

# **TopWorx™ D2-FF: FOUNDATION™ Fieldbus** Installation, Operation & Maintenance Manual



**TOPWORX™**

  
**EMERSON™**  
Process Management

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*valvetop*



# 1. Description & Specification

The TopWorx™ D2-FF Discrete Valve Controller combines position sensing and monitoring with FOUNDATION Fieldbus communications and pilot valve output drivers. It incorporates the following features:

### FOUNDATION Fieldbus digital communication:

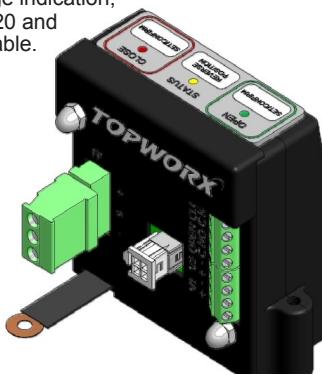
- Link active scheduler capability/Link Master (LAS)
- Pre-instantiated\*\* blocks include Resource Block (RB), Transducer Block (TB), Analog Input (AI) Function Block, Discrete Output (DO) Function Block, 2 Discrete Input (DI) Function Block, Proportional, Integral, and Derivative (PID) Function Block
- Function block instantiation, live download, auto commission/replacement
- Fast function block execution time: DI: 15ms, AI: 15ms, DO: 20ms, PID: 20ms
- Easy integration into AMS and DeltaV systems
- Device Dashboards powered by enhanced Electronic Device Description Language (EDDL)

### Position sensing/monitoring

- Optional GO switches for open/close status
- Optional potentiometer for position percentage indication, can be used for any rotation range between 20 and 320 degrees. End position offsets are adjustable.

### Control and monitor inputs and outputs

- Supports single/double and normal/reverse acting actuators
- Local LEDs for visual indication
- Local push buttons for calibration
- Remote configuration from control system or field communicator
- Stroke valve method
- Cycle count monitoring
- Open/close time monitoring
- Temperature monitoring
- Open/short circuit protection
- Integrated field diagnostics
- Embedded NAMUR NE 107 diagnostics



Intrinsically Safe Input Parameters: Bus Connector pins 1 to 3			
I.S. Parameters		FISCO Parameters	
Ui	30V	Ui	17.5V
li	380mA	li	380mA
Pi	1.5W	Pi	5.32W
Ci	5nF	Ci	5nF
Li	10µH	Li	10µH

Electrical Specifications	
Current Consumption	17.65mA nominal
Max. Applied Voltage	35VDC
Operating Voltage	9-32VDC
Fieldbus Specifications	
Topology	Point to Point Bus with Spurs Daisy Chain Tree
Cable	Twisted Pair
Bus Length	1900m (max)
Transmission Speed	31.25 kbit/s
Intrinsically Safe	Yes
Function Block Execution Times	DI 15ms AI 15ms DO 20ms PID 20ms

\*\*Pre-instantiated blocks are the pre-installed factory default function blocks. Instantiation is the capability to add blocks to and delete blocks from FF devices on the link. Up to 15 additional copies of each function block can be added to a device (except the transducer and resource blocks). Not an available feature in some DSC systems. Additional information is provided in FF-103.

## 1.1 Storage

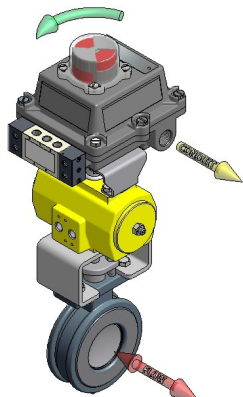
Until conduit, conduit plugs, and any applicable spool valve port connections are properly installed, the TopWorx™ unit will not support its IP/NEMA rating as the unit ships with temporary covers. Ensure that it is stored in a dry environment with a relative humidity range between 10%-95% and a temperature ranging from -40°F (-40°C) to 160°F (71°C). Once properly installed, the temperature range listed on the nameplate will supersede this storage temperature range.

## 2. Installation

This section provides instruction for installing the TopWorx D2-FF Discrete Valve Controller including mounting, tubing and wiring connections.

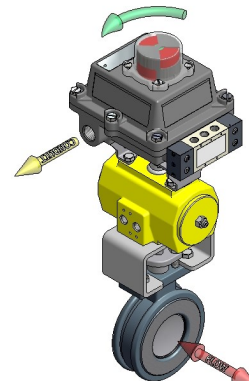
### 2.1. Orientations, Normal and Reverse Acting Actuators

*Normal acting* is full clockwise when the process valve is closed and counterclockwise when the process valve is open. *Reverse acting* is full clockwise when the process valve is open and counterclockwise when the process valve is closed.



The image to the left shows a TopWorx™ unit mounted parallel to the process valve in the closed position. The green arrow at the top shows the “normal acting” direction of travel to open the valve. This is the standard orientation and unless otherwise specified, your unit will be factory set to operate in this fashion.

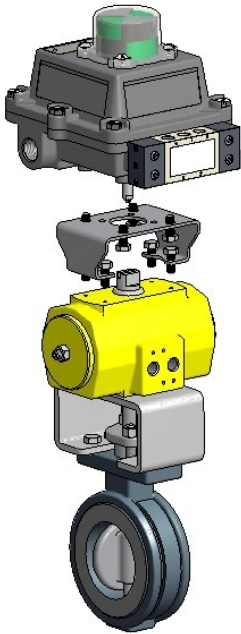
The image to the right shows a TopWorx™ mounted perpendicular to the process valve in the closed position. The green arrow at the top shows the “normal acting” direction of travel to open the valve. Notice that the TopWorx™ has been rotated 90° compared to the unit on the left.





## 2.2. Mounting

TopWorx has numerous mounting bracket kits, both rotary and linear, available to meet your specific application. Consult your local distributor or factory representative for ordering information. The illustration below shows a direct NAMUR mount on a quarter turn valve. Refer to your mounting kit documentation for specific mounting instructions.

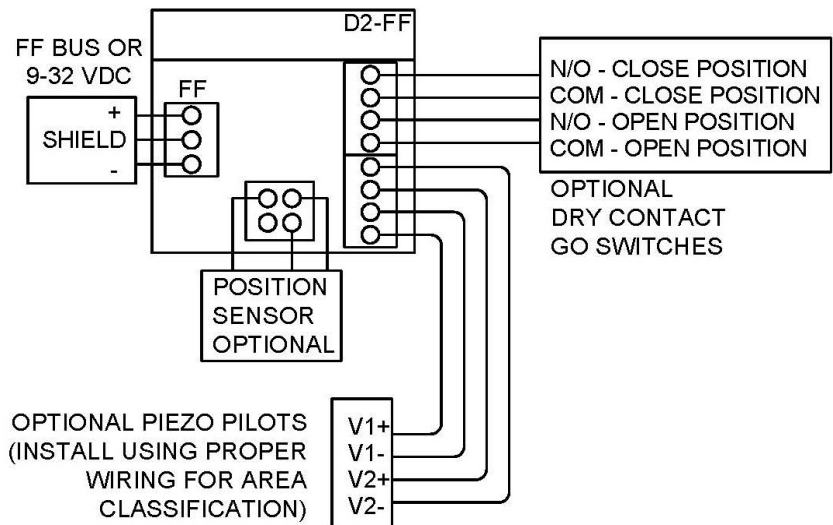
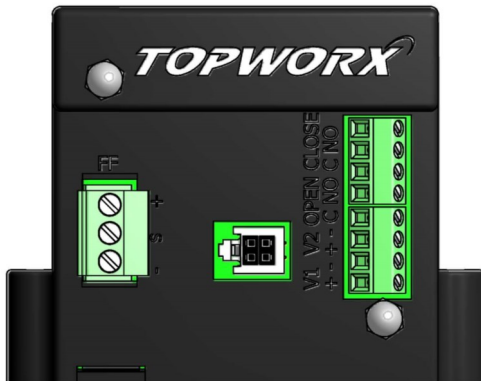
### 2.2.1. Mounting Assembly Installation Notes



1. Use caution not to allow undue axial (thrust) load on the shaft.
2. Cycle the valve a couple of times prior to final tightening of the mounting kit hardware. This allows the shaft to self-center in the pinion slot, or coupler. Refer to the *dimensions and materials* section of this document for appropriate tightening torque.
3. Always use sound mechanical practices when applying torque to any hardware or making pneumatic connections. Refer to the Integrated Pneumatic Control Valves section for detailed information.
4. This product comes shipped with plastic plugs in the conduit entries in an effort to protect the internal components from debris during shipment and handling. **It is the responsibility of the receiving and/or installing personnel to provide appropriate permanent sealing devices to prevent the intrusion of debris or moisture when stored or installed outdoors.** 
5. **It is the responsibility of the installer, or end user, to install this product in accordance with the National Electrical Code (NFPA 70) or any other national or regional code defining proper practices.** 

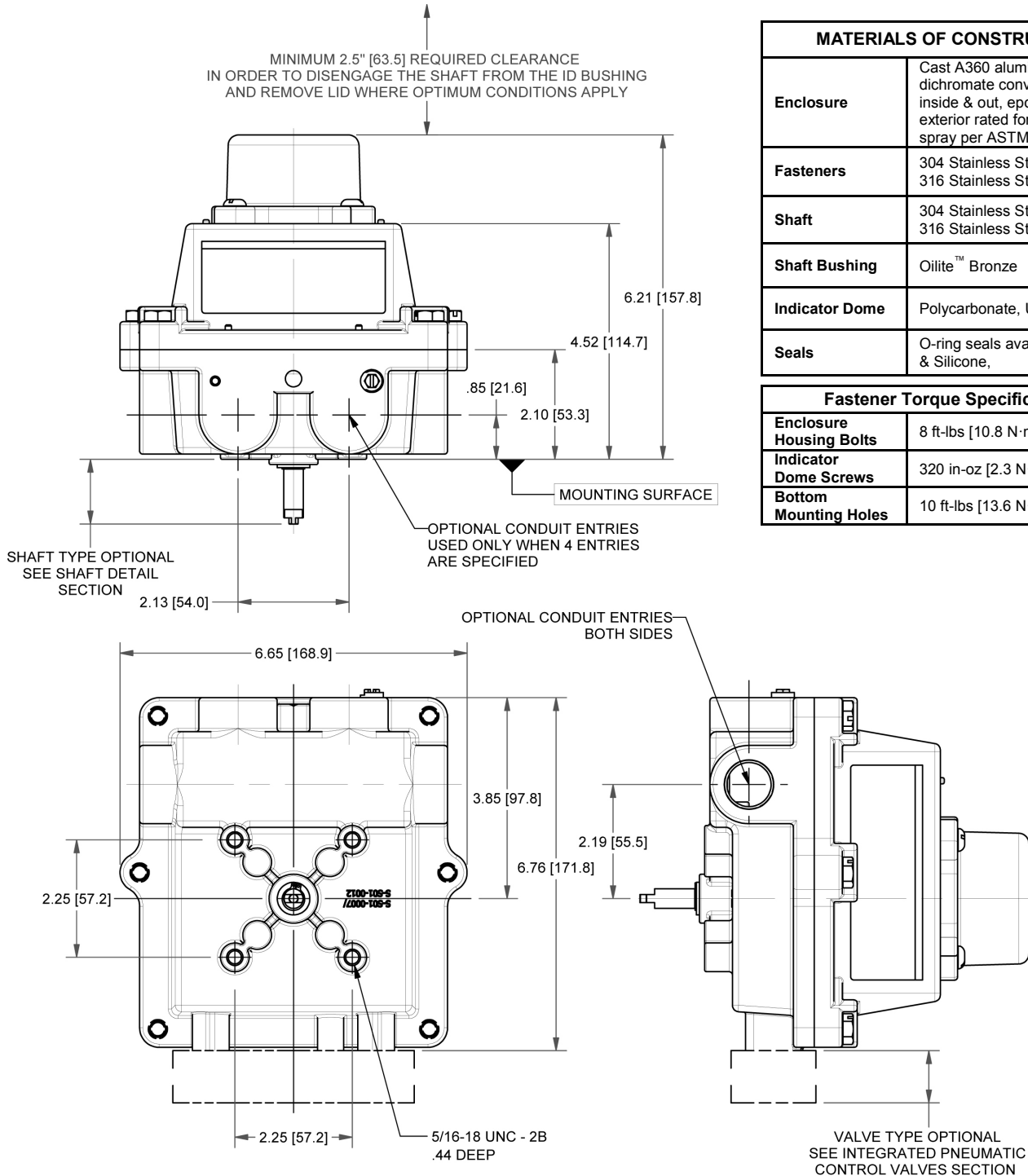
**NOTE: TopWorx has pre-configured modules and faceplates available for DeltaV control systems. Contact TopWorx factory for more information.**

## 2.3. Wiring



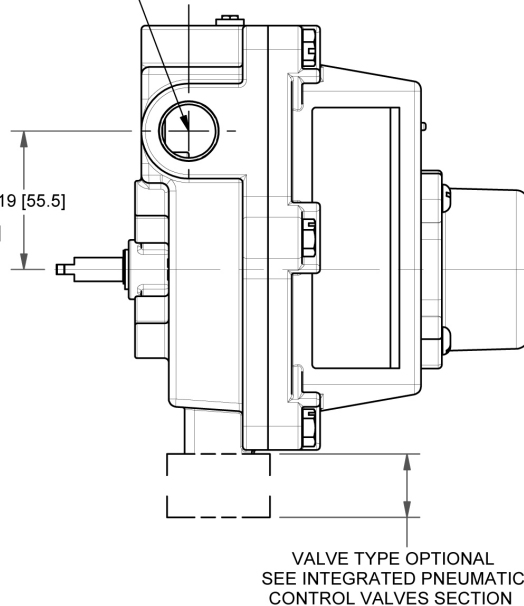
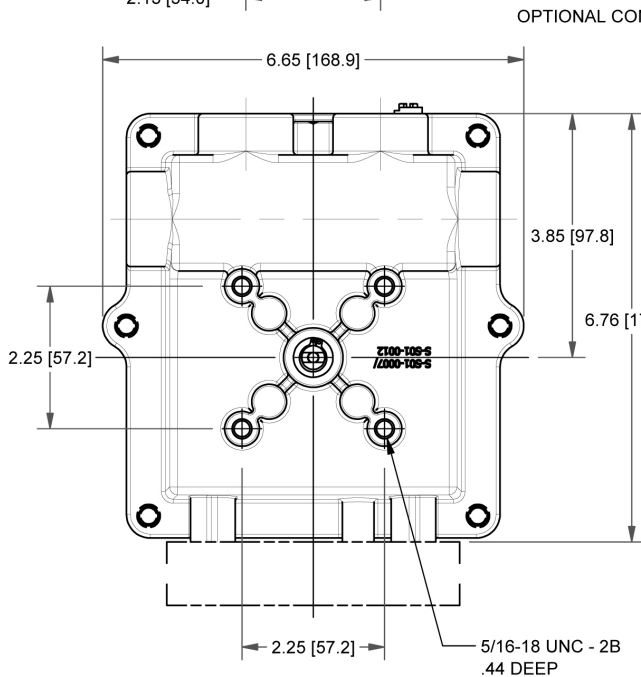
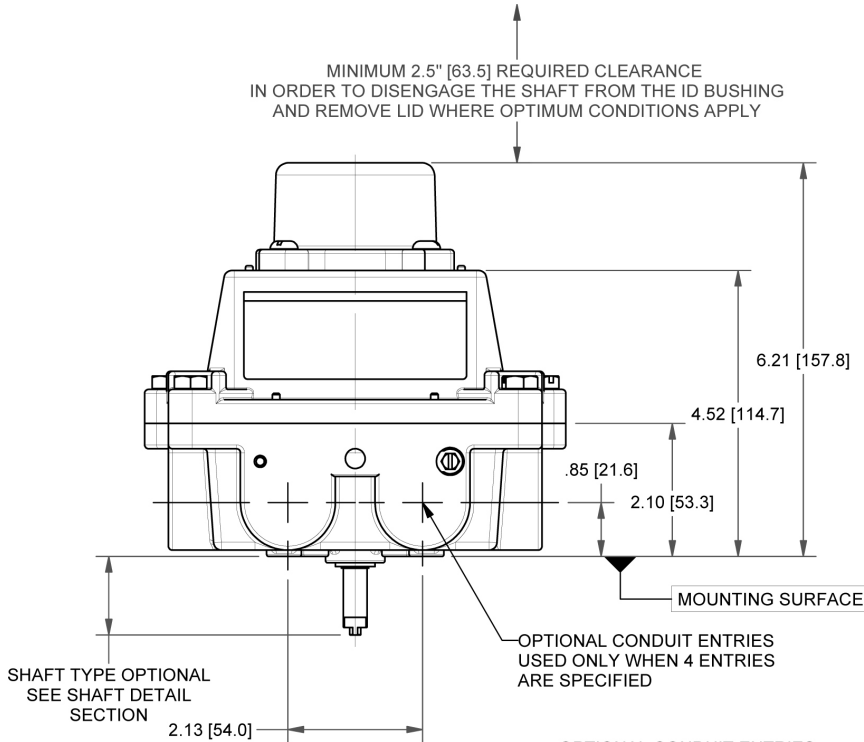
## 2.4. Dimensions and Materials

### 2.4.1. TopWorx™ DXP



2.4. Dimensions and Materials (Continued)

2.4.2. TopWorx™ DXS

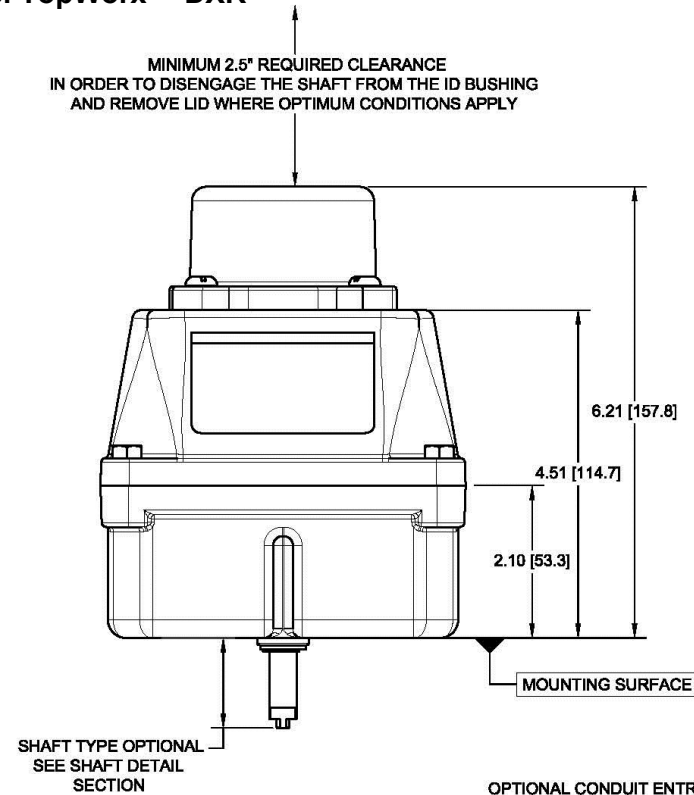


MATERIALS OF CONSTRUCTION	
Enclosure	Cast 316 Stainless Steel
Fasteners	304 Stainless Steel standard 316 Stainless Steel optional
Shaft	304 Stainless Steel standard 316 Stainless Steel optional
Shaft Bushing	N/A
Indicator Dome	Polycarbonate, UV F1 rated
Seals	O-ring seals available in: Buna & Silicone

Fastener Torque Specifications	
Enclosure Housing Bolts	8 ft-lbs [10.8 N·m] +/-10%
Indicator Dome Screws	320 in-oz [2.3 N·m] +/-10%
Bottom Mounting Holes	10 ft-lbs [13.6 N·m] +/-10%

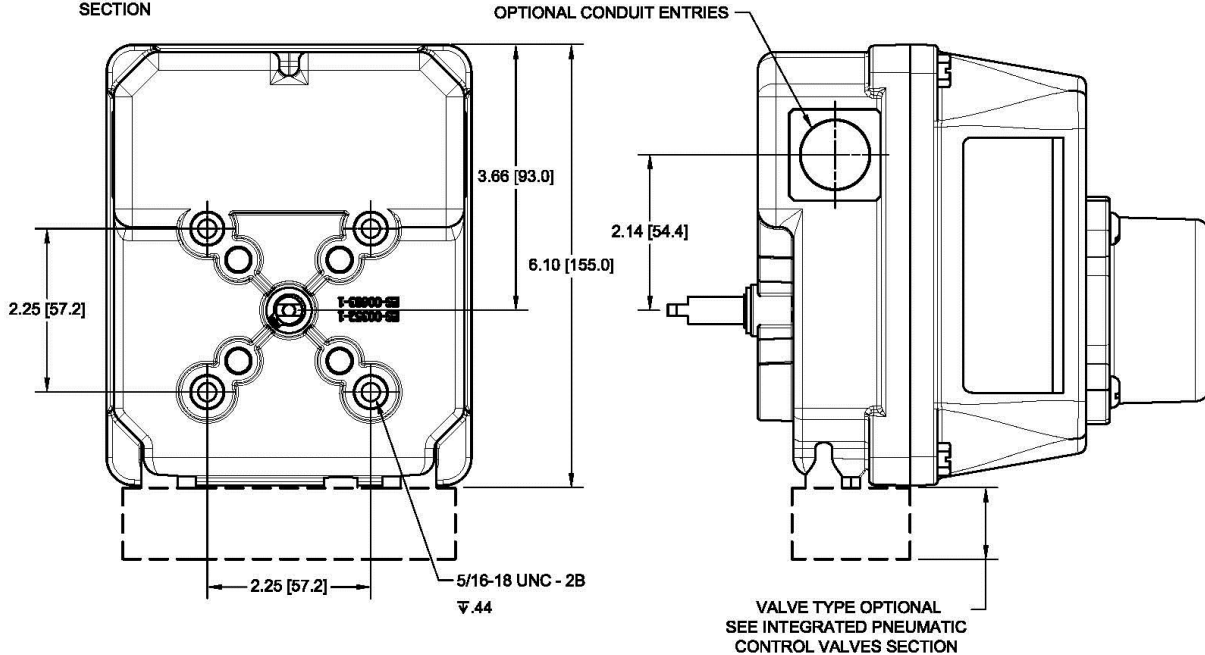
## 2.4. Dimensions and Materials (Continued)

### 2.4.3. TopWorx™ DXR



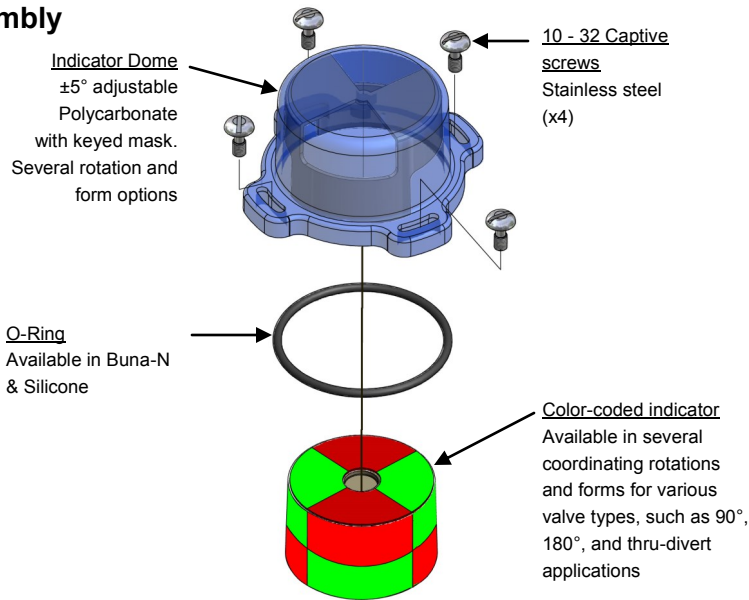
MATERIALS OF CONSTRUCTION	
Enclosure	Valox™ 364
Fasteners	304 Stainless Steel standard 316 Stainless Steel optional
Shaft	304 Stainless Steel standard 316 Stainless Steel optional
Shaft Bushing	Delrin™ 500P white
Indicator Dome	Polycarbonate, UV F1 rated
Seals	Silicone

Fastener Torque Specifications	
Enclosure Housing Bolts	20 in-lbs [2.3 N·m] +/-10%
Indicator Dome Screws	20 in-oz [2.3 N·m] +/-10%
Bottom Mounting Holes	8 ft-lbs [10.8 N·m] +/-10%

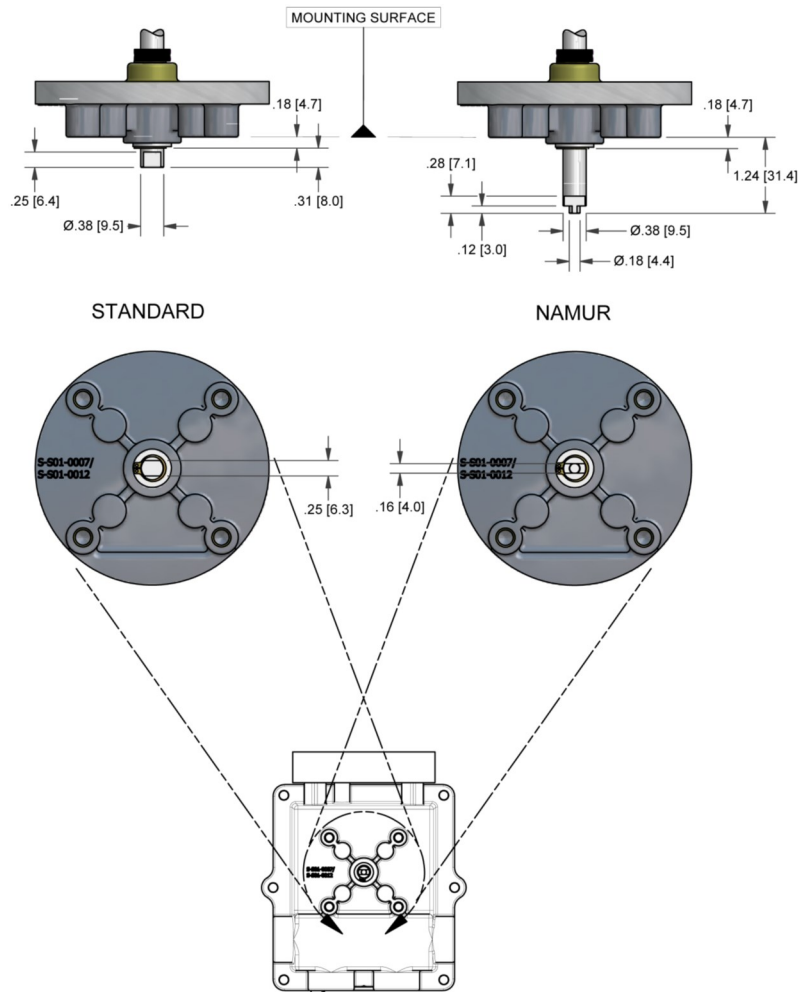
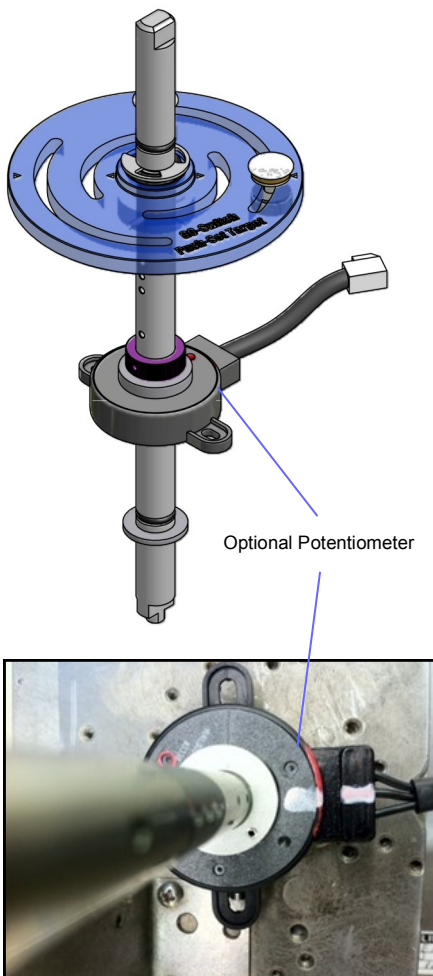


## 2.4. Dimensions and Materials (Continued)

### 2.4.4. Indicator Assembly



### 2.4.5. Cam/Shaft Assembly



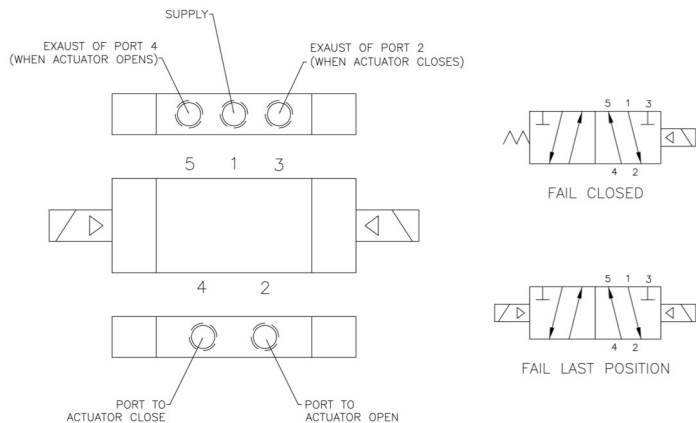


## 2.5. Spool Valves and Pilots

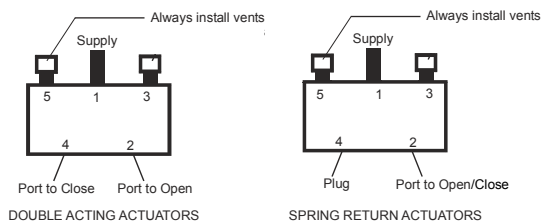
Prior to connecting the supply air to the spool valve, flush the system to remove any debris or contaminants. Galvanized pipe can easily flake and contaminate the system and therefore is not recommended. A 40 micron point of use filter at every device is recommended.

### 4-Way Spool Valves

The TopWorx spool valve is a 5 port, 4-way valve driven by an internally mounted pilot. The spool valve supply port and work ports are marked as follows:



**\*\*\*Never Plug, Block or Restrict Port 5\*\*\***



### Highly Recommended

TopWorx highly recommends Loctite 567 brand thread sealant. Do not use a hard setting pipe compound. If Teflon thread seal tape is used, start the wrap on the second thread from the leading thread of the fitting. This will prevent tape shreds from contaminating the spool valve seals.

Breathers (AL-M31) should be installed in the exhaust ports to keep debris from falling into the spool valve and damaging the seals. This must be addressed prior to installation, or storage.

A flow control may be used in Port 3, but should NEVER BE USED in Port 5. Any blockage or restriction may cause an internal pressure build-up inside the enclosure and pose a safety issue.

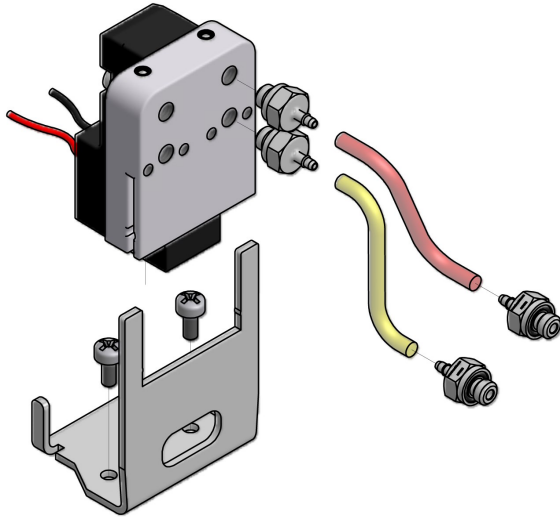
Spool Valve Specifications	
Medium	Dried, filtered air (40 micron)
Max Operating Pressure	100psi (0.69 MPa) (6.89Bar)
Min. Operating Pressure	30psi (0.21 MPa) (2.07Bar)
Max Consumption Rate"	600 cc/min @ 80psig
Ambient Temperature Range	Refer to Product Nameplate Marking
Flow Coefficient	1.2Cv or 3.0Cv
Environment Rating	Type 4, 4X, IP67
Port Size	1/2" NPT for 3.0Cv valve 1/4" NPT for 1.2Cv valve
Manual Override	Available in Latching/Non-Latching Push Type & Palm Actuator Type
Valve Body	Available in Hardcoat Anodized Aluminum, 304, or 316 Stainless Steel
Valve Seals	Valve Body Seals available in Buna-N & Silicone

**Don't forget!**  
TopWorx has a complete line of breathers, flow controls, regulators and filters.  
Check out [www.topworx.com](http://www.topworx.com) or call us at **502.969.8000** for more details

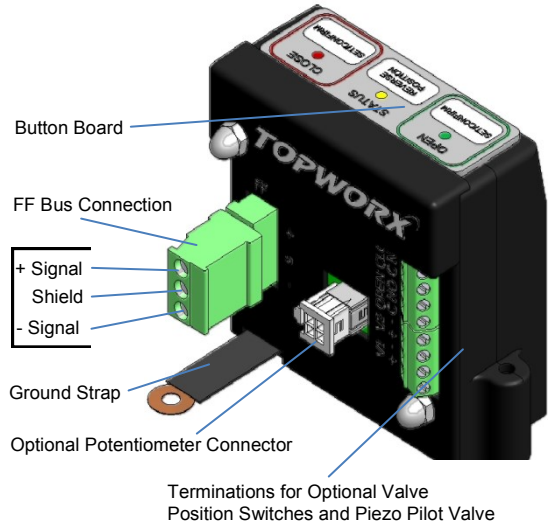
**DID YOU KNOW?**  
TopWorx manufactures the globally-known GO Switch Leverless Limit Switch, which comprises a full line of harsh environment sensors. If your application is very cold, very hot, under water or in a caustic atmosphere, then GO Switch has the answer.

## 2.6. Component Replacement

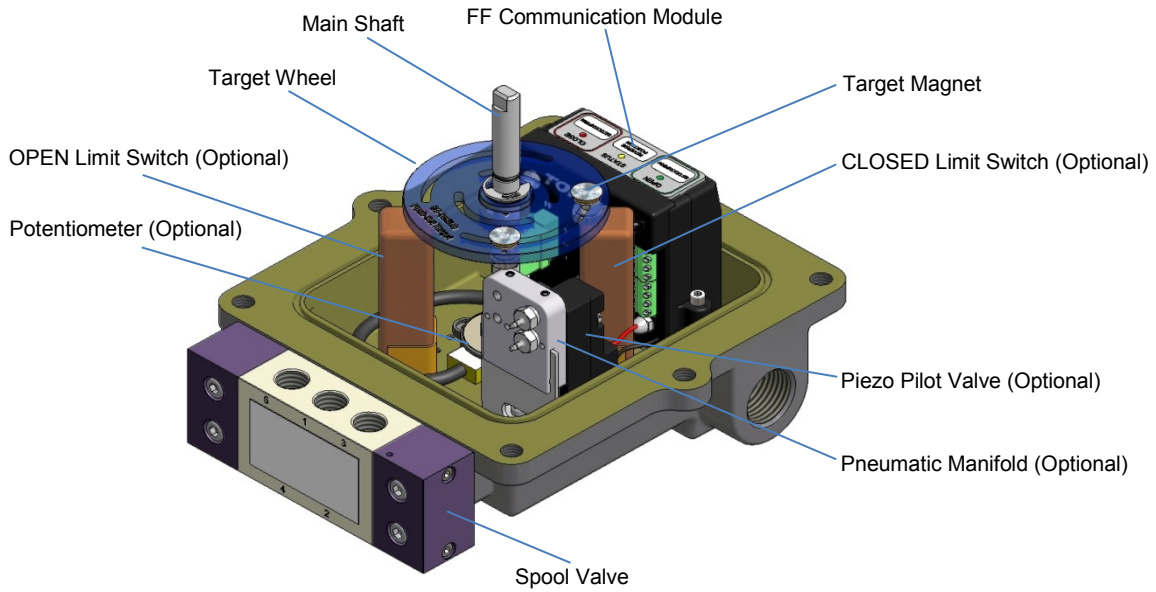
### Optional Piezo Pilot Valve



### FF Communication Module



### D2-FF Assembly: “Inside the Box”



Fail Closed Spool Valve Replacement Assemblies	
PART #	DESCRIPTION
AV-BFCVA20	Std Alum Spool Valve Assy w/Buna seals
AV-BFCVS20	Std 304SS Spool Valve Assy w/Buna seals
AV-BFCV620	Std 316SS Spool Valve Assy w/Buna seals

Fail Last Position Spool Valve Replacement Assemblies	
PART #	DESCRIPTION
AV-BFLPVA20	Std Alum Spool Valve Assy w/Buna seals
AV-BFLPVS20	Std 304SS Spool Valve Assy w/Buna seals
AV-BFLPV620	Std 316SS Spool Valve Assy w/Buna seals

### 3. Operation

This section of the manual provides operational information for configuring, control and monitoring the device locally or remotely through the FOUNDATION Fieldbus Host Control System.

#### 3.1 Operation Mode and Function Block Assignments

Automatic (Auto) and Out of Service (OOS) mode are available for all the function blocks in FOUNDATION Fieldbus Host Control System. To operate device using function block, first set the required Function Block mode to OOS, then set the required channel number according to Table 1. After downloading the Function Block to system, set the Function Block mode to AUTO.

**Note:** For DI block, if “Open Indicator Input” is chosen, FIELD\_VAL\_D parameter will indicate Open/Close status. If “Close Indicator Input” is chosen, FIELD\_VAL\_D parameter will indicate reversed Open/Close status.

**Table 1 Function Block Assignments**

Function Block	Signal	Channel	Unit
DO	Command to open or close	1	None
DI	Output command readback	2	None
	Open indicator input	3	None
	Close indicator input	4	None
AI	Instrument temperature	5	°C
	Analog position	6	%

**Table 2 LED Functionality**

LED Label	Off	On	Blink	Flash
STATUS	No power	Device is calibrated and full functioning	Reversing valve is in process	Calibration is required or error has occurred
CLOSE	Not in closed position	In closed position	Calibrating closed position is in process	Closed GO switch is triggered during calibration
OPEN	Not in open position	In open position	Calibrating open position is in process	Open GO switch is triggered during calibration

**NOTE:** LED duty cycle is shown on the right.

**Flashing:** LED is on for 5% of every second.  
**Blinking:** LED is on for 50% of every second.

on  
off

on  
off

LED=  
**Flashing**

LED=  
**Blinking**

Time →

**Table 3 Button Board Functionality**

Activity	Function
REVERSE button pressed	Reverse valve
OPEN button pressed once	Start to calibrate open position
OPEN button pressed again	Confirm current position as open position
CLOSE button pressed once	Start to calibrate closed position
CLOSE button pressed again	Confirm current position as closed position

### 3. Operation (Cont.)

Table 4 Calibration Statuses

Status	Description
Calibration needed	Device is not calibrated or calibration for the other end position is needed.
Running	Device calibration is in process
Timed Out	Device calibration timed out (maximum 5 minutes)
Both triggered	Both Go switches are triggered simultaneously
Range error	Less than minimum allowed rotation range (minimum 20 degrees)
In deadband	End position is too high/low or in deadband
No sensor detected	No sensor is detected during calibration
Successful	Device is calibrated

### 3.2. Device Calibration (Required Configuration)

Device can be calibrated either locally using buttons (see section 3.2.1) or remotely using bus command (see section 3.2.2). A summary for LED and button board functionalities is provided in Table 2 and 3.

#### 3.2.1. Calibrating End Positions Locally

##### 3.2.1.1. Perform Calibration

- This operation is only available if Transducer Block is in OOS mode and the button board is active. If Transducer Block is in Auto mode, change the mode to OOS. If the button board is disabled, set "Buttonboard Enable" parameter to "Active in OOS".
- STATUS LED will flash if device is not calibrated. To start calibration procedure, identify the current shaft position by sight, press (greater than 50ms and less than 5min) either the CLOSE or OPEN button according to the position to start the calibration.
- If CLOSE button is pressed, CLOSE LED will blink to indicate that calibration is in process, perform the following according to sensor type to calibrate the closed end position (note that either CLOSE or OPEN position can be calibrated first):

**Option #1: GO switch only case:** Move magnet to trigger the closed switch (the GO switch labeled as closed position switch). CLOSE LED will flash to indicate the switch is triggered.

**Option #2: Potentiometer only case:** Make sure the potentiometer is not in deadband (the red dot should not fall into the red line area).

**Option #3: Both GO switch and potentiometer case:** Move magnet to trigger the closed switch (the GO switch labeled as closed position switch). CLOSE LED will flash to indicate the switch is triggered. Make sure the potentiometer is not in deadband (the red dot should not fall into the red line area).

\* Press the CLOSE button **AGAIN** to confirm the position. CLOSE LED will become solid on.

- Press the REVERSE button (greater than 50ms and less than 5min) to move valve to the other position. If there is a potentiometer, as the shaft rotates, make sure the potentiometer is not rotating through its deadband area. STATUS LED will blink for 3 seconds to indicate the reverse action. Note: The REVERSE button is not operational in units without integral pilot valves supplied by TopWorx. For those applications, the valve will have to be moved manually or with existing controls.
- Press the OPEN button and perform the following according to sensor type to calibrate the open end position (note that these steps are similar to the calibration for the closed end position):

**Option #1: GO switch only case:** Move magnet to trigger the open switch (the GO switch labeled as open position switch). OPEN LED will flash to indicate the switch is triggered.

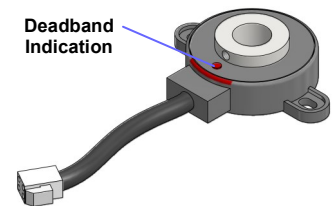
**Option #2: Potentiometer only case:** Make sure the potentiometer is not in deadband.

**Option #3: Both GO switch and potentiometer case:** Move magnet to trigger the open switch (the GO Switch labeled as open position switch). OPEN LED will flash to indicate the switch is triggered. Make sure the potentiometer is not in deadband.

\* Press the OPEN button **AGAIN** to confirm the position. OPEN LED will become solid on.

- STATUS LED will become solid on if the calibration procedure is successful. It will flash if the calibration is failed. The calibration status will be shown in "Calibration Status". Please see Table 4 for the list of calibration statuses.

**Note** that either end position can be re-calibrated/re-adjusted if the other end position is already calibrated. That is, after initial calibration, either position can be recalibrated individually without calibrating the other position.



#### 3.2.2. Calibrating End Positions Remotely

Calibration remotely using bus command can be done through guided method (For example, from AMS or Handheld screens, see section 3.2.2.1) or manual setup (see section 3.2.2.2).

##### 3.2.2.1. Perform Guided Calibration through Method (Recommended)

Click the method "Device Setup" or "Calibrate" on screen and follow the instructions for calibration.

##### 3.2.2.2. Perform Calibration by Setting Parameters

- This operation is only available if the Transducer Block is in OOS mode. If Transducer Block is in Auto mode, change the mode to OOS.

### 3. Operation (Cont.)

- b. STATUS LED will flash if device is not calibrated. To start calibration procedure, select the “Set to current position” from either the “Open End Position” or the “Close End Position” parameter. The corresponding OPEN or CLOSE LED will blink to indicate that calibration is in process.
- c. For calibrating the “Close End Position”, perform the following according to sensor type to calibrate the closed end position (note that either the “Open End Position” or the “Close End Position” can be calibrated first):
  - Option #1: GO switch only case:** Move magnet to trigger the closed switch (the GO switch labeled as closed position switch). CLOSE LED will flash to indicate the switch is triggered.
  - Option #2: Potentiometer only case:** Make sure the potentiometer is not in deadband (the red dot should not fall into the red line area).
  - Option #3: Both GO switch and potentiometer case:** Move magnet to trigger the closed switch (the GO Switch labeled as closed position switch). CLOSE LED will flash to indicate the switch is triggered. Make sure the potentiometer is not in deadband (the red dot should not fall into the red line area).

\* The status for “Close End Position” will automatically change back to “No Action Required” if the action is performed.

- d. Select the “Reverse” from the “Reverse Valve Position” parameter. If there is a potentiometer, as the shaft rotates, make sure the potentiometer is not rotating through its deadband area. STATUS LED will blink for 3 seconds to indicate the reverse action. Note: The REVERSE button and “Reverse Valve Position” is not operational in units without integral pilot valves supplied by TopWorx. For those applications, the valve will have to be moved manually or with existing controls.
- e. Select the “Set to current position” from the “Open End Position”. (note that these steps are similar to the calibration for the closed end position):
  - Option #1: GO switch only case:** Move magnet to trigger the open switch (the GO switch labeled as open position switch). OPEN LED will flash to indicate the switch is triggered.
  - Option #2: Potentiometer only case:** Make sure the potentiometer is not in deadband.
  - Option #3: Both GO switch and potentiometer case:** Move magnet to trigger the open switch (the GO switch labeled as open position switch). OPEN LED will flash to indicate the switch is triggered. Make sure the potentiometer is not in deadband.

\* The status for “Open End Position” will automatically change back to “No Action Required” if the action is performed.

- f. STATUS LED will become solid on if the calibration procedure is successful. It will flash if the calibration failed. The calibration status will be shown in “Calibration Status”. Please see Table 4 for the list of status.

\*Note that either end position can be re-calibrated/re-adjusted if the other end position is already calibrated.

#### 3.3. End Position Deadband Adjustment

If there is a potentiometer, the end position deadband is determined by the value for “Open/Close Stop Offset” parameter. This value is adjustable. Its default value is 10% and the allowable range is 5% to 40%. For example, with the default value, if the open position is at 100 degree and the closed position is at 50 degree, then if actual value position is within  $50 \pm (100-50) \times 10\% = 45 \sim 55$  degree, the “Close State” is “True”, and the “Open State” is “False”.

#### 3.4. Reverse Valve Position

Valve position can be reversed locally by pressing the REVERSE button on the button board if it is enabled. It can also be done remotely by selecting the “Reverse” from the “Reverse Valve” parameter when device is in OOS mode. The value for “Reverse Valve” will automatically change back to “No action” (default value) if the action is performed. STATUS LED will blink for 3 seconds to indicate the reverse action. Note: The REVERSE button is not operational in units without integral pilot valves supplied by TopWorx. For applications, the valve will have to be moved manually or with existing controls.

#### 3.5. Flash LED

To identify a device in the plant, put Transducer Block into OOS mode and select the “Flash LED” for the “Flash LED” parameter. Status LED on the unit will blink for 5 minutes. After 5 minutes, status for “Flash LED” will automatically change back to “Finished” (default value).

#### 3.6. Shutdown Configuration

Shutdown configuration controls the behavior of the valve in case of an internal communications failure in the electrical module. This is independent of the FF communication on the bus line. The “shutdown action” parameter is also re-used as the default position (initial status) for a device encountered a power loss.

##### 3.6.1. Parameters and functions

- a. Shutdown enable (SHUTD\_ENABLE parameter):
  - Enable, auto recovery:** If there is an internal failure, valve will move to certain position according to the setting of parameter SHUTDOWN\_ACTION. When the internal failure is solved, the valve will automatically go to its current setpoint position.
  - Enable, manual recovery:** If there is an internal failure, valve will move to certain position according to the setting of parameter SHUTDOWN\_ACTION. When the internal failure is solved, the valve will NOT automatically go to its current setpoint position unless SHUTD\_RESET parameter is manually selected as “reset”.
  - Disable:** Shutdown functionality is not operational; the valve will stay in its last position after an internal failure.
- b. Shutdown action (SHUTD\_ACTION parameter):
  - Open:** When performing shutdown operation or starting up after a power loss, valve will go to open position.
  - Close:** When performing shutdown operation or starting up after a power loss, valve will go to close position.
  - Hold:** When performing shutdown operation or starting up after a power loss, valve will stay in original position.

Note: The shutdown action is not operational in units without integral pilot valves supplied by TopWorx. For those applications, the valve will have to be moved manually or with existing controls.
- c. Shutdown delay (SHUTD\_DELAY\_TIME parameter):
  - The time waited to perform shutdown operation after the internal failure occurs. The default value is 5 seconds. The allowable range is from 2 to 255 seconds.

### 3. Operation (Cont.)

- d. Shutdown reset (SHUTD\_RESET parameter):  
**Inactive:** Shutdown reset function is not active. If “manual recovery” is selected for SHUTD\_ENABLE parameter and there is an internal error, after the internal failure is solved, the valve will NOT automatically go to its current setpoint position. Device stays in shutdown status.  
**Reset:** Shutdown reset function is active. If “manual recovery” is selected for SHUTD\_ENABLE parameter and there is an internal error, after the internal failure is solved, shutdown status will be reset, and the valve will automatically go to its current setpoint position. When this reset is completed, the SHUTD\_STATUS parameter will be “Device is operational” and the SHUTD\_RESET parameter will return to “inactive”.
- e. Shutdown status (SHUTD\_STATUS parameter):  
**Device operational:** there is no internal error.  
**Device shutdown:** there is internal error.

#### 3.6.2. Examples

- a. For internal communications failure  
 The factory default shutdown configuration settings are as following:  
**Shutdown enable:** Enable, Manual Recovery  
**Shutdown action:** Close  
**Shutdown delay:** 5 seconds  
**Shutdown reset:** Inactive  
 If there is an internal failure, after 5 seconds, valve will move to close position according to the setting of parameter SHUTDOWN\_ACTION. When the internal failure is solved, the valve will NOT automatically go to its current setpoint position unless SHUTD\_RESET parameter is manually selected as “reset”.
- b. For power loss  
 If the “shutdown action” is “Open”, when power is re-applied to device after a power loss, before valve receives the bus command (for example, the SP\_D from DO function block), valve will go to open position.  
 If the “shutdown action” is “Hold”, when power is re-applied to device after a power loss, before valve receives the bus command (for example, the SP\_D from DO function block), valve will stay in the previous position, that is, the position that power is off.

### 3.7. Buttonboard Enable

Local operation through push buttons is only available when the button board is active. The factory default value for “Buttonboard Enable” parameter is “Active in OOS”. When device is in OOS mode, the button board can be enabled by setting the “Buttonboard Enable” parameter to “Active in OOS” or disabled by setting it to “Never active”.

### 3.8. Valve Position Indication

The “Analog position” parameter will indicate current valve position in percentage (the display range for AI block: -200% to +199%, the display range for TB block: 0%~100%) if there is a potentiometer and the calibration is successful, otherwise, the value is 0. The percentage is calculated as the distance in degrees from current position to close position versus the full open to close distance in degrees. The “Final Discrete Position” parameter will indicate current valve position as “Closed”, “Open”, “Opening” or “Closing”. Device will indicate “Closed” or “Open” according to the discrete position. The assigned position from DO block is indicated by “DO Command” parameter as “Close” or “Open”.

### 3.9. Position Sensor Type Indication

The “Position Sensor Type” parameter will indicate the sensor type detected by the device during calibration. This parameter will indicate “GO switch only”, “Potentiometer only”, or “Both GO switch and potentiometer” if sensor type is detected. Otherwise, it will indicate “Not assigned” (default value).

### 3.10. Temperature Indication

Temperature is measured every 100 millisecond by the sensor on the circuit board and indicated as degree C by “Temperature” parameter. The allowed temperature range is -25 to +65 degree C. An alarm will be triggered if temperature is out of range (Please see the Alert section for more details). The maximum/minimum measured temperature is recorded in the device. It can be viewed through the command in base record.

### 3.11. Device Cycle Count, Adjustment and Control

The parameter “Cycle Count” (this parameter is read only) indicates the total end position cycles. The parameter “Adjusted Count” indicates the end position cycles after adjustment. If valve position changes from close to open and back to close, the value for both parameters will be increased by one. Users can set “Adjusted Count” to any non-negative value and the adjusted cycle count will start to increase based on this set value. Users can set a limit for them using the “Cycle Count Limit” and “Adjusted Count Limit” parameters. The default limit is 1000000 cycles. The allowed input value for “Cycle Count Limit” must be greater than the current cycle count and less than 4294967296. The allowed input value for “Adjusted Count Limit” must be greater than the current adjusted cycle count and less than 4294967296. An alarm will be triggered if the count is out of range limit (Please see the Alert section for more details).

### 3.12 Timers

There are 3 timers available in this device:

**Time in position:** the time in seconds that device is in current position since the last movement. It is automatically reset to zero when the power is switched off.

**Open travel time:** the time between when pilot valve position is changed due to request and when the open end position is reached. It is indicated in seconds with accuracy in 10 milliseconds.

**Close travel time:** the time between when pilot valve position is changed due to request and when the close end position is reached. It is indicated in seconds with accuracy in 10 milliseconds.

*(Section 3 Continued on next page)*

### 3. Operation (Cont.)

These values are important in determining abnormal events that recently occurred. For example, a temporary drop in pressure or a sticky process valve (valve that has been left in the same position for a long time without cycling) will affect the performance of the last operation of the valve, but does not necessarily mean the mechanical device is worn out. The average open/close travel time (in seconds) of the last 30 strokes is calculated and indicated in parameter "Average Time". Process valve/actuators typically wear out at a constant steadily pace. A good indication of wear will be the average travel times since the change is slow, but constant. Users can set an upper limit for "Time in position" using the "Time in Position Hi Limit" parameter. The default value is 864000 seconds (10 days). The allowed input value must be less than 4294967296. Users can also set the low/high limits for the open/close travel time and the average open/close travel time using their "Travel Lo Limit" and "Travel Hi Limit" parameters. The default value is 0 for the low limit and 300 seconds for the high limit. The allowed input value must be less than 65536. An alarm will be triggered if any time value is out of range limit (Please see the Alert section for more details).

#### 3.13 Field Diagnostic Alerts/Plantweb Alerts

##### 3.13.1. List of Alerts

**Check:** The Check condition is true if any transducer block has a normal mode other than Out of Service and the actual mode is not AUTO.

**Calibration Failed:** Device has not been calibrated or the calibration has failed. Please refer to Table 4 Calibration Statuses for the reason of failure.

**Bad Temperature Sensor:** Temperature sensor is malfunctioning. Temperature value is not reliable.

**System Temperature Exceeded:** Maximum/minimum temperature exceeds the value set in the limit.

**Software Error:** Controller card memory error occurs.

**Travel Deviation:**

- a. Valve/actuator moves to an undesired position. For example, the device energizes an output to OPEN a spring return actuator. The position feedback indicates the device has reached the OPEN position. Afterwards, air pressure is lost and the actuator moves back to the CLOSED position (spring-return). The position feedback sensor will indicate the actuator is in the CLOSED position although a command to CLOSE the actuator has never been issued. In this situation a Travel Deviation alert will be generated indicating the actuator was in a desired position, but moved to an undesired position.
- b. Valve/actuator doesn't move to a desired position. For example, the device energizes an output to OPEN a spring return actuator. But the air pressure is lost so the actuator doesn't move. After 5 minutes, the position feedback indicates the device still has not reached the OPEN position. Travel Deviation alert will be generated indicating the actuator can not move to a desired position.

**Shutdown is Set:** Device shutdown is operating due to an internal communications failure in the electrical module.

**Buttonboard Failure:** Button board is malfunctioning.

**Open/Short Circuit:** There is an open circuit for the main Piezo or there is a short circuit for any Piezos. If there is an open circuit or the main Piezo, only this alert is triggered. Device will automatically operate as normal once there is no open circuit for the main Piezo. If there is a short circuit for any Piezos, device will power off both Piezos. Device will return to normal Piezo operation only if no short circuit is detected after a power cycle.

**Adjusted Cycle Count Exceeded:** Adjusted cycle count has exceeded the value set in the limit.

**Control Module Life Cycle Exceeded:** Cycle count has exceeded the value set in the limit.

**Time in Position Limit Exceeded:** Time value has exceeded the value set in the limit.

**Open Travel Time Limit Exceeded:** Time value has exceeded the value set in the limit.

**Close Travel Time Limit Exceeded:** Time value has exceeded the value set in the limit.

**Internal I/O Failure:** Internal communications are lost; device will act according to shutdown configuration.

**NV Memory Failure:** Non-volatile EEPROM data corruption was detected on the Fieldbus electronics board. Default values were loaded into the faulty block. If the failure reoccurs it may indicate a faulty EEPROM memory chip.

**Electronics Failure:** The device has detected a fault with an electrical component on the Fieldbus electronics module assembly.

Note: The Travel Deviation and Open/Short Circuit Alerts are not monitored in units without integral pilot valves supplied by TopWorx. For those applications, the valve will have to be moved manually or with existing controls.

##### 3.13.2. Alert handling

Both field diagnostics and PlantWeb alerts are supported in this device. Although these alerts have default settings (see table 5), these can be changed by the customer to match their requirements.

**For field diagnostic alerts, there are four levels of alerts available:**

##### a. 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:

**FD\_FAIL\_MAP:** Enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the alarm categories.

**FD\_FAIL\_MASK:** 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.

**FD\_FAIL\_PRI:** Designates the priority.

**FD\_FAIL\_ACTIVE:** Reflects the error conditions that are being detected as active as selected for this category. Multiple conditions may be shown.

**FD\_FAIL\_ALM:** To report the particular failed condition to the host system.

### 3. Operation (Cont.)

- b. Off Spec Alerts  
 An Off Spec Alert indicates a condition within a device that is out of the range of the specification. 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:  
**FD\_OFFSPEC\_MAP**: Enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the alarm categories.  
**FD\_OFFSPEC\_MASK**: 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.  
**FD\_OFFSPEC\_PRI**: Designates the priority.  
**FD\_OFFSPEC\_ACTIVE**: Reflects the error conditions that are being detected as active as selected for this category. Multiple conditions may be shown.  
**FD\_OFFSPEC\_ALM**: To report the particular failed condition to the host system.
- c. 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:  
**FD\_MAINT\_MAP**: Enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the alarm categories.  
**FD\_MAINT\_MASK**: 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.  
**FD\_MAINT\_PRI**: Designates the priority.  
**FD\_MAINT\_ACTIVE**: Reflects the error conditions that are being detected as active as selected for this category. Multiple conditions may be shown.  
**FD\_MAINT\_ALM**: To report the particular failed condition to the host system.
- d. Check Alerts  
 A Check Alert indicates **output signal temporarily invalid** (e.g. frozen) due to on-going work on the device. This alert has the following five parameters:  
**FD\_CHECK\_MAP**: Enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the alarm categories.  
**FD\_CHECK\_MASK**: 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.  
**FD\_CHECK\_PRI**: Designates the priority.  
**FD\_CHECK\_ACTIVE**: Reflects the error conditions that are being detected as active as selected for this category. Multiple conditions may be shown.  
**FD\_CHECK\_ALM**: To report the particular failed condition to the host system.
- For Plantweb alerts, there are three levels of alerts available:**
- a. 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:  
**FAILED\_ENABLE**: Enable the indication and reporting.  
**FAILED\_MASK**: Suppress reporting.  
**FAILED\_PRI**: Designates the priority.  
**FAILED\_ACTIVE**: Displays which of the conditions within the alert is active.  
**FAILED\_ALM**: To report the particular failed condition to the host system.
- b. 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:  
**MAINT\_ENABLE**: Enable the indication and reporting.  
**MAINT\_MASK**: Suppress reporting.  
**MAINT\_PRI**: Designates the priority.  
**MAINT\_ACTIVE**: Displays which of the conditions within the alert is active.  
**MAINT\_ALM**: To report the particular failed condition to the host system.
- c. 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:  
**ADVISE\_ENABLE**: Enable the indication and reporting.  
**ADVISE\_MASK**: Suppress reporting.  
**ADVISE\_PRI**: Designates the priority.  
**ADVISE\_ACTIVE**: Displays which of the conditions within the alert is active.  
**ADVISE\_ALM**: To report the particular failed condition to the host system.



### 3. Operation (Cont.)

#### 3.13.3. Alert parameter description

a. Alerts – Enable/Map

These parameters are used to enable the indication and reporting of each corresponding alert. When an alert is disabled, the device shall not detect that particular alert; it shall not be indicated in the xxxx\_ACTIVE parameters or be reported via respectively 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.

b. Alerts - Mask

These parameters will mask any of the failed conditions listed in respectively alerts.

Setting a bit to true will cause the corresponding alert to be indicated in the xxxx\_ACTIVE parameters but not reported to the host via the alerts. If an alert mask is changed while the alert is active, the alert is cleared and all the conditions are reevaluated.

c. Alerts - Priority

This designates the priority of the alerts. The default is 0 and the recommended value is between 10 and 15. If left as initial value, no alerts will be delivered to the HOST.

d. Alerts - Active

These parameters display which of the conditions is active. When a device detects a condition has become active, it shall set the corresponding bit in the xxxx\_ACTIVE parameters. If it is not suppressed/masked, it will be reported using the associated alert parameter. These parameters are read only.

e. Alerts - Alarm

These parameters are used to report the particular condition to the host. These parameters are read only.

3.13.4. Recommended Actions and Default Settings for Alerts. Please see the **Table 5 below** for the recommended actions and default settings for all alerts. **Note: Enabling/disabling and masking for PlantWeb Alerts follow the NAMUR Field Diagnostics alerts and are not independent. However, the alarm priorities are independent such that it is possible to get "double" or no alerts.**

**Table 5 Recommended Actions and Default Setting/Mapping for Alerts** (Note that no alert is masked in factory default settings)

Alerts	Recommended Actions	Default Enabled Alert						
		Field Diagnostic				Plantweb		
		Failed	Off Spec	Maint.	Check	Failed	Maint.	Advisory
Check	Check transducer block mode.				✓			✓
Calibration Failed	Calibration required or failed, check calibration status for reasons, check air pressure, check valve system, re-calibrate valve controller.			✓				✓
Bad Temperature Sensor	Temperature sensor is not functioning, replace valve controller when possible.	✓				✓		
System Temperature Exceeded	Temperatures too high/low, take corrective actions to bring temperature within specified range.		✓				✓	
Software Error	Software error detected, cycle power, if problem persists, replace valve controller when possible.	✓				✓		
Travel Deviation	Lost position, check air pressure, check shaft assembly and position, check open/close go switch and/or potentiometer connection if available.	✓				✓		
Shutdown is Set	Internal communications problem, check shutdown configuration for restart, if problem persists after restart, replace valve controller when possible.	✓				✓		
Buttonboard Failure	Button board is not functioning correctly, replace valve controller when possible.	✓				✓		
Open or Short Circuit	Output to pilot valve disabled because of open/short circuit, check pilot valve connection. Replace malfunctioning Piezo. When short circuit issue is resolved, device must be power cycled.	✓				✓		
Adjusted Cycle Count Exceeded	Adjusted cycle counter exceeded limit, re-assign limit or re-adjust cycle count.		✓				✓	

### 3. Operation (Cont.)

**Table 5 Recommended Actions and Default Setting/Mapping for Alerts (Cont.)** (Note that no alert is masked in factory default settings)

Alerts	Recommended Actions	Default Enabled Alert						
		Field Diagnostic				Plantweb		
		Failed	Off Spec	Maint.	Check	Failed	Maint.	Advisory
Control Module Life Cycle Exceeded	Valve controller life cycle exceeded limit, replace valve controller. Recommend complete switchbox replacement.		✓				✓	
Time in Position Limit Exceeded	Time in position exceeded, check control system configuration, and check valve and valve actuator.		✓				✓	
Open Travel Time Limit Exceeded	Open travel timer exceeded, check air pressure, check shaft assembly and position, check open/close go switch and/or potentiometer connection if available.		✓				✓	
Close Travel Time Limit Exceeded	Close travel timer exceeded, check air pressure, check shaft assembly and position, check open/close go switch and/or potentiometer connection if available.		✓				✓	
Internal I/O Failure	Internal communications are lost; valve controller will act according to shutdown configuration. If problem persists, replace valve controller when possible.	✓				✓		
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 processor to clear the error. 3. Download a Device Configuration. NOTE: If the failure reoccurs it may indicate a faulty EEPROM memory chip.	✓				✓		
Electronics Failure	The valve controller has detected a fault with an electrical component on the Fieldbus Electronics Module Assembly. Replace the valve controller.	✓				✓		

## 3. Operation (Cont.)

### 3.14. Restart Methods

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.

#### 3.14.1. Restart using bus command

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

- a. Resource  
Performing a "Resource"-restart resets the dynamic variables in the Function Blocks but has no observable effect on the module. However, the dynamic variable within the module are reset and this could cause a "bump" in your process.
- b. 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.
- c. 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 module if device shutdown is set due to internal communication lost caused by incorrect power application.
- d. Valve Controller Processor  
Performing a "Valve Controller Processor"-Restart has the same effect as removing power from the module and re-applying power. This is typically used to restart the control part of the module.
- e. Valve Controller Defaults  
Performing a "Valve Controller Defaults"-restart should be done with care. This restart sets the calibration to default. It will erase the calibration information. It has the same effect as "restart locally using buttons" in the following subsection.
- f. Restore Factory Default Blocks  
Performing "Restore Factory Default Blocks" restores default blocks i.e. manufacturer pre-instantiated blocks. It will clear complete NV memory of device and this will result in NV Memory Failure error. **To clear this error in device, a "Restart Processor" should be performed.**

#### 3.14.2. Restart locally using buttons

To set valve controller to factory default locally using buttons: power off device, push both OPEN and CLOSE buttons, power on device, release buttons when status LED is on.

### 3.15. Device Options

#### 3.15.1. Enable/disable field diagnostics alerts simulation

This method will enable/disable field diagnostics alerts simulation.

#### 3.15.2. Enable/disable access to the TB base record parameter

This method will enable/disable access to the Transducer Block base record parameter.

### 3.16. Base Record Methods

3.16.1. Get current real position: get position in percentage.

3.16.2. Get open endpoint: Get open endpoint in degrees. Due to 18 degrees dead band, the range is from 0 to 341.

3.16.3. Get close endpoint: Get close endpoint in degrees.

3.16.4. Get minimum temperature ever in degree C.

3.16.5. Get maximum temperature ever in degree C.

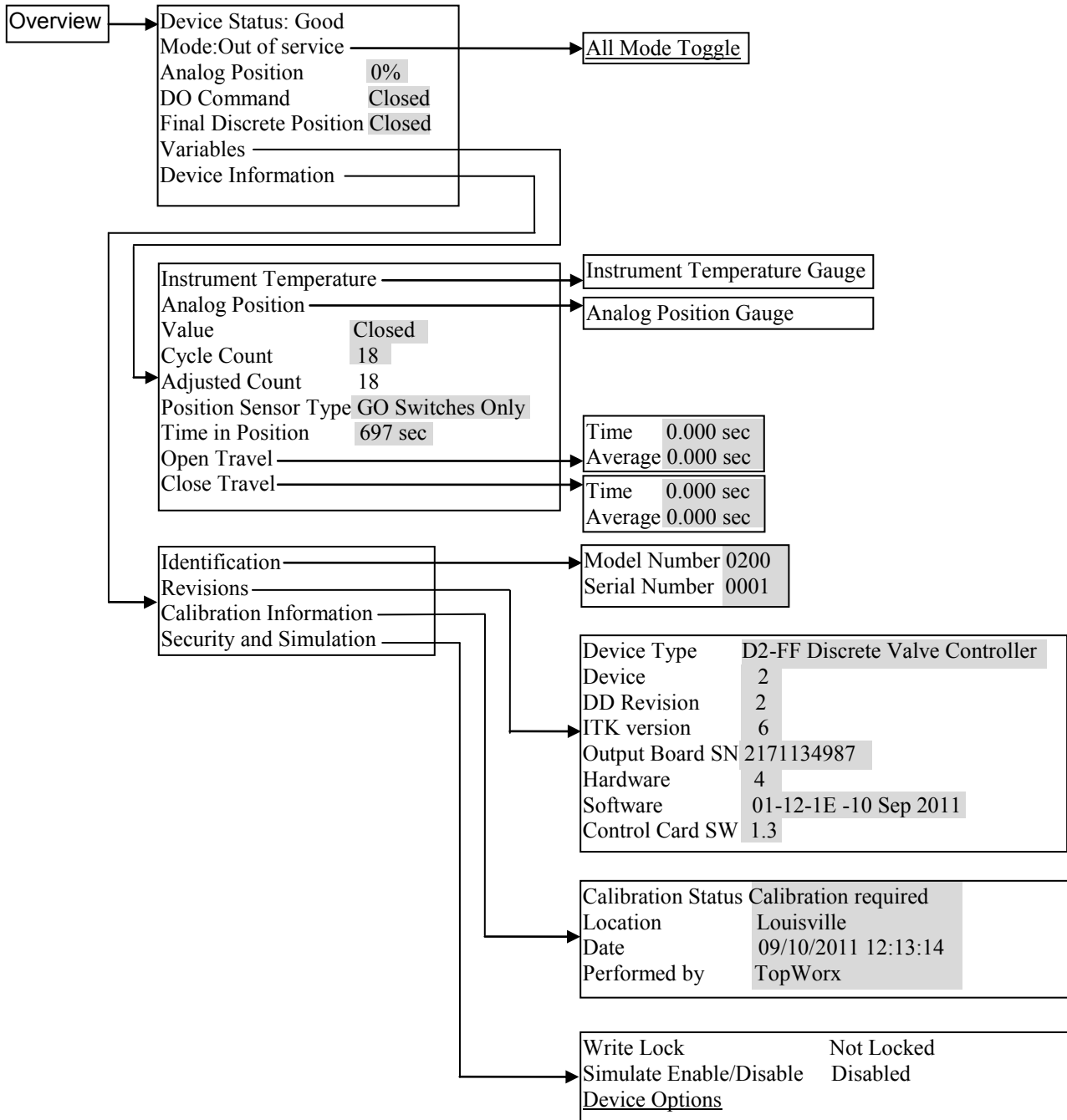
### 3.17. DD Version Info

This method will show the build number, date and info for the device description files.

3. Operation (Cont.)

3.18. Menu structure for handheld devices and host systems that support DD menus

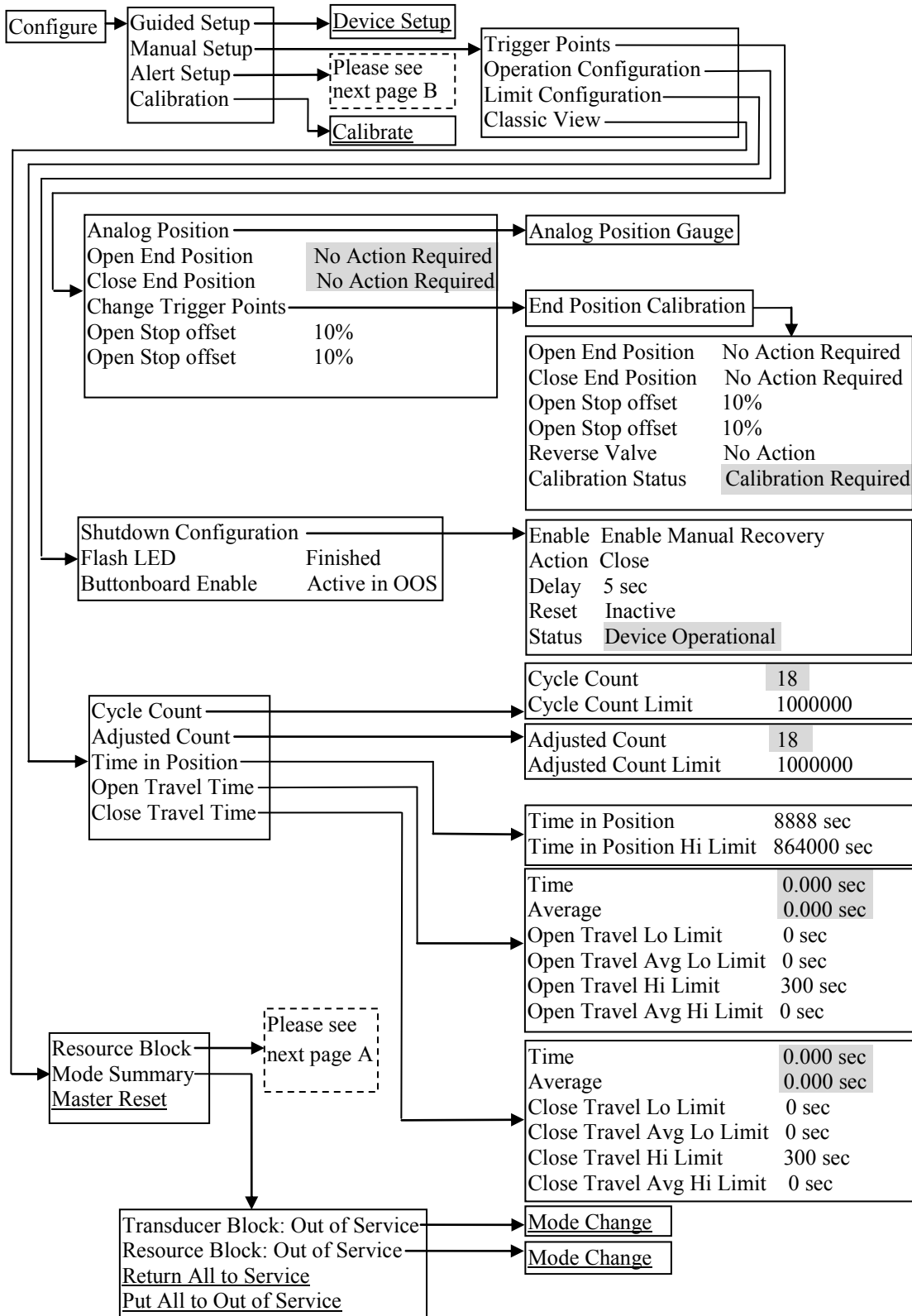
Note: Grey items are read only. Clicking on underlined item will lead to a method.



### 3. Operation (Cont.)

#### 3.18. Menu structure for handheld devices and host systems that support DD menus

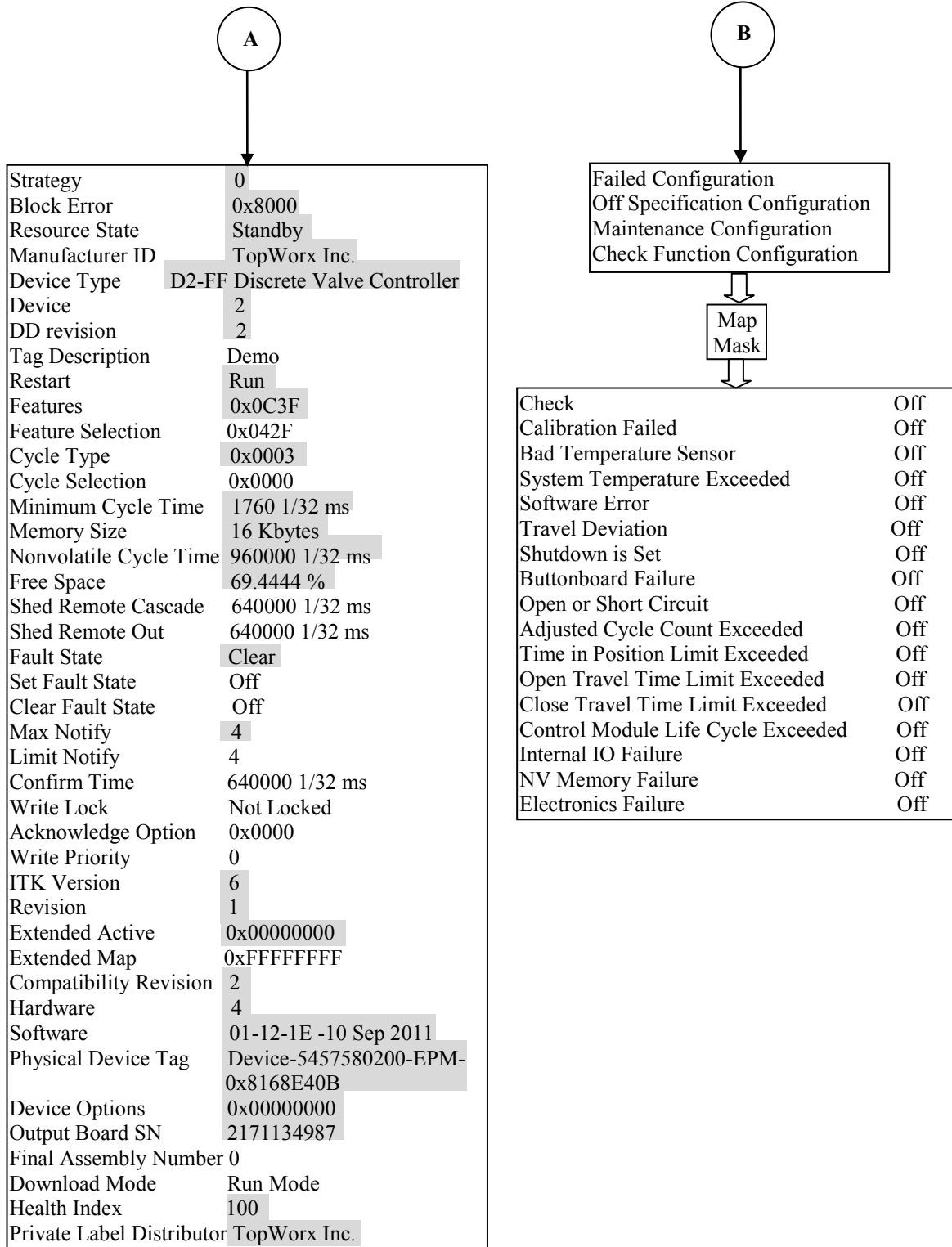
Note: Grey items are read only. Clicking on underlined item will lead to a method.



3. Operation (Cont.)

3.18. Menu structure for handheld devices and host systems that support DD menus

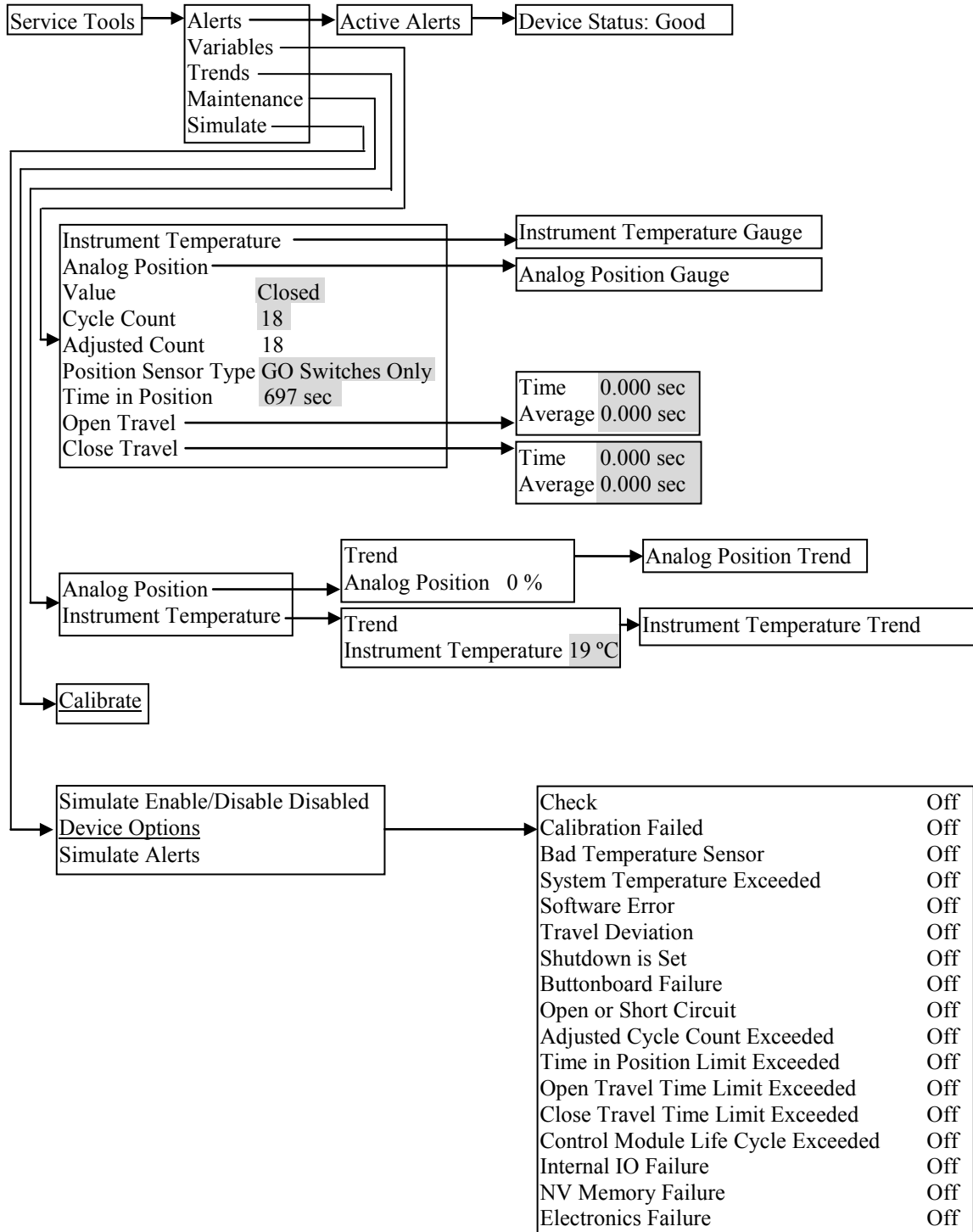
Note: Grey items are read only. Clicking on underlined item will lead to a method.



### 3. Operation (Cont.)

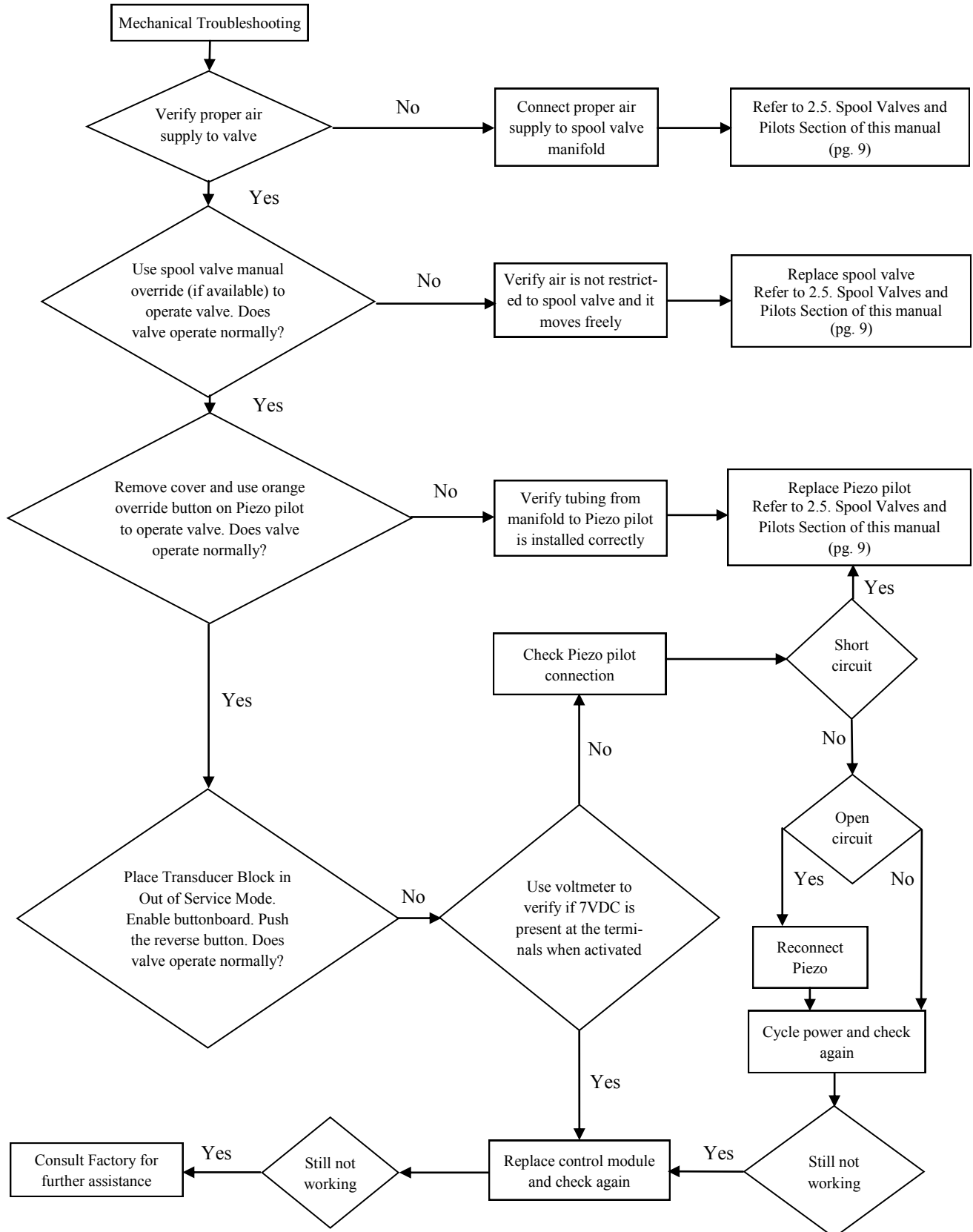
#### 3.18. Menu structure for handheld devices and host systems that support DD menus

Note: Grey items are read only. Clicking on underlined item will lead to a method.



3. Operation (Cont.)

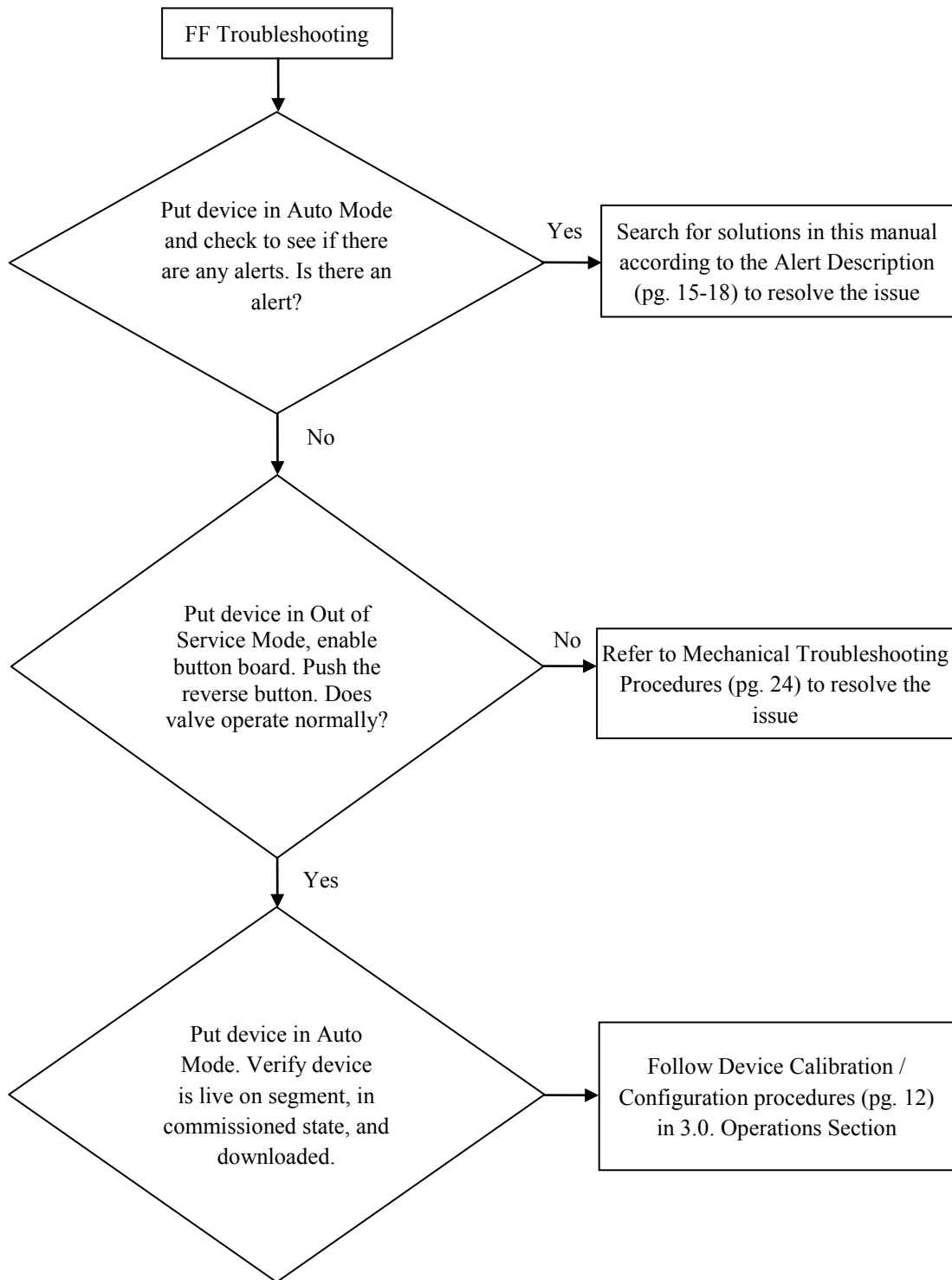
3.19. Troubleshooting





### 3. Operation (Cont.)

#### 3.19. Troubleshooting (Cont.)



## 3. Operation (Cont.)

### 3.19. Troubleshooting (Cont.)

**Problem:** Calibration status is: Calibration needed

**Analysis:** Device is not calibrated or calibration for the other end position is needed. Device calibration has failed or has not been finished.

**Solution:** Redo calibration for both open and closed end positions. If after calibration, it still shows the same message, check GO switch or potentiometer connections.

**Problem:** Calibration status is: Running

**Analysis:** Device calibration is in process.

**Solution:** Finish the calibration. If unable, wait 5 minutes for the device calibration to time out, then start the calibration process over.

**Problem:** Calibration status is: Timed Out

**Analysis:** Device calibration timed out (maximum 5 minutes). Device calibration has not been finished within 5 minutes.

**Solution:** Redo calibration.

**Problem:** Calibration status is: Both triggered

**Analysis:** Both Go switches are triggered simultaneously.

**Solution:** Check magnet position or go switch wiring.

**Problem:** Calibration status is: Range error

**Analysis:** Distance between the open and closed position is less than minimum allowed rotation range (20 degrees).

**Solution:** Redo calibration. During calibration, make sure the distance in degree between open and closed position is greater than 20 degrees, and make sure the red dot does not go through or fall into the red line area when confirming open/closed position.

**Problem:** Calibration status is: In deadband

**Analysis:** The red dot on potentiometer falls into the red line area when confirming open/closed position.

**Solution:** Redo calibration. During calibration, make sure the distance in degree between open and closed position is greater than 20 degrees, and make sure the red dot does not fall into the red line area when confirming open/closed position.

**Problem:** Calibration status is: No sensor detected

**Analysis:** No sensor is detected during calibration.

**Solution:** Check wire connections. Redo calibration. During calibration, for those with go switches, make sure go switch is triggered; for those with potentiometer, make sure the red dot does not fall into the red line area.

**Problem:** Active alert is: Check

**Analysis:** Transducer block is in OOS mode and resource block is in AUTO mode.

**Solution:** Put transducer block into AUTO mode.

**Problem:** Active alert is: Calibration Failed

**Analysis:** Calibration is required or the calibration procedure has failed

**Solution:** Re-calibrate valve controller. Check calibration status for reasons. Check air pressure. Check valve system.

**Problem:** Active alert is: Bad Temperature Sensor

**Analysis:** Valve Controller circuit board temperature sensor is not functioning properly.

**Solution:** Temperature sensor problem, replace valve controller when possible.

**Problem:** Active alert is: System Temperature Exceeded

**Analysis:** Valve controller circuit temperature range has been exceeded. Temperature is too high or too low.

**Solution:** Temperature is too high or too low. Take corrective actions to bring valve controller temperature within specified range.

**Problem:** Active alert is: Software Error

**Analysis:** Software error has been detected.

**Solution:** Cycle power to valve controller. If problem persists, replace valve controller.

**Problem:** Active alert is: Travel Deviation

**Analysis:** Current shaft position is not correct or not detected.

**Solution:** Check air pressure. Check shaft assembly and position. Check Open and Close Go Switch connections (if GO switches are available). Check potentiometer connection (if potentiometer is available).

**Problem:** Active alert is: Shutdown is Set

**Analysis:** Device has internal communication failure.

**Solution:** Internal communications problem, check shutdown configuration for restart. If problem persists after restart, replace valve controller when possible.

**Problem:** Active alert is: Buttonboard Failure

**Analysis:** Button board is not functioning correctly.

**Solution:** Replace valve controller when possible. Make sure button board is activated in Transducer Block.

### 3. Operation (Cont.)

#### 3.19. Troubleshooting (Cont.)

**Problem:** Active alert is: Open/Short Circuit

**Analysis:** Output to pilot valve disabled because of short/open circuit.

**Solution:** Check pilot valve connection. Possible Piezo Valve malfunction, replace. Note: When short circuit or open circuit issue is resolved, valve controller must be power cycled.

**Problem:** Active alert is: Adjusted Cycle Count Exceeded

**Analysis:** Adjusted cycle counter limit has been exceeded.

**Solution:** Adjusted cycle counter exceeded, re-assign limit or re-adjust cycle count.

**Problem:** Active alert is: Control Module Life Cycle Exceeded

**Analysis:** Valve controller life cycle has been exceeded.

**Solution:** Valve controller life cycle exceeded, replace valve controller. Recommend complete switchbox replacement.

**Problem:** Active alert is: Time in Position Limit Exceeded

**Analysis:** Set time that valve has been in one position has been exceeded.

**Solution:** Time in position exceeded. Check control system configuration. Check valve and valve actuator.

**Problem:** Active alert is: Open Travel Time Limit Exceeded

**Analysis:** Time to reach open position has been exceeded.

**Solution:** Check air pressure. Check shaft assembly and position. Check Open and Close GO switch connections if GO switches are available. Check potentiometer connections if it is available.

**Problem:** Active alert is: Close Travel Time Limit Exceeded

**Analysis:** Time to reach close position has been exceeded.

**Solution:** Check air pressure. Check shaft assembly and position. Check Open and Close GO switch connections if GO switches are available. Check potentiometer connection if it is available.

**Problem:** Active alert is: Internal I/O Failure

**Analysis:** Loss of device internal communications.

**Solution:** Internal communications are lost. Device will act according to shutdown configuration. Replace valve controller when possible if problem persists.

**Problem:** Active alert is: NV Memory Failure

**Analysis:** Non-volatile EEPROM data corruption was detected on the Fieldbus electronics board. Default values were loaded into the faulty block. Restart "Restore Factory Default Blocks" may have been performed.

**Solution:** Check the device configuration for changes in the block parameter values. Perform Restart "Processor" in resource block to clear the error. NOTE: If the failure reoccurs it may indicate a faulty EEPROM memory chip.

**Problem:** Active alert is: Electronics Failure

**Analysis:** The device has detected a fault with an electrical component on the Fieldbus electronics module assembly.

**Solution:** Replace the valve controller.

**Problem:** Potentiometer does not move as the shaft moves.

**Analysis:** Shaft is loose from potentiometer

**Solution:** Tighten set screw using an Allen wrench.

**Problem:** Status LED does not illuminate

**Analysis:** Bad LED or button board. Bad control module.

**Solution:** Apply power to device. Make sure at least 9VDC is connected to FF terminals. Cycle power. Change button board or control module.

**Problem:** Status LED is flashing.

**Analysis:** There are alerts.

**Solution:** Check calibration status. Put device to Auto mode and check for field diagnostics alerts. Take action to remove alerts.

**Problem:** Sensor type is wrong.

**Analysis:** Bad calibration.

**Solution:** Restart valve controller to factory default and redo calibration. During calibration, for those with go switches, make sure go switch is triggered; for those with potentiometer, make sure the red dot does not fall into the red line area. If problem persists, check wire connections.

**Problem:** Valve shifts according to control system command but is not moving after pushing reverse button

**Analysis:** Device is in incorrect mode

**Solution:** Change device to OOS mode and make sure button board is enabled.

## 3. Operation (Concluded)

### 3.19. Troubleshooting (Cont.)

**Problem:** Valve shifts according to reverse button push but is not moving after sending reverse command

**Analysis:** Device is not commissioned

**Solution:** Commission the device.

**Problem:** Valve will not shift due to reverse button push or reverse command

**Analysis:** Check electrical and mechanical setup

**Solution:** 1) Put device to Auto, check if there is alerts such as open/short circuit or NV memory error. If yes, fix it.

2) Put device to OOS, enable buttonboard. Check the voltage supply to Piezos while pushing reverse button several times.

3) Verify proper air supply to valve, verify air is not restricted to spool valve and it moves freely, and verify tubing from manifold to Piezo pilot is installed correctly.

**Problem:** Potentiometer rotates through the deadband during calibration.

**Analysis:** Analog position will not change between 0 to 100%.

**Solution:** Redo calibration.

**Problem:** Analog position is not correct.

**Analysis:** Calibration error.

**Solution:** Make sure there is a potentiometer and it is calibrated correctly. Redo calibration if needed. Please note that the display range for AI block is -200% ~199%, the display range for TB block is 0% ~100%.

**Problem:** Device shifts to un-wanted position on a power cycle.

**Analysis:** Shutdown action is not configured correctly.

**Solution:** Reconfigure shutdown action and test it by cycling power.

**Problem:** Buttonboard is not functioning

**Analysis:** Device is in Auto mode. Buttonboard is not enabled or bad.

**Solution:** Put device to Out of Service mode and enable buttonboard. If still not working, replace buttonboard or control module.

**Problem:** Parameter writing error occurs for "Simulation" parameter

**Analysis:** The Field Diagnostics Alerts Simulation has not been enabled in "Device options" method.

**Solution:** Use "Device options" method to enable Field Diagnostics Alerts simulation, then put Simulation parameter to Enabled.

**Problem:** Cannot write a parameter or perform an action.

**Analysis:** Value is out of range. The block is not in the right mode or there is NV memory error.

**Solution:** Make sure the value for this parameter is a valid value. Put transducer block or resource block into the OOS mode and write parameter again. If still not working, put resource block into AUTO mode, check FD\_FAIL\_ACTIVE for NV Memory Failure. If there is NV Memory Failure, restart processor.

**Problem:** Losing calibration.

**Analysis:** Restart "Valve Controller Defaults" has been performed.

**Solution:** Need recalibration.

## Appendix A: Resource Block Parameters

The resource block contains the hardware specific characteristics associated with a device. It has no input or output parameters. This block of contained parameters includes such things as Manufacturer's ID and revision information. Below is a complete listing of the Resource Block Parameters.

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String (32 bytes)	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MODE_BLK		The actual, target, permitted, and normal modes of the block. Target: The mode to "go to" Actual: The mode the "block is currently in" Permitted: Allowed modes that target may take on Normal: Most common mode for target	None	- TARGET (OOS) - ACTUAL (OOS) - PERMITTED (Auto   OOS) - NORMAL (Auto)
6	BLOCK_ERR	Bit String (2 bytes)	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	OOS
7	RS_STATE	Unsigned 8	State of the function block application state machine. Possible values: Uninitialized Start Restart: State entered after detection of restored power. Initialization: State entered from restart or failure condition. Online Linking: State entered to evaluate status of defined links Online: Normal operation, all links established Standby: Resource block mode is Out of Service Failure: Memory or hardware failure detected	None	Standby
8	TEST_RW		Read/write test parameter - used only for conformance testing.	None	0
9	DD_RESOURCE	Visible String (32 bytes)	String identifying the tag of the resource which contains the Device Description for this resource.	None	
10	MANUFAC_ID	Unsigned 32	Manufacturer identification number - used by an interface device to locate the DD file for the resource.	None	TopWorx Inc.
11	DEV_TYPE	Unsigned 16	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.	None	D2-FF Discrete Valve Controller
12	DEV_REV	Unsigned 8	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.	None	2
13	DD_REV	Unsigned 8	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.	None	2
14	GRANT_DENY		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	GRANT: 0 DENY: 0
15	HARD_TYPES	Bit String (2 bytes)	The types of hardware available as channel numbers.	None	Scalar Input

## Appendix A: Resource Block Parameters (Cont.)

Index	Name	Type	Description	Units	Initial Values
16	RESTART	Unsigned 8	Allows a manual restart to be initiated. Supported options: 0: Uninitialized 1: Run: Setting for normal operation 2: Restart resource: Restart resource as though power fail had occurred using NVM values 3: Restart with defaults: Restart resource as through power fail had occurred using default values 4: Restart processor: Reset processor and initiate execution as though power fail had occurred 5: Valve Controller Defaults: Restart D2-FF valve controller board as through power fail had occurred using default values 6: Valve Controller Processor: Reset D2-FF valve controller board processor and initiate execution as though power fail had occurred 11: Restore Factory Default Blocks	None	Run
17	FEATURES	Bit String (2 bytes)	Used to shows supported resource block options.	None	Unicode   Reports   Faultstate   Soft W Lock   Hard W Lock   Out Readback   Multi-bit Alarm (Bit-Alarm) Support   Restart/ Relink after FB_Action
18	FEATURE_SEL	Bit String (2 bytes)	Used to select resource block options.	None	Unicode   Reports   Faultstate   Soft W Lock   Out Readback   Multi-bit Alarm (Bit-Alarm) Support
19	CYCLE_TYPE	Bit String (2 bytes)	Identifies the block execution methods available for this resource. Supported values: Scheduled: Block execution is scheduled through system management. Block Execution: Block execution is scheduled the completion of another block Manuf Specific: Block execution is determined by the manufacturer	None	Scheduled   Block Execution
20	CYCLE_SEL	Bit String (2 bytes)	Used to select the block execution method for this resource. Supported values: Scheduled: Block execution is scheduled through system management. Block Execution: Block execution is scheduled the completion of another block Manuf Specific: Block execution is determined by the manufacturer	None	0
21	MIN_CYCLE_T	Unsigned 32	Time duration of the shortest cycle interval of which the resource is capable.	1/32 ms	1760
22	MEMORY_SIZE	Unsigned 16	Available configuration memory in the empty resource. To be checked before attempting a download.	Kbytes	16
23	NV_CYCLE_T	Unsigned 32	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.	1/32 ms	960000
24	FREE_SPACE	Float	Percent of memory available for further configuration. Zero in a preconfigured device.	%	69.4444
25	FREE_TIME	Float	Percent of the block processing time that is free to process additional blocks.	%	0

## Appendix A: Resource Block Parameters *(Cont.)*

Index	Name	Type	Description	Units	Initial Values
26	SHED_RCAS	Unsigned 32	Time duration at which to give up on computer writes to function block RCas locations.	1/32 ms	640000
27	SHED_ROUT	Unsigned 32	Time duration at which to give up on computer writes to function block ROut locations.	1/32 ms	640000
28	FAULT_STATE	Unsigned 8	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When faultstate condition is set, then output function blocks will perform their FSTATE actions. Supported options: Uninitialized Clear: Normal operating position Active: Fault state is active	None	Clear
29	SET_FSTATE	Unsigned 8	Allows the faultstate condition to be manually initiated by selecting Set. Supported values: Uninitialized Off: Normal operating condition Set: Activate Faultstate	None	Off
30	CLR_FSTATE	Unsigned 8	Writing a Clear to this parameter will clear the device faultstate state if the field condition, if any, has cleared. Supported values: Uninitialized Off: Normal operating condition Clear: Block fault state conditions will be cleared	None	Off
31	MAX_NOTIFY	Unsigned 8	Maximum number of unconfirmed alert notify messages possible.	None	4
32	LIM_NOTIFY	Unsigned 8	Maximum number of unconfirmed alert notify messages allowed.	None	4
33	CONFIRM_TIME	Unsigned 32	The minimum time between retries of alert reports.	1/32 ms	640000
34	WRITE_LOCK	Unsigned 8	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated. Supported options: Uninitialized Not Locked Locked	None	Not Locked
35	UPDATE_EVT		This alert is generated by any change to the static data.	None	- UNACKNOWLEDGED: Uninitialized - UPDATE_STATE: Uninitialized - TIME_STAMP: 0 - STATIC_REVISION: 0 - RELATIVE_INDEX: 0
36	BLOCK_ALM		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	- UNACKNOWLEDGED: Uninitialized - UPDATE_STATE: Active-Not Reported - TIME_STAMP: 0 - SUB_CODE: 0xc000 - RELATIVE_INDEX: 0
37	ALARM_SUM		The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	None	- CURRENT: Discrete Alarm Block Alarm - UNACKNOWLEDGED: Block Alm Unack - UNREPORTED: Block Alm Unrep - DISABLED: 0

## Appendix A: Resource Block Parameters (Cont.)

Index	Name	Type	Description	Units	Initial Values
38	ACK_OPTION	Bit String (2 bytes)	Selection of whether alarms associated with the function block will be automatically acknowledged. Supported options: Disc Alm Auto Ack Blk Alm Auto Ack Fail Alm Auto Ack Off Spec Alm Auto Ack Maint Alm Auto Ack Check Alm Auto Ack	None	0
39	WRITE_PRI	Unsigned 8	Priority of the alarm generated by clearing the write lock.	None	0
40	WRITE_ALM		This alert is generated if the write lock parameter is cleared.	None	- UNACKNOWLEDGED: Acknowledged - UPDATE_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: Other - VALUE: State 0
41	ITK_VER	Unsigned 16	Major revision number of the interoperability test case used to register this device.	None	6
42	FD_VER	Unsigned 16	The major version of the Field Diagnostics specification used for the development of this device.	None	1
43	FD_FAIL_ACTIVE	Bit String (4 bytes)	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.	None	0
44	FD_OFFSPEC_ACTIVE	Bit String (4 bytes)	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.	None	0
45	FD_MAINT_ACTIVE	Bit String (4 bytes)	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.	None	0
46	FD_CHECK_ACTIVE	Bit String (4 bytes)	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.	None	0
47	FD_FAIL_MAP	Bit String (4 bytes)	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.	None	- NV Memory Failure - Electronics Failure - Bad Temperature Sensor - Software Error - Travel Deviation - Shutdown is Set - Buttonboard Failure - Open or Short Circuit - Internal I/O Failure
48	FD_OFFSPEC_MAP	Bit String (4 bytes)	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.	None	- System Temperature Exceeded - Control Module Life Cycle Exceeded - Adjusted Cycle Count Exceeded - Time in Position Limit Exceeded - Open Travel Time Limit Exceeded - Close Travel Time Limit Exceeded
49	FD_MAINT_MAP	Bit String (4 bytes)	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.	None	Calibration Failed



## Appendix A: Resource Block Parameters *(Cont.)*

Index	Name	Type	Description	Units	Initial Values
50	FD_CHECK_MAP	Bit String (4 bytes)	This parameter enables or disables conditions to be detected as active for this alarm category.	None	Check
51	FD_FAIL_MASK	Bit String (4 bytes)	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.	None	0
52	FD_OFFSPEC_MASK	Bit String (4 bytes)	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.	None	0
53	FD_MAINT_MASK	Bit String (4 bytes)	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.	None	0
54	FD_CHECK_MASK	Bit String (4 bytes)	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.	None	0
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.	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: 0 - VALUE: 0
56	FD_OFFSPEC_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.	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: 0 - VALUE: 0
57	FD_MAINT_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.	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: 0 - VALUE: 0
58	FD_CHECK_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.	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: 0 - VALUE: 0
59	FD_FAIL_PRI	Unsigned 8	This parameter allows the user to specify the priority of this alarm category.	None	0
60	FD_OFFSPEC_PRI	Unsigned 8	This parameter allows the user to specify the priority of this alarm category.	None	0
61	FD_MAINT_PRI	Unsigned 8	This parameter allows the user to specify the priority of this alarm category.	None	0
62	FD_CHECK_PRI	Unsigned 8	This parameter allows the user to specify the priority of this alarm category.	None	0
63	FD_SIMULATE		Used as the field diagnostic condition when the simulation is enabled.	None	- DIAGNOSTIC_SIMULATE_VALUE: Calibration Failed - DIAGNOSTIC_VALUE: Calibration Failed - ENABLE_DISABLE: Disabled

## Appendix A: Resource Block Parameters (Cont.)

Index	Name	Type	Description	Units	Initial Values
64	FD_RECOMMEN_ACT	Unsigned 16	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.	None	No Action
65	FD_EXTENDED_ACTIVE	Bit String (4 bytes)	Allows finer control on enabling conditions contributing to the conditions in FD_*_ACTIVE parameters.	None	0
66	FD_EXTENDED_MAP	Bit String (4 bytes)	Allows finer control on enabling conditions contributing to the conditions in FD_*_ACTIVE parameters.	None	- Sensor Transducer Error - Hardware/Software Incompatible - Manufacturing Block Integrity Error - ROM (Flash) Integrity Error
67	COMPATIBILITY_REV	Unsigned 8	Last compatible device revision	None	9
68	HARDWARE_REVISION	Unsigned 8	Hardware Revision for the device.	None	4
69	SOFTWARE_REV	Visible String (32 bytes)	Software Revision for the device.	None	01-12-2A -20 Dec 2011
70	PD_TAG	Visible String (32 bytes)	PD Tag for the device	None	
71	DEV_STRING		Device String	None	0
72	DEV_OPTION	Bit String (4 bytes)	Device Options	None	0
73	OUTPUT_BOARD_SN	Unsigned 32	Output Board Serial Number	None	
74	FINAL_ASSY_NUM	Unsigned 32	Final Assembly Number	None	0
75	DOWNLOAD_MODE	Unsigned 8	Download Mode	None	Run Mode
76	HEALTH_INDEX	Unsigned 8	Health Index	None	100
77	FAILED_PRI	Unsigned 8	Failure Priority and PWA_FD switch	None	0
78	RECOMMENDED_ACTION	Unsigned 16	Recommended Action	None	No Action
79	FAILED_ALM		Failure Alarm	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: Check - VALUE:0
80	MAINT_ALM		Maintenance Alarm	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: Check - VALUE:0
81	ADVISE_ALM		Advisory Alarm	None	- UNACKNOWLEDGED: Acknowledged - ALARM_STATE: Clear-Reported - TIME_STAMP: 0 - SUB_CODE: Check - VALUE:0

## Appendix A: Resource Block Parameters *(Cont.)*

Index	Name	Type	Description	Units	Initial Values
82	<b>FAILED_ENABLE</b>	Bit String (4 bytes)	Failure Enable	None	<ul style="list-style-type: none"> <li>- NV Memory Failure</li> <li>- Electronics Failure</li> <li>- Bad Temperature Sensor</li> <li>- Software Error</li> <li>- Travel Deviation</li> <li>- Shutdown is Set</li> <li>- Buttonboard Failure</li> <li>- Open or Short Circuit</li> <li>- Internal I/O Failure</li> </ul>
83	<b>FAILED_MASK</b>	Bit String (4 bytes)	Failure Mask	None	0
84	<b>FAILED_ACTIVE</b>	Bit String (4 bytes)	Failure Active	None	0
85	<b>MAINT_PRI</b>	Unsigned 8	Maintenance Priority	None	0
86	<b>MAINT_ENABLE</b>	Bit String (4 bytes)	Maintenance Enable	None	<ul style="list-style-type: none"> <li>- System Temperature Exceeded</li> <li>- Control Module Life Cycle Exceeded</li> <li>- Adjusted Cycle Count Exceeded</li> <li>- Time in Position Limit Exceeded</li> <li>- Open Travel Time Limit Exceeded</li> <li>- Close Travel Time Limit Exceeded</li> </ul>
87	<b>MAINT_MASK</b>	Bit String (4 bytes)	Maintenance Mask	None	0
88	<b>MAINT_ACTIVE</b>	Bit String (4 bytes)	Maintenance Active	None	0
89	<b>ADVISE_PRI</b>	Unsigned 8	Advisory Priority	None	0
90	<b>ADVISE_ENABLE</b>	Bit String (4 bytes)	Advisory Enable	None	Check   Calibration Failed
91	<b>ADVISE_MASK</b>	Bit String (4 bytes)	Advisory Mask	None	0
92	<b>ADVISE_ACTIVE</b>	Bit String (4 bytes)	Advisory Active	None	0
93	<b>DISTRIBUTOR</b>	Unsigned 32	Private Label Distributor	None	0x00545758 (TopWorx Inc.)
94	<b>ELECTRONICS_SN</b>	Unsigned 8	The Manufacturer Specific Serial Number for the Electronics assembly within the instrument.	None	1
95	<b>FACTORY_SN</b>	Visible String (9 bytes)	The Serial number of the Instrument as assigned at the Factory. This parameter can only be changed by the Factory.	None	
96	<b>FIELD_SN</b>	Visible String (32 bytes)	This is the Instrument Serial Number, as assigned by the user, as applied to his field application.	None	
97	<b>DIAG_OPTIONS</b>	Bit String (4 bytes)	Diagnostic Options	None	0
98	<b>CONTROL_CARD_SW_REV</b>	Float	Control card software revision number	None	1.3 (1.4 for applications without integral piezo pilots)

## Appendix B: Transducer Block Parameters

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify group of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MODE_BLK		The actual, target, permitted, and normal modes of the block. Target: The mode to "go to" Actual: The mode the "block is currently in" Permitted: Allowed modes that target may take on Normal: Most common mode for target	None	Target (Auto) Actual (OOS) Permitted (Auto   OOS) Normal (Auto)
6	BLOCK_ERR	Bit String	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	0
7	UPDATE_EVT		This alert is generated by any change to the static data.	None	- UNACKNOWLEDGED 0 (Uninitialized) - UPDATE_STATE 0(Uninitialized) - TIME_STAMP 0x00 - STATIC_REVISION 0 - RELATIVE_INDEX 0
8	BLOCK_ALM		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	- UNACKNOWLEDGED 1(Acknowledged) - ALARM_STATE 1 (Clear-Reported) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
9	TRANSDUCER_DIRECTORY		Directory that specifies the number and starting indices of the transducers in the transducer block.	None	0
10	TRANSDUCER_TYPE	Unsigned 16	Identifies the transducer that follows	None	107(Standard Discrete Valve)
11	XD_ERROR	Unsigned 8	A transducer block alarm subcode	None	0
12	COLLECTION_DIRECTORY		A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer within a transducer block.	None	0
13	FINAL_VALUE_D		The proposed valve position and status written by a discrete Function Block.	None	- Status 28(Bad:: OutOfService: NotLimited) - Value 0(Close)
14	ACT_FAIL_ACTION	Unsigned 8	Specifies the action the actuator takes in case of failure.	None	0
15	ACT_MAN_ID	Unsigned 32	The valve controller manufacturer's identification number as defined by the Fieldbus Foundation.	None	5527384 (0x545758)
16	ACT_MODEL_NUM	Visible String	The valve controller model number.	None	200
17	ACT_SN	Visible String	The actuator serial number.	None	
18	VALVE_MAN_ID	Unsigned 32	The valve manufacturer's identification number as defined by the Fieldbus Foundation. Not used.	None	0 (Unknown)
19	VALVE_MODEL_NUM	Visible String	The valve model number. Not used.	None	

## Appendix B: Transducer Block Parameters *(Cont.)*

Index	Name	Type	Description	Units	Initial Values
20	VALVE_SN	Visible String	The valve serial number. Not used.	None	
21	VALVE_TYPE	Unsigned 8	The valve type. For Informational purposes only. Is not used by internal software.	None	2 (Rotary)
22	XD_CAL_LOC	Visible String	The physical location at which the last calibration was performed.	None	
23	XD_CAL_DATE	Date	The date of the last calibration.	None	
24	XD_CAL_WHO	Visible String	The name of the person responsible for the last calibration.	None	
25	DISCRETE_POSITION		Single signal indicating the current discrete position. Supported values: 0: Close, 1: Open, 2: Closing, 3: Opening.	None	-Status 28 (Bad::OutOfService: NotLimited) -Value 3 (Opening)
26	OPEN_STATE		Discrete position feedback. Supported values: 0: False, 1 True.	None	-Status 28 (Bad::OutOfService: NotLimited) -Value 0 (False)
27	CLOSE_STATE		Discrete position feedback. Supported values: 0: False, 1 True.	None	-Status 28 (Bad::OutOfService: NotLimited) -Value 0 (False)
28	REVERSE_VALVE		Controls the procedure for finding the endpoints. Supported reverse valve command: 0: No action, 1: Reverse.  <u>Possible calibration status:</u> - Both triggered: Both GO Switches are triggered simultaneously - Running: Device calibration is in process - Range error: Less than minimum allowed rotation range (minimum 20 degrees) - In deadband: End position is too high/low or in deadband - Timed Out: Device calibration timed out (maximum 5 minutes) - No sensor detected: No sensor is detected during calibration - Successful: Device is calibrated - Calibration needed: Device is not calibrated or calibration for the other end position is required.	None	-REVERSE_VALVE_COMMAND 0 (No Action) -CALIBRATION_STATUS 128 (Calibration required)
29	CFG_SWITCH_POINTS		Set trip points from end position. - OPEN_END_POSITION: use current position as open end position. Supported values: 0: No action required, 1 Set to current position - CLOSED_END_POSITION: use current position as close end position. Supported values: 0: No action required, 1 Set to current position - OPEN_STOP_OFFSET: distance to endpositionin % of full stroke. Range: 5% to 40%. - CLOSE_STOP_OFFSET: distance to endpositionin % of full stroke. Range: 5% to 40%.	None	-OPEN_END_POSITION 0 -CLOSED_END_POSITION 0 -OPEN_STOP_OFFSET 10 -CLOSE_STOP_OFFSET 10
30	FLASH_LED	Unsigned 8	For identification, blink status LED. Supported value: 0: Finished, 1: Flash LED.	None	0 (Finished)
31	INSTRUMENT_TEMP		Indicates the internal temperature of the instrument in degree C.	None	-Status 28 (Bad::OutOfService: NotLimited) -Value 19

Appendix B: Transducer Block Parameters

Index	Name	Type	Description	Units	Initial Values
32	SHUTDOWN_CFG		<p><u>Configures what actions to take after internal communications are lost.</u></p> <ul style="list-style-type: none"> <li>- SHUTDOWN_ENABLE: Shutdown Enable. Supported values: 0: Enable auto recovery, 1: Enable manual recovery, 2: Disable</li> <li>- SHUTDOWN_ACTION: Action that the valve will take if there is a Shutdown. Supported values: 0: Close, 1: Open, 2: Hold</li> <li>- SHUTDOWN_DELAY_TIME: Time in seconds before action will be taken after an event has occurred.</li> <li>- SHUTDOWN_RESET: If shutdown status indicates shutdown enable was set to manual recovery, then operator must set this parameter to normal operation before the device can recover. Supported values: 0: Inactive, 1: Reset.</li> <li>- SHUTDOWN_STATUS: Indicates if the system is shutdown or operational. Supported values: 0: Device operational, 1: Device shutdown.</li> </ul>	None	<ul style="list-style-type: none"> <li>- SHUTDOWN_ENABLE 1 (Enable manual recovery)</li> <li>- SHUTDOWN_ACTION 0(Close)</li> <li>- SHUTDOWN_DELAY_TIME 5</li> <li>- SHUTDOWN_RESET 0(Inactive)</li> <li>- SHUTDOWN_STATUS 0 (Device operational)</li> </ul>
33	SENSOR_TYPE_TOPWORX	Unsigned 8	The sensor type that determines the position. Supported values: 0: Not assigned, 1: GO switches only, 2: Potentiometer only, 3: Both potentiometer and GO Switches.	None	0 (Not assigned)
34	BUTTONBOARD_ENABLE	Unsigned 8	Enables and disables the buttonboard for initialization and reassignment of end positions. Can only be enabled when device is in OOS. Supported values: 0: Never active, 1: Active in OOS.	None	1 (Active in OOS)
35	INTERNAL_ALERTS	Bit String	Internal Alerts. Available items: Open/short circuit error, Calibration Failure, Bad temperature sensor, System temperature exceeded, Software error IO card, Travel deviation alert, Device shutdown, Buttonboard failure	None	0x4000 (Calibration Failure)
36	FUNCTION_MODULE_COUNTER		Counts the end position cycles performed by the control module. FM_COUNTER_VALUE: Control module cycle count value. FM_COUNTER_LIMIT: Control module cycle count limit.	None	<ul style="list-style-type: none"> <li>- FM_COUNTER_VALUE 5</li> <li>- FM_COUNTER_LIMIT 1000000</li> </ul>
37	PNEUMATIC_MODULE_COUNTER		Counts the end position cycles performed by the control module. ADJUSTED_COUNT_VALUE: Adjusted control module cycle count value. ADJUSTED_COUNT_LIMIT: Adjusted control module cycle count limit.	None	<ul style="list-style-type: none"> <li>- ADJUSTED_COUNT_VALUE 5</li> <li>- ADJUSTED_COUNT_LIMIT 1000000</li> </ul>
38	VALVE_POSITION	Unsigned 32	Indicates valve position in percentage	%	0
39	TIMERS		<p><u>Diagnostic timers in seconds for device</u></p> <ul style="list-style-type: none"> <li>- TIME_IN_POSITION: Holds the time in current position but not saved in NV, so reset when power is switched off.</li> <li>- TIME_IN_POSITION_HI_LIM: Sets a limit for an alert for the time in position.</li> <li>- OPEN_TRAVEL_TIME: Indicates time between position change commanded and open trip position reached.</li> <li>- OPEN_TRAVEL_TIME_HI_LIM: Open travel time high limit.</li> <li>- OPEN_TRAVEL_TIME_LO_LIM: Open travel time low limit.</li> <li>- OPEN_TRAVEL_TIME_AVERAGE: Open travel time average.</li> <li>- OPEN_TRAVEL_AVERAGE_HI_LIM: Open travel time average high limit.</li> <li>- OPEN_TRAVEL_AVERAGE_LO_LIM: Open travel time average low limit.</li> <li>- CLOSE_TRAVEL_TIME: Indicates time between position change commanded and close trip position reached.</li> <li>- CLOSE_TRAVEL_TIME_HI_LIM: Close travel time high limit.</li> <li>- CLOSE_TRAVEL_TIME_LO_LIM: Close travel time low limit.</li> <li>- CLOSE_TRAVEL_TIME_AVERAGE: Close travel time average.</li> <li>- CLOSE_TRAVEL_AVERAGE_HI_LIM: Close travel time average high limit.</li> <li>- CLOSE_TRAVEL_AVERAGE_LO_LIM: Close travel time average low limit.</li> </ul>	None	<ul style="list-style-type: none"> <li>- TIME_IN_POSITION 0</li> <li>- TIME_IN_POSITION_HI_LIM 864000</li> <li>- OPEN_TRAVEL_TIME 0</li> <li>- OPEN_TRAVEL_TIME_HI_LIM 300</li> <li>- OPEN_TRAVEL_TIME_LO_LIM 0</li> <li>- OPEN_TRAVEL_TIME_AVERAGE 0</li> <li>- OPEN_TRAVEL_AVERAGE_HI_LIM 300</li> <li>- OPEN_TRAVEL_AVERAGE_LO_LIM 0</li> <li>- CLOSE_TRAVEL_TIME 0</li> <li>- CLOSE_TRAVEL_TIME_HI_LIM 300</li> <li>- CLOSE_TRAVEL_TIME_LO_LIM 0</li> <li>- CLOSE_TRAVEL_TIME_AVERAGE 0</li> <li>- CLOSE_TRAVEL_AVERAGE_HI_LIM 300</li> <li>- CLOSE_TRAVEL_AVERAGE_LO_LIM 0</li> </ul>

## Appendix B: Transducer Block Parameters *(Concluded)*

Index	Name	Type	Description	Units	Initial Values
40	FF_COMM_STATS		<p><u>Statistics which indicate interboard communication quality.</u></p> <ul style="list-style-type: none"> <li>- FF_COMM_ATTEMPTS: States the number of interboard communication attempts. Counter will be reset to 0 when max count is reached.</li> <li>- FF_COMM_TIMEOUTS: Counts the communication attempts that timed out.</li> </ul>	None	<ul style="list-style-type: none"> <li>- FF_COMM_ATTEMPTS 0</li> <li>- FF_COMM_TIMEOUTS 0</li> </ul>
41	BASE_RECORD		<p><u>Base Record for Low Level Device Access.</u></p> <ul style="list-style-type: none"> <li>- BASE_VALUE: Value to be sent or received from valve controller.</li> <li>- BASE_COMMAND: Command controlling base array.</li> </ul> <p><u>Supported commands are listed as following:</u></p> <ul style="list-style-type: none"> <li>- No Command/Exit Method</li> <li>- Get Current Real Position</li> <li>- Get Open Endpoint</li> <li>- Get Close Endpoint</li> <li>- Get Min Temp Ever</li> <li>- Get Max Temp Ever</li> </ul>	None	<ul style="list-style-type: none"> <li>- BASE_VALUE 0</li> <li>- BASE_COMMAND 0</li> </ul>

## Appendix C: AI Function Block Parameters

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MODE_BLK		<p>The actual, target, permitted, and normal modes of the block.</p> <p>Target: The mode to "go to"</p> <p>Actual: The mode the "block is currently in"</p> <p>Permitted: Allowed modes that target may take on</p> <p>Normal: Most common mode for target</p>	None	<ul style="list-style-type: none"> <li>- TARGET (OOS)</li> <li>- ACTUAL (OOS)</li> <li>- PERMITTED (Auto   Man   OOS)</li> <li>- NORMAL (Auto)</li> </ul>
6	BLOCK_ERR	Bit String	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	0
7	PV		Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block	EU of XD_SCALE	STATUS 0 VALUE 0
8	OUT		The primary analog value calculated as a result of executing the function block	EU of OUT_SCALE	STATUS 0 VALUE 0

## Appendix C: AI Function Block Parameters (Cont.)

Index	Name	Type	Description	Units	Initial Values
9	<b>SIMULATE</b>		Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.	None	-SIMULATE_STATUS 0 -SIMULATE_VALUE 0 -TRANSDUCER_STATUS 0 Bad::NonSpecific: NotLimited) -TRANSDUCER_VALUE 0 -ENABLE_DISABLE 1(Disabled)
10	<b>XD_SCALE</b>		The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.	None	-EU_100 100 -EU_0 0 -UNITS_INDEX 1342(%) -DECIMAL 2
11	<b>OUT_SCALE</b>		The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT	None	-EU_100 100 -EU_0 0 -UNITS_INDEX 1342(%) -DECIMAL 0
12	<b>GRANT_DENY</b>		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	-GRANT 0 -DENY 0
13	<b>IO_OPTS</b>	Bit String	Option which the user may select to alter input and output block processing.	None	0
14	<b>STATUS_OPTS</b>	Bit String	Options which the user may select in the block processing of status.	None	0
15	<b>CHANNEL</b>	Unsigned 16	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. Supported channels are listed on the following: 0: No Channel Selected 5: Instrument Temperature 6: Analog Position	None	0 (No channel selected)
16	<b>L_TYPE</b>	Unsigned 8	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined for the transducer and the associated output range.	None	1 (Direct)
17	<b>LOW_CUT</b>	Float	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero from a flow sensor.	%	0
18	<b>PV_FTIME</b>	Float	Time constant of a single exponential filter for the PV, in seconds.	Seconds	0
19	<b>FIELD_VAL</b>		Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).	%	-STATUS 0 -VALUE 0
20	<b>UPDATE_EVT</b>		This alert is generated by any change to the static data.	None	-UNACKNOWLEDGED 0 (Uninitialized) -UPDATE_STATE 0 -TIME_STAMP 0 -STATIC_REVISION 0 -RELATIVE_INDEX 0
21	<b>BLOCK_ALM</b>		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	-UNACKNOWLEDGED 0(Uninitialized) -ALARM_STATE 0 -TIME_STAMP 0 -SUB_CODE 0 -VALUE 0
22	<b>ALARM_SUM</b>		The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	None	-CURRENT 0 -UNACKNOWLEDGED 0 -UNREPORTED 0 -DISABLED 0



## Appendix C: AI Function Block Parameters *(Concluded)*

Index	Name	Type	Description	Units	Initial Values
23	ACK_OPTION	Bit String	Selection of whether alarms associated with the function block will be automatically acknowledged.	None	0
24	ALARM_HYS	Float	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.	%	0.5
25	HI_HI_PRI	Unsigned 8	Priority of the high high alarm.	None	0
26	HI_HI_LIM	Float	The setting for high high alarm in engineering units.	EU of PV_SCALE	Positive Infinity
27	HI_PRI	Unsigned 8	Priority of the high alarm	None	0
28	HI_LIM	Float	The setting for high alarm in engineering units	EU of PV_SCALE	Positive Infinity
29	LO_PRI	Unsigned 8	Priority of the low alarm	None	0
30	LO_LIM	Float	The setting for the low alarm in engineering units.	EU of PV_SCALE	Negative Infinity
31	LO_LO_PRI	Unsigned 8	Priority of the low low alarm.	None	0
32	LO_LO_LIM	Float	The setting of the low low alarm in engineering units	EU of PV_SCALE	Negative Infinity
33	HI_HI_ALM		The status for high high alarm and its associated time stamp	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
34	HI_ALM		The status for high alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
35	LO_ALM		The status of the low alarm and its associated time stamp.	None	- UNACKNOWLEDGED (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
36	LO_LO_ALM		The status of the low low alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
37	OUT_D		The primary discrete value calculated as a result of executing the function block.	None	- STATUS 0 (Bad::NonSpecific:NotLimited) - VALUE 0
38	ALM_SEL	Bit String	Selected alarms that activate the alarm output	None	0
39	STDDEV	Float	Standard deviation of the measurement.	%	0
40	CAP_STDDEV	Float	Capability standard deviation, the best deviation that can be achieved.	Seconds	0

## Appendix C: AI Function Block Parameters (Cont.)

Index	Name	Type	Description	Units	Initial Values
9	<b>SIMULATE</b>		Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.	None	- SIMULATE_STATUS 0 - SIMULATE_VALUE 0 - TRANSDUCER_STATUS 0 Bad::NonSpecific: NotLimited) - TRANSDUCER_VALUE 0 - ENABLE_DISABLE 1 (Disabled)
10	<b>XD_SCALE</b>		The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.	None	- EU_100 100 - EU_0 0 - UNITS_INDEX 1342(%) - DECIMAL 2
11	<b>OUT_SCALE</b>		The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT	None	- EU_100 100 - EU_0 0 - UNITS_INDEX 1342(%) - DECIMAL 0
12	<b>GRANT_DENY</b>		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	- GRANT 0 - DENY 0
13	<b>IO_OPTS</b>	Bit String	Option which the user may select to alter input and output block processing.	None	0
14	<b>STATUS_OPTS</b>	Bit String	Options which the user may select in the block processing of status.	None	0
15	<b>CHANNEL</b>	Unsigned 16	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. Supported channels are listed on the following: 0: No Channel Selected 5: Instrument Temperature 6: Analog Position	None	0 (No channel selected)
16	<b>L_TYPE</b>	Unsigned 8	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined for the transducer and the associated output range.	None	1 (Direct)
17	<b>LOW_CUT</b>	Float	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero from a flow sensor.	%	0
18	<b>PV_FTIME</b>	Float	Time constant of a single exponential filter for the PV, in seconds.	Seconds	0
19	<b>FIELD_VAL</b>		Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).	%	- STATUS 0 - VALUE 0
20	<b>UPDATE_EVT</b>		This alert is generated by any change to the static data.	None	- UNACKNOWLEDGED 0 (Uninitialized) - UPDATE_STATE 0 - TIME_STAMP 0 - STATIC_REVISION 0 - RELATIVE_INDEX 0
21	<b>BLOCK_ALM</b>		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
22	<b>ALARM_SUM</b>		The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	None	- CURRENT 0 - UNACKNOWLEDGED 0 - UNREPORTED 0 - DISABLED 0

## Appendix C: AI Function Block Parameters *(Concluded)*

Index	Name	Type	Description	Units	Initial Values
23	<b>ACK_OPTION</b>	Bit String	Selection of whether alarms associated with the function block will be automatically acknowledged.	None	0
24	<b>ALARM_HYS</b>	Float	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.	%	0.5
25	<b>HI_HI_PRI</b>	Unsigned 8	Priority of the high high alarm.	None	0
26	<b>HI_HI_LIM</b>	Float	The setting for high high alarm in engineering units.	EU of PV_SCALE	Positive Infinity
27	<b>HI_PRI</b>	Unsigned 8	Priority of the high alarm	None	0
28	<b>HI_LIM</b>	Float	The setting for high alarm in engineering units	EU of PV_SCALE	Positive Infinity
29	<b>LO_PRI</b>	Unsigned 8	Priority of the low alarm	None	0
30	<b>LO_LIM</b>	Float	The setting for the low alarm in engineering units.	EU of PV_SCALE	Negative Infinity
31	<b>LO_LO_PRI</b>	Unsigned 8	Priority of the low low alarm.	None	0
32	<b>LO_LO_LIM</b>	Float	The setting of the low low alarm in engineering units	EU of PV_SCALE	Negative Infinity
33	<b>HI_HI_ALM</b>		The status for high high alarm and its associated time stamp	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
34	<b>HI_ALM</b>		The status for high alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
35	<b>LO_ALM</b>		The status of the low alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
36	<b>LO_LO_ALM</b>		The status of the low low alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
37	<b>OUT_D</b>		The primary discrete value calculated as a result of executing the function block.	None	- STATUS 0 (Bad::NonSpecific: NotLimited) - VALUE 0
38	<b>ALM_SEL</b>	Bit String	Selected alarms that activate the alarm output	None	0
39	<b>STDDEV</b>	Float	Standard deviation of the measurement.	%	0
40	<b>CAP_STDDEV</b>	Float	Capability standard deviation, the best deviation that can be achieved.	Seconds	0

## Appendix D: DI Function Block Parameters

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MODE_BLK		The actual, target, permitted, and normal modes of the block. Target: The mode to "go to" Actual: The mode the "block is currently in" Permitted: Allowed modes that target may take on Normal: Most common mode for target	None	- TARGET (OOS) - ACTUAL (OOS) - PERMITTED (Auto   Man   OOS) - NORMAL (Auto)
6	BLOCK_ERR	Bit String	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	0
7	PV_D		Either the primary discrete value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK_D value of a DO block.	None	- STATUS 0(Bad) - VALUE 0(Close)
8	OUT_D		The primary discrete value calculated as a result of executing the function block.	None	- STATUS 0(Bad) - VALUE 0(Close)
9	SIMULATE_D		Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.	None	- SIMULATE_STATUS 0 - SIMULATE_VALUE 0 (Close) - TRANSDUCER_STATUS 0 (Bad::NonSpecific: NotLimited) - TRANSDUCER_VALUE 0 (Close) - ENABLE_DISABLE 1(Disabled)
10	XD_STATE	Unsigned 16	Index to the text describing the states of a discrete for the value obtained from the transducer.	None	0
11	OUT_STATE	Unsigned 16	Index to the text describing the states of a discrete output.	None	0
12	GRANT_DENY		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	- GRANT 0 - DENY 0
13	IO_OPTS	Bit String (2 bytes)	Option which the user may select to alter input and output block processing.	None	0
14	STATUS_OPTS	Bit String (2 bytes)	Options which the user may select in the block processing of status.	None	0
15	CHANNEL	Unsigned 16	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. Supported channels are listed on the following: 0:No Channel Selected 2:Output Command Readback 3:Open Indicator Input 4:Close Indicator Input	None	3 (Open Indicator Input) or 4 (Close Indicator Input)
16	PV_FTIME	Float	Time constant of a single exponential filter for the PV, in seconds.	Seconds	0
17	FIELD_VAL_D		Raw value of the field device discrete input, with a status reflecting the Transducer condition.	None	- STATUS 0 (Close) - VALUE 0 (Bad)

## Appendix D: DI Function Block Parameters *(Concluded)*

Index	Name	Type	Description	Units	Initial Values
18	UPDATE_EVT		This alert is generated by any change to the static data.	None	- UNACKNOWLEDGED 0 (Uninitialized) - UPDATE_STATE 0 (Uninitialized) - TIME_STAMP 0 - STATIC_REVISION 0 - RELATIVE_INDEX 0
19	BLOCK_ALM		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0
20	ALARM_SUM		The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	None	- CURRENT 0 - UNACKNOWLEDGED 0 - UNREPORTED 0 - DISABLED 0
21	ACK_OPTION	Bit String	Selection of whether alarms associated with the function block will be automatically acknowledged.	None	0
22	DISC_PRI	Unsigned 8	Priority of the discrete alarm.	None	0
23	DISC_LIM	Unsigned 8	State of discrete input which will generate an alarm.	None	0
24	DISC_ALM		The status and time stamp associated with the discrete alarm.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 - TIME_STAMP 0 - SUB_CODE 0 - VALUE 0

## Appendix E: DO Function Block Parameters

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MODE_BLK		<u>The actual, target, permitted, and normal modes of the block.</u> - Target: The mode to "go to" - Actual: The mode the "block is currently in" - Permitted: Allowed modes that target may take on - Normal: Most common mode for target	None	- TARGET (OOS) - ACTUAL (OOS) - PERMITTED (RCas   Cas   Auto   Man   OOS) - NORMAL (Cas   Auto)
6	BLOCK_ERR	Bit String	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	0
7	PV_D		Either the primary discrete value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK_D value of a DO block.	None	- STATUS 0(Bad) - VALUE 0(Close)
8	SP_D		The discrete setpoint of this block.	None	- STATUS 0(Bad) - VALUE 0(Close)
9	OUT_D		The primary discrete value calculated as a result of executing the function block.	None	- STATUS 128 (Good_NonCascade: :NonSpecific: NotLimited) - VALUE 0 (Close)

Appendix E: DO Function Block Parameters *(Concluded)*

Index	Name	Type	Description	Units	Initial Values
10	<b>SIMULATE_D</b>		Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.	None	-SIMULATE_STATUS 0 -SIMULATE_VALUE 0 (Close) -TRANSDUCER_STATUS 0 (Bad::NonSpecific: NotLimited) -TRANSDUCER_VALUE 0 (Close) -ENABLE_DISABLE 1(Disabled)
11	<b>PV_STATE</b>	Unsigned 16	Index to the text describing the states of a discrete PV.	None	0
12	<b>XD_STATE</b>	Unsigned 16	Index to the text describing the states of a discrete for the value obtained from the transducer.	None	0
13	<b>GRANT_DENY</b>		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	-GRANT 0 -DENY 0
14	<b>IO_OPTS</b>	Bit String (2 bytes)	Option which the user may select to alter input and output block processing.	None	0
15	<b>STATUS_OPTS</b>	Bit String (2 bytes)	Options which the user may select in the block processing of status.	None	0
16	<b>READBACK_D</b>		This indicates the readback of the actual discrete valve or other actuator position, in the transducer state. Available readback value: 0: Close, 1: Open, 2: Closing, 3: Opening.	None	-STATUS 0 (Bad) -VALUE 0 (Close)
17	<b>CAS_IN_D</b>		This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link.	None	-STATUS 0 (Bad) -VALUE 0 (Close)
18	<b>CHANNEL</b>	Unsigned 16	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. Supported channel number: 0: No Channel Selected, 1: Output Command.	None	1 (Output Command)
19	<b>FSTATE_TIME</b>	Float	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists.	Sec-onds	0
20	<b>FSTATE_VAL_D</b>	Unsigned 8	The preset discrete SP_D value to use when failure occurs. This value will be used if the I/O option Faultstate to value is selected.	None	0
21	<b>BKCAL_OUT_D</b>		The output value and status provided to an upstream block output tracking when the loop is broken, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control.	None	STATUS 0 (Bad) VALUE 0 (Close)
22	<b>RCAS_IN_D</b>		Target setpoint and status provided by a supervisory Host to a discrete control or output block.	None	STATUS 0 (Bad) VALUE 0 (Close)
23	<b>SHED_OPT</b>	Unsigned 8	Defines action to be taken on remote control device timeout.	None	0 (Uninitialized)
24	<b>RCAS_OUT_D</b>		Block setpoint and status provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change.	None	STATUS 0 (Bad) VALUE 0 (Close)
25	<b>UPDATE_EVT</b>		This alert is generated by any change to the static data	None	-UNACKNOWLEDGED 0 (Uninitialized) -ALARM_STATE 0 (Uninitialized) -TIME_STAMP 0 -SUB_CODE 0 -VALUE 0
26	<b>BLOCK_ALM</b>		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	-UNACKNOWLEDGED 0 (Uninitialized) -ALARM_STATE 0 (Uninitialized) -TIME_STAMP 0 -SUB_CODE 0 -VALUE 0

## Appendix F: PID Function Block Parameters

Index	Name	Type	Description	Units	Initial Values
1	ST_REV	Unsigned 16	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.	None	0
2	TAG_DESC	Octet String	The user description of the intended application of the block.	None	
3	STRATEGY	Unsigned 16	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.	None	0
4	ALERT_KEY	Unsigned 8	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	None	0
5	MOD_BLK		<u>The actual, target, permitted, and normal modes of the block.</u> Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target	None	- TARGET (OOS) - ACTUAL (OOS) - PERMITTED (ROut   RCas   Cas   Auto   Man   OOS) - NORMAL (Auto)
6	BLOCK_ERR	Bit String	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.	None	0
7	PV		Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.	EU of PV_SCALE E	- STATUS 0 - VALUE 0
8	SP		The analog setpoint of this block.	EU of PV_ SCALE	- STATUS 0 - VALUE 0
9	OUT		The primary analog value calculated as a result of executing the function block.	EU of OUT_ SCALE	- STATUS 0 - VALUE 0
10	PV_SCALE		The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the PV parameter and parameters which have the same scaling as PV.	None	- EU_100 100 - EU_0 0 - UNITS_INDEX 1342(%) - DECIMAL 0
11	OUT_SCALE		The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.	None	- EU_100 100 - EU_0 0 - UNITS_INDEX 1342(%) - DECIMAL 0
12	GRANT_DENY		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.	None	- GRANT 0 - DENY 0
13	CONTROL_OPTS	Bit String	<u>Options which the user may select to alter the calculations done in a control block. Supported options are the following:</u> Bypass Enable SP-PV Track in Man SP-PV Track in Rout SP-PV Track in LO or lman SP Track retain Direct acting Track if Bad TRK_IN_D Track enable Track in manual PV for BKCal_Out Restrict SP to limits in Cas and RCas No output limits in Man	None	0
14	STATUS_OPTS	Bit String	<u>Options which the user may select in the block processing of status.</u> IFS if Bad IN IFS if Bad CAS_IN Use Uncertain as Good Target to Man if Bad IN Target to next permitted mode if BAD CAS_IN Target to Man if Bad TRK_IN_D IFS if Bad TRK_IN_D	None	0

## Appendix F: PID Function Block Parameters

Index	Name	Type	Description	Units	Initial Values
15	IN		Primary input value of the block, required for blocks that filter the input to get the PV.	EU of PV_SCALE	-STATUS 8 (Bad::NotConnected :NotLimited) -VALUE 0
16	PV_FTIME	Float	Time constant of a single exponential filter for the PV, in seconds.	Seconds	0
17	BYPASS	Unsigned 8	The normal control algorithm may be bypassed through this parameter. When bypass is set, the setpoint value (in percent) will be directly transferred to the output. To prevent a bump on transfer to/from bypass, the setpoint will automatically be initialized to the output value or process variable, respectively, and the path broken flag will be set for one execution.	None	0 (Uninitialized)
18	CAS_IN		This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link.	EU of PV_SCALE	-STATUS 8 (Bad::NotConnected :NotLimited) -VALUE 0
19	SP_RATE_DN	Float	Ramp rate at which downward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately.	EU of PV_SCALE per second	Positive Infinity
20	SP_RATE_UP	Float	Ramp rate at which upward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately.	EU of PV_SCALE per second	Positive Infinity
21	SP_HI_LIM	Float	The setpoint high limit is in the highest setpoint operator entry that can be used for the block.	EU of PV_SCALE	100
22	SP_LO_LIM	Float	The setpoint low limit is the lowest setpoint operator entry that can be used for the block.	EU of PV_SCALE	0
23	GAIN	Float	Dimensionless value used by the block algorithm in calculating the block output.	None	1
24	RESET	Float	The integral time constant, in seconds per repeat.	Seconds per repeat	Positive Infinity
25	BAL_TIME	Float	This specifies the time for the internal working value or bias or ratio to return to the operator set bias or ratio, in seconds. In the PID block, it may be used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is Auto, Cas, or RCas.	Seconds	0
26	RATE	Float	Defines the derivative time constant, in seconds.	Seconds	0
27	BKCAL_IN		The value and status used for backwards tracking of the output, provided by a link to the back calculation output parameter of a downstream block.	EU of OUT_SCALE	-STATUS 8 (Bad::NotConnected :NotLimited) -VALUE 0
28	OUT_HI_LIM	Float	Limits the maximum output value for modes other than Manual.	EU of OUT_SCALE	100
29	OUT_LO_LIM	Float	Limits the minimum output value for modes other than Manual.	EU of OUT_SCALE	0



## Appendix F: PID Function Block Parameters (Continued)

Index	Name	Type	Description	Units	Initial Values
30	<b>BKCAL_HYS</b>	Float	The amount that the block output must change away from its output limit before the limit status is turned off, expressed as a percent of the span of the output.	%	0.5
31	<b>BKCAL_OUT</b>		The output value and status provided to an upstream block for output tracking when the loop is broken or limited, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control and to prevent windup under limited conditions when that becomes possible.	EU of PV_SCALE	-STATUS 0 -VALUE 0
32	<b>RCAS_IN</b>		Target setpoint and status provided by a supervisory Host to an analog control or output block.	EU of PV_SCALE	-STATUS 8 (Bad::NotConnected:No tLimited) -VALUE 0
33	<b>ROUT_IN</b>		Target output and status provided by a Host to the control block for use as the output (ROut mode).	EU of OUT_SCALE	-STATUS 8 (Bad::NotConnected:No tLimited) -VALUE 0
34	<b>SHED_OPT</b>	Unsigned 8	Defines action to be taken on remote control device timeout.	None	0 (Uninitialized)
35	<b>RCAS_OUT</b>		Block setpoint and status after ramping - provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change.	EU of PV_SCALE	-STATUS 0 -VALUE 0
36	<b>ROUT_OUT</b>		Block output and status - provided to a Host for back calculation in ROut mode and to allow action to be taken under limited conditions or mode change.	EU of OUT_SCALE	-STATUS 0 -VALUE 0
37	<b>TRK_SCALE</b>		The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with TRK_VAL.	None	-EU_100 100 -EU_0 0 -UNITS_INDEX 1342 (%) -DECIMAL 0
38	<b>TRK_IN_D</b>		This discrete input is used to initiate external tracking of the block output to the value specified by TRL_VAL.	None	-STATUS 8 (Bad::NotConnected:No tLimited) -VALUE 0
39	<b>TRK_VAL</b>		This input is used as the track value when external tracking is enabled in TRK_IN_D.	None	-STATUS 8 (Bad::NotConnected:No tLimited) -VALUE 0
40	<b>FF_VAL</b>		The feed forward value and status.	EU of FF_SCALE	-STATUS 0 -VALUE 0
41	<b>FF_SCALE</b>		The feed forward input high and low scale values, engineering units code, and number of digits to the right of the decimal point.	None	-EU_100 100 -EU_0 0 -UNITS_INDEX 1342 (%) -DECIMAL 0
42	<b>FF_GAIN</b>	Float	The gain that the feed forward input is multiplied by before it is added to the calculated control output.	None	0
43	<b>UPDATE_EVT</b>		This alert is generated by any change to the static data.	None	-UNACKNOWLEDGED 0 (Uninitialized) -UPDATE_STATE 0 (Uninitialized) -TIME_STAMP 0 -STATIC_REVISION 0 -RELATIVE_INDEX 0
44	<b>BLOCK_ALM</b>		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	None	-UNACKNOWLEDGED 0 (Uninitialized) -ALARM_STATE 0 (Uninitialized) -TIME_STAMP 0 -SUB_CODE 0 (Other) -VALUE 0

## Appendix F: PID Function Block Parameters (Continued)

Index	Name	Type	Description	Units	Initial Values
45	ALARM_SUM		The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	None	CURRENT 0 UNACKNOWLEDGED 0 UNREPORTED 0 DISABLED 0
46	ACK_OPTION	Bit String	Selection of whether alarms associated with the function block will be automatically acknowledged.	None	0
47	ALARM_HYS	Float	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.	%	0.5
48	HI_HI_PRI	Unsigned 8	Priority of the high high alarm	None	0
49	HI_HI_LIM	Float	The setting for high high alarm in engineering units.	EU of PV_SCALE	Positive Infinity
50	HI_PRI	Unsigned 8	Priority of the high alarm.	None	0
51	HI_LIM	Float	The setting for high alarm in engineering units.	EU of PV_SCALE	Positive Infinity
52	LO_PRI	Unsigned 8	Priority of the low alarm.	None	0
53	LO_LIM	Float	The setting for the low alarm in engineering units.	EU of PV_SCALE	Negative Infinity
54	LO_LO_PRI	Unsigned 8	Priority of the low low alarm.	None	0
55	LO_LO_LIM	Float	The setting of the low low alarm in engineering units.	EU of PV_SCALE	Negative Infinity
56	DV_HI_PRI	Unsigned 8	Priority of the high deviation alarm.	None	0
57	DV_HI_LIM	Float	The setting of the high deviation alarm limit in engineering units.	EU of PV_SCALE	Positive Infinity
58	DV_LO_PRI	Unsigned 8	Priority of the low deviation alarm.	None	0
59	DV_LO_LIM	Float	The setting of the low deviation alarm limit in engineering units.	EU of PV_SCALE	Negative Infinity
60	HI_HI_ALM		The status for high high alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0(Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
61	HI_ALM		The status for high alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0(Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
62	LO_ALM		The status of the low alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0(Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
63	LO_LO_ALM		The status of the low low alarm and its associated time stamp.	None	- UNACKNOWLEDGED 0(Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
64	DV_HI_ALM		The status and time stamp associated with the high deviation alarm.	None	- UNACKNOWLEDGED 0(Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0

## Appendix F: PID Function Block Parameters (Continued)

Index	Name	Type	Description	Units	Initial Values
65	DV_LO_ALM		The status and time stamp associated with the low deviation alarm.	None	- UNACKNOWLEDGED 0 (Uninitialized) - ALARM_STATE 0 (Uninitialized) - TIME_STAMP 0 - SUB_CODE 0 (Other) - VALUE 0
66	BIAS	Float	The bias value used to calculate output for a PD-type controller.	EU of OUT_SCALE	0
67	ERROR	Float	The error (SP-PV) used to determine the control action.	EU of PV_SCALE	0
68	SP_WORK	Float	The working setpoint of the block after limiting and filtering is applied.	EU of PV_SCALE	0
69	SP_FTIME	Float	The time constant of the first-order SP filter. It is the time required for a 63 percent change in the IN value.	Seconds	0
70	MATHFORM	Unsigned 8	Selects equation form (series or standard). <u>Supported values:</u> 0: Standard, 1: Series.	None	0 (Standard)
71	STRUCTRECONFIG	Unsigned 8	Defines the structure of the PID equations. <u>Supported options are the following:</u> 0: PID terms on error 1: PI terms on error, D term on PV 2: I terms on error, PD term on PV 3: PD terms on error 4: P term on error, D term on PV 5: ID terms on error 6: I term on error, D term on PV 7: 2 Deg. of Freedom PID	None	1 (PI terms on error, D term on PV)
72	GAMMA	Float	The proportional gain value. This value cannot be zero.	%	0
73	BETA	Float	Weighting factor for derivative action when STRUCTURE_CONFIG is 2 Deg. of Freedom.	%	1
74	IDEADBAND	Float	Deadband that is applied to the integrator term.	None	0
75	STDDEV	Float	Standard deviation of the measurement.	%	0
76	CAP_STDDEV	Float	Capability standard deviation, the best deviation that can be achieved.	Seconds	0
77	T_REQUEST	Bit String	<u>Operator request to initiate/control autotuning.</u> <u>Supported values:</u> - Request tuning - Force tuning - Reset Tuner	None	0
78	T_STATE	Unsigned 8	Current auto tuner state.	None	0
79	T_STATUS	Bit String	<u>Auto tuner status, supported options:</u> - Scan Rate Too Low Warning - Insufficient Process Response (Obsolete) - Scan Rate Too High Warning - Inverse Direct Acting Error - PV Deviation Too Large - Initial PV Deviation Too Large - PV Limited Or Constant - PV Bad - Invalid Mode For Tuning - BKCAL_IN Non Good Or Limited - Out Limited - Bypass Active - Mode Changed - Tracking Active - Disconnected - SP Changed	None	0

## Appendix F: PID Function Block Parameters (Concluded)

Index	Name	Type	Description	Units	Initial Values
80	T_IPGAIN	Float	Integrated process gain.	None	0
81	T_UGAIN	Float	Ultimate gain.	None	0
82	T_UPERIOD	Float	Ultimate period.	None	0
83	T_PSGAIN	Float	Process static gain.	None	0
84	T_PTIMEC	Float	Process time constant.	None	0
85	T_PDTIME	Float	Process dead time.	None	0
86	T_TARGETOP	Unsigned 8	Target oscillation periods.	None	2
87	T_HYSTER	Float	Hysteresis.	None	0
88	T_RELAYSS	Float	Relay step size.	None	3
89	T_GAIN_MAGNIFIER	Float	Scales amount of gain.	None	1
90	T_AUTO_EXTRA_DT	Unsigned 8	Allows additional cycle with extra deadtime.	None	0
91	T_AUTO_HYSTERESIS	Unsigned 8	Allows calculation of hysteresis based on CAP_STDDEV.	None	0
92	T_AOPERIODS	Unsigned 8	Actual oscillation periods.	None	0


## Appendix G: Specifications and Reference Data

Intrinsically Safe Input Parameters: Bus Connector pins 1 to 3	
<b>I.S. Parameters</b>	
Ui	30V
Ii	380mA
Pi	1.5W
Ci	5nF
Li	10μH
<b>FISCO Parameters</b>	
Ui	17.5V
Ii	380mA
Pi	5.32W
Ci	5nF
Li	10μH

Electrical Specifications	
Current Consumption	17.65mA nominal
Maximum Applied Voltage	35VDC
Operating Voltage	9-32VDC
Fieldbus Specifications	
Topology	Point to Point Bus with Spurs Daisy Chain Tree
Cable	Twisted Pair
Bus Length	1900m (max)
Transmission Speed	31.25 kbit/s
Intrinsically Safe	Yes
Function Block Execution Times	DI: 15ms AI: 15ms DO: 20ms PID: 20ms

## Certifications & Approvals

### ATEX

**II 1 GD**   
**Baseefa 11ATEX0035X**  
**Ex ib IIC T4 Gb, Tamb =-20°C to +50°C;**  
**Ex tb IIIC T80°C Db, IP67, Tamb=20°C to +50°C**

**II 2 GD**  
**Sira 07ATEX1273X**  
**Ex d IIC T6 Gb, Tamb =-50°C to +60°C, IP66/67, or**  
**Ex d IIB +H2 T6, IP66/67, Tamb =-50°C to +60°C**  
**Ex tb IIIC T85°C Db, IP66/67**

**II 3 GD**  
**Baseefa 11ATEX0036X**  
**Ex nA nC IIC T6 Gc, Tamb =-20°C to +50°C;**  
**Ex tc IIIC T80°C Dc, IP67, Tamb=-20°C to +50°C**

### IECEX

**IECEX BAS 11.0022X**  
**Ex ib IIC T4 Gb, Tamb =-20°C to +50°C;**  
**Ex tb IIIC T80°C Db, IP67, Tamb=-20°C to +50°C**

**IECEX SIR 07.0093X**  
**Ex d IIC T6 Gb, Tamb =-50°C to +60°C, IP66/67, or**  
**Ex d IIB +H2 T6, IP66/67, Tamb =-50°C to +60°C**  
**Ex tb IIIC T85°C Db, IP66/67**

**IECEX BAS 11.0023X**  
**Ex nA nC IIC T6 Gc, Tamb =-20°C to +50°C;**  
**Ex tc IIIC T80°C Dc, IP67, Tamb=-20°C to +50°C**

### NCC

**NCC 12.1138X**  
**Ex d IIB+H2 T6 / Ex d IIC T6; Ex tb IIIC T85°C Db**  
**-50°C ≤ Ta ≤ 60°C, IP66/IP67**

**NCC 12.0767X**  
**Ex ib IIC T4 (-20°C ≤ Ta ≤ +50°C) Gb**  
**Ex tb IIIC T80°C (-20°C ≤ Ta ≤ +50°C) IP67**

**Ex nA nC IIC T6 Gc**  
**Ex tc IIIC T80°C IP67**



**UL Listed**  
**Class I, Div. 1, Groups A, B, C, & D Intrinsically Safe**  
**Class I, Div. 1, Groups C & D Explosion Proof**  
**Class I, Div. 2, Groups A, B, C, & D Non-Incendive**

## Safe Use

### Special Conditions of Safe Use (All installations)

Clean only with a damp cloth to prevent possibility of electrostatic discharge. For Explosion Proof installations, the internal ground connection shall be used and the external ground connection, if supplied in addition, is supplemental bonding allowed where local authorities permit, or is required. When installing with a third party listed nipple-mount solenoid, it is the responsibility of the installer to provide fittings, and apparatus, suitable for the area classification in accordance with the National Electrical Code. All cable entry devices or conduit stopping boxes shall be certified in type of explosion protection 'd', suitable for the conditions of use and correctly installed. The IIC enclosures are excluded from use in carbon disulphide atmospheres. The air pressure to the valve block, when fitted, shall not exceed 7bar. For ambient temperatures higher than 110°C, the IP66/IP67 protection level is not guaranteed.

### Preventative Maintenance

The TopWorx™ is designed to operate for one million cycles without servicing. Call TopWorx when you are approaching this milestone for a preventative maintenance kit and instructions.

## Warranty

### TERMS AND CONDITIONS OF SALE

These terms and conditions, the attendant quotation or acknowledgment, and all documents incorporated by reference therein, binds TopWorx, Inc. hereinafter the Seller, and the buyer, hereinafter Buyer, and constitutes the entire agreement (Agreement) between Buyer and Seller for the provision of services (Services) and/or the sale of goods (Goods) including (except as provided in Section 10) firmware incorporated therein.

**1. PRICES:** Unless otherwise specified by Seller, Seller's price for the Goods and/or Services shall remain in effect for thirty (30) days after the date of Seller's quotation or acceptance of the order for the Goods/Services, whichever is delivered first, provided an unconditional, complete authorization for the immediate manufacture and shipment of the Goods and/or provision of Services pursuant to Seller's standard order processing procedures is received and accepted by Seller within such time period. If such authorization is not received by Seller within such thirty (30) day period, Seller shall have the right to change the price for the Goods/Services to Seller's price in effect for the Goods/Services at the time the order is released to final manufacture. Prices for Goods do not cover storing, installing, starting up or maintaining Goods unless expressly stated in Seller's quotation. Notwithstanding the foregoing, the price for Goods/Services sold by Seller, but manufactured by others, shall be Seller's price in effect at the time of shipment to Buyer.

**2. DELIVERY, ORDER ACCEPTANCE AND DOCUMENTATION:** All shipping dates are approximate and are based upon Seller's prompt receipt of all necessary information from Buyer to properly process the order. Notwithstanding any provisions to the contrary in this or other documents related to this transaction, and regardless of how price was quoted, whether FOB, FAS, CIF or otherwise, legal title to the Goods and risk of loss thereto shall transfer to Buyer as follows: for sales in which the end destination of the Goods is within the United States, upon delivery to the freight carrier at the shipping point; for sales in which the end destination of the Goods is outside of the United States, immediately after the Goods have passed beyond the territorial limits of the United States. Seller shall provide Buyer with that data/documentation which is specifically identified in the quotation. If additional copies of data/documentation or non-standard data/documentation are to be provided by Seller, they shall be provided to Buyer at Seller's price then in effect. Data/documentation marked as confidential or proprietary may not be reproduced or used for any purpose other than the purpose for which it was provided and may not be disclosed to third parties without the prior written permission of Seller.

**3. EXCUSE OF PERFORMANCE:** Seller shall not be liable for delays in performance or for non-performance due to failure or interruption of computer or telecommunication systems, acts of God, war, riot, fire, terrorism, labor trouble, unavailability of materials or components, explosion, accident, compliance with governmental requests, laws, regulations, orders or actions, or other unforeseen circumstances or causes beyond Seller's reasonable control. In the event of such delay, the time for performance or delivery shall be extended by a period of time reasonably necessary to overcome the effect of the delay.

**4. TERMINATION AND SUSPENSION BY BUYER:** Buyer may terminate or suspend its order for any or all of the Goods/Services covered by the Agreement provided that Buyer gives Seller reasonable advance written notice of such termination or suspension and reimburses Seller for all losses, damages, costs and expenses arising from such termination or suspension.

**5. LIMITED WARRANTY:** Subject to the limitations contained in Section 6 herein, Seller warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care. The foregoing warranties will apply until the expiration of the applicable warranty period. All other Goods are warranted for twelve (12) months from the date of shipment by Seller. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

**6. LIMITATION OF REMEDY AND LIABILITY:** SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.

**7. PATENTS:** Subject to the limitations contained in Section 6, Seller shall defend any suits brought against Buyer based on a claim that use of the Goods manufactured by Seller constitutes an infringement of a valid patent of the United States, and shall pay any damages awarded therein against Buyer, provided that Buyer: promptly notifies Seller in writing of the filing of such suit or the threat thereof; permits Seller to control completely the defense or compromise of such claim of infringement; and provides all reasonable assistance and cooperation requested by Seller for the defense of such suit. In the event that only the Goods manufactured by Seller are held to be infringing in such suit and their use is enjoined, Seller shall, at its sole option and expense, provide a commercially reasonable alternative, including, but not limited to, procuring for Buyer the right to continue using the Goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that Seller shall not be liable for infringement, and that Buyer shall fully indemnify Seller therefore, if infringement is based upon the use of Goods in connection with goods not manufactured by Seller or in a manner for which the Goods were not designed by the Seller or if the Goods were not designed by the Seller or if the Goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.

**8. TAXES:** Any tax or governmental charge payable by the Seller because of the manufacture, sale or delivery of the Goods, or provision of Services, may at Seller's option be added to the price herein specified. The foregoing shall not apply to taxes based upon Seller's net income.

**9. TERMS OF PAYMENT:** Subject to the approval of Seller's Credit Department, terms are F.O.B. shipping point, net 30 days from date of Seller's invoice in U.S. currency, except for applicable milestone payments covered below or export shipments for which Seller may require other arrangements. Freight charges may include shipping and handling charges, and Buyer shall pay all such charges. If any payment owed to Seller hereunder is not paid when due, it shall bear interest at a rate 1-1/2% per month interest from the date on which it is due until it is received and future shipments may be placed on hold. Seller shall have the right among other remedies, either to terminate the Agreement or to suspend further deliveries under this and/or other agreements with Buyer in the event Buyer fails to make any payment hereunder when due. Buyer shall be liable for all expenses attendant to collection of past due amounts, including attorneys' fees. Unless otherwise provided in Seller's written quotation, periodic milestone payments shall be made by Buyer when the purchase price of this Agreement exceeds \$100,000. In such cases, invoices shall be issued by Seller and paid by Buyer based on the following milestones: Milestone 1: 30% of price upon acceptance of order by Seller. Milestone 2: 30% of price upon release by Seller of approved bills of material to manufacturing for assembly. Milestone 3: 40% of price upon shipment of the Goods by Seller. Seller reserves the right to designate additional Milestones where the Agreement provides for Services in excess of \$50,000.

**10. SOFTWARE AND FIRMWARE:** Notwithstanding any other provision herein to the contrary, Seller or applicable third party owner shall retain all rights of ownership and title in its respective firmware and software, including all copyrights relating to such firmware and software and all copies of such firmware and software. Except as otherwise provided herein, Buyer is hereby granted a nonexclusive, royalty free license to use firmware and software, and copies of firmware and software, incorporated into the Goods only in conjunction with such Goods and only at the Buyer's plant site where the Goods are first used. Buyer may negotiate with Seller separate licenses to use such copies and firmware and software at other plant sites. Buyer's use of certain firmware (as specified by Seller) and all other software shall be governed exclusively by Seller's and/or third party owner's applicable license terms.

**11. BUYER SUPPLIED DATA:** To the extent that Seller has relied upon any specifications, information, representation of operating conditions or other data or information supplied by Buyer to Seller ("Data") in the selection or design of the Goods and/or provision of the Services and the preparation of Seller's quotation, and in the event that actual operating conditions or other conditions differ from those represented by Buyer and relied upon by Seller, any warranties or other provisions contained herein which are affected by such conditions shall be null and void.

**12. EXPORT/IMPORT:** Buyer agrees that all applicable import and export control laws, regulations, orders and requirements, including without limitation those of the United States and the European Union, and the jurisdictions in which the Seller and Buyer are established or from which items may be supplied will apply to its receipt and use of Goods and Services. In no event shall Buyer use, transfer, release, import, export, or re-export Goods in violation of such applicable laws, regulations, orders, or requirements.

**13. GENERAL PROVISIONS:** (a) Buyer shall not assign its rights or obligations under the Agreement without Seller's prior written consent; (b) there are no understandings, agreements or representations, express or implied, not specified in the Agreement; (c) no action, regardless of form, arising out of transactions under the Agreement, may be brought by either party more than two years after the cause of action has accrued; (d) any modification of these terms and conditions must be set forth in a written instrument signed by a duly authorized representative of Seller; (e) the Agreement is formed and shall be construed, performed and enforced under the laws of the State of Missouri (however, Buyer and Seller agree that the proper venue for all actions arising under the Agreement shall be only in the State where the Goods involved in such actions were manufactured; (f) The 1980 United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement; (g) If any provision of the Agreement is invalid under any statute or rule of law, such provision, to that extent only, shall be deemed to be omitted without affecting the validity of the remainder of the Agreement; (h) Seller specifically objects to the application of any Federal Acquisition Regulation ("FAR") or other governmental procurement provision or clause to the Agreement; (i) UNLESS OTHERWISE SPECIFICALLY PROVIDED IN SELLER'S QUOTATION, GOODS AND SERVICES HEREUNDER ARE NOT INTENDED FOR USE IN ANY NUCLEAR OR NUCLEAR RELATED APPLICATIONS. Buyer (i) accepts Goods and Services in accordance with the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from any and all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from use of Goods and Services in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability; (j) The rights, remedies and protections afforded to Seller under this Agreement, including but not limited to indemnification of Seller, limitation of remedy and liability and limited warranty shall extend to Seller and to its affiliates, subsidiaries, or related companies performing or supplying work, services, or products under this Agreement or any agreement into which it is incorporated by reference, and (k) Seller does not agree to: (i) indemnify Buyer; or (ii) name Buyer as an additional insured.

**Notes:**

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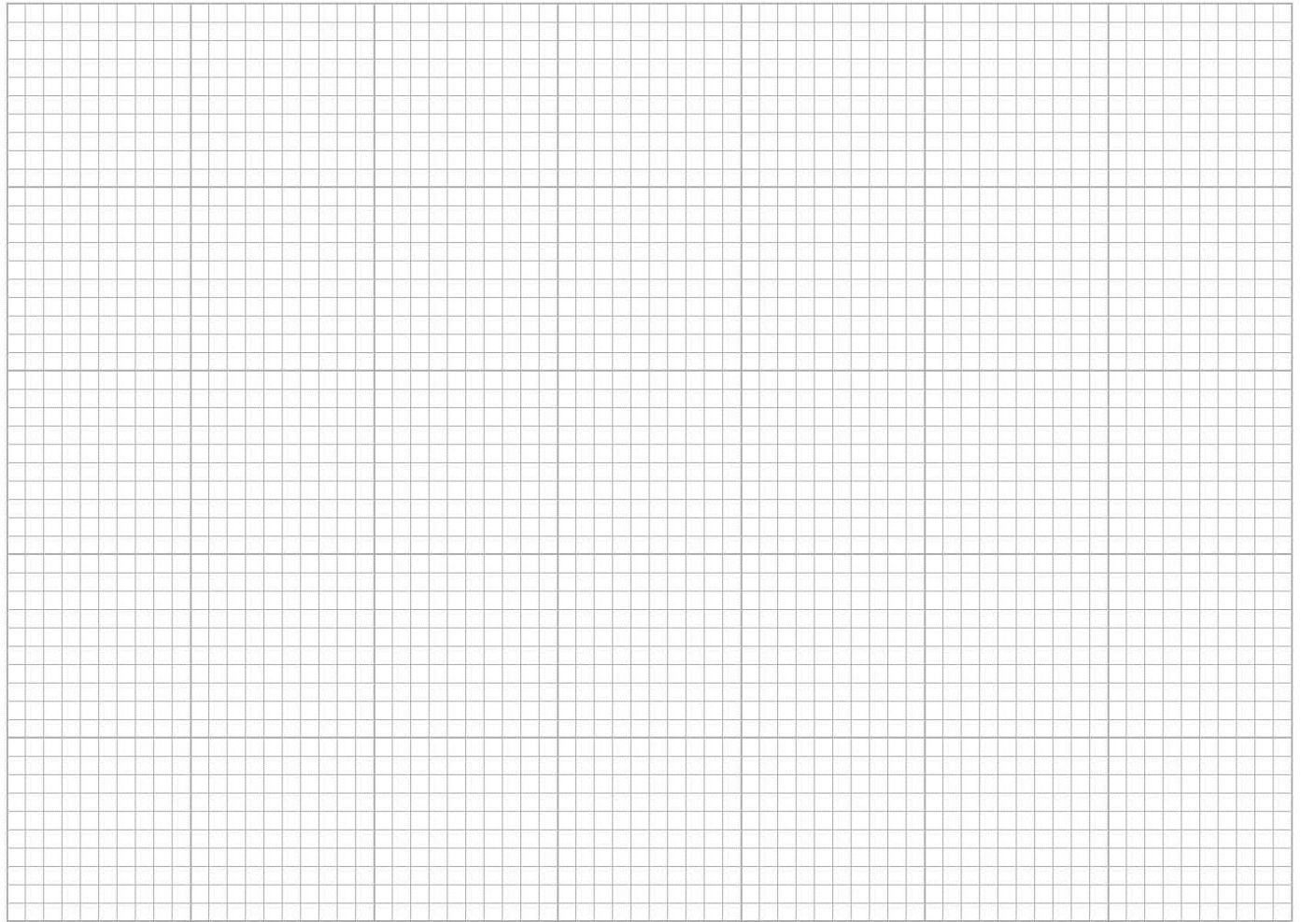
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