to its factory default settings, do the following;

1 Connect power according chapter 2 and observe that the Status LED is either on or flashing.
2 Disconnect the power.
3 Press both reassignment buttons.
4 Reconnect power.
5 Status LED goes on.
6 Release the reassignment buttons.
7 Observe that the Status LED indicates that the unit is in its "Init Default" state (flashing)

3.4.2 If auto initialization (Auto Calibration) procedure has failed

If the auto initialization (Auto Calibration) has failed, the status LED on the module will flash and the status of the AUTO_INITIALIZATION parameter will indicate a possible error:

Table 3.4 Status of the initialization procedure:

Error	Solution
Undetermined bad repeatability	Check air-pressure at the actuator and/or actuator sizing.
Running,	
Aborted	Operator: restart
Undetermined	Difference between open and close position too small. Check proper stroking of the actuator/valve unit.
Time Out	It takes too long before end-positions are found. Check air-pressure at the actuator and/or actuator sizing.
Range Error	Difference between open and closed end position is too small. Check air-pressure, check proper valve rotation.
No Valid Data	Not initialized, start initialization
Assembly error	The configuration of the module and actuator do not match and is incorrect. Check the actuator and module function for matching configurations.
Successful	

To solve this:

1 Check table 3.4 and try the suggested solution to solve the problem.
2 Check Actuator assembly code (see Installation & Operation Manual Bettis Q-Series Valve Actuator, DOC.IOM.BQ.E)
3 Repeat the initialization (calibration) procedure (see §3.2).
4 When the actuator does not move within 10 seconds, the auto initialization (calibration) will fail.
To solve this either;
- Perform the "default setting" procedure (see §3.4.1) and repeat the initialization procedure (calibration; see §3.2), or
- Set the limit switch points individually by the bus (see §3.4.4)

3.4.3 If the position feedback is reversed.

1 Go to Configure/Manual Setup/Switch Points/ Change Switch Points
2 To set the "Open" position;
Set sub parameter OPEN_END_POSITION of parameter CFG_SWITCH_POINTS to:
"set to current position".
The "Closed" position will change automatically.
3 To set the "Closed" position;
Set sub parameter OPEN_END_POSITION of parameter CFG_SWITCH_POINTS to:
"set to current position".
The "Open" position will change automatically.

Note:

- If "Shutdown" is activated (see 4.2.3.3), check if "SHUTDOWN_ACTION" matches with new position feedback setting.

3.4.4 If the "Open" or "Closed" feedback is lost.

1 Check if the actuator/valve unit is working correctly.

2 If it is safe to cycle the actuator, perform the initialization procedure (see §3.2).

3 If it is not safe to cycle the actuator, perform the following procedure:

1 Go to Configure/Manual Setup/Switch Points/ Change Switch Points.

2 In case the "Open" position is lost:

Set sub parameter OPEN_END_POSITION of parameter CFG_SWITCH_POINTS to: "set to current position".

3 In case the "Closed" position is lost:
Set sub parameter CLOSE_END_POSITION of parameter CFG_SWITCH_POINTS to: "set to current position".

Note:

- If the problem is persistent, increase the endstop offset (see 4.2.3.2).

3.4.5 If the initialization (Calibration) can not be started via the push buttons.

1 Ensure the device is "Out Of Service".

2 Ensure that the buttons are enabled in the transducer block (parameter BUTTONBOARD_ENABLE, index 34).

Remark:

Setting the device to default will always enable the push buttons as long as the device is in "Out Of Service" (see §3.4.1).

3 Ensure that the unit is not in Shutdown. See Transducer block parameter SHUTDOWN_STATUS, index 32. If the device is in Shutdown see 3.4.6

3.4.6 If the device is in Shutdown

When the device is in Shutdown, an internal failure has occurred.

If the internal failure is re-solved, the actuator shutdown status will be automatically reset.

If you want to capture the internal failure of the device, you can set the device to Manual-Recovery as described in 4.2.3.3 (in Manual-Recovery).

1 Normally the SHUTDOWN_RESET parameter is inactive. For reseting the shutdown status parameter SHUTDOWN_RESET must be set to "Reset".

2 When this reset is completed succesfully, the SHUTDOWN_STATUS parameter will be Bettis Q-Series operational and SHUTDOWN_RESET parameter will return to inactive.

If the problem persists, please contact your local Bettis Q-Series representative.

4 Detailed Configuration

The Bettis Q-Series QC54 Module contains the following function blocks:

Block	Index
Resource	1000
Transducer	1100
Discrete Input (DI)	1200
Discrete Input (DI)	1300
Discrete Output (DO)	1400
Analog Input (AI)	1500
PID	1600

See chapter 3, table 3.3, which channel should be assigned to which function block.

This section contains more detailed information for configuring the Resource and Transducer Block parameters to setup the module. Access to each parameter depends upon the host system software. For information on using the host system to modify block parameters, see the appropriate appendix and host system documentation.

- For reading or writing identification parameters open the resource block.
- For reading or writing configuration parameters and alerts open the transducer block.

4.1 Resource block

The Resource Block describes the characteristics of the field bus device such as device name and type, manufacturer, serial number, amount of free memory, and free time. There is only one Resource Block in the module.

The parameters for configuring the Resource Block are referenced by group within the following sections.

4.1.1 General Resource Block parameters according FOUNDATION Fieldbus™ Protocol

4.1.2 Bettis Q-Series™ specific parameters for Instrument Description

4.1.3 Bettis Q-Series™ specific parameters which have no influence on the function of the device.

4.1.4 PlantWeb™ Alerts.

4.1.5 NAMUR NE- 107 Alarms

- For complete details of the parameters listed, see table 4.1.
- Refer to the applicable host documentation for procedures to access the referenced parameters.

4.1.1 General Resource Block parameters according FOUNDATION Fieldbus™ Protocol

The resource block parameters with index number 1 to 41, are setup according to FOUNDATION Fieldbus™ protocol.

- For their default setting and adjustable range, see table 4.1.
- For use of the RESTART parameter see chapter 5.

4.1.2 Bettis Q-Series™ specific parameters for Instrument Description

The following parameters are setup specific for the Bettis Q-Series™ with FOUNDATION Fieldbus™ communication:

Distributor [DISTRIBUTOR],

Index 93

Private Label Distributor. Identifies the company that is responsible for the distribution of this Field Device to customers

Software Revisions [SOFTWARE_REV]:

Index 69

States the software revisions of the controller card and the FF interface card

Hardware Revision [HARDWARE_REVISION],

Index 68

Hardware revision of that hardware in which the Resource Block resides.

Electronics serial number [ELECTRONICS_SN]:

Index 94

Not used on QC54 Module.

Factory serial number [FACTORY_SN]:

Index 95

Serial number of the QC54 Module.

Field serial number [FIELD_SN]:

Index 96

Serial number for the QC54 Module.which can be set by the customer.

4.1.3 Bettis Q-Series™ specific parameters which have no influence on the function of the device.

The following Resource block parameter have no direct influence on the operation of the device.

Index No	Name
71	DEV_STRING
97	DIAG_OPTIONS

4.1.4 Alerts

The Bettis Q-Series™ QC54 Control module with Foundation Fieldbus™ communication features diagnostic capabilities combined with PlantWeb™ Alerts.

The Bettis Q-Series™ QC54 Control module generates a recommended action after an internal error has occurred, timer or counter limits have exceeded or when the initialization has failed

A full list of Alerts and Recommended Actions, combined with the Alert Default Setting is shown in table 4.3.

4.1.4.1 Alert handling

The Resource Block will act as a coordinator/collector for (PlantWeb™) alerts (see resource block index numbers 77 to 92).

Although the alerts have default settings (see table 4.3), these levels can be set by the customer to match their requirements.

There are three levels of alerts available:

1 Failed Alerts

A Failure Alert indicates a failure within a device that will make the device or some part of the device non-operational.
This implies that the **device is in need of repair** and must be **fixed immediately.**

This alert has the following five parameters:

1 FAILED_ENABLE : Enable the indication and reporting
2 FAILED_MASK : Suppress reporting
3 FAILED_PRI : Designates the priority
4 FAILED_ACTIVE : Displays which of the conditions within the alert is active.
5 FAILED_ALM : To report the particular failed condition to the host system.

2 Maintenance Alerts

A Maintenance Alert indicates a condition within a device that, if not attended to in the near future (the type of alert defines the time period for “Near Future”) will make the device or some part of the device non-operational.
This implies that **the device is in need of repair** and must be **fixed as soon as possible.**

This alert has the following five parameters:

1 MAINT_ENABLE : Enable the indication and reporting
2 MAINT_MASK : Suppress reporting
3 MAINT_PRI : Designates the priority
4 MAINT_ACTIVE : Displays which of the conditions within the alert is active.
5 MAINT_ALM : To report the particular failed condition to the host system.

3 Advisory Alerts

An Advisory Alert indicates a condition within a device that is informational in nature. The alert is used to notify the host that **the device has detected a condition** within the device that is **not critical**, will not cause a failure if left unattended but should be reported to the host for awareness and possible action.

This alert has the following five parameters:

1 ADVISE_ENABLE :Enable the indication and reporting
2 ADVISE_MASK : Suppress reporting
3 ADVISE_PRI : Designates the priority
4 ADVISE_ACTIVE: Displays which of the conditions within the alert is active.
5 ADVISE_ALM : To report the particular failed condition to the host system.

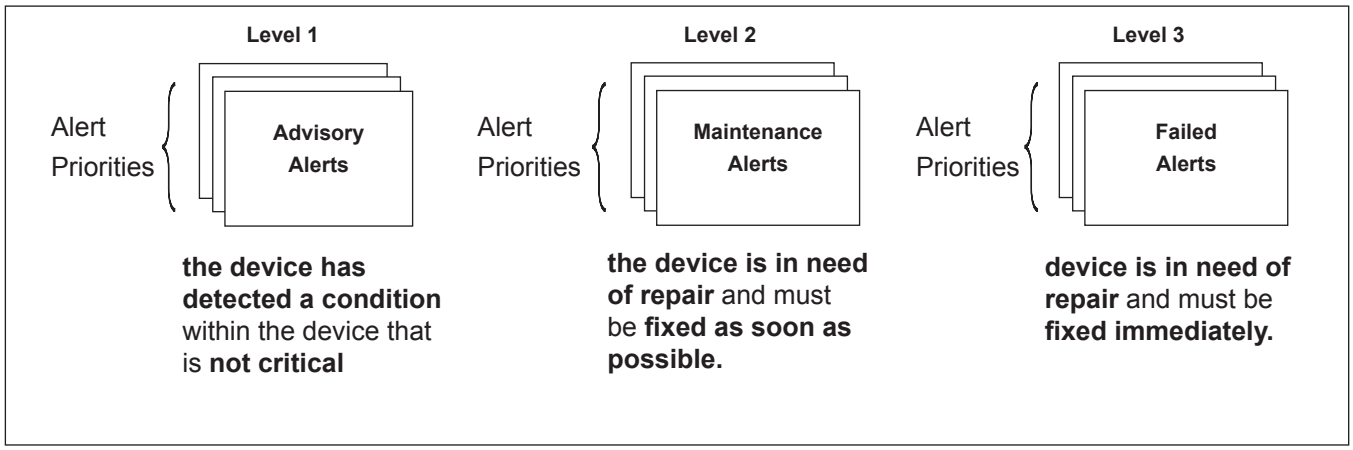

Fig 4.1 Alert levels and priorities

4.1.4.2 Alert parameter describtion.

1 Alerts - Enabled

These parameters are used to enable the indication and reporting of each corresponding alert. When a alert is disabled, the device shall not detect that particular alert, it shall not be indicated in the (FAILED_ACTIVE, MAINT_ACTIVE or ADVISE_ACTIVE parameters or be reported via respectively **Failed Alerts, Maintenance Alerts or Advisory Alerts.**

If an alert enable parameter is changed to 'disabled' while the alert is active, it shall clear the alert and re-evaluate the alert. (Writable, only affects the applicable condition modified. When set the condition will not be indicated or reported).

2 Alerts - masked:

These parameters will mask any of the failed conditions listed in respectively **Failed Alerts, Maintenance Alerts or Advisory Alerts.**

Setting a bit to true, will cause the corresponding alert to be indicated in the (FAILED_ACTIVE, MAINT_ACTIVE or ADVISE_ACTIVE parameters but it will not be reported to the host via **Failed Alerts, Maintenance Alerts or Advisory Alerts.**

If an alert mask is changed while the alert is active, the alert is cleared and all the conditions are reevaluated. (Writable, only affects the applicable condition modified. When set the condition will be indicated however, it will not be reported).

3 Alerts - Priority:

Designates the priority of the Failed, Maintenance or Advisory Alerts. The default is 2 and the recommended value is between 10 and 15. (Writable, changes the priority of the applicable alert).

4 Alerts - Active:

These parameters displays which of the conditions within the **Failed, Maintenance or Advisory Alerts** is active. When a device detects a condition has become active, it shall set the corresponding bit in the **Failed, Maintenance or Advisory Alerts - Active** parameters. If it is not suppressed, it will be reported using the associated alert parameter. (Read Only)

5 Alert Alarm:

These parameter are used to report the particular failed condition to the host. (Read Only). For parameter structure see table 4.2.

4.1.5 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 bits.

Then using the EXTENDED parameters in the resource block, more detailed information can be made available about the conditions for a maintenance person to get to the root of the problem.

The Common Practice Parameters named FD_EXTENDED_ACTIVE_n which are similar to the BLOCK_ERR_DESC_n parameter in function, are used to describe what lower level conditions are causing the condition in the FD_FAIL_ACTIVE, FD_MAINT_ACTIVE, FD_OFFSPEC_ACTIVE, or FD CHECKACTIVE to be true.

Additional Common Practice Parameters named FD_EXTENDED_MAP_n may be used to map multiple sensors or conditions into a single condition bit, Both FD_EXTENDED_ACTIVE_n and FD_EXTENDED_MAP_n parameters if present must follow the FD_RECOMMEN_ACT parameter.

Any number of bits in the extended parameters may be or'ed together to trigger a single condition bit in the standard Fail, Maint, OffSpec, and Check 32 bits, There is also no restriction on which bits out of the standard 32 that may be used for the Fail, Maint, OffSpec, or Check categories.

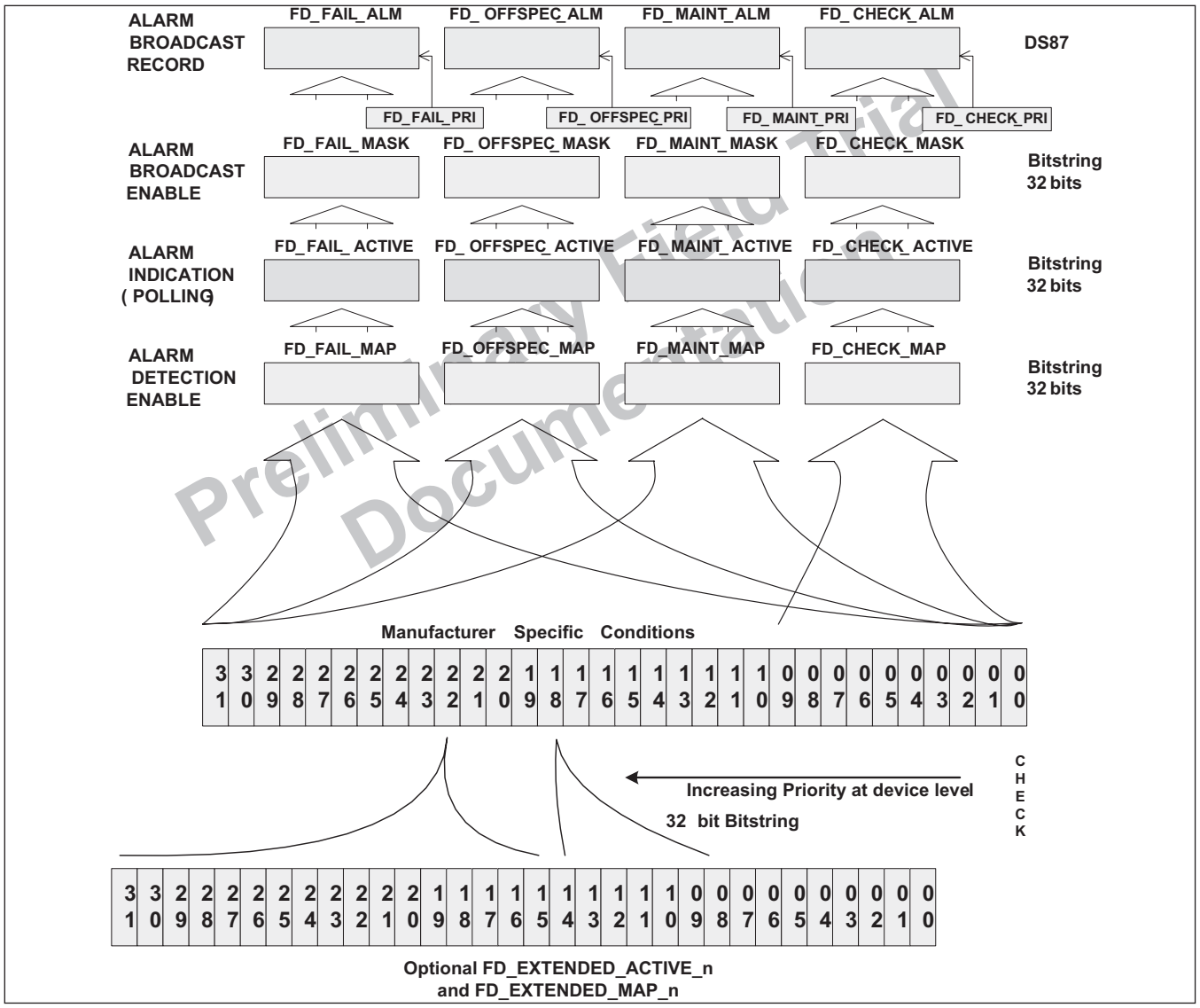

Fig 4.2 Field Diagnostics Alarm Schematic

Table 4.1 Bettis Q-Series™ Resource Block					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
1	ST_REV	Static data revision. Updated when static data is changed	0 to 65535	0	Read only
2	TAG_DESC	Unique description for the resource block within a system, writable by the host system operator.		Spaces	Read / Write
3	STRATEGY	Used by host system administrator to group blocks foe easy identification of location.	7 bit ASCII	0	Read / Write
4	ALERT_KEY	Plant unit ID, for host system operator for sorting alarms	1 to 255	0	Read / Write
5	MODE_BLK	The target, actual and permitted modes for the block			
		TARGET	OOS, AUTO	AUTO	Read / Write
		ACTUAL		N/A	Read Only
		PERMITTED		OOS, AUTO	Read / Write
		NORMAL		AUTO	Read / Write
6	BLOCK_ERR	Error status associated with the hardware or software of the resource block 0: Other 1: Block config error (not used) 2: Link configuration error 3: Simulate Active: Based on switch 4: Local override (not used) 5: Device Fail safe set 6: Device needs Maintenance Soon 7: Input failure (not used) 8: Output failure (not used) 9: Memory Failure (FF card) 10: Lost static data (FF card) 11: Lost NV data (FF card) 12: Readback check failed (not used) 13: Device needs Maintenance Now 14: Power-up (not used) 15: Out-of-Service	0 to F	N/A	Read Only
7	RS_STATE	State of the resource 1: Start restart 2: Initialization, actual mode = IMAN 3: Online linking 4: Online, actual mode = Auto 5: Standby 6: Failure	1 to 6	5	Read only
8	TEST_RW	Read write test parameter for interoperability testing	Not applicable	Not applicable	Not applicable
9	DD_RESOURCE	Tag ID string identifying DD resource for info only		spaces	Read only
10	MANUFAC_ID	Manufacturing identification number, used by an interface device to locate DD file for resource. Should show up as "Valve automation"	0x564144	0x564144	Read only
11	DEV_TYPE	Manufacturers model number 0xD3A0 = Q Series – Pneumatic Valve Actuator	0xD3A0	0xD3A0	Read only
12	DEV_REV	Device Revision; Used to locate DD file set to: 4	4	4	Read only
13	DD_REV	Minimum compatible DD revision number associated with this device	1	1	Read only
14	GRANT_DENY	Access control to host computer. GRANT DENY	Valid settings: 0 Program, 1 Tune, 2 Alarm, 3 Local	0x00	Read / Write
15	HARD_TYPES	The types of hardware available as channel numbers on this resource	0 Scalar Input, 1 Scalar output, 2 Discrete Input, 3 Discrete Output		Read only
16	RESTART	Shows current status and allows a manual restart to be initiated, implemented as method with warnings! 1 Run - Normal operation 2 Resource - Restart FF resource keep settings. 3 Defaults - Restart FF resource with default. 4 Processor - Restart FF Resource. 5 Actuator defaults - Restart control module with factory settings 6 Actuator processor - Restart control module, keep settings.	1 to 6	1	Read only

Table 4.1 Bettis Q-Series™ Resource Block (Continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
17	FEATURES	Shows the supported resource block options 0: Unicode strings 1: Reports 2: Fault state 3: Soft W Lock 4: Out read back 5. Multi-bit Alarm (Bit-Alarm) Support 6. Restart/Relink after FB Action	1 to 6	See Description	Read only
18	FEATURE_SEL	Shows the selected “Features” from the available options listed in the above “FEATURES” parameter. 0: Unicode strings N/A 1: Reports 2: Fault state 3: Soft W Lock 4: Out read back	1 to 4	0x1E (ALL)	Read / Write
19	CYCLE_TYPE	Indicates available function block execution routines 0: Scheduled 1: Completion of Block Execution N/A 2 : Manufacturer specific N/A	0 to 2	0	Read only
20	CYCLE_SEL	Indicates selected function block execution routines 0: Scheduled 1: Completion of Block Execution N/A 2 : Manufacturer specific N/A	0 to 2	0	Read only
21	MIN_CYCLE_T	Indicates shortest cycle of which the resource is capable	Set by FCS	3200	Read only
22	MEMORY_SIZE	Available memory in empty resource (Hornet).	Set by FCS	0	Read only
23	NV_CYCLE_T	Minimum time interval required to write internal parameters to non-volatile memory. 0 means only external writes	>=0		Read only
24	FREE_SPACE	Memory available for further configuration in FF card	0 to 100%	0	Read only
25	FREE_TIME	Block processing time available to additional blocks	0 to 100%	0	Read only
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations.	>=0	640000	Read only
27	SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations	>=0	640000	Read only
28	FAULT_STATE	Forces output function blocks to the FAULT_STATE condition if active. 1: clear, 2: active	1 to 2	1	Read only
29	SET_FSTATE	Writing a set to this parameter will force FAULT_STATE to be manually initiated 1: off 2: set	1 to 2	1	Read / Write, access controlled by operator
30	CLR_FSTATE	Writing a set to this parameter will force FAULT_STATE to be cleared 1: off 2: clear	1 to 2	1	Read / Write, access controlled by operator
31	MAX_NOTIFY	Absolute Maximum number of unconfirmed notify messages possible.	5	5	Read only
32	LIM_NOTIFY	Selected Maximum number of unconfirmed alert notify messages possible	0 to MAX_ NOTIFY	MAX_NOTIFY	Read / Write
33	CONFIRM_TIME	Wait time before re-try. 0 = no retry	>=0	640000	Read / Write
34	WRITE_LOCK	If set no writes accept to clear write lock will be allowed 1: not locked 2: locked	1 to 2	1	Read / Write, access controlled by operator
35	UPDATE_EVT	Alert generated by any change to the static data			
		UNACKNOWLEDGED: 0 undefined, 1 acknowledged, 2 unacknowledged	0 to 2	0	Read / Write
		UPDATE STATE: 0 undefined, 1 Update reported, 2 Update not reported	0 to 2	0	Read only
		TIME STAMP	time	0:00:00	Read only
		STATIC REVISION	N/A	0	Read only
		RELATIVE INDEX	N/A	0	Read only

Table 4.1 Bettis Q-Series™ Resource Block (Continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
36	BLOCK_ALM	The block alarm is used for all configurations, hardware connection failures and system problems in the block. The cause of the alert is entered in the sub-code.			
		UNACKNOWLEDGED: 0 undefined, 1 acknowledged, 2 Unacknowledged	0 to 2		Read / Write
		ALARM_STATE 0 :Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported	0 to 4		Read only
		TIME_STAMP	Time		Read only
		SUB_CODE = BLOCK_ERR			Read only
		VALUE- A value can be added by the customer for configuring alarms			Read only
37	ALARM_SUM	Status and states of the alarms associated with the block CURRENT- current status UNACKNOWLEDGED - states unacknowledged alarms UNREPORTED - states unreported alarms DISABLED - states disabled alarms	0: Discrete alarm set when write lock is turned off 7: Block alarm	0	Read only
38	ACK_OPTION	When enabled, the device automatically acknowledges alerts sent to the host 1 : Auto Acknowledge Disabled 2 : Auto Acknowledge Enabled	1 to 2	1	Read / Write
39	WRITE_PRI	Priority of the alarm generated by clearing the Write Lock	0 to 15	0	Read / Write
40	WRITE_ALM	Generated if the write lock is cleared			
		UNACKNOWLEDGED: 0 undefined, 1 acknowledged, 2 unacknowledged	0 to 2	0	Read / Write
		ALARM_STATE 0:Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported	0 to 4	0	Read only
		TIME_STAMP	Time	0	Read only
		SUB_CODE - indicates what alarm		0	Read only
		VALUE- A value can be added by the customer for configuring alarms		0	Read only
41	ITK_VER	Indicates the major revision number of the interoperability test case used in certifying this device as interoperable	Set by FF	6	Read only
NAMUR NE107 Alarm parameters					
42	FD_VER	A parameter equal to the value of the major version of the Field Diagnostics specification that this device was designed to.	1	1	Read only
43	FD_FAIL_ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.			Read only
44	FD_OFFSPEC_ACTIVE				Read only
45	FD_MAINT_ACTIVE				Read only
46	FD_CHECK_ACTIVE				Read only
47	FD_FAIL_MAP	This parameter maps conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 4 alarm categories.		NV Memory Failure; Electronics Failure; Software Error; Travel Deviation; Shutdown is Set; Internal IO Failure Assembly Error	ALARM
48	FD_OFFSPEC_MAP			Instrument Temperature Exceeded; Pilot Valve Error; Temperature sensor Error	ALARM
49	FD_MAINT_MAP			Bad Position Sensor; Button board Error	ALARM
50	FD_CHECK_MAP			Check	ALARM
51	FD_FAIL_MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask i.e. inhibit the broadcast of a condition, and a bit equal to '0' will unmask i.e. allow broadcast of a condition.			ALARM
52	FD_OFFSPEC_MASK				ALARM
53	FD_MAINT_MASK				ALARM
54	FD_CHECK_MASK				ALARM

Table 4.1 Bettis Q-Series™ Resource Block (Continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
55	FD_FAIL_ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.			
56	FD_OFFSPEC_ALM				
57	FD_MAINT_ALM				
58	FD_CHECK_ALM				
59	FD_FAIL_PRI	This parameter allows the user to specify the priority of this alarm category.	0 to 15	0	ALARM
60	FD_OFFSPEC_PRI		0 to 15	0	ALARM
61	FD_MAINT_PRI		0 to 15	0	ALARM
62	FD_CHECK_PRI		0 to 15	0	ALARM
63	FD_SIMULATE	This parameter allows the conditions to be manually supplied when simulation is enabled. When simulation is disabled both the diagnostic simulate value and the diagnostic value track the actual conditions. The simulation is enabled/disabled through a method and while simulation is enabled the recommended action will show that simulation is active.		Disabled	Read / Write
64	FD_RECOMMEN_ACT	This parameter is a device enumerated summarization of the most severe condition or conditions detected. The DD help should describe by enumerated action, what should be done to alleviate the condition or conditions. 0 is defined as Not Initialized, 1 is defined as No Action Required, all others defined by manuf.		0	ALARM
65	FD_EXTENDED_ACTIVE	An optional parameter or parameters to allow the user finer detail on conditions causing an active condition in the FD_*_ACTIVE parameters.			Read only
66	FD_EXTENDED_MAP	An optional parameter or parameters to allow the user finer control on enabling conditions contributing to the conditions in FD_*_ACTIVE parameters.			
67	COMPATIBILITY_REV	Compatibility Revision: This is used for device replacement and indicates whether a previous rev can be replaced by the current device. This is a new Foundation feature so previous revisions of the Bettis Q-Series will not comply with the new device replacement rules.		4	Read only
68	HARDWARE_REVISION	Revision of hardware	0 to 255	N/A	Read only
69	SOFTWARE_REV	Software revisions of FF card Rev: xx-yy-zz (xx=major, yy= middle, zz=minor) Rev. date: dd-month-yyyy	N/A	N/A	Read only
70	PD_TAG	This parameter is the physical device tag of the field device.			Read only
71	DEV_STRING	Resource Block. Used to load new licensing into the device. The value can be written but will always be read back with a value of 0			Read / Write
72	DEV_OPTIONS	This parameter allows the operator access to the 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. A method is used to enable/disable the parameter and a direct write is not necessary.		0	Read / Write
73	OUTPUT_BOARD_SN	Output Board Serial number is a unique 4 byte number of the FF card for each device.			Read only
74	FINAL_ASSY_NUM	Final Assembly Number is a 4 byte static value that can be set by the operator		0	Read / Write
75	DOWNLOAD_MODE	Indicates whether the device is in run or download mode			Read only
76	HEALTH_INDEX	Parameter representing the overall health of the device. - 100 being perfect and 1 being non-functioning. - No alerts -> 100 ADVISE_ACTIVE -> -10 per advice MAINT_ACTIVE -> - 40 per advise FAIL_ACTIVE -> = 10 (10 also lowest value)	10 to 100	100	Read only

Table 4.1 Bettis Q-Series™ Resource Block (Continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
		PlantWeb Alert parameters			
77	FAILED_PRI	Designates the alarming priority of the FAILED_ALM. Handling defined by FF. 0: All FAILED alerts disabled 1: All failed alerts suppressed 2: Higher process failed alerts	0 to 15	2	Read / Write
78	RECOMMENDED_ACTION	Enumerated list of recommended actions of the device, displayed with a device alert (can be multiple, see table below)	N/A	0	Read only
		See table			
79	FAILED_ALM	Alarm indicating a failure within a device which makes the device non-operational.			
		UNACKNOWLEDGED: 0: Undefined, 1: Acknowledged, 2: Unacknowledged			Read only
		ALARM_STATE 0:Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported			Read only
		TIME_STAMP			Read only
		SUBCODE value should match alert as stated under FAILED_ENABLE			Read only
		VALUE			Read only
80	MAINT_ALM	See index 79 FAILED_ALM			
81	ADVISE_ALM	See index 79 FAILED_ALM			
82	FAILED_ENABLE	See alert table 4.3	N/A		
83	FAILED_MASK	See alert table 4.3			
84	FAILED_ACTIVE	See alert table 4.3		N/A	Read only
85	MAINT_PRI	See index 77 FAILED_PRI	0 to 15	2	Read / Write
86	MAINT_ENABLE	See alert table 4.3	N/A		
87	MAINT_MASK	See alert table 4.3			
88	MAINT_ACTIVE	See alert table 4.3			Read only
89	ADVISE_PRI	See index 77 FAILED_PRI	0 to 15	2	Read / Write
90	ADVISE_ENABLE	See alert table 4.3	N/A		Read / write
91	ADVISE_MASK	See alert table 4.3			Read / write
92	ADVISE_ACTIVE	See alert table 4.3			Read only
93	DISTRIBUTOR	Private Label Distributor. Identifies the company that is responsible for the distribution of this Field Device to customers		0x564144	Read only
94	ELECTRONICS_SN	Set by factory	0 to 255	N/A	Read only
95	FACTORY_SN	Set by factory	N/A	N/A	Read only
96	FIELD_SN	Set by customer	N/A	All spaces	Read / Write
97	DIAG_OPTIONS	Currently not used			
98	CONTROL_CARD_SW_REV	CTRL_CRD_SWARE_REV interpret MSB.LSB	0 to 255	N/A	Read only

4.2 Transducer block

The Transducer Block manages data that moves between a function block and the device input/output (I/O) such as sensors and position switches that provide process data for automated process control. Transducer blocks control access to I/O devices through a device independent interface and manufacturer specific parameters defined for use by function blocks. Transducer blocks also perform functions, such as calibration and linearization, on I/O data to convert it to a device independent representation. The transducer block to function blocks interface is defined as one or more implementation independent channels.

The parameters for configuring the Transducer Block are referenced by group within the following sections.

- For complete details of the parameters listed, see table 4.1.
- Refer to the applicable host documentation for procedures to access the referenced parameters.

4.2.1 General Transducer Block parameters according FOUNDATION Fieldbus™ Protocol

4.2.2 Device position status parameters

4.2.3 Device configuration (Switch points and Shutdown).

4.2.4 Diagnostic configuration (Timers, Counters).

4.2.1 General Transducer Block parameters according FOUNDATION Fieldbus™ Protocol

The Transducer Blocks parameters with index number 1 to 24, are setup according the FOUNDATION Fieldbus™ protocol. For their default setting and adjustable range, see table 4.2.

4.2.2 Device position status parameters

There are 3 parameter which give information on the position status of the device.

Index No	Name
25	DISCRETE_POSITION
26	OPEN_STATE
27	CLOSE_STATE

For their default setting and adjustable range, see table 4.2.

4.2.3 Device configuration.

The following five parameter are available to configure the QC54 module for normal operation:

Index No	Name
28	AUTO_INITIALIZATION
29	CFG_SWITCH_POINTS
32	SHUTDOWN-CFG
33	ZERO_PWR_COND
34	BUTTONBOARD_ENABLE

4.2.3.1 AUTO_INITIALIZATION

Initialization sets the end positions for the position feedback of the actuator. The initialization procedures are described in detail in chapter 3. For the default setting and adjustable range, see table 4.2. index 28.

4.2.3.2 CFG_SWITCH_POINTS

The Bettis Q-Series™ QC54 Control module will be shipped with the default feedback characteristic, as per figure 4.3. This feedback characteristic is operational after initialization (see chapter 3) and is suitable for most applications.

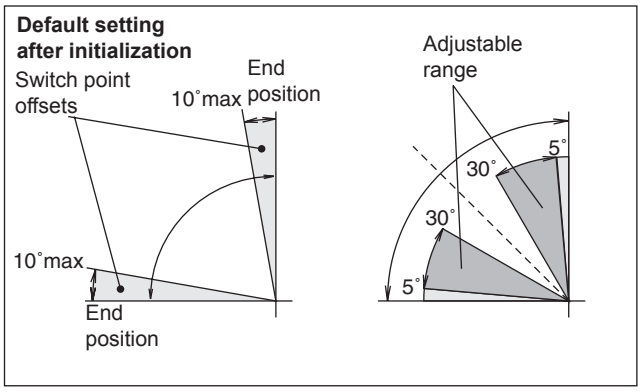

Fig. 4.3 Feedback characteristic

If the default configuration is not sufficient for your application, the switch points can be configured.

For the QC54 Module, there are three topics concerning the configuration of the switch points.

1 Mechanical limit stops.
Normally the mechanical limit stops limit the stroke of the actuator. (To adjust the mechanical limit stops see DOC.IOM.Q.1 chapter 3).
If the mechanical limit stop setting is changed, or the valve does not reach the fully open or closed positions (due to wear in the valve), the Open and Closed end positions have to be re-configured to assure position feedback.

2 "Open" and "Closed" end positions.
There are two procedures to re-configure the end positions:

1 If it is safe to cycle the actuator, perform the initialization procedure (see §3.2).

2 If it is not safe to cycle the actuator, perform the following re-assignment procedure:

1 Go to Configure/Manual Setup/Switch Points/ Change Switch Points.

2 In case the "Open" position needs an update:
Set sub parameter OPEN_END_POSITION of parameter CFG_SWITCH_POINTS to:
"set to current position".

3 In case the "Closed" position needs an update:
Set sub parameter CLOSED_END_POSITION of parameter CFG_SWITCH_POINTS to:
"set to current position".

3 "Open" and "Closed" stop offset.
The "Open" or "Closed" offset value is the number of degrees before the end of stroke within which the switches will be activated or deactivated. Default values for both positions are (see figure 4.1):

- Default offset 10° before end of stroke.
- Adjustable range 5° to 30° before end of stroke

Sub parameters OPEN_STOP_OFFSET and CLOSED_STOP_OFFSET can be used to change the end stop offsets and can be set per ° (degree)

4.2.3.3 SHUTDOWN-CFG

Shutdown configuration controls the behavior of the Bettis Q-Series™ actuator in case of an internal communications failure in the QC54 module. This is independent of the FF communication on the bus line.

This set of parameters can overrule the Failure modes of the basic actuator, as described in the Bettis Q-Series™ IOM manual, chapter 2.2 (DOC. IOM.BQ1).

1 General working of Shutdown configuration.

Shutdown configuration can work in three configurations, as set by the SHUTDOWN_ENABLE parameter:

- Enable, auto recovery
- Enable, manual recovery
- Disable.

Enable : After an internal failure, the setting of parameter SHUTDOWN_ACTION will be executed.

Auto Recovery : When the internal failure is solved, the actuator will automatically go to its current set point position.

Manual Recovery : When the internal failure is solved, the actuator shutdown status must be manually reset.

Normally the SHUTDOWN_RESET parameter is inactive. For resetting the shutdown status this parameter must be set to Reset. When this reset is completed successfully, the SHUTDOWN_STATUS parameter will be Device operational and SHUTDOWN_RESET parameter will return to inactive.

Disable : Shutdown functionality is not operational, the actuator will stay in its last position after an internal failure.

Parameter SHUTDOWN_DELAY_TIME defines a delay time (up to 4 minutes and 15 seconds) between the time the internal failure is detected by transducer block parameter XD_ERROR (I/O Failure) and the time that the unit will go in "Shutdown".

The sequence of events for 2 shutdown configurations is shown in figures 4.4 and 4.5.

2 Factory default Shutdown configuration setting (see figure 4.5):

SHUTD-ENABLE	: Enable, Auto Recovery
SHUTDOWN_ACTION	: Default (pilot valve de-energized)
SHUTDOWN_DELAY_TIME	: 5 seconds

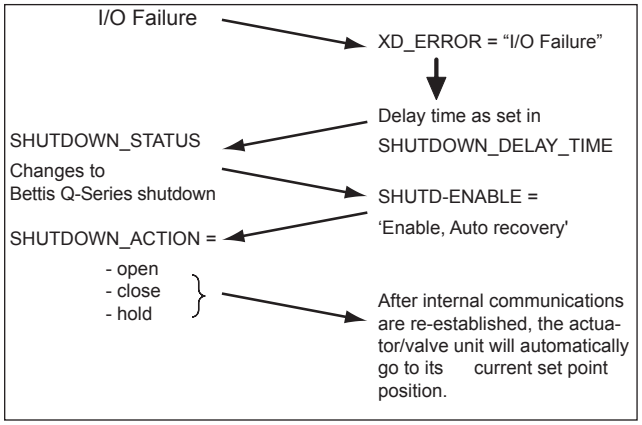

Fig 4.4 Shutdown configuration, Enable, Auto recovery

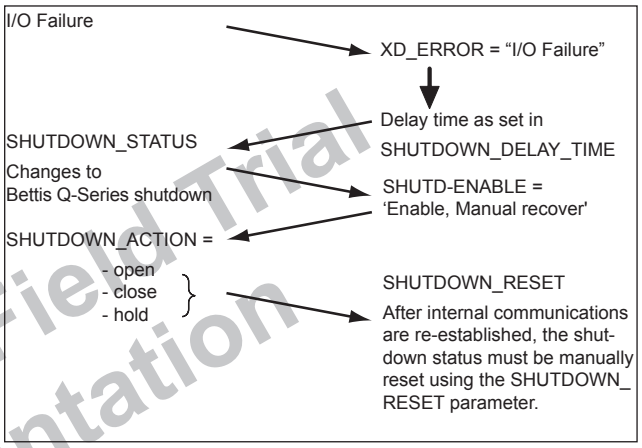

Fig. 4.5 Shutdown configuration, Enable, Manual recovery

Default shutdown configuration

- *** Means that 4 seconds after an internal failure is detected, DOUBLE ACTING AND SPRING RETURN (Single acting) actuators will go to the closed position, when pressure is available at the actuator, and**
- *** After the internal communications are re-established, the shutdown status must be reset.**

Important

- *** If feedback is reversed, the SHUT-DOWN_ACTION is following the latest feedback switch points automatically.**

4.2.3.4 ZERO_PWR_COND

This parameter helps identifying whether the device setup matches the actual mechanical configuration of the actuator;

- Fail in Last Position for double acting actuators.
- Fail-to-Close or Fail-to-Open for single acting actuators.

This parameter indicates the position where the actuator/valve unit will move to, when no power is present (air pressure should be present for DA).

- The value is set during initialization and position re-assignment and is valid for valve applications which close after a clockwise (CW) rotation and the operation of the valve may be Fail-to-Close or Fail-to-Open.
- For applications which close after a counter clock wise (CCW) rotation, the indication will be reversed after initialization. This can be corrected by re-assigning the end positions as described in §3.4.3.

4.2.3.5 BUTTONBOARD_ENABLE

The button board can be set to:

- Enabled when in OOS (factory default)
- Never active

4.2.4 Diagnostic configuration

This section describes the counter and timer parameters. The description how to set alerts and generate the recommended actions can be found in §4.1.4.

4.2.4.1 Counters

Four counter parameters are available for counting the cycles of the :

1 Control module

2 Actuator

3 Pneumatic module

4 Valve.

The Control (function) Module counter is the master counter and is read only. The other three counters can each be reset independently when required (e.g. replacement).

These counter parameters have :

- a sub parameter which records the cycles.

- a sub parameter to set a limit value.

When one of the set limits is exceeded an alert and a recommended action message will be generated as per table 4.3 and as per alert setting (see §4.2.5).

For the default setting and adjustable range, see table 4.2. index 36, 37, 38 and 39.

4.2.4.2 Timers

There are 3 timers available in this device:

1 Time in position (TIME_IN_POSITION)

- Records the time since the last movement. It is reset to zero when the power is switched off.
- In sub parameter TIME_IN_POSITION_HI_LIM, a limit can be set.

2 Open travel time (OPEN_TRAVEL_TIME)

- Indicates the time between: When pilot valve position is changed and when the Open trip position reached.
- In parameters OPEN_TRAVEL_TIME_HI_LIM and OPEN_TRAVEL_TIME_LO_LIM, high en low limits can be set.
- Parameter OPEN_TRAVEL_TIME_AVG calculates the average stroke time of the last 30 strokes.
- In parameters OPEN_TRAVEL_AVG_HI_LIM and OPEN_TRAVEL_AVG_LO_LIM, high en low limits can be set.

3 Close travel time (CLOSE_TRAVEL_TIME)

- Indicates the time between: When pilot valve position is changed and when the Closed trip position reached.
- In sub parameter CLOSE_TRAVEL_TIME_HI_LIM and CLOSE_TRAVEL_TIME_LO_LIM, high en low limits can be set.
- Parameter CLOSE_TRAVEL_TIME_AVG calculates the average stroke time of the last 30 strokes.
- In parameters CLOSE_TRAVEL_AVG_HI_LIM and CLOSE_TRAVEL_AVG_LO_LIM, high en low limits can be set.

When the limits of the above timers are exceeded, and the alerts are enabled, alerts and recommended action messages will be generated as per table 4.3 and as per alert setting (see §4.1.4).

Table 4.2 Bettis Q-Series™ Transducer Block					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
		General Transducer Block parameters			
1	ST_REV	Static data revision. Updated when static data is changed	0 to 65535	0	Read only
2	TAG_DESC	Unique description for the transducer block within a system, writable by the host system operator.		Spaces	Read / write
3	STRATEGY	Used by host system administrator to group blocks for easy identification of location.	7 bit ASCII	0	Read / write
4	ALERT_KEY	Plant unit ID, for host system operator for sorting alarms	1 to 255	0	Read / write
5	MODE_BLK	The target, actual and permitted modes for the block			
		TARGET	7: OOS, 3: AUTO	OOS	Read / write
		ACTUAL		N/A	Read Only
		PERMITTED		ALL	Read / write
		NORMAL		AUTO	Read / write
6	BLOCK_ERR	Error status associated with the hardware or software of the resource block (enumeration) 0: Other 1: Block config error (not used) 2: Link configuration error 3: Simulate Active: Based on switch 4: Local override (not used) 5: Device Fail safe set 6: Device needs Maintenance Soon 7: Input failure (not used) 8: Output failure (not used) 9: Memory Failure (FF card) 10: Lost static data (FF card) 11: Lost NV data (FF card) 12: Read back check failed (not used) 13: Device needs Maintenance Now 14: Power-up (not used) 15: Out-of-Service	0 to 15	N/A	Read Only
7	UPDATE_EVT	Alert generated by a change to static data. UNACKNOWLEDGED: 0 undefined, 1 acknowledged, 2 unacknowledged ALARM_STATE 0:Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported TIME_STAMP SUB_CODE RELATIVE INDEX			Read only
8	BLOCK_ALM	The block alarm is used for all configurations, hardware connection failures and system problems in the block. The cause of the alert is entered in the sub-code.			
		UNACKNOWLEDGED: 0 undefined, 1 acknowledged, 2 unacknowledged	0 to 2		Read / Write
		ALARM_STATE 0:Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported	0 to 4		Read only
		TIME_STAMP	Time		Read only
		SUB_CODE The alarm is stated here(only Device fail -safe set and OOS)			Read only
		VALUE- A value can be added by the customer for configuring alarms			Read only
9	TRANSDUCER_DIRECTORY	Array containing the transducer definitions (empty)	0,0	0,0	Read only
10	TRANSDUCER_TYPE	Identifies the type of Transducer Block.	Standard discrete positioner	Standard discrete positioner	Read only

Table 4.2 Bettis Q-Series™ Transducer Block (continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
General Transducer Block parameters (continued)					
11	XD_ERROR	Extensions to Block Error indicated by the "Other" bit 0 being set (enumeration) 16: Unspecified error 17: General error (not used) 18: Calibration error 19: Configuration error (not used) 20: Electronics failure 21: Mechanical failure (not used) 22: I/O Failure 23: Data Integrity error (not used) 24: Software error 25: Algorithm error (not used)	0 = no error	0 = no error	Read only
12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a Transducer Block.	0	0	Read only
13	FINAL_VALUE_D	States the requested valve position and status written by a discrete function block (set point)		2	Read only
		STATUS			Read only
		VALUE requested position 0: close, 1: open	0 to 1	0	Read only
14	ACT_FAIL_ACTION	Defined by Foundation Fieldbus, has no effect on our device! 0: undefined (DA), 1 Self-closing(SA), 2 Self opening(SA)	0 to 3	0	Read / Write
15	ACT_MAN_ID	Actuator manufacturer ID in Foundation Mfg id units. Is: Emerson Process Management Valve Automation Division	0x564144	0x564144	Read only
16	ACT_MODEL_NUM	Actuator model number. Depends where it is mounted. Can be set by customer.		All spaces	Read / Write
17	ACT_SN	Serial number of actuator. Can be set by customer.		All spaces	Read / Write
18	VALVE_MAN_ID	Valve manufacturer ID in Foundation Mfg id units. Can be set by customer.		0	Read / Write
19	VALVE_MODEL_NUM	Indicates available function block execution routines		All spaces	Read / Write
20	VALVE_SN	Serial number of valve. Can be set by customer.		All spaces	Read / Write
21	VALVE_TYPE	Type of valve. Can be set by customer, but it is not used by the device. 0: undefined, 1: Sliding stem, 2: Rotary	0 to 2	2	Read / Write
22	XD_CAL_LOC	The location where device was last initialized. Can be set by customer,		All spaces	Read / Write
23	XD_CAL_DATE	The date the unit was calibrated/initialized. Can be set by customer.			Read / Write
24	XD_CAL_WHO	Person who did the calibration. Can be set by customer.		All spaces	Read / Write
Device position status parameters					
25	DISCRETE_POSITION	Single signal indicating the current discrete position			
		STATUS			Read only
		VALUE 0 = closed, 1 = opened, 2 = Closing (based on not being 0 or 1 and the current position request) 3 = opening (based on not being 0 or 1 and the current position request)	0 to 3	0	Read only
26	OPEN_STATE	Discrete position feedback 0: false, 1: true	true/false	FALSE	
		STATUS (bad when loose IO board comms block err, uncertain sensor error)			Read only
		VALUE 0 false, 1: true	0 to 1	0	Read only
27	CLOSE_STATE	Discrete position feedback	true/false	FALSE	
		0: false, 1: true			
		STATUS (bad when loose IO board comms - block err, uncertain when sensor bad)			Read only
		VALUE	0 to 1	0	Read only
		0 false, 1: true			

Table 4.2 Bettis Q-Series™ Transducer Block (continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
		Device configuration			
28	AUTO_INITIALIZATION	Controls the procedure for finding the end positions			
		AUTO_INIT_COMMAND - 0: no action, 1: start auto init 2: start Zero point adjustment, 3: stop auto init	0 to 2		Read / Write
		Status of the initialization procedure - Undetermined, bad repeatability -> increase limit stop offset - Running, - Aborted, -> stopped, by user. - Undetermined, difference between open and close too small - Time Out, -> too long before end-positions are found -> check air-pressure and actuator sizing - Range Error -> Difference between open and closed end position is too small. -> Check air-pressure, check proper valve rotation. - Assembly Error -> the VOS configuration is incorrect. -> Check VOS function assembly - Successful - No Valid Data. -> Value after default (not initialized)		0	Read only
29	CFG_SWITCH_POINTS	Set switch points from end position			
		OPEN_END_POSITION use current position as open end position 0: normal, 1: set	0 to 1	0	Read / Write
		CLOSED_END_POSITION use current position as close end position 0: normal, 1: set	0 to 1	0	Read / Write
		OPEN_STOP_OFFSET - distance to end position (in ° before end position) Can be set per ° (degree)	5° to 30°	10°	Read / Write
		CLOSE_STOP_OFFSET - distance to end position (in ° before end position) Can be set per ° (degree)	5° to 30°	10°	Read / Write
30	FLASH_LED	For identification blink status led (5 min.) 0: finished 1:start	0 to 1	N/A	Read / Write
31	INSTRUMENT_TEMP	Indicates the internal temperature of the instrument STATUS VALUE Indicates the internal temperature of the device in degrees Celcius	N/A	N/A	Read only
32	SHUTDOWN_CFG	Configures what actions to take after internal communications are lost.			
		SHUTDOWN_ENABLE - 0: enable auto recovery, 1: enable manual recovery, 2: disable	0 to 2	0	Read / Write
		SHUTDOWN_ACTION - 0: default (de-energize pilots), 1: close, 2: open, 3: hold	0 to 3	0	Read / Write
		SHUTDOWN_DELAY_TIME - Time (in sec.) before action will be taken after event has occurred	1 to 255	5	Read / Write
		SHUTDOWN_RESET - Normally 0, unless SHUTDOWN_STATUS is 1 and SHUTDOWN_ENABLE set to manual recovery. Manual recovery will then require this bit to be set to 0	0 to 1	0	Read / Write
		SHUTDOWN_STATUS - Set to 1 when the system is shutdown, else 0	0 to 1	N/A	Read only
33	ZERO_POWER_CONDITION	The position where the valve will move to when no power is present (air pressure should be present for DA)closed, open, hold or undefined	Closed, open, hold, undefined	Undefined	Read only
34	BUTTONBOARD_ENABLE	Enables and disables the button board for initialization. Set to default will always be possible. Can only be enable when in OOS. When not in OOS it automatically returns to false, to come back to its original setting when in OOS. FF card must change this setting on the control board.	- Enable when in OOS - Never in OOS	Enable when in OOS	Read / Write
35	INTERNAL_ALERTS	Position sensor error System temperature exceeded Travel deviation alert Button board error Temperature sensor error Software error IO card Device shutdown Pilot Valve Error		N/A	Read only

Table 4.2 Bettis Q-Series™ Transducer Block (continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
		Diagnostic configuration			
36	FUNCTION_MODULE_ COUNTER	Counts the end position cycles performed by the control module.			
		FM_CNT_VALUE (read only)	0 - 4294967295	N/A	Read only
		FM_CNT_LIMIT	[2] 0 - 4294967295	1,000,000	Read / Write
37	PNEUMATIC_MODULE_ COUNTER	Counts the end position cycles performed by the pneumatic module			
		PM_CNT_VALUE	0 - 4294967295	N/A	Read / Write
		PM_CNT_LIMIT	[2] 0 - 4294967295	1,000,000	Read / Write
38	ACTUATOR_MODULE_ COUNTER	Counts the end position cycles performed by the actuator			
		ACT_CNT_VALUE	0 - 4294967295	N/A	Read / Write
		ACT_CNT_LIMIT	[2] 0 - 4294967295	1,000,000	Read / Write
39	VALVE_MODULE_COUNTER	Counts the end position cycles performed by the valve			
		VLV_CNT_VALUE	0 - 4294967295	N/A	Read / Write
		VLV_CNT_LIMIT	[2] 0 - 4294967295	1,000,000	Read / Write
40	TIMERS (units are seconds).	TIME_IN_POSITION - Holds the time in current position Reset to zero when power switched off	0 to 4294967295	0	Read only
		TIME_IN_POSITION_HI_LIM - Sets a limit for an alert for the time in position	[2] 0 to 4294967295	0	read.write
		OPEN_TIMERAVEL_TIME Indicates time between: - Pilot position change commanded and - Open trip position reached.	0 to 65536	0	Read only
		OPEN_TRAVEL_TIME_HI_LIM	[2] 0 to 65536	0	Read / Write
		OPEN_TRAVEL_TIME_LO_LIM	[2] 0 to 65536	0	Read / Write
		OPEN_TRAVEL_TIME_AVG (average of 30 strokes)	0 to 65536	0	Read only
		OPEN_TRAVEL_AVG_HI_LIM	[2] 0 to 65536	0	Read / Write
		OPEN_TRAVEL_AVG_LO_LIM	[2] 0 to 65536	0	Read / Write
		CLOSE_TRAVEL_T Indicates time between: - Pilot position change commanded and - Close trip position reached.	0 to 65536	0	Read only
		CLOSE_TRAVEL_TIME_HI_LIM	[2] 0 to 65536	0	Read / Write
		CLOSE_TRAVEL_TIME_LO_LIM	[2] 0 to 65536	0	Read / Write
		CLOSE_TRAVEL_TIME_AVG (average of 30 strokes)	0 to 65536	0	Read only
		CLOSE_TRAVEL_AVG_HI_LIM	[2] 0 to 65536	0	Read / Write
		CLOSE_TRAVEL_AVG_LO_LIM	[2] 0 to 65536	0	Read / Write

Table 4.2 Bettis Q-Series™ Transducer Block (continued)					
Index No.	**Name**	**Description**	**Valid Range**	**Initial Value**	**Permission**
		Alerts			
41	RECOMMENDED_ACTION	Enumerated list of recommended actions of the device, displayed with a device alert (can be multiple, see table 4.3)	N/A	0	Read only
42	FAILED_PRI	Designates the alarming priority of the FAILED_ALM. Handling defined by FF. 0: All FAILED alerts disabled 1: All failed alerts suppressed 2: Higher process failed alerts	0 to 15	2	Read / Write
43	FAILED_ENABLE	See alert table 4.3	N/A		
44	FAILED_MASK	See alert table 4.3			
45	FAILED_ACTIVE	See alert table 4.3		N/A	Read only
46	FAILED_ALM	Alarm indicating a failure within a device which makes the device non-operational.			
		UNACKNOWLEDGED: 0: Undefined, 1: Acknowledged, 2: Unacknowledged			Read only
		ALARM_STATE 0:Undefined 0 1:Clear- Reported 2:Clear- Not reported 3:Active- Reported 4:Active- Not reported			Read only
		TIME_STAMP			Read only
		SUBCODE value should match alert as stated under FAILED_ENABLE			Read only
		VALUE			Read only
47	MAINT_PRI	See index 42 FAILED_PRI	0 to 15	2	Read / Write
48	MAINT_ENABLE	See alert table 4.3	N/A		
49	MAINT_MASK	See alert table 4.3			
50	MAINT_ACTIVE	See alert table 4.3			Read only
51	MAINT_ALM	See index 46 FAILED_ALM			
52	ADVISE_PRI	See index 42 FAILED_PRI	0 to 15	2	Read / Write
53	ADVISE_ENABLE	See alert table 4.3	N/A		Read / write
54	ADVISE_MASK	See alert table 4.3			Read / write
55	ADVISE_ACTIVE	See alert table 4.3			Read only
56	ADVISE_ALM	See index 46 FAILED_ALM			
57	HEALTH_INDEX	Parameter representing the overall health of the device. - 100 being perfect and 1 being non-functioning. - No alerts -> 100 ADVISE_ACTIVE -> -10 per advice MAINT_ACTIVE -> - 40 per advise FAIL_ACTIVE -> = 10 (10 also lowest value)	10 to 100	100	Read only
		Others			
58	FF_COMM_STAT	Indicates quality of FF communications			
		FF_COMM_ATTEMPTS - States the number of attempts. When at max, reset to 0 for timed out messages also!	0 to 65535	0	Read only
		FF_COMM_TIME_OUT - States how many of the attempts were timed out	0 to 65535	0	Read only
59	PWA_SIMULATE	Password protected and off when power cycled! If this is set to 2 then all the alert parameters are writable 1: simulate off, 2 simulate enabled	1 and 2	1	Read / Write

Table 4.3 Bettis Q-Series™ 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	Position Sensor Error	Feedback problem, replace Control module when possible	n	n	y	y	n	n
bad_temperature_sensor	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	n	n	y	y
travel_deviation	Travel Deviation	Lost position, Check air pressure	n	n	n	n	y	y
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	Replace control module when possible	n	n	y	y	n	n
Counter alerts									
cm_life_exceeded	Control Module Life Cycle Exceeded	Control module life cycle exceeded, replace control module	n	n	n	n	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	n	n	y	y
initialization_failed	Initialization Failure	Device failed initialization; Check air pressure, check actuator sizing, check valve system	n	n	n	n	n	n

Table 4.3 Bettis Q-Series™ 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.	n	n	n	n	y	y
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 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	n	n
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.						
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.	n	n	n	n	y	y
rb_nv_electronics_failure	Output Board Electronics Failure	Output Board Electronics Failure: The Device has detected a fault with an electrical component on the Fieldbus Electronics Module Assembly. Replace the Device.	n	n	n	n	y	y
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.						

Table 4.4 Bettis Q-Series™ NAMUR NE- 107 Alarms										
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	

5 Operations and Maintenance

5.1 Fault state

The fault state parameter, when active, indicates a loss of communication to an output block, a fault promoted to an output block, or loss of a physical contact. If the fault state is active, the output function blocks perform their **Fault State** actions. Selecting the feature **Fault State** enables the ability to manually set and clear the fault state of the device. Setting the **Set Fault State** parameter to "**Set**" manually places the instrument in the fault state. Setting the **Clear Fault State** parameter to "**Clear**" clears the device fault state if no faults are currently active. You can test the actions the output blocks will perform by manually setting the fault state active.

5.2 Restart method

The following method is provided with the Bettis Q-Series Module Device **Description:**

- **Restart**

Method **Description:**

- **Master Reset** - Available via the Resource Block, the Master Reset method is required for restarting the module without removing power. It also allows the user to set data within the module to its default state. In addition to restarting the module, this method also performs module integrity tests to verify that it is acceptable to restart the module. This method is only available via the Resource Block and is described in detail in the detailed setup section (§ 4.1).

5.3 Restarting the module

You can restart the module via different mechanisms. Depending on which restart option is used; the communication links, static parameters, etc. may be affected. However, due to the effect that a restart can have on the module, and therefore the process, restarting the module should be used cautiously.

WARNING

Restarting the Bettis Q-Series may cause loss of control of the process.

5.3.1 Software restart

There are several Restart options as described bellow. This can be done via parameter RESTART (index 16) in the Resource block. The following is a brief description for each of the restart options:

- **Resource** - Performing a "Resource"-restart has no observable effect on the module resetting the dynamic variables in the Function Blocks. However, the dynamic variable within the module are reset and this could cause a "bump" in your process.
- **Processor** - Performing a "Restart Processor" has the same effect as removing power from the module and re-applying power. This is typically used to restart the Foundation Fieldbus Interface card should the Interface Card and the Module I/O card get out of sync due to incorrect power application.
- **Defaults** - Performing a "Restart with Defaults" should be done with care. This restart sets the static parameters of the function blocks in the module to their default state. It also disconnects all links within the module. After performing a "Restart with Defaults", a "Restart Processor" should be performed. Within the Bettis Q-Series Series of modules, the "Restart with Defaults" option is the only option that will read certain data from the Bettis Q-Series Communications board.
- **Actuator Processor** - Performing a "Actuator Processor"-Restart has the same effect as removing power from the control part of the module and re-applying power. This is typically used to restart the control part of the module.
- **Actuator Defaults** - Performing a "Actuator Defaults"-restart should be done with care. This restart sets the switch point to default (see §3.2).

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